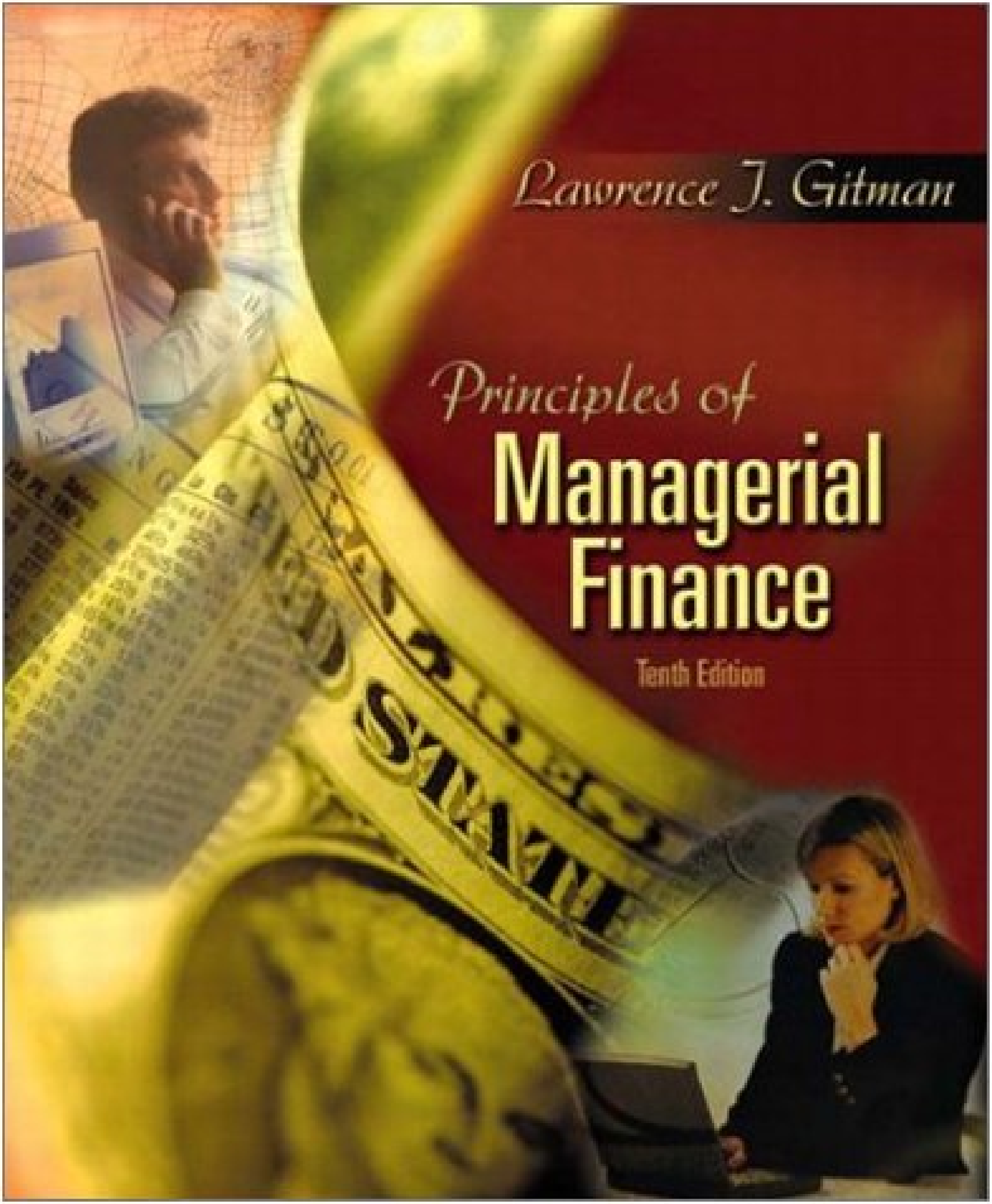


Lawrence J. Gitman

Principles of Managerial Finance

Tenth Edition

PART 1

INTRODUCTION TO MANAGERIAL FINANCE

CHAPTERS IN THIS PART

CHAPTER

1

THE ROLE AND ENVIRONMENT OF MANAGERIAL FINANCE

LEARNING GOALS

LG1 Define *finance,* the major areas of finance and the career opportunities available in this field, and the legal forms of business organization.

LG2 Describe the managerial finance function and its relationship to economics and accounting.

LG3 Identify the primary activities of the financial manager within the firm.

LG4 Explain why wealth maximization, rather than profit maximization, is the firm's goal and how the agency issue is related to it.

LG5 Understand the relationship between financial institutions and markets, and the role and operations of the money and capital markets.

LG6 Discuss the fundamentals of business taxation of ordinary income and capital gains, and explain the treatment of tax losses.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

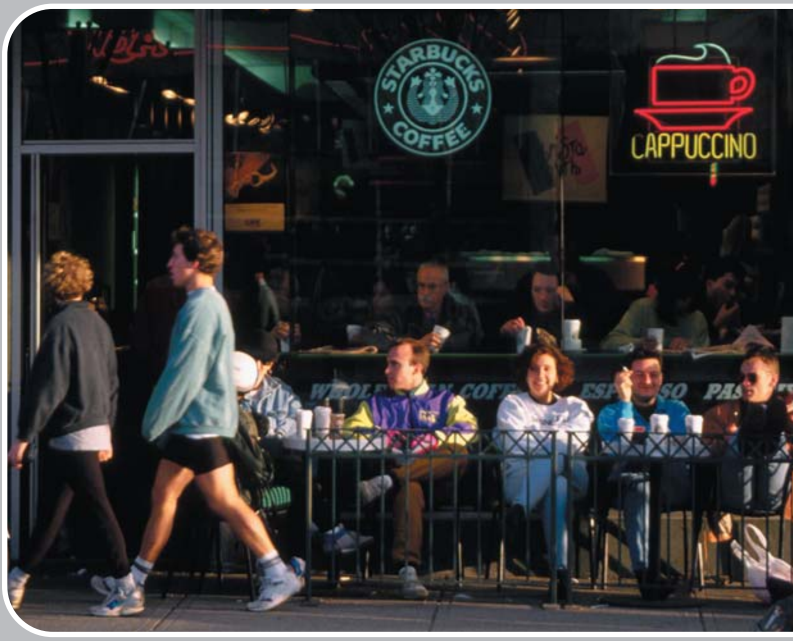
Accounting: You need to understand the relationships between the firm's accounting and finance functions; how the financial statements you prepare will be used for making investment and financing decisions; ethical behavior by those responsible for a firm's funds; what agency costs are and why the firm must bear them; and how to calculate the tax effects of proposed transactions.

Information systems: You need to understand the organization of the firm; why finance personnel require both historical and projected data to support investment and financing decisions; and what data are necessary for determining the firm's tax liability.

Management: You need to understand the legal forms of business organization; the tasks that will be performed by finance personnel; the goal of the firm; the issue of management compensation; the role of ethics in the firm; the agency problem; and the firm's relationship to various financial institutions and markets.

Marketing: You need to understand how the activities you pursue will be affected by the finance function, such as the firm's cash and credit management policies; the role of ethics in promoting a sound corporate image; and the role the financial markets play in the firm's ability to raise capital for new projects.

Operations: You need to understand the organization of the firm and of the finance function in particular; why maximizing profit is not the main goal of the firm; the role of financial institutions and markets in providing funds for the firm's production capacity; and the agency problem and the role of ethics.



STARBUCKS

KEEPING STARBUCKS HOT AND STRONG

Sometimes it seems that there's a **Starbucks** on every corner—and now in supermarkets and hospitals, too. The company that revolutionized the way we think about coffee now has over 4,800 retail locations worldwide and 15 million customers lining up for lattes and other concoctions each week.

The chain's success is tied to somewhat unusual business strategies. Its mission statement emphasizes creating a better work environment for employees first, then satisfying customers and promoting good corporate citizenship within its communities. For example, Starbucks was one of the first companies to offer part-time employees health benefits and equity (ownership). The goal is to create an experience that builds trust with the customer. Profits are among the last of the company's guiding principles.

Starbucks' bond with employees and customers has translated into sales and earnings as strong as its coffee. Annual sales growth from 1997 to 2000 ranged from 28 to almost 40 percent, and annual growth in earnings per share ranged from about 12 to 81 percent. A share of Starbucks' stock purchased in November 1996 increased in value by 17 percent over the five years ended November 2001. That compares favorably with the 15 percent gain realized by its industry peers and the 7 percent gain for companies in the Standard & Poor's 500 Index.

Despite the U.S. economic slowdown in 2001, the company expects to keep its growth perking over the next five years. Although some fear that Starbucks has saturated the domestic market, same-store sales keep rising as the company introduces new products. Starbucks has even become quite successful in unexpected markets, such as Japan.

Accomplishing its business objectives while building shareholder value requires sound financial management—raising funds to open new stores and build more roasting plants, deciding when and where to put them, managing cash collections, reducing purchasing costs, and dealing with fluctuations in the value of foreign currency and with other risks as it buys coffee beans and expands overseas. To finance its growth, Starbucks went public (sold common stock) in 1992, and its stock trades on the Nasdaq national market. Its next securities offering was the sale of convertible bonds, debt securities that could be converted into common stock at a specified price. Those bonds were successfully converted into common stock by 1996, and today the company has almost no long-term debt.

Like Starbucks, every company must deal with many different issues to keep its financial condition solid. Chapter 1 introduces managerial finance and its key role in helping an organization meet its financial and business objectives.

LG1 1.1 Finance and Business

The field of finance is broad and dynamic. It directly affects the lives of every person and every organization. There are many areas and career opportunities in the field of finance. Basic principles of finance, such as those you will learn in this textbook, can be universally applied in business organizations of different types.

What Is Finance?

finance
The art and science of managing money.

Finance can be defined as the art and science of managing money. Virtually all individuals and organizations earn or raise money and spend or invest money. Finance is concerned with the process, institutions, markets, and instruments involved in the transfer of money among individuals, businesses, and governments. Most adults will benefit from an understanding of finance, which will enable them to make better personal financial decisions. Those who work in financial jobs will benefit by being able to interface effectively with the firm's financial personnel, processes, and procedures.

Major Areas and Opportunities in Finance

The major areas of finance can be summarized by reviewing the career opportunities in finance. These opportunities can, for convenience, be divided into two broad parts: financial services and managerial finance.

Financial Services

financial services
The part of finance concerned with the design and delivery of advice and financial products to individuals, business, and government.

WWW

Financial services is the area of finance concerned with the design and delivery of advice and financial products to individuals, business, and government. It involves a variety of interesting career opportunities within the areas of banking and related institutions, personal financial planning, investments, real estate, and insurance. Career opportunities available in each of these areas are described at this textbook's Web site at *www.aw.com/gitman*.

Managerial Finance

managerial finance
Concerns the duties of the financial manager in the business firm.

financial manager
Actively manages the financial affairs of any type of business, whether financial or nonfinancial, private or public, large or small, profit-seeking or not-for-profit.

Managerial finance is concerned with the duties of the financial manager in the business firm. **Financial managers** actively manage the financial affairs of any type of businesses—financial and nonfinancial, private and public, large and small, profit-seeking and not-for-profit. They perform such varied financial tasks as planning, extending credit to customers, evaluating proposed large expenditures, and raising money to fund the firm's operations. In recent years, the changing economic and regulatory environments have increased the importance and complexity of the financial manager's duties. As a result, many top executives have come from the finance area.

Another important recent trend has been the globalization of business activity. U.S. corporations have dramatically increased their sales, purchases, investments, and fund raising in other countries, and foreign corporations have likewise increased these activities in the United States. These changes have created a need for financial managers who can help a firm to manage cash flows in different currencies and protect against the risks that naturally arise from international transactions. Although these changes make the managerial finance function more complex, they can also lead to a more rewarding and fulfilling career.

Legal Forms of Business Organization

The three most common legal forms of business organization are the *sole proprietorship,* the *partnership,* and the *corporation.* Other specialized forms of business organization also exist. Sole proprietorships are the most numerous. However, corporations are overwhelmingly dominant with respect to receipts and net profits. Corporations are given primary emphasis in this textbook.

Sole Proprietorships

sole proprietorship
A business owned by one person and operated for his or her own profit.

A **sole proprietorship** is a business owned by one person who operates it for his or her own profit. About 75 percent of all business firms are sole proprietorships. The typical sole proprietorship is a small business, such as a bike shop, personal trainer, or plumber. The majority of sole proprietorships are found in the wholesale, retail, service, and construction industries.

unlimited liability
The condition of a sole proprietorship (or general partnership) allowing the owner's total wealth to be taken to satisfy creditors.

Typically, the proprietor, along with a few employees, operates the proprietorship. He or she normally raises capital from personal resources or by borrowing and is responsible for all business decisions. The sole proprietor has **unlimited liability;** his or her total wealth, not merely the amount originally invested, can be taken to satisfy creditors. The key strengths and weaknesses of sole proprietorships are summarized in Table 1.1.

Partnerships

partnership
A business owned by two or more people and operated for profit.

articles of partnership
The written contract used to formally establish a business partnership.

A **partnership** consists of two or more owners doing business together for profit. Partnerships account for about 10 percent of all businesses, and they are typically larger than sole proprietorships. Finance, insurance, and real estate firms are the most common types of partnership. Public accounting and stock brokerage partnerships often have large numbers of partners.

Most partnerships are established by a written contract known as **articles of partnership.** In a *general* (or *regular*) *partnership,* all partners have unlimited liability, and each partner is legally liable for all of the debts of the partnership. Strengths and weaknesses of partnerships are summarized in Table 1.1.

Corporations

corporation
An artificial being created by law (often called a "legal entity").

Hint For many small corporations, as well as small proprietorships and partnerships, there is no access to financial markets. In addition, whenever the owners take out a loan, they usually must personally cosign the loan.

A **corporation** is an artificial being created by law. Often called a "legal entity," a corporation has the powers of an individual in that it can sue and be sued, make and be party to contracts, and acquire property in its own name. Although only about 15 percent of all businesses are incorporated, the corporation is the dominant form of business organization in terms of receipts and profits. It accounts for nearly 90 percent of business receipts and 80 percent of net profits. Although

TABLE 1.1 Strengths and Weaknesses of the Common Legal Forms of Business Organization

	Sole proprietorship	Partnership	Corporation
Strengths	• Owner receives all profits (and sustains all losses) • Low organizational costs • Income included and taxed on proprietor's personal tax return • Independence • Secrecy • Ease of dissolution	• Can raise more funds than sole proprietorships • Borrowing power enhanced by more owners • More available brain power and managerial skill • Income included and taxed on partner's tax return	• Owners have *limited liability,* which guarantees that they cannot lose more than they invested • Can achieve large size via sale of stock • Ownership (stock) is readily transferable • Long life of firm • Can hire professional managers • Has better access to financing • Receives certain tax advantages
Weaknesses	• Owner has *unlimited liability*—total wealth can be taken to satisfy debts • Limited fund-raising power tends to inhibit growth • Proprietor must be jack-of-all-trades • Difficult to give employees long-run career opportunities • Lacks continuity when proprietor dies	• Owners have *unlimited liability* and may have to cover debts of other partners • Partnership is dissolved when a partner dies • Difficult to liquidate or transfer partnership	• Taxes generally higher, because corporate income is taxed, and dividends paid to owners are also taxed • More expensive to organize than other business forms • Subject to greater government regulation • Lacks secrecy, because stockholders must receive financial reports

stockholders
The owners of a corporation, whose ownership, or *equity,* is evidenced by either common stock or preferred stock.

common stock
The purest and most basic form of corporate ownership.

dividends
Periodic distributions of earnings to the stockholders of a firm.

board of directors
Group elected by the firm's stockholders and having ultimate authority to guide corporate affairs and make general policy.

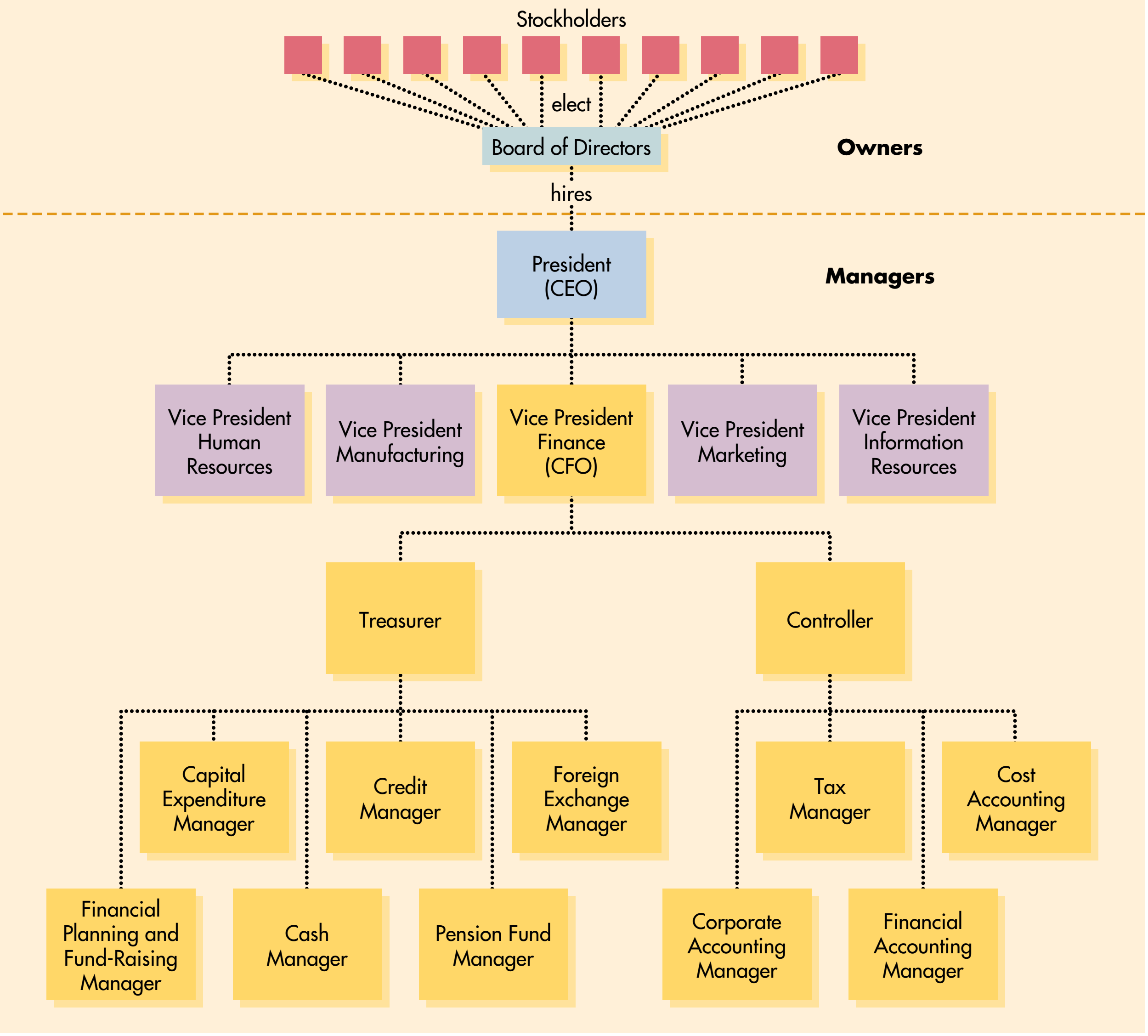
corporations are involved in all types of businesses, manufacturing corporations account for the largest portion of corporate business receipts and net profits. The key strengths and weaknesses of large corporations are summarized in Table 1.1.

The owners of a corporation are its **stockholders,** whose ownership, or *equity,* is evidenced by either common stock or preferred stock.[1] These forms of ownership are defined and discussed in Chapter 7; at this point suffice it to say that **common stock** is the purest and most basic form of corporate ownership. Stockholders expect to earn a return by receiving **dividends**—periodic distributions of earnings—or by realizing gains through increases in share price.

As noted in the upper portion of Figure 1.1, the stockholders vote periodically to elect the members of the board of directors and to amend the firm's corporate charter. The **board of directors** has the ultimate authority in guiding corporate affairs and in making general policy. The directors include key corporate personnel as well as outside individuals who typically are successful businesspeople and executives of other major organizations. Outside directors for major corporations are generally paid an annual fee of $10,000 to $20,000 or more. Also, they are

1. Some corporations do not have stockholders but rather have "members" who often have rights similar to those of stockholders—that is, they are entitled to vote and receive dividends. Examples include mutual savings banks, credit unions, mutual insurance companies, and a whole host of charitable organizations.

FIGURE 1.1 **Corporate Organization**
The general organization of a corporation and the finance function (which is shown in yellow)



frequently granted options to buy a specified number of shares of the firm's stock at a stated—and often attractive—price.

president or chief executive officer (CEO)
Corporate official responsible for managing the firm's day-to-day operations and carrying out the policies established by the board of directors.

The **president** or **chief executive officer** (**CEO**) is responsible for managing day-to-day operations and carrying out the policies established by the board. The CEO is required to report periodically to the firm's directors.

It is important to note the division between owners and managers in a large corporation, as shown by the dashed horizontal line in Figure 1.1. This separation and some of the issues surrounding it will be addressed in the discussion of *the agency issue* later in this chapter.

Other Limited Liability Organizations

limited partnership (LP)
S corporation (S corp)
limited liability corporation (LLC)
limited liability partnership (LLP)
See Table 1.2.

A number of other organizational forms provide owners with limited liability. The most popular are **limited partnerships** (LPs), **S corporations** (S corps), **limited liability corporations** (LLCs), and **limited liability partnerships** (LLPs). Each represents a specialized form or blending of the characteristics of the organizational forms described before. What they have in common is that their owners enjoy limited liability, and they typically have fewer than 100 owners. Each of these limited liability organizations is briefly described in Table 1.2.

The Study of Managerial Finance

An understanding of the theories, concepts, techniques, and practices presented throughout this text will fully acquaint you with the financial manager's activities and decisions. Because most business decisions are measured in financial terms, the financial manager plays a key role in the operation of the firm. People in all areas of responsibility—accounting, information systems, management, marketing, operations, and so forth—need a basic understanding of the managerial finance function.

All managers in the firm, regardless of their job descriptions, work with financial personnel to justify laborpower requirements, negotiate operating budgets, deal with financial performance appraisals, and sell proposals at least partly on the basis of their financial merits. Clearly, those managers who understand the finan-

TABLE 1.2 Other Limited Liability Organizations

Organization	Description
Limited partnership (LP)	A partnership in which one or more partners have limited liability as long as at least *one* partner (the general partner) has unlimited liability. The *limited partners* cannot take an active role in the firm's management; they are passive investors.
S corporation (S corp)	A tax-reporting entity that (under Subchapter S of the Internal Revenue Code) allows certain corporations with 75 or fewer stockholders to choose to be taxed as partnerships. Its stockholders receive the organizational benefits of a corporation and the tax advantages of a partnership. But S corps lose certain tax advantages related to pension plans.
Limited liability corporation (LLC)	Permitted in most states, the LLC gives its owners, like those of S corps, limited liability and taxation as a partnership. But unlike an S corp, the LLC can own more than 80% of another corporation, and corporations, partnerships, or non-U.S. residents can own LLC shares. LLCs work well for corporate joint ventures or projects developed through a subsidiary.
Limited liability partnership (LLP)[a]	A partnership permitted in many states; governing statutes vary by state. All LLP partners have limited liability. They are liable for their own acts of malpractice, not for those of other partners. The LLP is taxed as a partnership. LLPs are frequently used by legal and accounting professionals.

[a]In recent years this organizational form has begun to replace *professional corporations* or *associations*—corporations formed by groups of professionals such as attorneys and accountants that provide limited liability except for that related to malpractice—because of the tax advantages it offers.

TABLE 1.3 Career Opportunities in Managerial Finance

Position	Description
Financial analyst	Primarily prepares the firm's financial plans and budgets. Other duties include financial forecasting, performing financial comparisons, and working closely with accounting.
Capital expenditures manager	Evaluates and recommends proposed asset investments. May be involved in the financial aspects of implementing approved investments.
Project finance manager	In large firms, arranges financing for approved asset investments. Coordinates consultants, investment bankers, and legal counsel.
Cash manager	Maintains and controls the firm's daily cash balances. Frequently manages the firm's cash collection and disbursement activities and short-term investments; coordinates short-term borrowing and banking relationships.
Credit analyst/manager	Administers the firm's credit policy by evaluating credit applications, extending credit, and monitoring and collecting accounts receivable.
Pension fund manager	In large companies, oversees or manages the assets and liabilities of the employees' pension fund.
Foreign exchange manager	Manages specific foreign operations and the firm's exposure to fluctuations in exchange rates.

cial decision-making process will be better able to address financial concerns and will therefore more often get the resources they need to attain their own goals. The "Across the Disciplines" element that appears on each chapter-opening page should help you understand some of the many interactions between managerial finance and other business careers.

As you study this text, you will learn about the career opportunities in managerial finance, which are briefly described in Table 1.3. Although this text focuses on publicly held profit-seeking firms, the principles presented here are equally applicable to private and not-for-profit organizations. The decision-making principles developed in this text can also be applied to personal financial decisions. I hope that this first exposure to the exciting field of finance will provide the foundation and initiative for further study and possibly even a future career.

Review Questions

1–1 What is *finance?* Explain how this field affects the lives of everyone and every organization.

1–2 What is the *financial services* area of finance? Describe the field of *managerial finance*.

1–3 Which legal form of business organization is most common? Which form is dominant in terms of business receipts and net profits?

1–4 Describe the roles and the basic relationship among the major parties in a corporation—stockholders, board of directors, and president. How are corporate owners compensated?

1–5 Briefly name and describe some organizational forms other than corporations that provide owners with limited liability.

1–6 Why is the study of managerial finance important regardless of the specific area of responsibility one has within the business firm?

LG2 LG3 1.2 The Managerial Finance Function

People in all areas of responsibility within the firm must interact with finance personnel and procedures to get their jobs done. For financial personnel to make useful forecasts and decisions, they must be willing and able to talk to individuals in other areas of the firm. The managerial finance function can be broadly described by considering its role within the organization, its relationship to economics and accounting, and the primary activities of the financial manager.

Organization of the Finance Function

treasurer
The firm's chief financial manager, who is responsible for the firm's financial activities, such as financial planning and fund raising, making capital expenditure decisions, and managing cash, credit, the pension fund, and foreign exchange.

controller
The firm's chief accountant, who is responsible for the firm's accounting activities, such as corporate accounting, tax management, financial accounting, and cost accounting.

Hint A *controller* is sometimes referred to as a *comptroller*. Not-for-profit and governmental organizations frequently use the title of comptroller.

foreign exchange manager
The manager responsible for monitoring and managing the firm's exposure to loss from currency fluctuations.

The size and importance of the managerial finance function depend on the size of the firm. In small firms, the finance function is generally performed by the accounting department. As a firm grows, the finance function typically evolves into a separate department linked directly to the company president or CEO through the chief financial officer (CFO). The lower portion of the organizational chart in Figure 1.1 (on page 7) shows the structure of the finance function in a typical medium-to-large-size firm.

Reporting to the CFO are the treasurer and the controller. The **treasurer** (the chief financial manager) is commonly responsible for handling financial activities, such as financial planning and fund raising, making capital expenditure decisions, managing cash, managing credit activities, managing the pension fund, and managing foreign exchange. The **controller** (the chief accountant) typically handles the accounting activities, such as corporate accounting, tax management, financial accounting, and cost accounting. The treasurer's focus tends to be more external, the controller's focus more internal. *The activities of the treasurer, or financial manager, are the primary concern of this text.*

If international sales or purchases are important to a firm, it may well employ one or more finance professionals whose job is to monitor and manage the firm's exposure to loss from currency fluctuations. A trained financial manager can "hedge," or protect against such a loss, at reasonable cost by using a variety of financial instruments. These **foreign exchange managers** typically report to the firm's treasurer.

Relationship to Economics

marginal analysis
Economic principle that states that financial decisions should be made and actions taken only when the added benefits exceed the added costs.

The field of finance is closely related to economics. Financial managers must understand the economic framework and be alert to the consequences of varying levels of economic activity and changes in economic policy. They must also be able to use economic theories as guidelines for efficient business operation. Examples include supply-and-demand analysis, profit-maximizing strategies, and price theory. The primary economic principle used in managerial finance is **marginal analysis,** the principle that financial decisions should be made and actions taken only when the added benefits exceed the added costs. Nearly all financial decisions ultimately come down to an assessment of their marginal benefits and marginal costs.

EXAMPLE

Jamie Teng is a financial manager for Nord Department Stores, a large chain of upscale department stores operating primarily in the western United States. She is currently trying to decide whether to replace one of the firm's online computers with a new, more sophisticated one that would both speed processing and handle a larger volume of transactions. The new computer would require a cash outlay of $80,000, and the old computer could be sold to net $28,000. The total benefits from the new computer (measured in today's dollars) would be $100,000. The benefits over a similar time period from the old computer (measured in today's dollars) would be $35,000. Applying marginal analysis, Jamie organizes the data as follows:

Benefits with new computer	$100,000	
Less: Benefits with old computer	35,000	
(1) Marginal (added) benefits		$65,000
Cost of new computer	$ 80,000	
Less: Proceeds from sale of old computer	28,000	
(2) Marginal (added) costs		52,000
Net benefit [(1) − (2)]		$13,000

Because the marginal (added) benefits of $65,000 exceed the marginal (added) costs of $52,000, Jamie recommends that the firm purchase the new computer to replace the old one. The firm will experience a net benefit of $13,000 as a result of this action.

Relationship to Accounting

The firm's finance (treasurer) and accounting (controller) activities are closely related and generally overlap. Indeed, managerial finance and accounting are not often easily distinguishable. In small firms the controller often carries out the finance function, and in large firms many accountants are closely involved in various finance activities. However, there are two basic differences between finance and accounting; one is related to the emphasis on cash flows and the other to decision making.

Emphasis on Cash Flows

accrual basis
In preparation of financial statements, recognizes revenue at the time of sale and recognizes expenses when they are incurred.

cash basis
Recognizes revenues and expenses only with respect to actual inflows and outflows of cash.

The accountant's primary function is to develop and report data for measuring the performance of the firm, assessing its financial position, and paying taxes. Using certain standardized and generally accepted principles, the accountant prepares financial statements that recognize revenue at the time of sale (whether payment has been received or not) and recognize expenses when they are incurred. This approach is referred to as the **accrual basis.**

The financial manager, on the other hand, places primary emphasis on *cash flows,* the intake and outgo of cash. He or she maintains the firm's solvency by planning the cash flows necessary to satisfy its obligations and to acquire assets needed to achieve the firm's goals. The financial manager uses this **cash basis** to recognize the revenues and expenses only with respect to actual inflows and outflows of cash.

Regardless of its profit or loss, a firm must have a sufficient flow of cash to meet its obligations as they come due.

EXAMPLE Nassau Corporation, a small yacht dealer, sold one yacht for $100,000 in the calendar year just ended. The yacht was purchased during the year at a total cost of $80,000. Although the firm paid in full for the yacht during the year, at year-end it has yet to collect the $100,000 from the customer. The accounting view and the financial view of the firm's performance during the year are given by the following income and cash flow statements, respectively.

Accounting View (accrual basis)		Financial View (cash basis)	
Nassau Corporation Income Statement for the Year Ended 12/31		Nassau Corporation Cash Flow Statement for the Year Ended 12/31	
Sales revenue	$100,000	Cash inflow	$ 0
Less: Costs	80,000	Less: Cash outflow	80,000
Net profit	$ 20,000	Net cash flow	($80,000)

In an accounting sense Nassau Corporation is profitable, but in terms of actual cash flow it is a financial failure. Its lack of cash flow resulted from the uncollected account receivable of $100,000. Without adequate cash inflows to meet its obligations, the firm will not survive, regardless of its level of profits.

Hint The primary emphasis of accounting is on accrual methods; the primary emphasis of financial management is on cash flow methods.

As the example shows, accrual accounting data do not fully describe the circumstances of a firm. Thus the financial manager must look beyond financial statements to obtain insight into existing or developing problems. Of course, accountants are well aware of the importance of cash flows, and financial managers use and understand accrual-based financial statements. Nevertheless, the financial manager, by concentrating on cash flows, should be able to avoid insolvency and achieve the firm's financial goals.

Decision Making

The second major difference between finance and accounting has to do with decision making. Accountants devote most of their attention to the *collection and presentation of financial data*. Financial managers evaluate the accounting statements, develop additional data, and *make decisions* on the basis of their assessment of the associated returns and risks. Of course, this does not mean that accountants never make decisions or that financial managers never gather data. Rather, the primary focuses of accounting and finance are distinctly different.

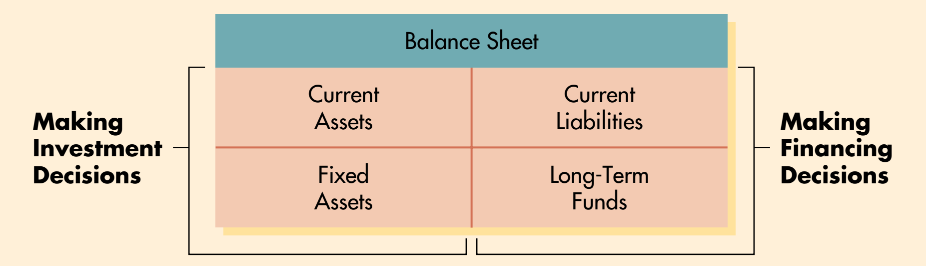
Primary Activities of the Financial Manager

In addition to ongoing involvement in financial analysis and planning, the financial manager's primary activities are making investment decisions and making financing decisions. Investment decisions determine both the mix and the type of

FIGURE 1.2

Financial Activities

Primary activities of the financial manager



assets held by the firm. Financing decisions determine both the mix and the type of financing used by the firm. These sorts of decisions can be conveniently viewed in terms of the firm's balance sheet, as shown in Figure 1.2. However, the decisions are actually made on the basis of their cash flow effects on the overall value of the firm.

Review Questions

1–7 What financial activities is the treasurer, or financial manager, responsible for handling in the mature firm?

1–8 What is the primary economic principle used in managerial finance?

1–9 What are the major differences between accounting and finance with respect to emphasis on cash flows and decision making?

1–10 What are the two primary activities of the financial manager that are related to the firm's balance sheet?

LG4 1.3 Goal of the Firm

As noted earlier, the owners of a corporation are normally distinct from its managers. Actions of the financial manager should be taken to achieve the objectives of the firm's owners, its stockholders. In most cases, if financial managers are successful in this endeavor, they will also achieve their own financial and professional objectives. Thus financial managers need to know what the objectives of the firm's owners are.

Maximize Profit?

Some people believe that the firm's objective is always to maximize profit. To achieve this goal, the financial manager would take only those actions that were expected to make a major contribution to the firm's overall profits. For each alternative being considered, the financial manager would select the one that is expected to result in the highest monetary return.

earnings per share (EPS)
The amount earned during the period on behalf of each outstanding share of common stock, calculated by dividing the period's total earnings available for the firm's common stockholders by the number of shares of common stock outstanding.

Corporations commonly measure profits in terms of **earnings per share (EPS)**, which represent the amount earned during the period on behalf of each outstanding share of common stock. EPS are calculated by dividing the period's total earnings available for the firm's common stockholders by the number of shares of common stock outstanding.

EXAMPLE Nick Dukakis, the financial manager of Neptune Manufacturing, a producer of marine engine components, is choosing between two investments, Rotor and Valve. The following table shows the EPS that each investment is expected to have over its 3-year life.

	Earnings per share (EPS)			
Investment	Year 1	Year 2	Year 3	Total for years 1, 2, and 3
Rotor	$1.40	$1.00	$0.40	$2.80
Valve	0.60	1.00	1.40	3.00

In terms of the profit maximization goal, Valve would be preferred over Rotor, because it results in higher total earnings per share over the 3-year period ($3.00 EPS compared with $2.80 EPS).

But is profit maximization a reasonable goal? No. It fails for a number of reasons: It ignores (1) the timing of returns, (2) cash flows available to stockholders, and (3) risk.[2]

Timing

Because the firm can earn a return on funds it receives, *the receipt of funds sooner rather than later is preferred*. In our example, in spite of the fact that the total earnings from Rotor are smaller than those from Valve, Rotor provides much greater earnings per share in the first year. The larger returns in year 1 could be reinvested to provide greater future earnings.

Cash Flows

Profits do *not* necessarily result in cash flows available to the stockholders. Owners receive cash flow in the form of either cash dividends paid them or the proceeds from selling their shares for a higher price than initially paid. Greater EPS do not necessarily mean that a firm's board of directors will vote to increase dividend payments.

Furthermore, higher EPS do not necessarily translate into a higher stock price. Firms sometimes experience earnings increases without any correspondingly favorable change in stock price. Only when earnings increases are accompanied by increased future cash flows would a higher stock price be expected. For example, a firm in a highly competitive technology-driven business could increase its earnings by significantly reducing its research and development expenditures. As a result the firm's expenses would be reduced, thereby increasing its profits. But because of its impaired competitive position, the firm's stock price would drop, as many well-informed investors sell the stock in recognition of lower future cash flows. In this case, the earnings increase was accompanied by lower future cash flows and therefore a lower stock price.

2. Another criticism of profit maximization is the potential for profit manipulation through the creative use of elective accounting practices.

Risk

risk
The chance that actual outcomes may differ from those expected.

Profit maximization also disregards **risk**—the chance that actual outcomes may differ from those expected. A basic premise in managerial finance is that a tradeoff exists between return (cash flow) and risk. *Return and risk are in fact the key determinants of share price, which represents the wealth of the owners in the firm.*

Hint This is one of the most important concepts in the book. Investors who seek to avoid risk will *always* require a bigger reward for taking bigger risks.

Cash flow and risk affect share price differently: Higher cash flow is generally associated with a higher share price. Higher risk tends to result in a lower share price because the stockholder must be compensated for the greater risk. For example, if a lawsuit claiming significant damages is filed against a company, its share price typically will drop immediately. This occurs not because of any near-term cash flow reduction but in response to the firm's increased risk—there's a chance that the firm will have to pay out a large amount of cash some time in the future to eliminate or fully satisfy the claim. Simply put, the increased risk reduces the firm's share price. In general, stockholders are **risk-averse**—that is, they want to avoid risk. When risk is involved, stockholders expect to earn higher rates of return on investments of higher risk and lower rates on lower-risk investments. The key point, which will be fully developed in Chapter 5, is that differences in risk can significantly affect the value of an investment.

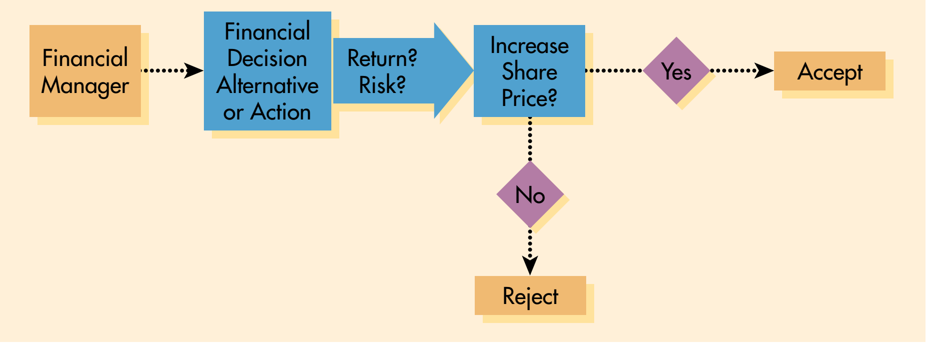
risk-averse
Seeking to avoid risk.

Because profit maximization does not achieve the objectives of the firm's owners, it should *not* be the goal of the financial manager.

Maximize Shareholder Wealth

The goal of the firm, and therefore of all managers and employees, is *to maximize the wealth of the owners for whom it is being operated.* The wealth of corporate owners is measured by the share price of the stock, which in turn is based on the timing of returns (cash flows), their magnitude, and their risk. When considering each financial decision alternative or possible action in terms of its impact on the share price of the firm's stock, *financial managers should accept only those actions that are expected to increase share price.* Figure 1.3 depicts this process. Because share price represents the owners' wealth in the firm, maximizing share price will maximize owner wealth. Note that *return (cash flows) and risk are the key decision variables in maximizing owner wealth.* It is important to recognize that earnings per share (EPS), because they are viewed as an indicator of the

FIGURE 1.3
Share Price Maximization
Financial decisions and share price



In Practice

FOCUS ON PRACTICE Creating Shareholder Value and WaMu

Once a small Northwest thrift, **Washington Mutual** (WaMu) is now the nation's largest savings institution and the seventh largest U.S. bank. Its financial performance has been as exceptional as its rapid growth. Under the financial leadership of CFO William Longbrake, its assets grew 10-fold (to $220 billion) in a recent 5-year period, earnings rose an average of 18.6 percent per year, and the stock price nearly tripled.

How has WaMu's management team increased shareholder value so much? Four major acquisitions played an important role in adding branch networks. Greater penetration in existing markets has also been a driver. Another differentiating factor is the "pay for performance" plan that Longbrake introduced. The compensation plan encourages all employees, from managers to tellers, to cross-sell products and to give customers the highest level of service possible. As a result, the number of customers and the profits per customer have soared, helped along by a clever advertising campaign that emphasizes WaMu's personal service.

But it's not enough to grow revenues if expenses aren't under control. At the same time as its revenues grew, the bank's operating efficiency improved significantly, the best among WaMu's major competitors.

Longbrake and his financial managers continually look for ways to boost revenues and improve earnings. A successful campaign to increase noninterest income from depositor and other retail banking fees, which are not subject to interest-rate movements, lessened the effect on earnings of changes in interest rates. Another strategy was to sell off all but the most profitable single-family mortgages in the bank's loan portfolio. In spite of interest-rate fluctuations in 2000, WaMu earned $1.9 billion—its most profitable year ever. The bank continued to post record results in 2001, as interest rates fell, by increasing mortgage origination and refinancing activities. As a result, the firm even increased cash dividends at a time when many companies were cutting them. Clearly, Longbrake and his managers' actions were effective in creating value for WaMu's shareholders.

Sources: Adapted from Stephen Barr, "The Revenue Revolution at Washington Mutual," *CFO,* October 2001, downloaded from *www.cfo.com;* "Washington Mutual Profits Rise 84 Percent," October 16, 2001, *Reuters Business Report,* downloaded from eLibrary, *ask.elibrary.com;* Washington Mutual Web site, *www.wamu.com.*

firm's future returns (cash flows), often appear to affect share price. Two important issues related to maximizing share price are economic value added (EVA®) and the focus on stakeholders.

Economic Value Added (EVA®)

economic value added (EVA®)
A popular measure used by many firms to determine whether an investment contributes positively to the owners' wealth; calculated by subtracting the cost of funds used to finance an investment from its after-tax operating profits.

Economic value added (EVA®) is a popular measure used by many firms to determine whether an investment—proposed or existing—contributes positively to the owners' wealth.[3] EVA® is calculated by subtracting the cost of funds used to finance an investment from its after-tax operating profits. Investments with positive EVA®s increase shareholder value and those with negative EVA®s reduce shareholder value. Clearly, only those investments with positive EVA®s are desirable. For example, the EVA® of an investment with after-tax operating profits of $410,000 and associated financing costs of $375,000 would be $35,000 (i.e., $410,000 – $375,000). Because this EVA® is positive, the investment is expected to increase owner wealth and is therefore acceptable. (EVA®-type models are discussed in greater detail as part of the coverage of stock valuation in Chapter 7.)

3. For a good summary of economic value added (EVA®), see Shaun Tully, "The Real Key to Creating Wealth," *Fortune* (September 20, 1993), pp. 38–49.

What About Stakeholders?

Although maximization of shareholder wealth is the primary goal, many firms broaden their focus to include the interests of *stakeholders* as well as shareholders. **Stakeholders** are groups such as employees, customers, suppliers, creditors, owners, and others who have a direct economic link to the firm. A firm with a *stakeholder focus* consciously avoids actions that would prove detrimental to stakeholders. The goal is not to maximize stakeholder well-being but to preserve it.

stakeholders
Groups such as employees, customers, suppliers, creditors, owners, and others who have a direct economic link to the firm.

The stakeholder view does not alter the goal of maximizing shareholder wealth. Such a view is often considered part of the firm's "social responsibility." It is expected to provide long-run benefit to shareholders by maintaining positive stakeholder relationships. Such relationships should minimize stakeholder turnover, conflicts, and litigation. Clearly, the firm can better achieve its goal of shareholder wealth maximization by fostering cooperation with its other stakeholders, rather than conflict with them.

The Role of Ethics

In recent years, the ethics of actions taken by certain businesses have received major media attention. Examples include an agreement by American Express Co. in early 2002 to pay $31 million to settle a sex- and age-discrimination lawsuit filed on behalf of more than 4,000 women who said they were denied equal pay and promotions; Enron Corp.'s key executives indicating to employee-shareholders in mid-2001 that the firm's then-depressed stock price would soon recover while, at the same time, selling their own shares and, not long after, taking the firm into bankruptcy; and Liggett & Meyers' early 1999 agreement to fund the payment of more than $1 billion in smoking-related health claims.

ethics
Standards of conduct or moral judgment.

Clearly, these and similar actions have raised the question of **ethics—**standards of conduct or moral judgment. Today, the business community in general and the financial community in particular are developing and enforcing ethical standards. The goal of these ethical standards is to motivate business and market participants to adhere to both the letter and the spirit of laws and regulations concerned with business and professional practice. Most business leaders believe businesses actually strengthen their competitive positions by maintaining high ethical standards.

Considering Ethics

Robert A. Cooke, a noted ethicist, suggests that the following questions be used to assess the ethical viability of a proposed action.[4]

1. Is the action arbitrary or capricious? Does it unfairly single out an individual or group?
2. Does the action violate the moral or legal rights of any individual or group?
3. Does the action conform to accepted moral standards?
4. Are there alternative courses of action that are less likely to cause actual or potential harm?

4. Robert A. Cooke, "Business Ethics: A Perspective," in *Arthur Andersen Cases on Business Ethics* (Chicago: Arthur Andersen, September 1991), pp. 2 and 5.

In Practice

FOCUS ON ETHICS "Doing Well by Doing Good"

Hewlett-Packard (H-P) was founded in 1939 by Bill Hewlett and Dave Packard on the basis of principles of fair dealing and respect—long before anyone coined the expression "corporate social responsibility." H-P credits its ongoing commitment to "doing well by doing good" as a major reason why employees, suppliers, customers, and shareholders seek it out. H-P is clear on its obligation to increase the market value of its common stock, yet it strives to maintain the integrity of each employee in every country in which it does business. Its "Standards of Business Conduct" include a provision that triggers immediate dismissal of any employee who is found to have told a lie. Its internal auditors are expected to adhere to all of these standards, which set forth the "highest principles of business ethics and conduct," according to H-P's 2000 annual report.

Maximizing shareholder wealth is what some call a "moral imperative," in that stockholders are owners with property rights, and in that managers as stewards are obliged to look out for owners' interests. Many times, doing what is right is consistent with maximizing the stock price, but what if integrity causes a company to lose a contract or causes analysts to reduce the rating of the stock from "buy" to "sell"? The objective to maximize shareholder wealth holds, but company officers must do so within ethical constraints. Those constraints occasionally limit the alternative actions from which managers may choose. Some critics have mistakenly assumed that the objective of maximizing shareholder wealth is somehow the cause of unethical behavior, ignoring the fact that *any* business goal might be cited as a factor pressuring individuals to be unethical.

U.S. business professionals have tended to operate from within a strong moral framework based on early-childhood moral development that takes place in families and religious institutions. This does not prevent all ethical lapses, obviously. But it is not surprising that chief financial officers declare that the number-1 personal attribute that finance grads need is ethics—which they rank above interpersonal skills, communication skills, decision-making ability, and computer skills. H-P is aware of this need and has institutionalized it in the company's culture and policies.

Clearly, considering such questions before taking an action can help to ensure its ethical viability. Specifically, Cooke suggests that the impact of a proposed decision should be evaluated from a number of perspectives before it is finalized:

1. Are the rights of any stakeholder being violated?
2. Does the firm have any overriding duties to any stakeholder?
3. Will the decision benefit any stakeholder to the detriment of another stakeholder?
4. If there is detriment to any stakeholder, how should this be remedied, if at all?
5. What is the relationship between stockholders and other stakeholders?

Today, more and more firms are directly addressing the issue of ethics by establishing corporate ethics policies and requiring employee compliance with them. Frequently, employees are required to sign a formal pledge to uphold the firm's ethics policies. Such policies typically apply to employee actions in dealing with all corporate stakeholders, including the public. Many companies also require employees to participate in ethics seminars and training programs. To provide further insight into the ethical dilemmas and issues sometimes facing the financial manager, a number of the *In Practice* boxes appearing throughout this book are labeled to note their focus on ethics.

Ethics and Share Price

An effective ethics program is believed to enhance corporate value. An ethics program can produce a number of positive benefits. It can reduce potential litigation and judgment costs; maintain a positive corporate image; build shareholder confidence; and gain the loyalty, commitment, and respect of the firm's stakeholders. Such actions, by maintaining and enhancing cash flow and reducing perceived risk, can positively affect the firm's share price. *Ethical behavior is therefore viewed as necessary for achieving the firm's goal of owner wealth maximization.*[5]

The Agency Issue

We have seen that the goal of the financial manager should be to maximize the wealth of the firm's owners. Thus managers can be viewed as *agents* of the owners who have hired them and given them decision-making authority to manage the firm. Technically, any manager who owns less than 100 percent of the firm is to some degree an agent of the other owners. This separation of owners and managers is shown by the dashed horizontal line in Figure 1.1 on page 7.

In theory, most financial managers would agree with the goal of owner wealth maximization. In practice, however, managers are also concerned with their personal wealth, job security, and fringe benefits. Such concerns may make managers reluctant or unwilling to take more than moderate risk if they perceive that taking too much risk might jeopardize their jobs or reduce their personal wealth. The result is a less-than-maximum return and a potential loss of wealth for the owners.

Hint A stockbroker confronts the same issue. If she gets you to buy and sell more stock, it's good for *her,* but it may *not* be good for you.

The Agency Problem

agency problem
The likelihood that managers may place personal goals ahead of corporate goals.

From this conflict of owner and personal goals arises what has been called the **agency problem,** the likelihood that managers may place personal goals ahead of corporate goals.[6] Two factors—market forces and *agency costs*—serve to prevent or minimize agency problems.

Market Forces One market force is *major shareholders,* particularly large institutional investors such as mutual funds, life insurance companies, and pension funds. These holders of large blocks of a firm's stock exert pressure on management to perform. When necessary, they exercise their voting rights as stockholders to replace underperforming management.

5. For an excellent discussion of this and related issues by a number of finance academics and practitioners who have given a lot of thought to financial ethics, see James S. Ang, "On Financial Ethics," *Financial Management* (Autumn 1993), pp. 32–59.

6. The agency problem and related issues were first addressed by Michael C. Jensen and William H. Meckling, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics* 3 (October 1976), pp. 305–306. For an excellent discussion of Jensen and Meckling and subsequent research on the agency problem, see William L. Megginson, *Corporate Finance Theory* (Boston, MA: Addison Wesley, 1997), Chapter 2.

agency costs
The costs borne by stockholders to minimize agency problems.

incentive plans
Management compensation plans that tend to tie management compensation to share price; most popular incentive plan involves the grant of *stock options.*

stock options
An incentive allowing managers to purchase stock at the market price set at the time of the grant.

performance plans
Plans that tie management compensation to measures such as EPS, growth in EPS, and other ratios of return. *Performance shares* and/or *cash bonuses* are used as compensation under these plans.

performance shares
Shares of stock given to management for meeting stated performance goals.

cash bonuses
Cash paid to management for achieving certain performance goals.

Another market force is the *threat of takeover* by another firm that believes it can enhance the target firm's value to restructuring its management, operations, and financing.[7] The constant threat of a takeover tends to motivate management to act in the best interests of the firm's owners.

Agency Costs To minimize agency problems and contribute to the maximization of owners' wealth, stockholders incur **agency costs.** These are the costs of monitoring management behavior, ensuring against dishonest acts of management, and giving managers the financial incentive to maximize share price.

The most popular, powerful, and expensive approach is to *structure management compensation* to correspond with share price maximization. The objective is to give managers incentives to act in the best interests of the owners. In addition, the resulting compensation packages allow firms to compete for and hire the best managers available. The two key types of compensation plans are incentive plans and performance plans.

Incentive plans tend to tie management compensation to share price. The most popular incentive plan is the granting of **stock options** to management. These options allow managers to purchase stock at the market price set at the time of the grant. If the market price rises, managers will be rewarded by being able to resell the shares at the higher market price.

Many firms also offer **performance plans,** which tie management compensation to measures such as earnings per share (EPS), growth in EPS, and other ratios of return. **Performance shares,** shares of stock given to management as a result of meeting the stated performance goals, are often used in these plans. Another form of performance-based compensation is **cash bonuses,** cash payments tied to the achievement of certain performance goals.

The Current View of Management Compensation

The execution of many compensation plans has been closely scrutinized in recent years. Both individuals and institutional stockholders, as well as the Securities and Exchange Commission (SEC), have publicly questioned the appropriateness of the multimillion-dollar compensation packages that many corporate executives receive. For example, the three highest-paid CEOs in 2001 were (1) Lawrence Ellison, of Oracle, who earned $706.1 million; (2) Jozef Straus, of JDS Uniphase, who earned $150.8 million; and (3) Howard Solomon, of Forest Laboratories, who earned $148.5 million. Tenth on the same list was Timothy Koogle, of Yahoo!, who earned $64.6 million. During 2001, the compensation of the average CEO of a major U.S. corporation declined by about 16 percent from 2000. CEOs of 365 of the largest U.S. companies surveyed by *Business Week,* using data from Standard & Poor's EXECUCOMP, earned an average of $11 million in total compensation; the average for the 20 highest paid CEOs was $112.5 million.

Recent studies have failed to find a strong relationship between CEO compensation and share price. Publicity surrounding these large compensation packages (without corresponding share price performance) is expected to drive down

7. Detailed discussion of the important aspects of corporate takeovers is included in Chapter 17, "Mergers, LBOs, Divestitures, and Business Failure."

executive compensation in the future. Contributing to this publicity is the SEC requirement that publicly traded companies disclose to shareholders and others both the amount of compensation to their highest paid executives and the method used to determine it. At the same time, new compensation plans that better link managers' performance with regard to shareholder wealth to their compensation are expected to be developed and implemented.

Unconstrained, managers may have other goals in addition to share price maximization, but much of the evidence suggests that share price maximization—the focus of this book—is the primary goal of most firms.

Review Questions

1–11 For what three basic reasons is profit maximization inconsistent with wealth maximization?

1–12 What is *risk?* Why must risk as well as return be considered by the financial manager who is evaluating a decision alternative or action?

1–13 What is the goal of the firm and therefore of all managers and employees? Discuss how one measures achievement of this goal.

1–14 What is *economic value added (EVA®)?* How is it used?

1–15 Describe the role of corporate ethics policies and guidelines, and discuss the relationship that is believed to exist between ethics and share price.

1–16 How do market forces, both shareholder activism and the threat of takeover, act to prevent or minimize the *agency problem?*

1–17 Define *agency costs,* and explain why firms incur them. How can management *structure management compensation* to minimize agency problems? What is the current view with regard to the execution of many compensation plans?

LG5 1.4 Financial Institutions and Markets

Most successful firms have ongoing needs for funds. They can obtain funds from external sources in three ways. One is through a *financial institution* that accepts savings and transfers them to those that need funds. Another is through *financial markets,* organized forums in which the suppliers and demanders of various types of funds can make transactions. A third is through *private placement*. Because of the unstructured nature of private placements, here we focus primarily on financial institutions and financial markets.

financial institution
An intermediary that channels the savings of individuals, businesses, and governments into loans or investments.

Financial Institutions

Hint Think about how inefficient it would be if each individual saver had to negotiate with each potential user of savings. Institutions make the process very efficient by becoming intermediaries between savers and users.

Financial institutions serve as intermediaries by channeling the savings of individuals, businesses, and governments into loans or investments. Many financial institutions directly or indirectly pay savers interest on deposited funds; others provide services for a fee (for example, checking accounts for which customers pay service charges). Some financial institutions accept customers' savings deposits and lend this money to other customers or to firms; others invest customers' savings in earning assets such as real estate or stocks and bonds; and some do both. Financial institutions are required by the government to operate within established regulatory guidelines.

Key Customers of Financial Institutions

The key suppliers of funds to financial institutions and the key demanders of funds from financial institutions are individuals, businesses, and governments. The savings that individual consumers place in financial institutions provide these institutions with a large portion of their funds. Individuals not only supply funds to financial institutions but also demand funds from them in the form of loans. However, individuals as a group are the *net suppliers* for financial institutions: They save more money than they borrow.

Business firms also deposit some of their funds in financial institutions, primarily in checking accounts with various commercial banks. Like individuals, firms also borrow funds from these institutions, but firms are *net demanders* of funds. They borrow more money than they save.

Governments maintain deposits of temporarily idle funds, certain tax payments, and Social Security payments in commercial banks. They do not borrow funds *directly* from financial institutions, although by selling their debt securities to various institutions, governments indirectly borrow from them. The government, like business firms, is typically a *net demander* of funds. It typically borrows more than it saves. We've all heard about the federal budget deficit.

Major Financial Institutions

The major financial institutions in the U.S. economy are commercial banks, savings and loans, credit unions, savings banks, insurance companies, pension funds, and mutual funds. These institutions attract funds from individuals, businesses, and governments, combine them, and make loans available to individuals and businesses. Descriptions of the major financial institutions are found at the textbook's Web site at www.aw.com/gitman.

Financial Markets

financial markets
Forums in which suppliers of funds and demanders of funds can transact business directly.

Financial markets are forums in which suppliers of funds and demanders of funds can transact business directly. Whereas the loans and investments of institutions are made without the direct knowledge of the suppliers of funds (savers), suppliers in the financial markets know where their funds are being lent or invested. The two key financial markets are the money market and the capital market. Transactions in short-term debt instruments, or marketable securities, take place in the *money market*. Long-term securities—bonds and stocks—are traded in the *capital market*.

private placement
The sale of a new security issue, typically bonds or preferred stock, directly to an investor or group of investors.

public offering
The nonexclusive sale of either bonds or stocks to the general public.

To raise money, firms can use either private placements or public offerings. **Private placement** involves the sale of a new security issue, typically bonds or preferred stock, directly to an investor or group of investors, such as an insurance company or pension fund. Most firms, however, raise money through a **public offering** of securities, which is the nonexclusive sale of either bonds or stocks to the general public.

primary market
Financial market in which securities are initially issued; the only market in which the issuer is directly involved in the transaction.

secondary market
Financial market in which preowned securities (those that are not new issues) are traded.

All securities are initially issued in the **primary market.** This is the only market in which the corporate or government issuer is directly involved in the transaction and receives direct benefit from the issue. That is, the company actually receives the proceeds from the sale of securities. Once the securities begin to trade between savers and investors, they become part of the **secondary market.** The primary market is the one in which "new" securities are sold. The secondary market can be viewed as a "preowned" securities market.

The Relationship Between Institutions and Markets

Financial institutions actively participate in the financial markets as both suppliers and demanders of funds. Figure 1.4 depicts the general flow of funds through and between financial institutions and financial markets; private placement transactions are also shown. The individuals, businesses, and governments that supply and demand funds may be domestic or foreign. We next briefly discuss the money market, including its international equivalent—the *Eurocurrency market.* We then end this section with a discussion of the capital market, which is of key importance to the firm.

The Money Market

money market
A financial relationship created between suppliers and demanders of *short-term funds.*

marketable securities
Short-term debt instruments, such as U.S. Treasury bills, commercial paper, and negotiable certificates of deposit issued by government, business, and financial institutions, respectively.

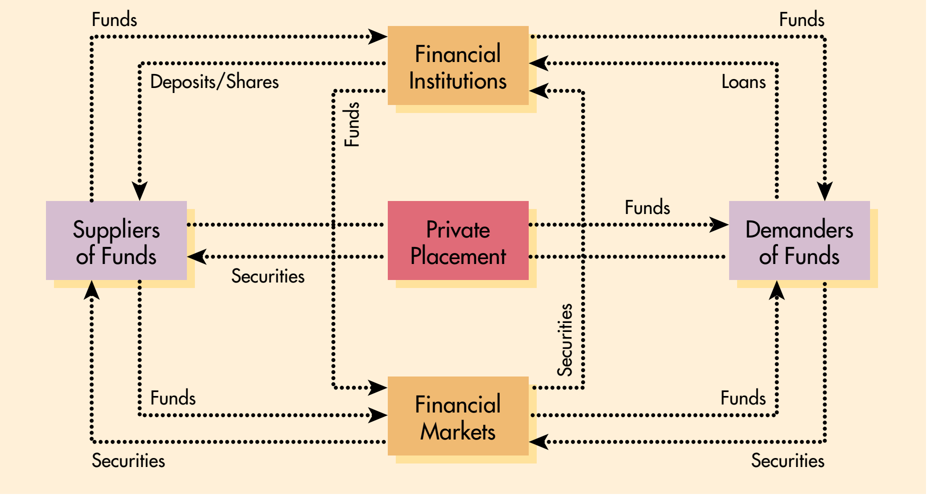
The **money market** is created by a financial relationship between suppliers and demanders of *short-term funds* (funds with maturities of one year or less). The money market exists because some individuals, businesses, governments, and financial institutions have temporarily idle funds that they wish to put to some interest-earning use. At the same time, other individuals, businesses, governments, and financial institutions find themselves in need of seasonal or temporary financing. The money market brings together these suppliers and demanders of short-term funds.

Most money market transactions are made in **marketable securities—**short-term debt instruments, such as U.S. Treasury bills, commercial paper, and

FIGURE 1.4

Flow of Funds

Flow of funds for financial institutions and markets



negotiable certificates of deposit issued by government, business, and financial institutions, respectively. (Marketable securities are described in Chapter 14.)

The Operation of the Money Market

The money market is not an actual organization housed in some central location. How, then, are suppliers and demanders of short-term funds brought together? Typically, they are matched through the facilities of large New York banks and through government securities dealers. A number of stock brokerage firms purchase money market instruments for resale to customers. Also, financial institutions purchase money market instruments for their portfolios in order to provide attractive returns on their customers' deposits and share purchases. Additionally, the Federal Reserve banks become involved in loans from one commercial bank to another; these loans are referred to as transactions in **federal funds.**

federal funds
Loan transactions between commercial banks in which the Federal Reserve banks become involved.

In the money market, businesses and governments demand short-term funds (borrow) by *issuing* a money market instrument. Parties who supply short-term funds (invest) *purchase* the money market instruments. To issue or purchase a money market instrument, one party must go directly to another party or use an intermediary, such as a bank or brokerage firm, to make the transaction. The secondary (resale) market for marketable securities is no different from the primary (initial issue) market with respect to the basic transactions that are made. Individuals also participate in the money market as purchasers and sellers of money market instruments. Although individuals do not issue marketable securities, they may sell them in the money market to liquidate them prior to maturity.

Hint Remember that the *money market* is for short-term fund raising and is represented by current liabilities on the balance sheet. The *capital market* is for long-term fund raising and is reflected by long-term debt and equity on the balance sheet.

The Eurocurrency Market

The international equivalent of the domestic money market is called the **Eurocurrency market.** This is a market for short-term bank deposits denominated in U.S. dollars or other easily convertible currencies. Historically, the Eurocurrency market has been centered in London, but it has evolved into a truly global market.

Eurocurrency market
International equivalent of the domestic money market.

Eurocurrency deposits arise when a corporation or individual makes a bank deposit in a currency other than the local currency of the country where the bank is located. If, for example, a multinational corporation were to deposit U.S. dollars in a London bank, this would create a Eurodollar deposit (a dollar deposit at a bank in Europe). Nearly all Eurodollar deposits are *time deposits*. This means that the bank would promise to repay the deposit, with interest, at a fixed date in the future—say, in 6 months. During the interim, the bank is free to lend this dollar deposit to creditworthy corporate or government borrowers. If the bank cannot find a borrower on its own, it may lend the deposit to another international bank. The rate charged on these "interbank loans" is called the **London Interbank Offered Rate (LIBOR),** and this is the base rate that is used to price all Eurocurrency loans.

London Interbank Offered Rate (LIBOR)
The base rate that is used to price all Eurocurrency loans.

The Eurocurrency market has grown rapidly, primarily because it is an unregulated, wholesale, and global market that fills the needs of both borrowers and lenders. Investors with excess cash to lend are able to make large, short-term, and safe deposits at attractive interest rates. Likewise, borrowers are able to arrange large loans, quickly and confidentially, also at attractive interest rates.

The Capital Market

capital market
A market that enables suppliers and demanders of *long-term funds* to make transactions.

The **capital market** is a market that enables suppliers and demanders of *long-term funds* to make transactions. Included are securities issues of business and government. The backbone of the capital market is formed by the various *securities exchanges* that provide a forum for bond and stock transactions.

Key Securities Traded: Bonds and Stocks

bond
Long-term debt instrument used by business and government to raise large sums of money, generally from a diverse group of lenders.

The key capital market securities are bonds (long-term debt) and both common and preferred stock (equity, or ownership). **Bonds** are long-term debt instruments used by business and government to raise large sums of money, generally from a diverse group of lenders. *Corporate bonds* typically pay interest *semiannually* (every 6 months) at a stated *coupon interest rate*. They have an initial *maturity* of from 10 to 30 years, and a *par*, or *face, value* of $l,000 that must be repaid at maturity. Bonds are described in detail in Chapter 6.

EXAMPLE

Lakeview Industries, a major microprocessor manufacturer, has issued a 9 percent coupon interest rate, 20-year bond with a $1,000 par value that pays interest semiannually. Investors who buy this bond receive the contractual right to $90 annual interest (9% coupon interest rate $\times$ $1,000 par value) distributed as $45 at the end of each 6 months (1/2 $\times$ $90) for 20 years, plus the $1,000 par value at the end of year 20.

As noted earlier, shares of *common stock* are units of ownership, or equity, in a corporation. Common stockholders earn a return by receiving dividends—periodic distributions of earnings—or by realizing increases in share price. **Preferred stock** is a special form of ownership that has features of both a bond and common stock. Preferred stockholders are promised a fixed periodic dividend that must be paid prior to payment of any dividends to common stockholders. In other words, preferred stock has "preference" over common stock. Preferred and common stock are described in detail in Chapter 7.

preferred stock
A special form of ownership having a fixed periodic dividend that must be paid prior to payment of any common stock dividends.

Major Securities Exchanges

securities exchanges
Organizations that provide the marketplace in which firms can raise funds through the sale of new securities and purchasers can resell securities.

Securities exchanges provide the marketplace in which firms can raise funds through the sale of new securities and purchasers of securities can easily resell them when necessary. Many people call securities exchanges "stock markets," but this label is misleading because bonds, common stock, preferred stock, and a variety of other investment vehicles are all traded on these exchanges. The two key types of securities exchanges are the organized exchange and the over-the-counter exchange. In addition, important markets exist outside the United States.

organized securities exchanges
Tangible organizations that act as *secondary markets* where outstanding securities are resold.

Organized Securities Exchanges **Organized securities exchanges** are tangible organizations that act as *secondary markets* where outstanding securities are resold. Organized exchanges account for about 46 percent of the *total dollar volume* of domestic shares traded. The best-known organized exchanges are the New York Stock Exchange (NYSE) and the American Stock Exchange (AMEX), both headquartered in New York City. There are also regional exchanges, such as the Chicago Stock Exchange and the Pacific Stock Exchange.

Most exchanges are modeled after the New York Stock Exchange, which accounts for about 93 percent of the total annual dollar volume of shares traded on *organized* U.S. exchanges. In order for a firm's securities to be listed for trading on an organized exchange, a firm must file an application for listing and meet a number of requirements. For example, to be eligible for listing on the NYSE, a firm must have at least 2,000 stockholders owning 100 or more shares; a minimum of 1.1 million shares of publicly held stock; pretax earnings of at least $6.5 million over the previous 3 years, with no loss in the previous 2 years; and a minimum of $100 million in stockholders' equity. Clearly, only large, widely held firms are candidates for NYSE listing.

To make transactions on the "floor" of the New York Stock Exchange, an individual or firm must own a "seat" on the exchange. There are a total of 1,366 seats on the NYSE, most of which are owned by brokerage firms. Trading is carried out on the floor of the exchange through an *auction process*. The goal of trading is to fill *buy orders* at the lowest price and to fill *sell orders* at the highest price, thereby giving both purchasers and sellers the best possible deal.

Once placed, an order to buy or sell can be executed in minutes, thanks to sophisticated telecommunication devices. New Internet-based brokerage systems enable investors to place their buy and sell orders electronically. Information on publicly traded securities is reported in various media, both print, such as the *Wall Street Journal,* and electronic, such as MSN Money Central Investor (*www.moneycentral.msn.com*).

over-the-counter (OTC) exchange
An intangible market for the purchase and sale of securities not listed by the organized exchanges.

The Over-the-Counter Exchange The **over-the-counter (OTC) exchange** is an intangible market for the purchase and sale of securities not listed by the organized exchanges. OTC traders, known as *dealers,* are linked with the purchasers and sellers of securities through the *National Association of Securities Dealers Automated Quotation (Nasdaq) system.*

This sophisticated telecommunications network provides current bid and ask prices on thousands of actively traded OTC securities. The *bid price* is the highest price offered by a dealer to purchase a given security, and the *ask price* is the lowest price at which the dealer is willing to sell the security. The dealer in effect adds securities to his or her inventory by purchasing them at the bid price and sells securities from the inventory at the ask price. The dealer expects to profit from the *spread* between the bid and ask prices. Unlike the auction process on the organized securities exchanges, the prices at which securities are traded in the OTC market result from both competitive bids and negotiation.

Unlike the organized exchanges, the OTC handles *both* outstanding securities and new public issues, making it both a *secondary* and a *primary market.* The OTC accounts for about 54 percent of the *total dollar volume* of domestic shares traded.

Eurobond market
The market in which corporations and governments typically issue bonds denominated in dollars and sell them to investors located outside the United States.

International Capital Markets Although U.S. capital markets are by far the world's largest, there are important debt and equity markets outside the United States. In the **Eurobond market,** corporations and governments typically issue bonds denominated in dollars and sell them to investors located outside the United States. A U.S. corporation might, for example, issue dollar-denominated bonds that would be purchased by investors in Belgium, Germany, or Switzerland. Through the Eurobond market, issuing firms and governments can tap a much larger pool of investors than would be generally available in the local market.

foreign bond
Bond that is issued by a foreign corporation or government and is denominated in the investor's home currency and sold in the investor's home market.

The foreign bond market is another international market for long-term debt securities. A **foreign bond** is a bond issued by a foreign corporation or government that is denominated in the investor's home currency and sold in the investor's home market. A bond issued by a U.S. company that is denominated in Swiss francs and sold in Switzerland is an example of a foreign bond. Although the foreign bond market is much smaller than the Eurobond market, many issuers have found this to be an attractive way of tapping debt markets in Germany, Japan, Switzerland, and the United States.

international equity market
A market that allows corporations to sell blocks of shares to investors in a number of different countries simultaneously.

Finally, the **international equity market** allows corporations to sell blocks of shares to investors in a number of different countries simultaneously. This market enables corporations to raise far larger amounts of capital than they could raise in any single national market. International equity sales have also proven to be indispensable to governments that have sold state-owned companies to private investors during recent years.

The Role of Securities Exchanges

efficient market
A market that allocates funds to their most productive uses as a result of competition among wealth-maximizing investors that determines and publicizes prices that are believed to be close to their true value.

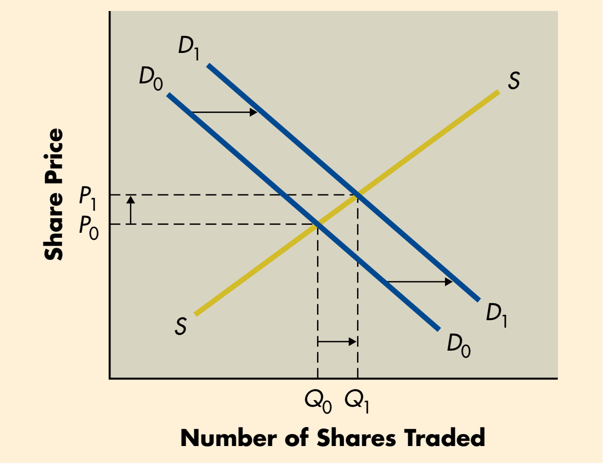
Securities exchanges create continuous liquid markets in which firms can obtain needed financing. They also create **efficient markets** that allocate funds to their most productive uses. This is especially true for securities that are actively traded on major exchanges, where the competition among wealth-maximizing investors determines and publicizes prices that are believed to be close to their true value.

The price of an individual security is determined by the demand for and supply of the security. Figure 1.5 depicts the interaction of the forces of demand (represented by line D_0) and supply (represented by line S) for a given security currently selling at an equilibrium price P_0. At that price, Q_0 shares of the stock are traded.

Changing evaluations of a firm's prospects cause changes in the demand for and supply of its securities and ultimately result in a new price for the securities.

FIGURE 1.5

Supply and Demand
Supply and demand for a security



Suppose, for example, that the firm shown in Figure 1.5 announces a favorable discovery. Investors expect rewarding results from the discovery, so they increase their valuations of the firm's shares. The changing evaluation results in a shift in demand from D_0 to D_1. At that new level of demand, Q_1 shares will be traded, and a new, higher equilibrium price of P_1 will result. The competitive market created by the major securities exchanges provides a forum in which share price is continuously adjusted to changing demand and supply.

Review Questions

1–18 Who are the key participants in the transactions of financial institutions? Who are net suppliers and who are net demanders?

1–19 What role do *financial markets* play in our economy? What are *primary* and *secondary* markets? What relationship exists between financial institutions and financial markets?

1–20 What is the *money market?* How does it work?

1–21 What is the *Eurocurrency market?* What is the *London Interbank Offered Rate (LIBOR)* and how is it used in this market?

1–22 What is the *capital market?* What are the primary securities traded in it?

1–23 What role do securities exchanges play in the capital market? How does the *over-the-counter exchange* operate? How does it differ from the *organized securities exchanges?*

1–24 Briefly describe the international capital markets, particularly the *Eurobond market* and the *international equity market.*

1–25 What are *efficient markets?* What determines the price of an individual security in such a market?

LG6 1.5 Business Taxes

Taxes are a fact of life, and businesses, like individuals, must pay taxes on income. The income of sole proprietorships and partnerships is taxed as the income of the individual owners; corporate income is subject to corporate taxes. Regardless of their legal form, all businesses can earn two types of income: ordinary and capital gains. Under current law, these two types of income are treated differently in the taxation of individuals; they are not treated differently for entities subject to corporate taxes. Frequent amendments in the tax code, such as the *Economic Growth and Tax Relief Reconciliation Act of 2001* (reflected in the following discussions), make it likely that these rates will change before the next edition of this text is published. Emphasis here is given to *corporate taxation.*

Ordinary Income

ordinary income
Income earned through the sale of a firm's goods or services.

The **ordinary income** of a corporation is income earned through the sale of goods or services. Ordinary income is currently taxed subject to the rates depicted in the corporate tax rate schedule in Table 1.4.

TABLE 1.4 Corporate Tax Rate Schedule

Range of taxable income			Tax calculation: Base tax	+	(Marginal rate × amount over base bracket)		
$ 0	to	$ 50,000	$ 0	+	(15%	× amount over	$ 0)
50,000	to	75,000	7,500	+	(25	× amount over	50,000)
75,000	to	100,000	13,750	+	(34	× amount over	75,000)
100,000	to	335,000[a]	22,250	+	(39	× amount over	100,000)
335,000	to	10,000,000	113,900	+	(34	× amount over	335,000)
Over $10,000,000			3,400,000	+	(35	× amount over	10,000,000)

[a]Because corporations with taxable income in excess of $100,000 must increase their tax by the lesser of $11,750 or 5% of the taxable income in excess of $100,000, they will end up paying a 39% tax on taxable income between $100,000 and $335,000. The 5% surtax that raises the tax rate from 34% to 39% causes all corporations with taxable income between $335,000 and $10,000,000 to have an *average tax rate* of 34%.

EXAMPLE Webster Manufacturing, Inc., a small manufacturer of kitchen knives, has before-tax earnings of $250,000. The tax on these earnings can be found by using the tax rate schedule in Table 1.4:

$$\begin{aligned}\text{Total taxes due} &= \$22{,}250 + [0.39 \times (\$250{,}000 - \$100{,}000)]\\ &= \$22{,}250 + (0.39 \times \$150{,}000)\\ &= \$22{,}250 + \$58{,}500 = \underline{\underline{\$80{,}750}}\end{aligned}$$

From a financial point of view, it is important to understand the difference between average and marginal tax rates, the treatment of interest and dividend income, and the effects of tax deductibility.

Average Versus Marginal Tax Rates

average tax rate
A firm's taxes divided by its taxable income.

The **average tax rate** paid on the firm's ordinary income can be calculated by dividing its taxes by its taxable income. For firms with taxable income of $10,000,000 or less, the average tax rate ranges from 15 to 34 percent, reaching 34 percent when taxable income equals or exceeds $335,000. For firms with taxable income in excess of $10,000,000, the average tax rate ranges between 34 and 35 percent. The average tax rate paid by Webster Manufacturing, Inc., in the preceding example was 32.3 percent ($80,750 ÷ $250,000). As a corporation's taxable income increases, its average tax rate approaches and finally reaches 34 percent. It remains at that level up to $10,000,000 of taxable income, beyond which it rises toward but never reaches 35 percent.

marginal tax rate
The rate at which *additional income* is taxed.

The **marginal tax rate** represents the rate at which *additional income* is taxed. In the current corporate tax structure, the marginal tax rate on income up to $50,000 is 15 percent; from $50,000 to $75,000 it is 25 percent; and so on, as shown in Table 1.4. Webster Manufacturing's marginal tax rate is currently 39 percent because its next dollar of taxable income (bringing its before-tax earnings to $250,001) would be taxed at that rate. To simplify calculations in the text, *a fixed 40 percent tax rate is assumed to be applicable to ordinary corporate income.* Given our focus on financial decision making, this rate is assumed to represent the firm's *marginal tax rate*.

Interest and Dividend Income

double taxation
Occurs when the already once-taxed earnings of a corporation are distributed as cash dividends to stockholders, who must pay taxes on them.

intercorporate dividends
Dividends received by one corporation on common and preferred stock held in other corporations.

In the process of determining taxable income, any *interest received* by the corporation is included as ordinary income. Dividends, on the other hand, are treated differently. This different treatment moderates the effect of **double taxation,** which occurs when the already once-taxed earnings of a corporation are distributed as cash dividends to stockholders, who must pay taxes on them. Therefore, dividends that the firm receives on common and preferred stock held in other corporations, and representing less than 20 percent ownership in them, are subject to a 70 percent exclusion for tax purposes.[8]

Because of the dividend exclusion, only 30 percent of these **intercorporate dividends** are included as ordinary income. The tax law provides this exclusion to avoid *triple taxation*. Triple taxation would occur if the first and second corporations were taxed on income before the second corporation paid dividends to its shareholders, who must then include the dividends in their taxable incomes. The dividend exclusion in effect eliminates most of the potential tax liability from the dividends received by the second and any subsequent corporations.

EXAMPLE

Charnes Industries, a large foundry that makes custom castings for the automobile industry, during the year just ended received $100,000 in interest on bonds it held and $100,000 in dividends on common stock it owned in other corporations. The firm is subject to a 40% marginal tax rate and is eligible for a 70% exclusion on its intercorporate dividend receipts. The after-tax income realized by Charnes from each of these sources of investment income is found as follows:

	Interest income	Dividend income	
(1) Before-tax amount	$100,000		$100,000
Less: Applicable exclusion	0	(0.70 × $100,000) =	70,000
Taxable amount	$100,000		$ 30,000
(2) Tax (40%)	40,000		12,000
After-tax amount [(1) − (2)]	$ 60,000		$ 88,000

As a result of the 70% dividend exclusion, the after-tax amount is greater for the dividend income than for the interest income. Clearly, the dividend exclusion enhances the attractiveness of stock investments relative to bond investments made by one corporation in another.

Tax-Deductible Expenses

In calculating their taxes, corporations are allowed to deduct operating expenses, as well as interest expense. The tax deductibility of these expenses reduces their after-tax cost. The following example illustrates the benefit of tax deductibility.

8. The exclusion is 80% if the corporation owns between 20 and 80% of the stock in the corporation paying it dividends; 100% of the dividends received are excluded if it owns more than 80% of the corporation paying it dividends. For convenience, we are assuming here that the ownership interest in the dividend-paying corporation is less than 20%.

EXAMPLE

Two companies, Debt Co. and No Debt Co., both expect in the coming year to have earnings before interest and taxes of $200,000. Debt Co. during the year will have to pay $30,000 in interest. No Debt Co. has no debt and therefore will have no interest expense. Calculation of the earnings after taxes for these two firms is as follows:

	Debt Co.	No Debt Co.
Earnings before interest and taxes	$200,000	$200,000
Less: Interest expense	30,000	0
Earnings before taxes	$170,000	$200,000
Less: Taxes (40%)	68,000	80,000
Earnings after taxes	$102,000	$120,000
Difference in earnings after taxes	$18,000	

Whereas Debt Co. had $30,000 more interest expense than No Debt Co., Debt Co.'s earnings after taxes are only $18,000 less than those of No Debt Co. ($102,000 for Debt Co. versus $120,000 for No Debt Co.). This difference is attributable to the fact that Debt Co.'s $30,000 interest expense deduction provided a tax savings of $12,000 ($68,000 for Debt Co. versus $80,000 for No Debt Co.). This amount can be calculated directly by multiplying the tax rate by the amount of interest expense ($0.40 \times \$30{,}000 = \$12{,}000$). Similarly, the $18,000 *after-tax cost* of the interest expense can be calculated directly by multiplying one minus the tax rate by the amount of interest expense [$(1 - 0.40) \times \$30{,}000 = \$18{,}000$].

The tax deductibility of certain expenses reduces their actual (after-tax) cost to the profitable firm. Note that both for accounting and tax purposes *interest is a tax-deductible expense, whereas dividends are not.* Because dividends are not tax deductible, their after-tax cost is equal to the amount of the dividend. Thus a $30,000 cash dividend has an after-tax cost of $30,000.

Capital Gains

capital gain
The amount by which the sale price of an asset exceeds the asset's initial purchase price.

If a firm sells a capital asset (such as stock held as an investment) for more than its initial purchase price, the difference between the sale price and the purchase price is called a **capital gain.** For corporations, capital gains are added to ordinary corporate income and taxed at the regular corporate rates, with a maximum marginal tax rate of 39 percent.[9] To simplify the computations presented in the text, as for ordinary income, *a fixed 40 percent tax rate is assumed to be applicable to corporate capital gains.*

9. The *Omnibus Budget Reconciliation Act of 1993* included a provision that allows the capital gains tax to be halved on gains resulting from investments made after January 1, 1993, in startup firms with a value of less than $50 million that have been held for at least 5 years. This special provision, which is intended to help startup firms, is ignored throughout this text.

EXAMPLE

Ross Company, a manufacturer of pharmaceuticals, has pretax operating earnings of \$500,000 and has just sold for \$40,000 an asset that was purchased 2 years ago for \$36,000. Because the asset was sold for more than its initial purchase price, there is a capital gain of \$4,000 (\$40,000 sale price − \$36,000 initial purchase price). The corporation's taxable income will total \$504,000 (\$500,000 ordinary income plus \$4,000 capital gain). Because this total is above \$335,000, the capital gain will be taxed at the 34% rate (see Table 1.4), resulting in a tax of \$1,360 (0.34 × \$4,000).

Tax Loss Carrybacks and Carryforwards

tax loss carryback/carryforward
A tax benefit that allows corporations experiencing operating losses to carry tax losses *back up to 2 years* and *forward for as many as 20 years.*

Corporations that are experiencing operating losses may obtain tax relief by using a **tax loss carryback/carryforward.** The tax laws allow corporations to carry tax losses *back up to 2 years* and *forward for as many as 20 years*. This feature is especially attractive for firms in cyclic businesses such as durable goods manufacturing and construction. It effectively allows them to average out their taxes over the good and bad years. The law requires the net amount of losses to first be carried back, applying them to the earliest year allowable, and progressively moving forward until the loss has been fully recovered or the carryforward period has passed. Because tax losses can be carried back and applied to previous pretax earnings as soon as they are realized, the firm can apply for an immediate tax refund on its carrybacks. A carryforward, if any, can be used to reduce future income, thereby reducing future tax payments. See the book's Web site at www.aw.com/gitman for an example of how tax loss carrybacks/carryforwards work.

Review Questions

1–26 Describe the tax treatment of *ordinary income* and that of *capital gains*. What is the difference between the *average tax rate* and the *marginal tax rate?*

1–27 Why might the *intercorporate dividend* exclusion make corporate stock investments by one corporation in another more attractive than bond investments?

1–28 What benefit results from the tax deductibility of certain corporate expenses?

1–29 How is the *tax loss carryback/carryforward* used when a firm experiences an operating loss in a given year?

1.6 Using This Text

The organization of this textbook links the firm's activities to its value, as determined in the securities markets. The activities of the financial manager are described in the six parts of the book. Each major decision area is presented in terms of both return and risk factors and their potential impact on owners' wealth. Coverage of international events and topics is integrated into the chapter discussions, and a separate chapter on international managerial finance is also included.

The text has been developed around a group of learning goals—six per chapter. Mastery of these goals results in a broad understanding of managerial finance. These goals have been carefully integrated into a learning system. Each chapter begins with a numbered list of learning goals. Next to each major text heading is a "toolbox," which notes by number the specific learning goal(s) addressed in that section. At the end of each section of the chapter (positioned before the next major heading) are review questions that test your understanding of the material in that section. At the end of each chapter, the chapter summaries, self-test problems, and problems are also keyed by number to each chapter's learning goals. By linking all elements to the learning goals, the integrated learning system facilitates your mastery of the goals.

Also keyed to various parts of the text is the *PMF CD-ROM Software,* a disk for use with IBM PCs and compatible microcomputers. The disk contains three different sets of routines:

1. The *PMF Tutor* is a user-friendly program that extends self-testing opportunities in the more quantitative chapters beyond those included in the end-of-chapter materials. It gives immediate feedback with detailed solutions and provides tutorial assistance (including text references). Text discussions and end-of-chapter problems with which the *PMF Tutor* can be used are marked with a .
2. The *PMF Problem-Solver* can be used as an aid in performing many of the routine financial calculations presented in the book. A disk symbol, , identifies those text discussions and end-of-chapter problems that can be solved with the *PMF Problem-Solver*.
3. The *PMF Excel Spreadsheet Templates* can be used with Microsoft Excel to input data and carry out "what-if" types of analyses in selected chapters. These problems are marked by the symbol .

A detailed discussion of how to use the *PMF CD-ROM Software*—the *Tutor,* the *Problem-Solver,* and the *Excel Spreadsheet Templates*—is included in Appendix D at the back of this book.

Each chapter ends with a case that integrates the chapter materials, and each part ends with an integrative case that ties together the key topical material covered in the chapters within that part. Where applicable, the symbols for the *PMF Problem-Solver* and/or the *PMF Tutor* identify case questions that can be solved with the aid of these programs. Both the chapter-end and the part-end cases can be used to synthesize and apply related concepts and techniques.

SUMMARY

FOCUS ON VALUE

Chapter 1 established the primary goal of the firm—**to maximize the wealth of the owners for whom the firm is being operated.** For public companies, which are the focus of this text, value at any time is reflected in the stock price. Therefore, management should act only on those alternatives or opportunities that are expected to create value for owners by increasing the stock price. Doing this requires management to consider the returns (magnitude and timing of cash flows) and the risk of each proposed action and their combined impact on value.

REVIEW OF LEARNING GOALS

LG1 **Define *finance,* the major areas of finance and the career opportunities available in this field and the legal forms of business organization.** Finance, the art and science of managing money, affects the lives of every person and every organization. Major opportunities in financial services exist within banking and related institutions, personal financial planning, investments, real estate, and insurance. Managerial finance is concerned with the duties of the financial manager in the business firm. It offers numerous career opportunities, as shown in Table 1.3. The recent trend toward globalization of business activity has created new demands and opportunities in managerial finance.

The legal forms of business organization are the sole proprietorship, the partnership, and the corporation. The corporation is dominant in terms of business receipts and profits, and its owners are its common and preferred stockholders. Stockholders expect to earn a return by receiving dividends or by realizing gains through increases in share price. The key strengths and weaknesses of the common legal forms of business organization are summarized in Table 1.1. Other limited liability organizations are listed and described in Table 1.2.

LG2 **Describe the managerial finance function and its relationship to economics and accounting.** All areas of responsibility within a firm interact with finance personnel and procedures. In large firms, the managerial finance function might be handled by a separate department headed by the vice president of finance (CFO), to whom the treasurer and controller report. The financial manager must understand the economic environment and relies heavily on the economic principle of marginal analysis to make financial decisions. Financial managers use accounting but concentrate on cash flows and decision making.

LG3 **Identify the primary activities of the financial manager within the firm.** The primary activities of the financial manager, in addition to ongoing involvement in financial analysis and planning, are making investment decisions and making financing decisions.

LG4 **Explain why wealth maximization, rather than profit maximization, is the firm's goal and how the agency issue is related to it.** The goal of the financial manager is to maximize the owners' wealth, as evidenced by stock price. Profit maximization ignores the timing of returns, does not directly consider cash flows, and ignores risk, so it is an inappropriate goal. Both return and risk must be assessed by the financial manager who is evaluating decision alternatives. The wealth-maximizing actions of financial managers should also reflect the interests of stakeholders, groups who have a direct economic link to the firm. Positive ethical practices help the firm and its managers to achieve the firm's goal of owner wealth maximization.

An agency problem results when managers, as agents for owners, place personal goals ahead of corporate goals. Market forces, in the firm of shareholder activism and the threat of takeover, tend to prevent or minimize agency problems. Firms incur agency costs to monitor managers' actions and provide incentives for them to act in the best interests of owners. Stock options and performance plans are examples of such agency costs.

LG5 **Understand the relationship between financial institutions and markets, and the role and operations of the money and capital markets.** Financial institutions serve as intermediaries by channeling into loans or investments the savings of individuals, businesses, and governments. The financial markets are forums in which suppliers and demanders of funds can transact business directly. Financial institutions actively participate in the financial markets as both suppliers and demanders of funds.

In the money market, marketable securities (short-term debt instruments) are traded, typically through large New York banks and government securities dealers. The Eurocurrency market is the international equivalent of the domestic money market.

In the capital market, transactions in long-term debt (bonds) and equity (common and preferred stock) are made. The organized securities exchanges provide secondary markets for securities. The over-the-counter exchange, a telecommunications network, offers a secondary market for securities and is a primary market in which new public issues are sold. Important debt and equity markets—the Eurobond market and the international equity market—exist outside of the United States. The securities exchanges create continuous liquid markets for needed financing and allocate funds to their most productive uses.

LG6 **Discuss the fundamentals of business taxation of ordinary income and capital gains, and explain the treatment of tax losses.** Corporate income is subject to corporate taxes. Corporate tax rates are applicable to both ordinary income (after deduction of allowable expenses) and capital gains. The average tax rate paid by a corporation ranges from 15 to nearly 35 percent. (For convenience, we assume a 40 percent marginal tax rate in this book.) Corporate taxpayers can reduce their taxes through certain provisions in the tax code: intercorporate dividend exclusions, tax-deductible expenses, and tax loss carrybacks and carryforwards.

SELF-TEST PROBLEMS (Solutions in Appendix B)

LG6 **ST 1–1** **Corporate taxes** Montgomery Enterprises, Inc., had operating earnings of $280,000 for the year just ended. During the year the firm sold stock that it held in another company for $180,000, which was $30,000 above its original purchase price of $150,000, paid 1 year earlier.

a. What is the amount, if any, of capital gains realized during the year?

b. How much total taxable income did the firm earn during the year?

c. Use the corporate tax rate schedule given in Table 1.4 to calculate the firm's total taxes due.

d. Calculate both the *average tax rate* and the *marginal tax rate* on the basis of your findings.

PROBLEMS

LG1 **1–1** **Liability comparisons** Merideth Harper has invested $25,000 in Southwest Development Company. The firm has recently declared bankruptcy and has $60,000 in unpaid debts. Explain the nature of payments, if any, by Ms. Harper in each of the following situations.

a. Southwest Development Company is a sole proprietorship owned by Ms. Harper.

b. Southwest Development Company is a 50–50 partnership of Ms. Harper and Christopher Black.

c. Southwest Development Company is a corporation.

LG2 LG4 **1–2** **Marginal analysis and the goal of the firm** Ken Allen, capital budgeting analyst for Bally Gears, Inc., has been asked to evaluate a proposal. The manager of the automotive division believes that replacing the robotics used on the heavy truck gear line will produce total benefits of $560,000 (in today's dollars) over the next 5 years. The existing robotics would produce benefits of $400,000 (also in today's dollars) over that same time period. An initial cash investment of $220,000 would be required to install the new equipment. The manager estimates that the existing robotics can be sold for $70,000. Show how Ken will apply marginal analysis techniques to determine the following:

a. The marginal (added) benefits of the proposed new robotics.

b. The marginal (added) cost of the proposed new robotics.

c. The net benefit of the proposed new robotics.

d. What should Ken Allen recommend that the company do? Why?

e. What factors besides the costs and benefits should be considered before the final decision is made?

LG2 **1–3 Accrual income versus cash flow for a period** Thomas Book Sales, Inc., supplies textbooks to college and university bookstores. The books are shipped with a proviso that they must be paid for within 30 days but can be returned for a full refund credit within 90 days. In 2003, Thomas shipped and billed book titles totaling $760,000. Collections, net of return credits, during the year totaled $690,000. The company spent $300,000 acquiring the books that it shipped.

a. Using accrual accounting and the preceding values, show the firm's net profit for the past year.

b. Using cash accounting and the preceding values, show the firm's net cash flow for the past year.

c. Which of these statements is more useful to the financial manager? Why?

LG4 **1–4 Identifying agency problems, costs, and resolutions** Explain why each of the following situations is an agency problem and what costs to the firm might result from it. Suggest how the problem might be dealt with short of firing the individual(s) involved.

a. The front desk receptionist routinely takes an extra 20 minutes of lunch to run personal errands.

b. Division managers are padding cost estimates in order to show short-term efficiency gains when the costs come in lower than the estimates.

c. The firm's chief executive officer has secret talks with a competitor about the possibility of a merger in which (s)he would become the CEO of the combined firms.

d. A branch manager lays off experienced full-time employees and staffs customer service positions with part-time or temporary workers to lower employment costs and raise this year's branch profit. The manager's bonus is based on profitability.

LG6 **1–5 Corporate taxes** Tantor Supply, Inc., is a small corporation acting as the exclusive distributor of a major line of sporting goods. During 2003 the firm earned $92,500 before taxes.

a. Calculate the firm's tax liability using the corporate tax rate schedule given in Table 1.4.

b. How much are Tantor Supply's 2003 after-tax earnings?

c. What was the firm's *average tax rate,* based on your findings in part **a**?

d. What is the firm's *marginal tax rate,* based on your findings in part **a**?

LG6 **1–6 Average corporate tax rates** Using the corporate tax rate schedule given in Table 1.4, perform the following:

a. Calculate the tax liability, after-tax earnings, and average tax rates for the following levels of corporate earnings before taxes: $10,000; $80,000; $300,000; $500,000; $1.5 million; $10 million; and $15 million.

b. Plot the average tax rates (measured on the y axis) against the pretax income levels (measured on the x axis). What generalization can be made concerning the relationship between these variables?

LG6 **1–7 Marginal corporate tax rates** Using the corporate tax rate schedule given in Table 1.4, perform the following:

a. Find the marginal tax rate for the following levels of corporate earnings before taxes: $15,000; $60,000; $90,000; $200,000; $400,000; $1 million; and $20 million.

b. Plot the marginal tax rates (measured on the *y* axis) against the pretax income levels (measured on the *x* axis). Explain the relationship between these variables.

LG6 **1–8 Interest versus dividend income** During the year just ended, Shering Distributors, Inc., had pretax earnings from operations of $490,000. In addition, during the year it received $20,000 in income from interest on bonds it held in Zig Manufacturing and received $20,000 in income from dividends on its 5% common stock holding in Tank Industries, Inc. Shering is in the 40% tax bracket and is eligible for a 70% dividend exclusion on its Tank Industries stock.

a. Calculate the firm's tax on its operating earnings only.
b. Find the tax and the after-tax amount attributable to the interest income from Zig Manufacturing bonds.
c. Find the tax and the after-tax amount attributable to the dividend income from the Tank Industries, Inc., common stock.
d. Compare, contrast, and discuss the after-tax amounts resulting from the interest income and dividend income calculated in parts **b** and **c.**
e. What is the firm's total tax liability for the year?

LG6 **1–9 Interest versus dividend expense** Michaels Corporation expects earnings before interest and taxes to be $40,000 for this period. Assuming an ordinary tax rate of 40%, compute the firm's earnings after taxes and earnings available for common stockholders (earnings after taxes and preferred stock dividends, if any) under the following conditions:

a. The firm pays $10,000 in interest.
b. The firm pays $10,000 in preferred stock dividends.

LG6 **1–10 Capital gains taxes** Perkins Manufacturing is considering the sale of two nondepreciable assets, X and Y. Asset X was purchased for $2,000 and will be sold today for $2,250. Asset Y was purchased for $30,000 and will be sold today for $35,000. The firm is subject to a 40% tax rate on capital gains.

a. Calculate the amount of capital gain, if any, realized on each of the assets.
b. Calculate the tax on the sale of each asset.

LG6 **1–11 Capital gains taxes** The following table contains purchase and sale prices for the nondepreciable capital assets of a major corporation. The firm paid taxes of 40% on capital gains.

Asset	Purchase price	Sale price
A	$ 3,000	$ 3,400
B	12,000	12,000
C	62,000	80,000
D	41,000	45,000
E	16,500	18,000

a. Determine the amount of capital gain realized on each of the five assets.
b. Calculate the amount of tax paid on each of the assets.

CHAPTER 1 CASE Assessing the Goal of Sports Products, Inc.

Loren Seguara and Dale Johnson both work for Sports Products, Inc., a major producer of boating equipment and accessories. Loren works as a clerical assistant in the Accounting Department, and Dale works as a packager in the Shipping Department. During their lunch break one day, they began talking about the company. Dale complained that he had always worked hard trying not to waste packing materials and efficiently and cost-effectively performing his job. In spite of his efforts and those of his co-workers in the department, the firm's stock price had declined nearly $2 per share over the past 9 months. Loren indicated that she shared Dale's frustration, particularly because the firm's profits had been rising. Neither could understand why the firm's stock price was falling as profits rose.

Loren indicated that she had seen documents describing the firm's profit-sharing plan under which all managers were partially compensated on the basis of the firm's profits. She suggested that maybe it was profit that was important to management, because it directly affected their pay. Dale said, "That doesn't make sense, because the stockholders own the firm. Shouldn't management do what's best for stockholders? Something's wrong!" Loren responded, "Well, maybe that explains why the company hasn't concerned itself with the stock price. Look, the only profits that stockholders receive are in the form of cash dividends, and this firm has never paid dividends during its 20-year history. We as stockholders therefore don't directly benefit from profits. The only way we benefit is for the stock price to rise." Dale chimed in, "That probably explains why the firm is being sued by state and federal environmental officials for dumping pollutants in the adjacent stream. Why spend money for pollution control? It increases costs, lowers profits, and therefore lowers management's earnings!"

Loren and Dale realized that the lunch break had ended and they must quickly return to work. Before leaving, they decided to meet the next day to continue their discussion.

Required

a. What should the management of Sports Products, Inc., pursue as its overriding goal? Why?
b. Does the firm appear to have an *agency problem?* Explain.
c. Evaluate the firm's approach to pollution control. Does it seem to be *ethical?* Why might incurring the expense to control pollution be in the best interests of the firm's owners in spite of its negative impact on profits?
d. On the basis of the information provided, what specific recommendations would you offer the firm?

WEB EXERCISE

At the Careers in Finance Web site, *www.careers-in-finance.com*, you will find information on career opportunities in seven different areas of finance. First click on **Corporate Finance** in the **Areas to Explore** section and use the various subsections to answer the following questions:

1. What are the primary responsibilities of the financial manager?
2. Summarize the types of skills a financial manager needs.

3. Describe the key job areas in corporate finance.
4. What are the salary ranges for the following positions in corporate finance: rookie financial analyst, credit manager, chief financial officer? How do these compare to salaries at General Motors or PepsiCo?

Now return to the home page and click on either **Commercial Banking** or **Investment Banking**.

5. How do careers in the area you chose (commercial banking or investment banking) compare to careers in corporate finance in terms of skills required, responsibilities, and salaries?

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

CHAPTER

2

Financial Statements and Analysis

LEARNING GOALS

LG1 Review the contents of the stockholders' report and the procedures for consolidating international financial statements.

LG2 Understand who uses financial ratios, and how.

LG3 Use ratios to analyze a firm's liquidity and activity.

LG4 Discuss the relationship between debt and financial leverage and the ratios used to analyze a firm's debt.

LG5 Use ratios to analyze a firm's profitability and its market value.

LG6 Use a summary of financial ratios and the DuPont system of analysis to perform a complete ratio analysis.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand the stockholders' report and preparation of the four key financial statements; how firms consolidate international financial statements; and how to calculate and interpret financial ratios for decision making.

Information systems: You need to understand what data are included in the firm's financial statements in order to design systems that will supply such data to those who prepare the statements and to those in the firm who use the data for ratio calculations.

Management: You need to understand what parties are interested in the annual report and why; how the financial statements will be analyzed by those both inside and outside the firm to assess various aspects of performance; the caution that should be exercised in using financial ratio analysis; and how the financial statements affect the value of the firm.

Marketing: You need to understand the effects your decisions will have on the financial statements, particularly the income statement and the statement of cash flows, and how analysis of ratios, especially those involving sales figures, will affect the firm's decisions about levels of inventory, credit policies, and pricing decisions.

Operations: You need to understand how the costs of operations are reflected in the firm's financial statements and how analysis of ratios, particularly those involving assets, cost of goods sold, or inventory, may affect requests for new equipment or facilities.

Home Depot

Building Strong Financials

Financial reporting is no longer the primary responsibility of the chief financial officer (CFO). The role of today's CFO, a key member of the executive team, has broadened to include strategic planning and, at many companies, information management. Managing a company's financial operations takes many different skills. Financial planning, operations, and analysis; treasury operations (raising funds and managing cash); business acquisition and valuation; tax planning; and investor relations are also under his or her control.

Home Depot CFO and treasurer Carol Tomé reports directly to chief executive officer Robert L. Nardelli. She works closely with him and with Dennis J. Carey, an executive vice president and the chief strategy officer, to guide the giant home improvement retailer's future growth. Along with her strategic responsibilities, Tomé chooses the key financial measurements on which she wants managers to focus. These are tied to the economic climate. When the economy was strong, her objective was improving the company's return on investment (ROI). By late 2001, Home Depot's ROI was 16.0 percent, compared to 14.7 percent for the home improvement retail industry, 6.7 percent for the services sector, and 10.2 percent for the S&P 500.

In 2001's slower economy, the emphasis shifted to activity ratios that measure how quickly accounts are converted into cash. Particularly important to a retail chain are inventory turnover, receivables collection period, and accounts payable periods. Home Depot hired consultants to benchmark its financial operations with other best-in-class companies. "We're looking for processing efficiencies," Tomé says. Improved new-store productivity and lower pre-opening costs per store, together with attention to cost control, are boosting margins. In the third quarter of 2001, when many companies reported earnings drops, Home Depot's net income and earnings per share rose over the same period in 2000.

The company's measures of debt also indicate a strong financial position. Its ratio of debt to total capital indicates that only about 10 percent of its total long-term financing is debt, a very low degree of indebtedness. This strong position gives Home Depot more flexibility to pursue new projects, such as its new high-end line of stores called Expo, and more opportunities to raise funds from banks, which use ratio analysis to assess creditworthiness.

In this chapter you will learn how to analyze financial statements using financial ratios.

LG1 2.1 The Stockholders' Report

generally accepted accounting principles (GAAP)
The practice and procedure guidelines used to prepare and maintain financial records and reports; authorized by the *Financial Accounting Standards Board (FASB).*

Financial Accounting Standards Board (FASB)
The accounting profession's rule-setting body, which authorizes *generally accepted accounting principles (GAAP).*

Securities and Exchange Commission (SEC)
The federal regulatory body that governs the sale and listing of securities.

stockholders' report
Annual report that publicly owned corporations must provide to stockholders; it summarizes and documents the firm's financial activities during the past year.

Every corporation has many and varied uses for the standardized records and reports of its financial activities. Periodically, reports must be prepared for regulators, creditors (lenders), owners, and management. The guidelines used to prepare and maintain financial records and reports are known as **generally accepted accounting principles (GAAP).** These accounting practices and procedures are authorized by the accounting profession's rule-setting body, the **Financial Accounting Standards Board (FASB).**

Publicly owned corporations with more than $5 million in assets and 500 or more stockholders[1] are required by the **Securities and Exchange Commission (SEC)**—the federal regulatory body that governs the sale and listing of securities—to provide their stockholders with an annual **stockholders' report.** The annual report summarizes and documents the firm's financial activities during the past year. It begins with a letter to the stockholders from the firm's president and/or chairman of the board.

The Letter to Stockholders

letter to stockholders
Typically, the first element of the annual stockholders' report and the primary communication from management.

The **letter to stockholders** is the primary communication from management. It describes the events that are considered to have had the greatest impact on the firm during the year. It also generally discusses management philosophy, strategies, and actions, as well as plans for the coming year. Links at this book's Web site (www.aw.com/gitman) will take you to some representative letters to stockholders.

The Four Key Financial Statements

The four key financial statements required by the SEC for reporting to shareholders are (1) the income statement, (2) the balance sheet, (3) the statement of retained earnings, and (4) the statement of cash flows.[2] The financial statements from the 2003 stockholders' report of Bartlett Company, a manufacturer of metal fasteners, are presented and briefly discussed.

Income Statement

income statement
Provides a financial summary of the firm's operating results during a specified period.

The **income statement** provides a financial summary of the firm's operating results during a specified period. Most common are income statements covering a 1-year period ending at a specified date, ordinarily December 31 of the calendar year.

1. Although the Securities and Exchange Commission (SEC) does not have an official definition of *publicly owned,* these financial measures mark the cutoff point it uses to require informational reporting, regardless of whether the firm publicly sells its securities. Firms that do not meet these requirements are commonly called "closely owned" firms.

2. Whereas these statement titles are consistently used throughout this text, it is important to recognize that in practice, companies frequently use different titles. For example, General Electric uses "Statement of Earnings" rather than "Income Statement" and "Statement of Financial Position" rather than "Balance Sheet." Bristol Myers Squibb uses "Statement of Earnings and Retained Earnings" rather than "Income Statement." Pfizer uses "Statement of Shareholders' Equity" rather than "Statement of Retained Earnings."

Hint Some firms, such as retailers and agricultural firms, end their fiscal year at the end of their operating cycle rather than at the end of the calendar year—for example, retailers at the end of January and agricultural firms at the end of September.

Many large firms, however, operate on a 12-month financial cycle, or *fiscal year*, that ends at a time other than December 31. In addition, monthly income statements are typically prepared for use by management, and quarterly statements must be made available to the stockholders of publicly owned corporations.

Table 2.1 presents Bartlett Company's income statements for the years ended December 31, 2003 and 2002. The 2003 statement begins with *sales revenue*—the total dollar amount of sales during the period—from which the *cost of goods sold* is deducted. The resulting *gross profits* of $986,000 represent the amount remaining to satisfy operating, financial, and tax costs. Next, *operating expenses*, which include selling expense, general and administrative expense, lease expense,

TABLE 2.1 Bartlett Company Income Statements ($000)

	For the years ended December 31	
	2003	2002
Sales revenue	$3,074	$2,567
Less: Cost of goods sold	2,088	1,711
Gross profits	$ 986	$ 856
Less: Operating expenses		
Selling expense	$ 100	$ 108
General and administrative expenses	194	187
Lease expense[a]	35	35
Depreciation expense	239	223
Total operating expense	$ 568	$ 553
Operating profits	$ 418	$ 303
Less: Interest expense	93	91
Net profits before taxes	$ 325	$ 212
Less: Taxes (rate = 29%)[b]	94	64
Net profits after taxes	$ 231	$ 148
Less: Preferred stock dividends	10	10
Earnings available for common stockholders	$ 221	$ 138
Earnings per share (EPS)[c]	$ 2.90	$ 1.81
Dividend per share (DPS)[d]	$ 1.29	$ 0.75

[a]Lease expense is shown here as a separate item rather than being included as part of interest expense, as specified by the FASB for financial-reporting purposes. The approach used here is consistent with tax-reporting rather than financial-reporting procedures.

[b]The 29% tax rate for 2003 results because the firm has certain special tax write-offs that do not show up directly on its income statement.

[c]Calculated by dividing the earnings available for common stockholders by the number of shares of common stock outstanding—76,262 in 2003 and 76,244 in 2002. Earnings per share in 2003: $221,000 ÷ 76,262 = $2.90; in 2002: $138,000 ÷ 76,244 = $1.81.

[d]Calculated by dividing the dollar amount of dividends paid to common stockholders by the number of shares of common stock outstanding. Dividends per share in 2003: $98,000 ÷ 76,262 = $1.29; in 2002: $57,183 ÷ 76,244 = $0.75.

and depreciation expense, are deducted from gross profits.[3] The resulting *operating profits* of $418,000 represent the profits earned from producing and selling products; this amount does not consider financial and tax costs. (Operating profit is often called *earnings before interest and taxes,* or *EBIT.*) Next, the financial cost—*interest expense*—is subtracted from operating profits to find *net profits* (or *earnings) before taxes*. After subtracting $93,000 in 2003 interest, Bartlett Company had $325,000 of net profits before taxes.

Next, taxes are calculated at the appropriate tax rates and deducted to determine *net profits* (or *earnings*) *after taxes*. Bartlett Company's net profits after taxes for 2003 were $231,000. Any preferred stock dividends must be subtracted from net profits after taxes to arrive at *earnings available for common stockholders*. This is the amount earned by the firm on behalf of the common stockholders during the period.

Dividing earnings available for common stockholders by the number of shares of common stock outstanding results in *earnings per share (EPS)*. EPS represents the number of dollars earned during the period on behalf of each outstanding share of common stock. In 2003, Bartlett Company earned $221,000 for its common stockholders, which represents $2.90 for each outstanding share. The actual cash **dividend per share (DPS),** which is the dollar amount of cash distributed during the period on behalf of each outstanding share of common stock, paid in 2003 was $1.29.

dividend per share (DPS)
The dollar amount of cash distributed during the period on behalf of each outstanding share of common stock.

Balance Sheet

The **balance sheet** presents a summary statement of the firm's financial position at a given point in time. The statement balances the firm's *assets* (what it owns) against its financing, which can be either *debt* (what it owes) or *equity* (what was provided by owners). Bartlett Company's balance sheets as of December 31 of 2003 and 2002 are presented in Table 2.2. They show a variety of asset, liability (debt), and equity accounts.

balance sheet
Summary statement of the firm's financial position at a given point in time.

current assets
Short-term assets, expected to be converted into cash within 1 year or less.

current liabilities
Short-term liabilities, expected to be paid within 1 year or less.

An important distinction is made between short-term and long-term assets and liabilities. The **current assets** and **current liabilities** are *short-term* assets and liabilities. This means that they are expected to be converted into cash (current assets) or paid (current liabilities) within 1 year or less. All other assets and liabilities, along with stockholders' equity, which is assumed to have an infinite life, are considered *long-term,* or *fixed,* because they are expected to remain on the firm's books for more than 1 year.

As is customary, the assets are listed from the most liquid—*cash*—down to the least liquid. *Marketable securities* are very liquid short-term investments, such as U.S. Treasury bills or certificates of deposit, held by the firm. Because they are highly liquid, marketable securities are viewed as a form of cash ("near cash"). *Accounts receivable* represent the total monies owed the firm by its customers on credit sales made to them. *Inventories* include raw materials, work in process (partially finished goods), and finished goods held by the firm. The entry for *gross fixed assets* is the original cost of all fixed (long-term) assets owned by the

3. Depreciation expense can be, and frequently is, included in manufacturing costs—cost of goods sold—to calculate gross profits. Depreciation is shown as an expense in this text to isolate its impact on cash flows.

TABLE 2.2 Bartlett Company Balance Sheets ($000)

	December 31	
Assets	**2003**	**2002**
Current assets		
Cash	$ 363	$ 288
Marketable securities	68	51
Accounts receivable	503	365
Inventories	289	300
Total current assets	$1,223	$1,004
Gross fixed assets (at cost)[a]		
Land and buildings	$2,072	$1,903
Machinery and equipment	1,866	1,693
Furniture and fixtures	358	316
Vehicles	275	314
Other (includes financial leases)	98	96
Total gross fixed assets (at cost)	$4,669	$4,322
Less: Accumulated depreciation	2,295	2,056
Net fixed assets	$2,374	$2,266
Total assets	$3,597	$3,270
Liabilities and Stockholders' Equity		
Current liabilities		
Accounts payable	$ 382	$ 270
Notes payable	79	99
Accruals	159	114
Total current liabilities	$ 620	$ 483
Long-term debt (includes financial leases)[b]	$1,023	$ 967
Total liabilities	$1,643	$1,450
Stockholders' equity		
Preferred stock—cumulative 5%, $100 par, 2,000 shares authorized and issued[c]	$ 200	$ 200
Common stock—$2.50 par, 100,000 shares authorized, shares issued and outstanding in 2003: 76,262; in 2002: 76,244	191	190
Paid-in capital in excess of par on common stock	428	418
Retained earnings	1,135	1,012
Total stockholders' equity	$1,954	$1,820
Total liabilities and stockholders' equity	$3,597	$3,270

[a]In 2003, the firm has a 6-year financial lease requiring annual beginning-of-year payments of $35,000. Four years of the lease have yet to run.

[b]Annual principal repayments on a portion of the firm's total outstanding debt amount to $71,000.

[c]The annual preferred stock dividend would be $5 per share (5% × $100 par), or a total of $10,000 annually ($5 per share × 2,000 shares).

In Practice

FOCUS ON PRACTICE Extraordinary? Not to the FASB!

To most of us, the events of September 11, 2001, would certainly qualify as extraordinary. The plane crashes that took thousands of lives, destroyed the World Trade Center Towers, and damaged part of the Pentagon were circumstances well outside what we consider "ordinary." Yet, several weeks after the tragedy the Financial Accounting Standards Board (FASB) announced that the terrorist attack did not constitute an extraordinary event—at least not in accounting terms.

As a result, companies will not be able to separate costs and expenses related to the disaster as extraordinary on their financial statements. Those expenses will show up as normal operating costs in the continuing operations section of the income statement.

Explained Tim Lucas, chair of the FASB Emerging Issues Task Force, "The task force understood that this was an extraordinary event in the English-language sense of the word. But in the final analysis, we decided it wasn't going to improve the financial reporting system to show it [separately]."

The FASB task force had prepared a draft document with guidelines on accounting for disaster-related costs as extraordinary. As they considered how to apply these recommendations, they realized that the impact of the attack was so far-ranging that it was almost impossible to divide direct financial and economic effects from the weakening economic conditions prior to September 11. Nor was it possible to develop one set of guidelines appropriate for all industries. FASB members were concerned that companies would blame negative financial performance on the attacks when in fact the costs were unrelated. As one member pointed out, almost every company was affected in some way. Because the whole business climate changed, "it almost made it ordinary."

Companies will, however, be able to separate costs they believe to be attributable to September 11 in the footnotes to financial statements and in management's discussion of financial results.

Sources: Jennifer Davies, "Will Attacks Cover Up Weak Earnings?" *San Diego Union-Tribune* (October 14, 2001), pp. H1, H6; Steve Liesman, "Accountants, in a Reversal, Say Costs from the Attack Aren't 'Extraordinary,'" *Wall Street Journal* (October 1, 2001), pp. C1-2; Keith Naughton, "Out of the Ordinary," *Newsweek* (October 15, 2001), p. 9.

Hint Another interpretation of the balance sheet is that on one side are the assets that have been purchased to be used to increase the profit of the firm. The other side indicates how these assets were acquired, either by borrowing or by investing the owner's money.

long-term debt
Debts for which payment is not due in the current year.

paid-in capital in excess of par
The amount of proceeds in excess of the par value received from the original sale of common stock.

firm.[4] *Net fixed assets* represent the difference between gross fixed assets and *accumulated depreciation*—the total expense recorded for the depreciation of fixed assets. (The net value of fixed assets is called their *book value*.)

Like assets, the liabilities and equity accounts are listed from short-term to long-term. Current liabilities include *accounts payable,* amounts owed for credit purchases by the firm; *notes payable,* outstanding short-term loans, typically from commercial banks; and *accruals,* amounts owed for services for which a bill may not or will not be received. (Examples of accruals include taxes due the government and wages due employees.) **Long-term debt** represents debt for which payment is not due in the current year. *Stockholders' equity* represents the owners' claims on the firm. The *preferred stock* entry shows the historical proceeds from the sale of preferred stock ($200,000 for Bartlett Company).

Next, the amount paid by the original purchasers of common stock is shown by two entries: common stock and paid-in capital in excess of par on common stock. The *common stock* entry is the *par value* of common stock. **Paid-in capital in excess of par** represents the amount of proceeds in excess of the par value received from the original sale of common stock. The sum of the common stock

4. For convenience the term *fixed assets* is used throughout this text to refer to what, in a strict accounting sense, is captioned "property, plant, and equipment." This simplification of terminology permits certain financial concepts to be more easily developed.

and paid-in capital accounts divided by the number of shares outstanding represents the original price per share received by the firm on a single issue of common stock. Bartlett Company therefore received about $8.12 per share [($191,000 par + $428,000 paid-in capital in excess of par) ÷ 76,262 shares] from the sale of its common stock.

retained earnings
The cumulative total of all earnings, net of dividends, that have been retained and reinvested in the firm since its inception.

Finally, **retained earnings** represent the cumulative total of all earnings, net of dividends, that have been retained and reinvested in the firm since its inception. It is important to recognize that retained earnings *are not cash* but rather have been utilized to finance the firm's assets.

Bartlett Company's balance sheets in Table 2.2 show that the firm's total assets increased from $3,270,000 in 2002 to $3,597,000 in 2003. The $327,000 increase was due primarily to the $219,000 increase in current assets. The asset increase in turn appears to have been financed primarily by an increase of $193,000 in total liabilities. Better insight into these changes can be derived from the statement of cash flows, which we will discuss shortly.

Statement of Retained Earnings

statement of retained earnings
Reconciles the net income earned during a given year, and any cash dividends paid, with the change in retained earnings between the start and the end of that year.

The **statement of retained earnings** reconciles the net income earned during a given year, and any cash dividends paid, with the change in retained earnings between the start and the end of that year. Table 2.3 presents this statement for Bartlett Company for the year ended December 31, 2003. The statement shows that the company began the year with $1,012,000 in retained earnings and had net profits after taxes of $231,000, from which it paid a total of $108,000 in dividends, resulting in year-end retained earnings of $1,135,000. Thus the net increase for Bartlett Company was $123,000 ($231,000 net profits after taxes minus $108,000 in dividends) during 2003.

Statement of Cash Flows

statement of cash flows
Provides a summary of the firm's operating, investment, and financing cash flows and reconciles them with changes in its cash and marketable securities during the period.

The **statement of cash flows** is a summary of the cash flows over the period of concern. The statement provides insight into the firm's operating, investment, and financing cash flows and reconciles them with changes in its cash and marketable securities during the period. Bartlett Company's statement of cash flows for the year ended December 31, 2003, is presented in Table 2.4. Further insight into this statement is included in the discussion of cash flow of in Chapter 3.

TABLE 2.3 Bartlett Company Statement of Retained Earnings ($000) for the Year Ended December 31, 2003

Retained earnings balance (January 1, 2003)		$1,012
Plus: Net profits after taxes (for 2003)		231
Less: Cash dividends (paid during 2003)		
Preferred stock	($10)	
Common stock	(98)	
Total dividends paid		(108)
Retained earnings balance (December 31, 2003)		$1,135

TABLE 2.4 Bartlett Company Statement of Cash Flows ($000) for the Year Ended December 31, 2003

Cash Flow from Operating Activities		
Net profits after taxes	$231	
Depreciation	239	
Increase in accounts receivable	(138)[a]	
Decrease in inventories	11	
Increase in accounts payable	112	
Increase in accruals	45	
Cash provided by operating activities		$500
Cash Flow from Investment Activities		
Increase in gross fixed assets	($347)	
Change in business interests	0	
Cash provided by investment activities		(347)
Cash Flow from Financing Activities		
Decrease in notes payable	($ 20)	
Increase in long-term debts	56	
Changes in stockholders' equity[b]	11	
Dividends paid	(108)	
Cash provided by financing activities		(61)
Net increase in cash and marketable securities		$ 92

[a]As is customary, parentheses are used to denote a negative number, which in this case is a cash outflow.

[b]Retained earnings are excluded here, because their change is actually reflected in the combination of the "net profits after taxes" and "dividends paid" entries.

Notes to the Financial Statements

notes to the financial statements
Footnotes detailing information on the accounting policies, procedures, calculations, and transactions underlying entries in the financial statements.

Included with published financial statements are explanatory notes keyed to the relevant accounts in the statements. These **notes to the financial statements** provide detailed information on the accounting policies, procedures, calculations, and transactions underlying entries in the financial statements. Common issues addressed by these notes include revenue recognition, income taxes, breakdowns of fixed asset accounts, debt and lease terms, and contingencies. Professional securities analysts use the data in the statements and notes to develop estimates of the value of securities that the firm issues, and these estimates influence the actions of investors and therefore the firm's share value.

Consolidating International Financial Statements

So far, we've discussed financial statements involving only one currency, the U.S. dollar. The issue of how to consolidate a company's foreign and domestic financial statements has bedeviled the accounting profession for many years. The cur-

Financial Accounting Standards Board (FASB) Standard No. 52
Mandates that U.S.-based companies translate their foreign-currency-denominated assets and liabilities into dollars, for consolidation with the parent company's financial statements. This is done by using the *current rate (translation) method.*

rent policy is described in **Financial Accounting Standards Board (FASB) Standard No. 52,** which mandates that U.S.-based companies translate their foreign-currency-denominated assets and liabilities into dollars, for consolidation with the parent company's financial statements. This is done by using a technique called the **current rate (translation) method,** under which all of a U.S. parent company's foreign-currency-denominated assets and liabilities are converted into dollar values using the exchange rate prevailing at the fiscal year ending date (the current rate). Income statement items are treated similarly. Equity accounts, on the other hand, are translated into dollars by using the exchange rate that prevailed when the parent's equity investment was made (the historical rate). Retained earnings are adjusted to reflect each year's operating profits or losses. Further details on this procedure can be found at the book's Web site at www.aw.com/gitman or in an intermediate accounting text.

current rate (translation) method
Technique used by U.S.-based companies to translate their foreign-currency-denominated assets and liabilities into dollars, for consolidation with the parent company's financial statements, using the exchange rate prevailing at the fiscal year ending date (the current rate).

Review Questions

2–1 Describe the purpose of each of the four major financial statements.
2–2 Why are the notes to the financial statements important to professional securities analysts?
2–3 How is the *current rate (translation) method* used to consolidate a firm's foreign and domestic financial statements?

LG2 2.2 Using Financial Ratios

ratio analysis
Involves methods of calculating and interpreting financial ratios to analyze and monitor the firm's performance.

The information contained in the four basic financial statements is of major significance to various interested parties who regularly need to have relative measures of the company's operating efficiency. *Relative* is the key word here, because the analysis of financial statements is based on the use of *ratios* or *relative values*. **Ratio analysis** involves methods of calculating and interpreting financial ratios to analyze and monitor the firm's performance. The basic inputs to ratio analysis are the firm's income statement and balance sheet.

Interested Parties

Hint Management should be the most interested party of this group. Managers not only have to worry abut the financial situation of the firm, but they are also critically interested in what the other parties think about the firm.

Ratio analysis of a firm's financial statements is of interest to shareholders, creditors, and the firm's own management. Both present and prospective shareholders are interested in the firm's current and future level of risk and return, which directly affect share price. The firm's creditors are interested primarily in the short-term liquidity of the company and its ability to make interest and principal payments. A secondary concern of creditors is the firm's profitability; they want assurance that the business is healthy. Management, like stockholders, is concerned with all aspects of the firm's financial situation, and it attempts to produce financial ratios that will be considered favorable by both owners and creditors. In addition, management uses ratios to monitor the firm's performance from period to period.

Types of Ratio Comparisons

Ratio analysis is not merely the calculation of a given ratio. More important is the *interpretation* of the ratio value. A meaningful basis for comparison is needed to answer such questions as "Is it too high or too low?" and "Is it good or bad?" Two types of ratio comparisons can be made: cross-sectional and time-series.

Cross-Sectional Analysis

cross-sectional analysis
Comparison of different firms' financial ratios at the same point in time; involves comparing the firm's ratios to those of other firms in its industry or to industry averages.

benchmarking
A type of *cross-sectional analysis* in which the firm's ratio values are compared to those of a key competitor or group of competitors that it wishes to emulate.

Hint Industry averages are not particularly useful for analyzing firms with multiproduct lines. In the case of multiproduct firms, it is difficult to select the appropriate benchmark industry.

Cross-sectional analysis involves the comparison of different firms' financial ratios at the same point in time. Analysts are often interested in how well a firm has performed in relation to other firms in its industry. Frequently, a firm will compare its ratio values to those of a key competitor or group of competitors that it wishes to emulate. This type of cross-sectional analysis, called **benchmarking,** has become very popular.

Comparison to industry averages is also popular. These figures can be found in the *Almanac of Business and Industrial Financial Ratios, Dun & Bradstreet's Industry Norms and Key Business Ratios, Business Month, FTC Quarterly Reports, Robert Morris Associates Statement Studies, Value Line,* and industry sources.[5] A sample from one available source of industry averages is given in Table 2.5.

Many people mistakenly believe that as long as the firm being analyzed has a value "better than" the industry average, it can be viewed favorably. However, this "better than average" viewpoint can be misleading. Quite often a ratio value that is far better than the norm can indicate problems that, on more careful analysis, may be more severe than had the ratio been worse than the industry average. It is therefore important to investigate significant deviations *to either side* of the industry standard.

EXAMPLE

In early 2004, Mary Boyle, the chief financial analyst at Caldwell Manufacturing, a producer of heat exchangers, gathered data on the firm's financial performance during 2003, the year just ended. She calculated a variety of ratios and obtained industry averages. She was especially interested in inventory turnover, which reflects the speed with which the firm moves its inventory from raw materials through production into finished goods and to the customer as a completed sale. Generally, higher values of this ratio are preferred, because they indicate a quicker turnover of inventory. Caldwell Manufacturing's calculated inventory turnover for 2003 and the industry average inventory turnover were as follows:

	Inventory turnover, 2003
Caldwell Manufacturing	14.8
Industry average	9.7

5. Cross-sectional comparisons of firms operating in several lines of business are difficult to perform. The use of weighted-average industry average ratios based on the firm's product-line mix or, if data are available, analysis of the firm on a product-line basis can be performed to evaluate a multiproduct firm.

TABLE 2.5 Industry Average Ratios (2001) for Selected Lines of Business[a]

Line of business (number of concerns reporting)[b]	Current ratio (X)	Quick ratio (X)	Sales to inventory (X)	Collection period (days)	Total assets to sales (%)	Total liabilities to net worth (%)	Return on sales (%)	Return on total assets (%)	Return on net worth (%)
Department	6.2	1.9	6.0	2.9	34.3	19.7	4.0	8.5	14.6
stores	**3.0**	**0.8**	**4.7**	**8.0**	**50.9**	**62.0**	**1.8**	**3.3**	**6.5**
(167)	1.9	0.3	3.3	34.7	68.2	164.9	0.6	0.9	2.0
Electronic	3.6	1.8	19.0	34.7	36.4	121.4	7.1	11.7	23.9
computers	**1.8**	**1.0**	**9.1**	**55.9**	**59.7**	**230.4**	**1.8**	**3.5**	**9.8**
(91)	1.3	0.6	5.3	85.4	102.3	428.4	(0.8)	(3.1)	2.0
Grocery	2.5	0.9	31.0	1.1	14.4	46.2	2.2	9.9	24.3
stores	**1.5**	**0.4**	**19.7**	**2.9**	**20.3**	**128.4**	**0.8**	**3.9**	**11.1**
(541)	1.0	0.2	14.0	5.8	31.3	294.2	0.3	1.0	3.8
Motor	2.0	1.0	11.2	18.5	27.9	95.9	3.7	9.7	24.1
vehicles	**1.5**	**0.7**	**8.7**	**26.7**	**39.0**	**174.3**	**1.9**	**3.7**	**15.6**
(38)	1.2	0.3	5.8	47.5	59.2	393.9	0.6	1.4	3.4

[a]These values are given for each ratio for each line of business. The center value is the median, and the values immediately above and below it are the upper and lower quartiles, respectively.

[b]Standard Industrial Classification (SIC) codes for the lines of business shown are, respectively: SIC #5311, SIC #3571, SIC #5411, SIC #3711.

Source: "Industry Norms and Key Business Ratios," Copyright © 2001 Dun & Bradstreet, Inc. Reprinted with permission.

Mary's initial reaction to these data was that the firm had managed its inventory significantly *better than* the average firm in the industry. The turnover was nearly 53% faster than the industry average. Upon reflection, however, she realized that a very high inventory turnover could also mean very low levels of inventory. The consequence of low inventory could be excessive stockouts (insufficient inventory). Discussions with people in the manufacturing and marketing departments did in fact uncover such a problem: Inventories during the year were extremely low, the result of numerous production delays that hindered the firm's ability to meet demand and resulted in lost sales. What had initially appeared to reflect extremely efficient inventory management was actually the symptom of a major problem.

Time-Series Analysis

time-series analysis
Evaluation of the firm's financial performance over time using financial ratio analysis.

Time-series analysis evaluates performance over time. Comparison of current to past performance, using ratios, enables analysts to assess the firm's progress. Developing trends can be seen by using multiyear comparisons. As in cross-sectional analysis, any significant year-to-year changes may be symptomatic of a major problem.

Combined Analysis

The most informative approach to ratio analysis combines cross-sectional and time-series analyses. A combined view makes it possible to assess the trend in the behavior of the ratio in relation to the trend for the industry. Figure 2.1 depicts this type of approach using the average collection period ratio of Bartlett Company, over the years 2000–2003. This ratio reflects the average amount of time it takes the firm to collect bills, and lower values of this ratio generally are preferred. The figure quickly discloses that (1) Bartlett's effectiveness in collecting its receivables is poor in comparison to the industry, and (2) Bartlett's trend is toward longer collection periods. Clearly, Bartlett needs to shorten its collection period.

Cautions About Using Ratio Analysis

Before discussing specific ratios, we should consider the following cautions about their use:

1. Ratios with large deviations from the norm only indicate *symptoms* of a problem. Additional analysis is typically needed to isolate the *causes* of the problem. The fundamental point is this: Ratio analysis merely directs attention to potential areas of concern; it does not provide conclusive evidence as to the existence of a problem.
2. A single ratio does not generally provide sufficient information from which to judge the *overall* performance of the firm. Only when a group of ratios is used can reasonable judgments be made. However, if an analysis is concerned only with certain *specific* aspects of a firm's financial position, one or two ratios may be sufficient.
3. The ratios being compared should be calculated using financial statements dated at the same point in time during the year. If they are not, the effects of

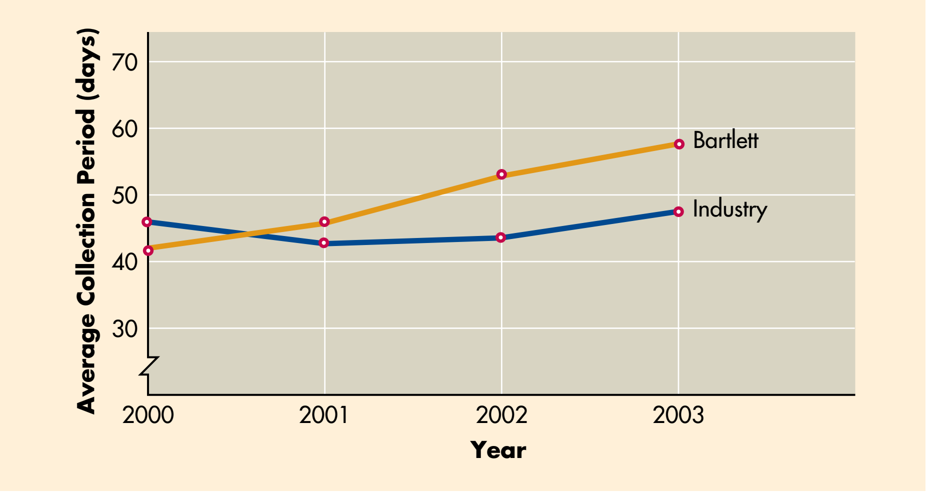


FIGURE 2.1

Combined Analysis
Combined cross-sectional and time-series view of Bartlett Company's average collection period, 2000–2003

seasonality may produce erroneous conclusions and decisions. For example, comparison of the inventory turnover of a toy manufacturer at the end of June with its end-of-December value can be misleading. Clearly, the seasonal impact of the December holiday selling season would skew any comparison of the firm's inventory management.

4. It is preferable to use *audited financial statements* for ratio analysis. If the statements have not been audited, the data contained in them may not reflect the firm's true financial condition.
5. The financial data being compared should have been developed in the same way. The use of differing accounting treatments—especially relative to inventory and depreciation—can distort the results of ratio analysis, regardless of whether cross-sectional or time-series analysis is used.
6. Results can be distorted by *inflation,* which can cause the book values of inventory and depreciable assets to differ greatly from their true (replacement) values. Additionally, inventory costs and depreciation write-offs can differ from their true values, thereby distorting profits. Without adjustment, inflation tends to cause older firms (older assets) to appear more efficient and profitable than newer firms (newer assets). Clearly, in using ratios, care must be taken to compare older to newer firms or a firm to itself over a long period of time.

Categories of Financial Ratios

Financial ratios can be divided for convenience into five basic categories: liquidity, activity, debt, profitability, and market ratios. Liquidity, activity, and debt ratios primarily measure risk. Profitability ratios measure return. Market ratios capture both risk and return.

As a rule, the inputs necessary to an effective financial analysis include, at a minimum, the income statement and the balance sheet. We will use the 2003 and 2002 income statements and balance sheets for Bartlett Company, presented earlier in Tables 2.1 and 2.2, to demonstrate ratio calculations. Note, however, that the ratios presented in the remainder of this chapter can be applied to almost any company. Of course, many companies in different industries use ratios that focus on aspects peculiar to their industry.

Review Questions

2–4 With regard to financial ratio analysis, how do the viewpoints held by the firm's present and prospective shareholders, creditors, and management differ?

2–5 What is the difference between *cross-sectional* and *time-series* ratio analysis? What is *benchmarking?*

2–6 What types of deviations from the norm should the analyst pay primary attention to when performing cross-sectional ratio analysis? Why?

2–7 Why is it preferable to compare ratios calculated using financial statements that are dated at the same point in time during the year?

2.3 Liquidity Ratios

liquidity
A firm's ability to satisfy its short-term obligations *as they come due.*

The **liquidity** of a firm is measured by its ability to satisfy its short-term obligations *as they come due*. Liquidity refers to the solvency of the firm's *overall* financial position—the ease with which it can pay its bills. Because a common precursor to financial distress and bankruptcy is low or declining liquidity, these ratios are viewed as good leading indicators of cash flow problems. The two basic measures of liquidity are the current ratio and the quick (acid-test) ratio.

Current Ratio

current ratio
A measure of liquidity calculated by dividing the firm's current assets by its current liabilities.

The **current ratio,** one of the most commonly cited financial ratios, measures the firm's ability to meet its short-term obligations. It is expressed as follows:

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

The current ratio for Bartlett Company in 2003 is

$$\frac{\$1{,}223{,}000}{\$620{,}000} = 1.97$$

Generally, the higher the current ratio, the more liquid the firm is considered to be. A current ratio of 2.0 is occasionally cited as acceptable, but a value's acceptability depends on the industry in which the firm operates. For example, a current ratio of 1.0 would be considered acceptable for a public utility but might be unacceptable for a manufacturing firm. The more predictable a firm's cash flows, the lower the acceptable current ratio. Because Bartlett Company is in a business with a relatively predictable annual cash flow, its current ratio of 1.97 should be quite acceptable.

Quick (Acid-Test) Ratio

quick (acid-test) ratio
A measure of liquidity calculated by dividing the firm's current assets minus inventory by its current liabilities.

The **quick (acid-test) ratio** is similar to the current ratio except that it excludes inventory, which is generally the least liquid current asset. The generally low liquidity of inventory results from two primary factors: (1) many types of inventory cannot be easily sold because they are partially completed items, special-purpose items, and the like; and (2) inventory is typically sold on credit, which means that it becomes an account receivable before being converted into cash. The quick ratio is calculated as follows:[6]

$$\text{Quick ratio} = \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}}$$

The quick ratio for Bartlett Company in 2003 is

$$\frac{\$1{,}223{,}000 - \$289{,}000}{\$620{,}000} = \frac{\$934{,}000}{\$620{,}000} = 1.51$$

6. Sometimes the quick ratio is defined as (cash + marketable securities + accounts receivable) ÷ current liabilities. If a firm were to show as current assets items other than cash, marketable securities, accounts receivable, and inventories, its quick ratio might vary, depending on the method of calculation.

A quick ratio of 1.0 or greater is occasionally recommended, but as with the current ratio, what value is acceptable depends largely on the industry. The quick ratio provides a better measure of overall liquidity only when a firm's inventory cannot be easily converted into cash. If inventory is liquid, the current ratio is a preferred measure of overall liquidity.

Review Question

2–8 Under what circumstances would the current ratio be the preferred measure of overall firm liquidity? Under what circumstances would the quick ratio be preferred?

LG3 2.4 Activity Ratios

activity ratios
Measure the speed with which various accounts are converted into sales or cash—inflows or outflows.

Activity ratios measure the speed with which various accounts are converted into sales or cash—inflows or outflows. With regard to current accounts, measures of liquidity are generally inadequate because differences in the *composition* of a firm's current assets and current liabilities can significantly affect its "true" liquidity. It is therefore important to look beyond measures of overall liquidity and to assess the activity (liquidity) of specific current accounts. A number of ratios are available for measuring the activity of the most important current accounts, which include inventory, accounts receivable, and accounts payable.[7] The efficiency with which total assets are used can also be assessed.

Inventory Turnover

inventory turnover
Measures the activity, or liquidity, of a firm's inventory.

Inventory turnover commonly measures the activity, or liquidity, of a firm's inventory. It is calculated as follows:

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold}}{\text{Inventory}}$$

Applying this relationship to Bartlett Company in 2003 yields

$$\text{Inventory turnover} = \frac{\$2{,}088{,}000}{\$289{,}000} = 7.2$$

The resulting turnover is meaningful only when it is compared with that of other firms in the same industry or to the firm's past inventory turnover. An inventory

7. For convenience, the activity ratios involving these current accounts assume that their end-of-period values are good approximations of the average account balance during the period—typically 1 year. Technically, when the month-end balances of inventory, accounts receivable, or accounts payable vary during the year, the average balance, calculated by summing the 12 month-end account balances and dividing the total by 12, should be used instead of the year-end value. If month-end balances are unavailable, the average can be approximated by dividing the sum of the beginning-of-year and end-of-year balances by 2. These approaches ensure a ratio that on the average better reflects the firm's circumstances. Because the data needed to find averages are generally unavailable to the external analyst, year-end values are frequently used to calculate activity ratios for current accounts.

turnover of 20.0 would not be unusual for a grocery store, whereas a common inventory turnover for an aircraft manufacturer is 4.0.

average age of inventory
Average number of days' sales in inventory.

Inventory turnover can be easily converted into an **average age of inventory** by dividing it into 360—the assumed number of days in a year.[8] For Bartlett Company, the average age of inventory in 2003 is 50.0 days (360 ÷ 7.2). This value can also be viewed as the average number of days' sales in inventory.

Average Collection Period

average collection period
The average amount of time needed to collect accounts receivable.

The **average collection period,** or average age of accounts receivable, is useful in evaluating credit and collection policies.[9] It is arrived at by dividing the average daily sales[10] into the accounts receivable balance:

$$\text{Average collection period} = \frac{\text{Accounts receivable}}{\text{Average sales per day}}$$

$$= \frac{\text{Accounts receivable}}{\frac{\text{Annual sales}}{360}}$$

The average collection period for Bartlett Company in 2003 is

$$\frac{\$503{,}000}{\frac{\$3{,}074{,}000}{360}} = \frac{\$503{,}000}{\$8{,}539} = 58.9 \text{ days}$$

On the average, it takes the firm 58.9 days to collect an account receivable.

The average collection period is meaningful only in relation to the firm's credit terms. If Bartlett Company extends 30-day credit terms to customers, an average collection period of 58.9 days may indicate a poorly managed credit or collection department, or both. It is also possible that the lengthened collection period resulted from an intentional relaxation of credit-term enforcement in response to competitive pressures. If the firm had extended 60-day credit terms, the 58.9-day average collection period would be quite acceptable. Clearly, additional information is needed to evaluate the effectiveness of the firm's credit and collection policies.

Average Payment Period

average payment period
The average amount of time needed to pay accounts payable.

The **average payment period,** or average age of accounts payable, is calculated in the same manner as the average collection period:

$$\text{Average payment period} = \frac{\text{Accounts payable}}{\text{Average purchases per day}}$$

8. Unless otherwise specified, a 360-day year consisting of twelve 30-day months is assumed throughout this textbook. This assumption simplifies the calculations used to illustrate key concepts.

9. The average collection period is sometimes called the *days' sales outstanding (DSO)*. A discussion of the evaluation and establishment of credit and collection policies is presented in Chapter 14.

10. The formula as presented assumes, for simplicity, that all sales are made on a credit basis. If this is not the case, *average credit sales per day* should be substituted for average sales per day.

$$= \frac{\text{Accounts payable}}{\frac{\text{Annual purchases}}{360}}$$

The difficulty in calculating this ratio stems from the need to find annual purchases,[11] a value not available in published financial statements. Ordinarily, purchases are estimated as a given percentage of cost of goods sold. If we assume that Bartlett Company's purchases equaled 70 percent of its cost of goods sold in 2003, its average payment period is

$$\frac{\$382{,}000}{\frac{0.70 \times \$2{,}088{,}000}{360}} = \frac{\$382{,}000}{\$4{,}060} = 94.1 \text{ days}$$

This figure is meaningful only in relation to the average credit terms extended to the firm. If Bartlett Company's suppliers have extended, on average, 30-day credit terms, an analyst would give Bartlett a low credit rating. Prospective lenders and suppliers of trade credit are most interested in the average payment period because it provides insight into the firm's bill-paying patterns.

Total Asset Turnover

total asset turnover
Indicates the efficiency with which the firm uses its assets to generate sales.

The **total asset turnover** indicates the efficiency with which the firm uses its assets to generate sales. Total asset turnover is calculated as follows:

$$\text{Total asset turnover} = \frac{\text{Sales}}{\text{Total assets}}$$

The value of Bartlett Company's total asset turnover in 2003 is

$$\frac{\$3{,}074{,}000}{\$3{,}597{,}000} = 0.85$$

Hint The higher the cost of the new assets, the larger the denominator and thus the smaller the ratio. Therefore, because of inflation and the use of historical costs, firms with newer assets will tend to have lower turnovers than those with older assets.

This means the company turns over its assets 0.85 times a year.

Generally, the higher a firm's total asset turnover, the more efficiently its assets have been used. This measure is probably of greatest interest to management, because it indicates whether the firm's operations have been financially efficient.

Review Question

2–9 To assess the firm's average collection period and average payment period ratios, what additional information is needed, and why?

11. Technically, annual *credit* purchases—rather than annual purchases—should be used in calculating this ratio. For simplicity, this refinement is ignored here.

LG4

2.5 Debt Ratios

The *debt position* of a firm indicates the amount of other people's money being used to generate profits. In general, the financial analyst is most concerned with long-term debts, because these commit the firm to a stream of payments over the long run. Because creditors' claims must be satisfied before the earnings can be distributed to shareholders, present and prospective shareholders pay close attention to the firm's ability to repay debts. Lenders are also concerned about the firm's indebtedness. Management obviously must be concerned with indebtedness.

financial leverage
The magnification of risk and return introduced through the use of fixed-cost financing, such as debt and preferred stock.

In general, the more debt a firm uses in relation to its total assets, the greater its *financial leverage.* **Financial leverage** is the magnification of risk and return introduced through the use of fixed-cost financing, such as debt and preferred stock. The more fixed-cost debt a firm uses, the greater will be its expected risk and return.

EXAMPLE

Patty Akers is in the process of incorporating her new business. After much analysis she determined that an initial investment of $50,000—$20,000 in current assets and $30,000 in fixed assets—is necessary. These funds can be obtained in either of two ways. The first is the *no-debt plan,* under which she would invest the full $50,000 without borrowing. The other alternative, the *debt plan,* involves investing $25,000 and borrowing the balance of $25,000 at 12% annual interest.

Regardless of which alternative she chooses, Patty expects sales to average $30,000, costs and operating expenses to average $18,000, and earnings to be taxed at a 40% rate. Projected balance sheets and income statements associated with the two plans are summarized in Table 2.6. The no-debt plan results in after-tax profits of $7,200, which represent a 14.4% rate of return on Patty's $50,000 investment. The debt plan results in $5,400 of after-tax profits, which represent a 21.6% rate of return on Patty's investment of $25,000. The debt plan provides Patty with a higher rate of return, but the risk of this plan is also greater, because the annual $3,000 of interest must be paid before receipt of earnings.

The example demonstrates that *with increased debt comes greater risk as well as higher potential return.* Therefore, the greater the financial leverage, the greater the potential risk and return. A detailed discussion of the impact of debt on the firm's risk, return, and value is included in Chapter 12. Here, we emphasize the use of financial debt ratios to assess externally a firm's debt position.

degree of indebtedness
Measures the amount of debt relative to other significant balance sheet amounts.

ability to service debts
The ability of a firm to make the payments required on a scheduled basis over the life of a debt.

coverage ratios
Ratios that measure the firm's ability to pay certain fixed charges.

There are two general types of debt measures: measures of the degree of indebtedness and measures of the ability to service debts. The **degree of indebtedness** measures the amount of debt relative to other significant balance sheet amounts. A popular measure of the degree of indebtedness is the debt ratio.

The second type of debt measure, the **ability to service debts,** reflects a firm's ability to make the payments required on a scheduled basis over the life of a debt.[12] The firm's ability to pay certain fixed charges is measured using **coverage ratios.** Typically, higher coverage ratios are preferred, but too high a ratio (above

12. The term *service* refers to the payment of interest and repayment of principal associated with a firm's debt obligations. When a firm services its debts, it pays—or fulfills—these obligations.

TABLE 2.6 Financial Statements Associated with Patty's Alternatives

	No-debt plan		Debt plan	
Balance Sheets				
Current assets	$20,000			$20,000
Fixed assets	30,000			30,000
Total assets	$50,000			$50,000
Debt (12% interest)	$ 0			$25,000
(1) Equity	50,000			25,000
Total liabilities and equity	$50,000			$50,000
Income Statements				
Sales	$30,000			$30,000
Less: Costs and operating expenses	18,000			18,000
Operating profits	$12,000			$12,000
Less: Interest expense	0		$0.12 \times \$25{,}000 =$	3,000
Net profit before taxes	$12,000			$ 9,000
Less: Taxes (rate = 40%)	4,800			3,600
(2) Net profit after taxes	$ 7,200			$ 5,400
Return on equity [(2) ÷ (1)]	$\frac{\$7{,}200}{\$50{,}000}$	$= 14.4\%$		$\frac{\$5{,}400}{\$25{,}000} = 21.6\%$

industry norms) may result in unnecessarily low risk and return. In general, the lower the firm's coverage ratios, the less certain it is to be able to pay fixed obligations. If a firm is unable to pay these obligations, its creditors may seek immediate repayment, which in most instances would force a firm into bankruptcy. Two popular coverage ratios are the times interest earned ratio and the fixed-payment coverage ratio.[13]

Debt Ratio

debt ratio
Measures the proportion of total assets financed by the firm's creditors.

The **debt ratio** measures the proportion of total assets financed by the firm's creditors. The higher this ratio, the greater the amount of other people's money being used to generate profits. The ratio is calculated as follows:

$$\text{Debt ratio} = \frac{\text{Total liabilities}}{\text{Total assets}}$$

13. Coverage ratios use data that are derived on an *accrual basis* (discussed in Chapter 1) to measure what in a strict sense should be measured on a *cash basis*. This occurs because debts are serviced by using cash flows, not the accounting values shown on the firm's financial statements. But because it is difficult to determine cash flows available for debt service from the firm's financial statements, the calculation of coverage ratios as presented here is quite common thanks to the ready availability of financial statement data.

The debt ratio for Bartlett Company in 2003 is

$$\frac{\$1{,}643{,}000}{\$3{,}597{,}000} = 0.457 = 45.7\%$$

This value indicates that the company has financed close to half of its assets with debt. The higher this ratio, the greater the firm's degree of indebtedness and the more financial leverage it has.

Times Interest Earned Ratio

times interest earned ratio
Measures the firm's ability to make contractual interest payments; sometimes called the *interest coverage ratio.*

The **times interest earned ratio,** sometimes called the *interest coverage ratio,* measures the firm's ability to make contractual interest payments. The higher its value, the better able the firm is to fulfill its interest obligations. The times interest earned ratio is calculated as follows:

$$\text{Times interest earned ratio} = \frac{\text{Earnings before interest and taxes}}{\text{Interest}}$$

The figure for *earnings before interest and taxes* is the same as that for *operating profits* shown in the income statement. Applying this ratio to Bartlett Company yields the following 2003 value:

$$\text{Times interest earned ratio} = \frac{\$418{,}000}{\$93{,}000} = 4.5$$

The times interest earned ratio for Bartlett Company seems acceptable. A value of at least 3.0—and preferably closer to 5.0—is often suggested. The firm's earnings before interest and taxes could shrink by as much as 78 percent $[(4.5 - 1.0) \div 4.5]$, and the firm would still be able to pay the \$93,000 in interest it owes. Thus it has a good margin of safety.

Fixed-Payment Coverage Ratio

fixed-payment coverage ratio
Measures the firm's ability to meet all fixed-payment obligations.

The **fixed-payment coverage ratio** measures the firm's ability to meet all fixed-payment obligations, such as loan interest and principal, lease payments, and preferred stock dividends.[14] As is true of the times interest earned ratio, the higher this value, the better. The formula for the fixed-payment coverage ratio is

$$\text{Fixed-payment coverage ratio} = \frac{\text{Earnings before interest and taxes} + \text{Lease payments}}{\text{Interest} + \text{Lease payments} + \{(\text{Principal payments} + \text{Preferred stock dividends}) \times [1/(1-T)]\}}$$

where T is the corporate tax rate applicable to the firm's income. The term $1/(1-T)$ is included to adjust the after-tax principal and preferred stock dividend payments back to a before-tax equivalent that is consistent with the before-

14. Although preferred stock dividends, which are stated at the time of issue, can be "passed" (not paid) at the option of the firm's directors, it is generally believed that the payment of such dividends is necessary. *This text therefore treats the preferred stock dividend as a contractual obligation, to be paid as a fixed amount, as scheduled.*

tax values of all other terms. Applying the formula to Bartlett Company's 2003 data yields

$$\text{Fixed-payment coverage ratio} = \frac{\$418{,}000 + \$35{,}000}{\$93{,}000 + \$35{,}000 + \{(\$71{,}000 + \$10{,}000) \times [1/(1 - 0.29)]\}}$$

$$= \frac{\$453{,}000}{\$242{,}000} = 1.9$$

Because the earnings available are nearly twice as large as its fixed-payment obligations, the firm appears safely able to meet the latter.

Like the times interest earned ratio, the fixed-payment coverage ratio measures risk. The lower the ratio, the greater the risk to both lenders and owners; the greater the ratio, the lower the risk. This ratio allows interested parties to assess the firm's ability to meet additional fixed-payment obligations without being driven into bankruptcy.

Review Questions

2–10 What is *financial leverage?*

2–11 What ratio measures the firm's *degree of indebtedness*? What ratios assess the firm's *ability to service debts?*

LG5 2.6 Profitability Ratios

There are many measures of profitability. As a group, these measures enable the analyst to evaluate the firm's profits with respect to a given level of sales, a certain level of assets, or the owners' investment. Without profits, a firm could not attract outside capital. Owners, creditors, and management pay close attention to boosting profits because of the great importance placed on earnings in the marketplace.

Common-Size Income Statements

common-size income statement
An income statement in which each item is expressed as a percentage of sales.

A popular tool for evaluating profitability in relation to sales is the **common-size income statement.**[15] Each item on this statement is expressed as a percentage of sales. Common-size income statements are especially useful in comparing performance across years. Three frequently cited ratios of profitability that can be read directly from the common-size income statement are (1) the gross profit margin, (2) the operating profit margin, and (3) the net profit margin.

Common-size income statements for 2003 and 2002 for Bartlett Company are presented and evaluated in Table 2.7. These statements reveal that the firm's

15. This statement is sometimes called a *percent income statement*. The same treatment is often applied to the firm's balance sheet to make it easier to evaluate changes in the asset and financial structures of the firm. In addition to measuring profitability, these statements in effect can be used as an alternative or supplement to liquidity, activity, and debt-ratio analysis.

TABLE 2.7 Bartlett Company Common-Size Income Statements

	For the years ended December 31		Evaluation[a]
	2003	2002	2002–2003
Sales revenue	100.0%	100.0%	same
Less: Cost of goods sold	67.9	66.7	worse
(1) Gross profit margin	32.1%	33.3%	worse
Less: Operating expenses			
Selling expense	3.3%	4.2%	better
General and administrative expenses	6.8	6.7	better
Lease expense	1.1	1.3	better
Depreciation expense	7.3	9.3	better
Total operating expense	18.5%	21.5%	better
(2) Operating profit margin	13.6%	11.8%	better
Less: Interest expense	3.0	3.5	better
Net profits before taxes	10.6%	8.3%	better
Less: Taxes	3.1	2.5	worse[b]
Net profits after taxes	7.5%	5.8%	better
Less: Preferred stock dividends	0.3	0.4	better
(3) Net profit margin	7.2%	5.4%	better

[a]Subjective assessments based on data provided.

[b]Taxes as a percent of sales increased noticeably between 2002 and 2003 because of differing costs and expenses, whereas the average tax rates (taxes ÷ net profits before taxes) for 2002 and 2003 remained about the same—30% and 29%, respectively.

cost of goods sold increased from 66.7 percent of sales in 2002 to 67.9 percent in 2003, resulting in a worsening gross profit margin. However, thanks to a decrease in total operating expenses, the firm's net profit margin rose from 5.4 percent of sales in 2002 to 7.2 percent in 2003. The decrease in expenses more than compensated for the increase in the cost of goods sold. A decrease in the firm's 2003 interest expense (3.0 percent of sales versus 3.5 percent in 2002) added to the increase in 2003 profits.

Gross Profit Margin

gross profit margin
Measures the percentage of each sales dollar remaining after the firm has paid for its goods.

The **gross profit margin** measures the percentage of each sales dollar remaining after the firm has paid for its goods. The higher the gross profit margin, the better (that is, the lower the relative cost of merchandise sold). The gross profit margin is calculated as follows:

$$\text{Gross profit margin} = \frac{\text{Sales} - \text{Cost of goods sold}}{\text{Sales}} = \frac{\text{Gross profits}}{\text{Sales}}$$

In Practice

FOCUS ON e-FINANCE ShopKo's Software Solution

Specialized financial analysis tools can help companies achieve significant improvements in ratio measures of performance. With assistance from sophisticated new software programs, for example, companies can convert masses of historical sales data into useful information that guides pricing strategy and improves operating efficiency.

Like many of its rivals, ShopKo Stores, a Fortune 500 discount chain based in Green Bay, Wisconsin, had no underlying strategy to sell slow-moving items. It used "guesstimates" to reduce prices a bit at a time, until eventually the merchandise sold. However, total sales suffered from the company's having no way to determine the maximum price at which goods would sell. Because the dollar volume of sales enters into both the numerator and the denominator in the gross profit margin, when sales numbers were down, the ShopKo's gross profit margin also suffered.

Software from Spotlight Solutions, a Cincinnati company, applied information technology to ShopKo's decisions about markdowns. Company research indicated that multiple markdowns are not so profitable as properly timed single markdowns. It developed a program (Markdown Optimizer) to automate optimal price change actions so that retailers can achieve higher sales and margins from existing merchandise inventories. The program analyzes several years of sales figures on similar products and develops a demand pattern, taking into account the sensitivity of customer demand to price changes (price elasticity). The software is dynamic—that is, it "learns" retail customers' preferences and incorporates that information into its models.

During a six-month pilot project, ShopKo provided three years of sales data on 300 apparel, home, and other products. Markdown Optimizer ran through a series of mathematical models to arrive at optimal timing for and amount of price cuts. ShopKo tracked and compared sales for these clearance items using the recommended markdowns. Sales on those products were 14 percent higher than the prior year. The company's gross profit margin rose 24 percent, despite flat same-store sales in one quarter. ShopKo now uses Markdown Optimizer for all products.

Sources: Amy Merrick, "Retailers Try to Get Leg Up on Markdowns with New Software," *Wall Street Journal* (August 7, 2001), pp. A1, A6; "ShopKo Uses Spotlight Solutions Price Optimization Software," downloaded from Spotlight Solutions Web site, *www.spotlightsolutions.com/cshopko.html,* November 6, 2001.

Hint This is a very significant ratio for small retailers, especially during times of inflationary prices. If the owner of the firm does not raise prices when the cost of sales is rising, the gross profit margin will erode.

Bartlett Company's gross profit margin for 2003 is

$$\frac{\$3{,}074{,}000 - \$2{,}088{,}000}{\$3{,}074{,}000} = \frac{\$986{,}000}{\$3{,}074{,}000} = 32.1\%$$

This value is labeled (1) on the common-size income statement in Table 2.7.

Operating Profit Margin

operating profit margin
Measures the percentage of each sales dollar remaining after all costs and expenses *other than* interest, taxes, and preferred stock dividends are deducted; the "pure profits" earned on each sales dollar.

The **operating profit margin** measures the percentage of each sales dollar remaining after all costs and expenses *other than* interest, taxes, and preferred stock dividends are deducted. It represents the "pure profits" earned on each sales dollar. Operating profits are "pure" because they measure only the profits earned on operations and ignore interest, taxes, and preferred stock dividends. A high operating profit margin is preferred. The operating profit margin is calculated as follows:

$$\text{Operating profit margin} = \frac{\text{Operating profits}}{\text{Sales}}$$

Bartlett Company's operating profit margin for 2003 is

$$\frac{\$418{,}000}{\$3{,}074{,}000} = 13.6\%$$

This value is labeled (2) on the common-size income statement in Table 2.7.

Net Profit Margin

net profit margin
Measures the percentage of each sales dollar remaining after all costs and expenses, *including* interest, taxes, and preferred stock dividends, have been deducted.

The **net profit margin** measures the percentage of each sales dollar remaining after all costs and expenses, *including* interest, taxes, and preferred stock dividends, have been deducted. The higher the firm's net profit margin, the better. The net profit margin is calculated as follows:

$$\text{Net profit margin} = \frac{\text{Earnings available for common stockholders}}{\text{Sales}}$$

Bartlett Company's net profit margin for 2003 is

$$\frac{\$221{,}000}{\$3{,}074{,}000} = 7.2\%$$

This value is labeled (3) on the common-size income statement in Table 2.7.

The net profit margin is a commonly cited measure of the firm's success with respect to earnings on sales. "Good" net profit margins differ considerably across industries. A net profit margin of 1 percent or less would not be unusual for a grocery store, whereas a net profit margin of 10 percent would be low for a retail jewelry store.

Earnings per Share (EPS)

Hint EPS represents the dollar amount earned *on behalf of* each share—not the amount of earnings *actually distributed* to shareholders.

The firm's *earnings per share (EPS)* is generally of interest to present or prospective stockholders and management. As we noted earlier, EPS represents the number of dollars earned during the period on behalf of each outstanding share of common stock. Earnings per share is calculated as follows:

$$\text{Earnings per share} = \frac{\text{Earnings available for common stockholders}}{\text{Number of shares of common stock outstanding}}$$

Bartlett Company's earnings per share in 2003 is

$$\frac{\$221{,}000}{76{,}262} = \$2.90$$

This figure represents the dollar amount earned on behalf of each share. The dollar amount of cash *actually distributed* to each shareholder is the *dividend per share (DPS),* which, as noted in Bartlett Company's income statement (Table 2.1), rose to \$1.29 in 2003 from \$0.75 in 2002. EPS is closely watched by the investing public and is considered an important indicator of corporate success.

Return on Total Assets (ROA)

return on total assets (ROA)
Measures the overall effectiveness of management in generating profits with its available assets; also called the *return on investment (ROI)*.

The **return on total assets (ROA),** often called the *return on investment (ROI),* measures the overall effectiveness of management in generating profits with its available assets. The higher the firm's return on total assets, the better. The return on total assets is calculated as follows:

$$\text{Return on total assets} = \frac{\text{Earnings available for common stockholders}}{\text{Total assets}}$$

Bartlett Company's return on total assets in 2003 is

$$\frac{\$221{,}000}{\$3{,}597{,}000} = 6.1\%$$

This value indicates that the firm earned 6.1 cents on each dollar of asset investment.

Return on Common Equity (ROE)

return on common equity (ROE)
Measures the return earned on the common stockholders' investment in the firm.

The **return on common equity** (**ROE**) measures the return earned on the common stockholders' investment in the firm. Generally, the higher this return, the better off are the owners. Return on common equity is calculated as follows:

$$\text{Return on common equity} = \frac{\text{Earnings available for common stockholders}}{\text{Common stock equity}}$$

This ratio for Bartlett Company in 2003 is

$$\frac{\$221{,}000}{\$1{,}754{,}000} = 12.6\%$$

Note that the value for common stock equity ($1,754,000) was found by subtracting the $200,000 of preferred stock equity from the total stockholders' equity of $1,954,000 (see Bartlett Company's 2003 balance sheet in Table 2.2). The calculated ROE of 12.6 percent indicates that during 2003 Bartlett earned 12.6 cents on each dollar of common stock equity.

Review Questions

2–12 What three ratios of profitability are found on a *common-size income statement?*

2–13 What would explain a firm's having a high gross profit margin and a low net profit margin?

2–14 Which measure of profitability is probably of greatest interest to the investing public? Why?

LG5 2.7 Market Ratios

market ratios
Relate a firm's market value, as measured by its current share price, to certain accounting values.

Market ratios relate the firm's market value, as measured by its current share price, to certain accounting values. These ratios give insight into how well investors in the marketplace feel the firm is doing in terms of risk and return. They tend to reflect, on a relative basis, the common stockholders' assessment of all aspects of the firm's past and expected future performance. Here we consider two popular market ratios, one that focuses on earnings and another that considers book value.

Price/Earnings (P/E) Ratio

price/earnings (P/E) ratio
Measures the amount that investors are willing to pay for each dollar of a firm's earnings; the higher the P/E ratio, the greater is investor confidence.

The **price/earnings (P/E) ratio** is commonly used to assess the owners' appraisal of share value.[16] The P/E ratio measures the amount that investors are willing to pay for each dollar of a firm's earnings. The level of the price/earnings ratio indicates the degree of confidence that investors have in the firm's future performance. The higher the P/E ratio, the greater is investor confidence. The P/E ratio is calculated as follows:

$$\text{Price/earnings (P/E) ratio} = \frac{\text{Market price per share of common stock}}{\text{Earnings per share}}$$

If Bartlett Company's common stock at the end of 2003 was selling at \$32.25, using the EPS of \$2.90, the P/E ratio at year-end 2003 is

$$\frac{\$32.25}{\$2.90} = 11.1$$

This figure indicates that investors were paying \$11.10 for each \$1.00 of earnings. The P/E ratio is most informative when applied in cross-sectional analysis using an industry average P/E ratio or the P/E ratio of a benchmark firm.

Market/Book (M/B) Ratio

market/book (M/B) ratio
Provides an assessment of how investors view the firm's performance. Firms expected to earn high returns relative to their risk typically sell at higher M/B multiples.

The **market/book (M/B) ratio** provides an assessment of how investors view the firm's performance. It relates the market value of the firm's shares to their book—strict accounting—value. To calculate the firm's M/B ratio, we first need to find the *book value per share of common stock:*

$$\begin{array}{l}\text{Book value per}\\ \text{share of common stock}\end{array} = \frac{\text{Common stock equity}}{\text{Number of shares of common stock outstanding}}$$

Substituting the appropriate values for Bartlett Company from its 2003 balance sheet, we get

$$\text{Book value per share of common stock} = \frac{\$1{,}754{,}000}{76{,}262} = \$23.00$$

16. Use of the price/earnings ratio to estimate the value of the firm is part of the discussion of "Other approaches to common stock valuation" in Chapter 7.

The formula for the market/book ratio is

$$\text{Market/book (M/B) ratio} = \frac{\text{Market price per share of common stock}}{\text{Book value per share of common stock}}$$

Substituting Bartlett Company's end of 2003 common stock price of $32.25 and its $23.00 book value per share of common stock (calculated above) into the M/B ratio formula, we get

$$\text{Market/book (M/B) ratio} = \frac{\$32.25}{\$23.00} = 1.40$$

This M/B ratio means that investors are currently paying $1.40 for each $1.00 of book value of Bartlett Company's stock.

The stocks of firms that are expected to perform well—improve profits, increase their market share, or launch successful products—typically sell at higher M/B ratios than the stocks of firms with less attractive outlooks. Simply stated, firms expected to earn high returns relative to their risk typically sell at higher M/B multiples. Clearly, Bartlett's future prospects are being viewed favorably by investors, who are willing to pay more than its book value for the firm's shares. Like P/E ratios, M/B ratios are typically assessed cross-sectionally, to get a feel for the firm's risk and return compared to peer firms.

Review Question

2–15 How do the *price/earnings (P/E) ratio* and the *market/book (M/B) ratio* provide a feel for the firm's risk and return?

LG6 2.8 A Complete Ratio Analysis

Analysts frequently wish to take an overall look at the firm's financial performance and status. Here we consider two popular approaches to a complete ratio analysis: (1) summarizing all ratios and (2) the DuPont system of analysis. The summary analysis approach tends to view *all aspects* of the firm's financial activities to isolate key areas of responsibility. The DuPont system acts as a search technique aimed at finding the *key areas* responsible for the firm's financial condition.

Summarizing All Ratios

We can use Bartlett Company's ratios to perform a complete ratio analysis using both cross-sectional and time-series analysis approaches. The 2003 ratio values calculated earlier and the ratio values calculated for 2001 and 2002 for Bartlett Company, along with the industry average ratios for 2003, are summarized in Table 2.8, which also shows the formula used to calculate each ratio. Using these data, we can discuss the five key aspects of Bartlett's performance—liquidity, activity, debt, profitability, and market.

TABLE 2.8 Summary of Bartlett Company Ratios (2001–2003, Including 2003 Industry Averages)

		Year				Evaluation[d]		
Ratio	Formula	2001[a]	2002[b]	2003[b]	Industry average 2003[c]	Cross-sectional 2003	Time-series 2001–2003	Overall
Liquidity								
Current ratio	$\frac{\text{Current assets}}{\text{Current liabilities}}$	2.04	2.08	1.97	2.05	OK	OK	OK
Quick (acid-test) ratio	$\frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}}$	1.32	1.46	1.51	1.43	OK	good	good
Activity								
Inventory turnover	$\frac{\text{Cost of goods sold}}{\text{Inventory}}$	5.1	5.7	7.2	6.6	good	good	good
Average collection period	$\frac{\text{Accounts receivable}}{\text{Average sales per day}}$	43.9 days	51.2 days	58.9 days	44.3 days	poor	poor	poor
Average payment period	$\frac{\text{Accounts payable}}{\text{Average purchases per day}}$	75.8 days	81.2 days	94.1 days	66.5 days	poor	poor	poor
Total asset turnover	$\frac{\text{Sales}}{\text{Total assets}}$	0.94	0.79	0.85	0.75	OK	OK	OK
Debt								
Debt ratio	$\frac{\text{Total liabilities}}{\text{Total assets}}$	36.8%	44.3%	45.7%	40.0%	OK	OK	OK
Times interest earned ratio	$\frac{\text{Earnings before interest and taxes}}{\text{Interest}}$	5.6	3.3	4.5	4.3	good	OK	OK
Fixed-payment coverage ratio	$\frac{\text{Earnings before interest and taxes} + \text{Lease payments}}{\text{Int.} + \text{Lease pay.} + \{(\text{Prin.} + \text{Pref. div.}) \times [1/(1-T)]\}}$	2.4	1.4	1.9	1.5	good	OK	good

Ratio	Formula	Year 2001[a]	2002[b]	2003[b]	Industry average 2003[c]	Evaluation[d] Cross-sectional 2003	Time-series 2001–2003	Overall
Profitability								
Gross profit margin	$\frac{\text{Gross profits}}{\text{Sales}}$	31.4%	33.3%	32.1%	30.0%	OK	OK	OK
	Operating profit margin	$\frac{\text{Operating profits}}{\text{Sales}}$ good	14.6%	11.8%	13.6%	11.0%	good	OK
Net profit margin	$\frac{\text{Earnings available for common stockholders}}{\text{Sales}}$	8.2%	5.4%	7.2%	6.2%	good	OK	good
$2.90 OK	$2.26 good	Earnings per share (EPS) good	$\frac{\text{Earnings available for common stockholders}}{\text{Number of shares of common stock outstanding}}$				$3.26	$1.81
Return on total assets (ROA)	$\frac{\text{Earnings available for common stockholders}}{\text{Total assets}}$	7.8%	4.2%	6.1%	4.6%	good	OK	good
Return on common equity (ROE) good good	OK	$\frac{\text{Earnings available for common stockholders}}{\text{Common stock equity}}$			13.7%	8.5%	12.6%	8.5%
Market								
Price/earnings (P/E) ratio	$\frac{\text{Market price per share of common stock}}{\text{Earnings per share}}$	10.5	10.0[e]	11.1	12.5	OK	OK	OK
1.40 OK	1.30 OK	Market/book (M/B) ratio OK	$\frac{\text{Market price per share of common stock}}{\text{Book value per share of common stock}}$				1.25	0.85[e]

[a]Calculated from data not included in the chapter.
[b]Calculated by using the financial statements presented in Tables 2.1 and 2.2.

Liquidity

The overall liquidity of the firm seems to exhibit a reasonably stable trend, having been maintained at a level that is relatively consistent with the industry average in 2003. The firm's liquidity seems to be good.

Activity

Bartlett Company's inventory appears to be in good shape. Its inventory management seems to have improved, and in 2003 it performed at a level above that of the industry. The firm may be experiencing some problems with accounts receivable. The average collection period seems to have crept up above that of the industry. Bartlett also appears to be slow in paying its bills; it pays nearly 30 days slower than the industry average. This could adversely affect the firm's credit standing. Although overall liquidity appears to be good, the management of receivables and payables should be examined. Bartlett's total asset turnover reflects a decline in the efficiency of total asset utilization between 2001 and 2002. Although in 2003 it rose to a level considerably above the industry average, it appears that the pre-2002 level of efficiency has not yet been achieved.

Debt

Bartlett Company's indebtedness increased over the 2001–2003 period and is currently above the industry average. Although this increase in the debt ratio could be cause for alarm, the firm's ability to meet interest and fixed-payment obligations improved, from 2002 to 2003, to a level that outperforms the industry. The firm's increased indebtedness in 2002 apparently caused a deterioration in its ability to pay debt adequately. However, Bartlett has evidently improved its income in 2003 so that it is able to meet its interest and fixed-payment obligations at a level consistent with the average in the industry. In summary, it appears that although 2002 was an off year, the company's ability to pay debts in 2003 compensates for its increased degree of indebtedness.

Profitability

Bartlett's profitability relative to sales in 2003 was better than the average company in the industry, although it did not match the firm's 2001 performance. Although the *gross* profit margin was better in 2002 and 2003 than in 2001, higher levels of operating and interest expenses in 2002 and 2003 appear to have caused the 2003 *net* profit margin to fall below that of 2001. However, Bartlett Company's 2003 net profit margin is quite favorable when compared to the industry average.

The firm's earnings per share, return on total assets, and return on common equity behaved much as its net profit margin did over the 2001–2003 period. Bartlett appears to have experienced either a sizable drop in sales between 2001 and 2002 or a rapid expansion in assets during that period. The exceptionally high 2003 level of return on common equity suggests that the firm is performing quite well. The firm's above-average returns—net profit margin, EPS, ROA, and ROE—may be attributable to the fact that it is more risky than average. A look at market ratios is helpful in assessing risk.

Market

Investors have greater confidence in the firm in 2003 than in the prior two years, as reflected in the price/earnings (P/E) ratio of 11.1. However, this ratio is below the industry average. The P/E ratio suggests that the firm's risk has declined but remains above that of the average firm in its industry. The firm's market/book (M/B) ratio has increased over the 2001–2003 period, and in 2003 it exceeds the industry average. This implies that investors are optimistic about the firm's future performance. The P/E and M/B ratios reflect the firm's increased profitability over the 2001–2003 period: Investors expect to earn high future returns as compensation for the firm's above-average risk.

In summary, the firm appears to be growing and has recently undergone an expansion in assets, financed primarily through the use of debt. The 2002–2003 period seems to reflect a phase of adjustment and recovery from the rapid growth in assets. Bartlett's sales, profits, and other performance factors seem to be growing with the increase in the size of the operation. In addition, the market response to these accomplishments appears to have been positive. In short, the firm seems to have done well in 2003.

DuPont System of Analysis

DuPont system of analysis
System used to dissect the firm's financial statements and to assess its financial condition.

The **DuPont system of analysis** is used to dissect the firm's financial statements and to assess its financial condition. It merges the income statement and balance sheet into two summary measures of profitability: return on total assets (ROA) and return on common equity (ROE). Figure 2.2 depicts the basic DuPont system with Bartlett Company's 2003 monetary and ratio values. The upper portion of the chart summarizes the income statement activities; the lower portion summarizes the balance sheet activities.

DuPont formula
Multiplies the firm's *net profit margin* by its *total asset turnover* to calculate the firm's *return on total assets (ROA)*.

The DuPont system first brings together the *net profit margin,* which measures the firm's profitability on sales, with its *total asset turnover,* which indicates how efficiently the firm has used its assets to generate sales. In the **DuPont formula,** the product of these two ratios results in the *return on total assets (ROA)*:

$$\text{ROA} = \text{Net profit margin} \times \text{Total asset turnover}$$

Substituting the appropriate formulas into the equation and simplifying results in the formula given earlier,

$$\text{ROA} = \frac{\text{Earnings available for common stockholders}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}} = \frac{\text{Earnings available for common stockholders}}{\text{Total assets}}$$

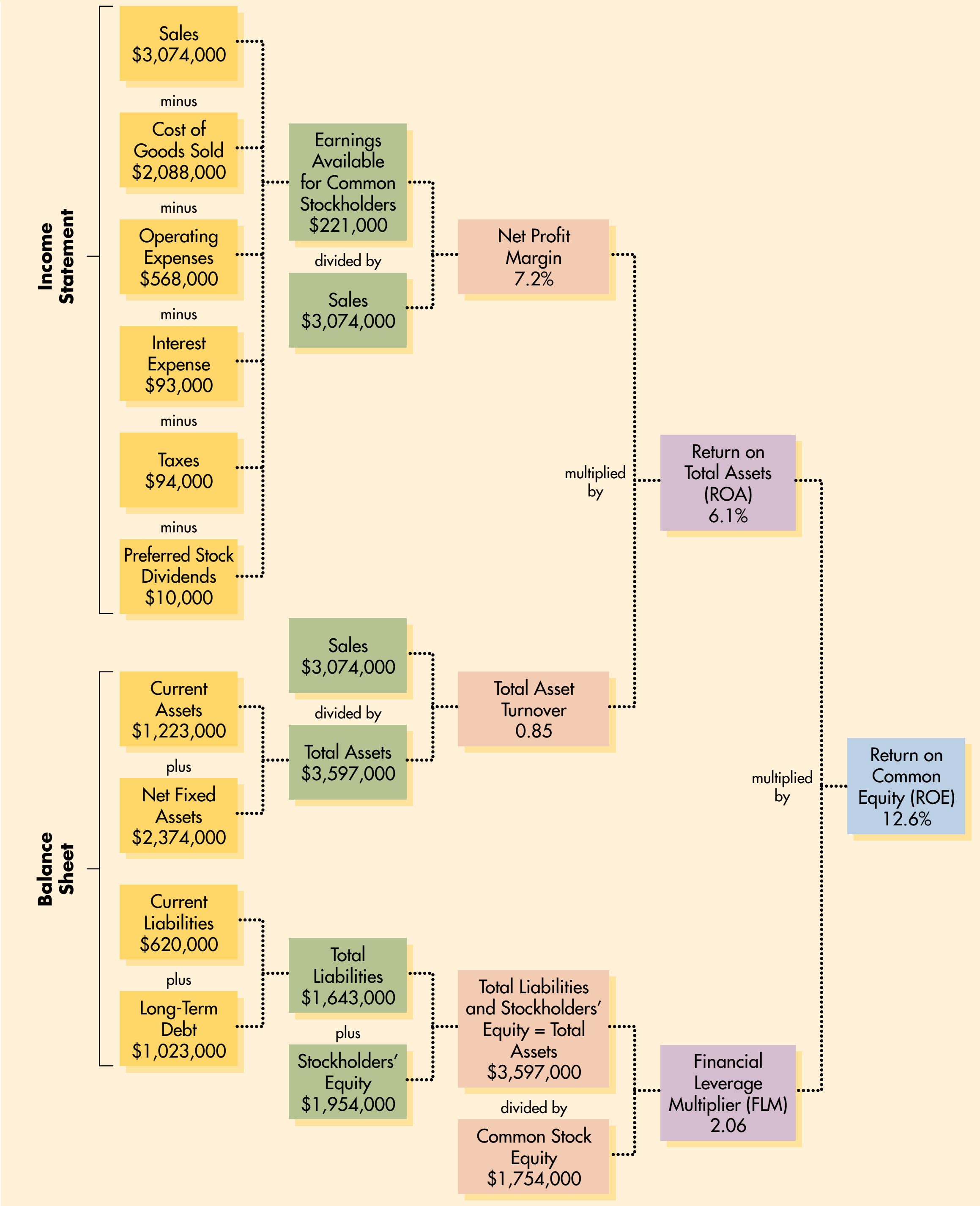
When the 2003 values of the net profit margin and total asset turnover for Bartlett Company, calculated earlier, are substituted into the DuPont formula, the result is

$$\text{ROA} = 7.2\% \times 0.85 = 6.1\%$$

This value is the same as that calculated directly in an earlier section (page 65). The DuPont formula enables the firm to break down its return into profit-on-sales and efficiency-of-asset-use components. Typically, a firm with a low net profit margin has a high total asset turnover, which results in a reasonably good return on total assets. Often, the opposite situation exists.

FIGURE 2.2 **DuPont System of Analysis**

The DuPont system of analysis with application to Bartlett Company (2003)



modified DuPont formula
Relates the firm's *return on total assets (ROA)* to its *return on common equity (ROE)* using the *financial leverage multiplier (FLM)*.

financial leverage multiplier (FLM)
The ratio of the firm's total assets to its common stock equity.

The second step in the DuPont system employs the **modified DuPont formula.** This formula relates the firm's return on total assets (ROA) to its return on common equity (ROE). The latter is calculated by multiplying the return on total assets (ROA) by the **financial leverage multiplier (FLM),** which is the ratio of total assets to common stock equity:

$$\text{ROE} = \text{ROA} \times \text{FLM}$$

Substituting the appropriate formulas into the equation and simplifying results in the formula given earlier,

$$\text{ROE} = \frac{\text{Earnings available for common stockholders}}{\text{Total assets}} \times \frac{\text{Total assets}}{\text{Common stock equity}} = \frac{\text{Earnings available for common stockholders}}{\text{Common stock equity}}$$

Use of the financial leverage multiplier (FLM) to convert the ROA into the ROE reflects the impact of financial leverage on owners' return. Substituting the values for Bartlett Company's ROA of 6.1 percent, calculated earlier, and Bartlett's FLM of 2.06 ($3,597,000 total assets ÷ $1,754,000 common stock equity) into the modified DuPont formula yields

$$\text{ROE} = 6.1\% \times 2.06 = 12.6\%$$

The 12.6 percent ROE calculated by using the modified DuPont formula is the same as that calculated directly (page 65).

The advantage of the DuPont system is that it allows the firm to break its return on equity into a profit-on-sales component (net profit margin), an efficiency-of-asset-use component (total asset turnover), and a use-of-financial-leverage component (financial leverage multiplier). The total return to owners therefore can be analyzed in these important dimensions.

The use of the DuPont system of analysis as a diagnostic tool is best explained using Figure 2.2. Beginning with the rightmost value—the ROE—the financial analyst moves to the left, dissecting and analyzing the inputs to the formula in order to isolate the probable cause of the resulting above-average (or below-average) value. For the sake of discussion, let's assume that Bartlett's ROE of 12.6 percent is actually below the industry average. Moving to the left, we would examine the inputs to the ROE—the ROA and the FLM—relative to the industry averages. Let's assume that the FLM is in line with the industry average, but the ROA is below the industry average. Moving farther to the left, we examine the two inputs to the ROA—the net profit margin and total asset turnover. Assume that the net profit margin is in line with the industry average, but the total asset turnover is below the industry average. Moving still farther to the left, we find that whereas the firm's sales are consistent with the industry value, Bartlett's total assets have grown significantly during the past year. Looking farther to the left, we would review the firm's activity ratios for current assets. Let's say that whereas the firm's inventory turnover is in line with the industry average, its average collection period is well above the industry average.

Clearly, we can trace the possible problem back to its cause: Bartlett's low ROE is primarily the consequence of slow collections of accounts receivable, which resulted in high levels of receivables and therefore high levels of total assets. The high total assets slowed Bartlett's total asset turnover, driving down its ROA, which then drove down its ROE. By using the DuPont system of analysis to dissect Bartlett's overall returns as measured by its ROE, we found that slow collections of receivables caused the below-industry-average ROE. Clearly, the firm needs to manage its credit operations better.

Review Questions

2–16 Financial ratio analysis is often divided into five areas: *liquidity, activity, debt, profitability,* and *market* ratios. Differentiate each of these areas of analysis from the others. Which is of the greatest concern to creditors?

2–17 Describe how you would use a large number of ratios to perform a complete ratio analysis of the firm.

2–18 What three areas of analysis are combined in the *modified DuPont formula?* Explain how the *DuPont system of analysis* is used to dissect the firm's results and isolate their causes.

SUMMARY

FOCUS ON VALUE

Financial managers review and analyze the firm's financial statements periodically, both to uncover developing problems and to assess the firm's progress toward achieving its goals. These actions are aimed at **preserving and creating value for the firm's owners.** Financial ratios enable financial managers to monitor the pulse of the firm and its progress toward its strategic goals. Although financial statements and financial ratios rely on accrual concepts, they can provide useful insights into important aspects of risk and return (cash flow) that affect share price, which management is attempting to maximize.

REVIEW OF LEARNING GOALS

LG1 **Review the contents of the stockholders' report and the procedures for consolidating international financial statements.** The annual stockholders' report, which publicly owned corporations are required to provide to stockholders, documents the firm's financial activities during the past year. It includes the letter to stockholders and various subjective and factual information, as well as four key financial statements: the income statement, the balance sheet, the statement of retained earnings, and the statement of cash flows. Notes describing the technical aspects of the financial statements follow them. Financial statements of companies that have operations whose cash flows are denominated in one or more foreign currencies must be translated into dollars in accordance with *FASB Standard No. 52.*

LG2 **Understand who uses financial ratios, and how.** Ratio analysis enables present and prospective stockholders and lenders and the firm's management to evaluate the firm's financial performance. It can be performed on a cross-sectional or a time-series basis. Benchmarking is a popular type of cross-sectional analysis. Key cautions for applying financial ratios are: (1) Ratios with large deviations from the norm only indicate symptoms of a problem. (2) A single ratio does not generally provide sufficient information. (3) The ratios being compared should be calculated using financial statements dated at the same point in time during the year. (4) Audited financial statements should be used. (5) Data should be checked for consistency of accounting treatment. (6) Inflation and different asset ages can distort ratio comparisons.

LG3 **Use ratios to analyze a firm's liquidity and activity.** Liquidity, or ability of the firm to pay its bills as they come due, can be measured by the current ratio and the quick (acid-test) ratio. Activity ratios measure the speed with which accounts are converted into sales or cash—inflows or outflows. The activity of inventory can be measured by its turnover, that of accounts receivable by the average collection period, and that of accounts payable by the average payment period. Total asset turnover measures the efficiency with which the firm uses its assets to generate sales. Formulas for these liquidity and activity ratios are summarized in Table 2.8.

LG4 **Discuss the relationship between debt and financial leverage and the ratios used to analyze a firm's debt.** The more debt a firm uses, the greater its financial leverage, which magnifies both risk and return. Financial debt ratios measure both the degree of indebtedness and the ability to service debts. A common measure of indebtedness is the debt ratio. The ability to pay fixed charges can be measured by times interest earned and fixed-payment coverage ratios. Formulas for these debt ratios are summarized in Table 2.8.

LG5 **Use ratios to analyze a firm's profitability and its market value.** The common-size income statement, which shows all items as a percentage of sales, can be used to determine gross profit margin, operating profit margin, and net profit margin. Other measures of profitability include earnings per share, return on total assets, and return on common equity. Market ratios include the price/earnings ratio and the market/book ratio. Formulas for these profitability and market ratios are summarized in Table 2.8.

LG6 **Use a summary of financial ratios and the DuPont system of analysis to perform a complete ratio analysis.** A summary of all ratios—liquidity, activity, debt, profitability, and market—as shown in Table 2.8 can be used to perform a complete ratio analysis using cross-sectional and time-series analysis approaches. The DuPont system of analysis, summarized in Figure 2.2, is a diagnostic tool used to find the key areas responsible for the firm's financial performance. It enables the firm to break the return on common equity into three components: profit on sales, efficiency of asset use, and use of leverage. The DuPont system of analysis makes it possible to assess all aspects of the firm's activities in order to isolate key areas of responsibility.

SELF-TEST PROBLEMS (Solutions in Appendix B)

LG3 LG4 LG5 ST 2–1 **Ratio formulas and interpretations** Without referring to the text, indicate for each of the following ratios the formula for calculating it and the kinds of problems, if any, the firm is likely to have if that ratio is too high relative to the industry average. What if the ratio is too low relative to the industry? Create a table similar to the one that follows and fill in the empty blocks.

Ratio	Too high	Too low
Current ratio =		
Inventory turnover =		
Times interest earned =		
Gross profit margin =		
Return on total assets =		

LG3 LG4 LG5 **ST 2–2 Balance sheet completion using ratios** Complete the 2003 balance sheet for O'Keefe Industries using the information that follows it.

O'Keefe Industries
Balance Sheet
December 31, 2003

Assets		**Liabilities and Stockholders' Equity**	
Cash	$30,000	Accounts payable	$120,000
Marketable securities	25,000	Notes payable	_____
Accounts receivable	_____	Accruals	20,000
Inventories	_____	Total current liabilities	_____
Total current assets	_____	Long-term debt	_____
Net fixed assets	_____	Stockholders' equity	$600,000
Total assets	$ _____	Total liabilities and stockholders' equity	$ _____

The following financial data for 2003 are also available:

(1) Sales totaled $1,800,000.
(2) The gross profit margin was 25%.
(3) Inventory turnover was 6.0.
(4) There are 360 days in the year.
(5) The average collection period was 40 days.
(6) The current ratio was 1.60.
(7) The total asset turnover ratio was 1.20.
(8) The debt ratio was 60%.

PROBLEMS

LG1 **2–1 Reviewing basic financial statements** The income statement for the year ended December 31, 2003, the balance sheets for December 31, 2003 and 2002, and the statement of retained earnings for the year ended December 31, 2003, for Technica, Inc., are given here. Briefly discuss the form and informational content of each of these statements.

Technica, Inc.
Income Statement
for the Year Ended December 31, 2003

Sales revenue		$600,000
Less: Cost of goods sold		460,000
Gross profits		$140,000
Less: Operating expenses		
General and administrative expense	$30,000	
Depreciation expense	30,000	
Total operating expense		60,000
Operating profits		$ 80,000
Less: Interest expense		10,000
Net profits before taxes		$ 70,000
Less: Taxes		27,100
Earnings available for common stockholders		$ 42,900
Earnings per share (EPS)		$2.15

Technica, Inc.
Balance Sheets

Assets	December 31 2003	December 31 2002
Cash	$ 15,000	$ 16,000
Marketable securities	7,200	8,000
Accounts receivable	34,100	42,200
Inventories	82,000	50,000
Total current assets	$138,300	$116,200
Land and buildings	$150,000	$150,000
Machinery and equipment	200,000	190,000
Furniture and fixtures	54,000	50,000
Other	11,000	10,000
Total gross fixed assets	$415,000	$400,000
Less: Accumulated depreciation	145,000	115,000
Net fixed assets	$270,000	$285,000
Total assets	$408,300	$401,200
Liabilities and Stockholders' Equity		
Accounts payable	$ 57,000	$ 49,000
Notes payable	13,000	16,000
Accruals	5,000	6,000
Total current liabilities	$ 75,000	$ 71,000
Long-term debt	$150,000	$160,000
Stockholders' equity		
Common stock equity (shares outstanding: 19,500 in 2003 and 20,000 in 2002)	$110,200	$120,000
Retained earnings	73,100	50,200
Total stockholders' equity	$183,300	$170,200
Total liabilities and stockholders' equity	$408,300	$401,200

Technica, Inc.
Statement of Retained Earnings
for the Year Ended December 31, 2003

Retained earnings balance (January 1, 2003)	$50,200
Plus: Net profits after taxes (for 2003)	42,900
Less: Cash dividends (paid during 2003)	(20,000)
Retained earnings balance (December 31, 2003)	$73,100

LG1 **2–2 Financial statement account identification** Mark each of the accounts listed in the following table as follows:

a. In column (1), indicate in which statement—income statement (IS) or balance sheet (BS)—the account belongs.

b. In column (2), indicate whether the account is a current asset (CA), current liability (CL), expense (E), fixed asset (FA), long-term debt (LTD), revenue (R), or stockholders' equity (SE).

Account name	(1) Statement	(2) Type of account
Accounts payable	_______	_______
Accounts receivable	_______	_______
Accruals	_______	_______
Accumulated depreciation	_______	_______
Administrative expense	_______	_______
Buildings	_______	_______
Cash	_______	_______
Common stock (at par)	_______	_______
Cost of goods sold	_______	_______
Depreciation	_______	_______
Equipment	_______	_______
General expense	_______	_______
Interest expense	_______	_______
Inventories	_______	_______
Land	_______	_______
Long-term debts	_______	_______
Machinery	_______	_______
Marketable securities	_______	_______
Notes payable	_______	_______
Operating expense	_______	_______
Paid-in capital in excess of par	_______	_______
Preferred stock	_______	_______
Preferred stock dividends	_______	_______
Retained earnings	_______	_______
Sales revenue	_______	_______
Selling expense	_______	_______
Taxes	_______	_______
Vehicles	_______	_______

LG1 **2–3** **Income statement preparation** On December 31, 2003, Cathy Chen, a self-employed certified public accountant (CPA), completed her first full year in business. During the year, she billed $180,000 for her accounting services. She had two employees: a bookkeeper and a clerical assistant. In addition to her *monthly* salary of $4,000, Ms. Chen paid *annual* salaries of $24,000 and $18,000 to the bookkeeper and the clerical assistant, respectively. Employment taxes and benefit costs for Ms. Chen and her employees totaled $17,300 for the year. Expenses for office supplies, including postage, totaled $5,200 for the year. In addition, Ms. Chen spent $8,500 during the year on tax-deductible travel and entertainment associated with client visits and new business development. Lease payments for the office space rented (a tax-deductible expense) were $1,350 *per month*. Depreciation expense on the office furniture and fixtures was $7,800 for the year. During the year, Ms. Chen paid interest of $7,500 on the $60,000 borrowed to start the business. She paid an average tax rate of 30 percent during 2003.

a. Prepare an income statement for Cathy Chen, CPA, for the year ended December 31, 2003.

b. Evaluate her 2003 financial performance.

LG1

2–4 Calculation of EPS and retained earnings Philagem, Inc., ended 2003 with net profit *before* taxes of $218,000. The company is subject to a 40% tax rate and must pay $32,000 in preferred stock dividends before distributing any earnings on the 85,000 shares of common stock currently outstanding.

a. Calculate Philagem's 2003 earnings per share (EPS).

b. If the firm paid common stock dividends of $0.80 per share, how many dollars would go to retained earnings?

LG1

2–5 Balance sheet preparation Use the *appropriate items* from the following list to prepare in good form Owen Davis Company's balance sheet at December 31, 2003.

Item	Value ($000) at December 31, 2003
Accounts payable	$ 220
Accounts receivable	450
Accruals	55
Accumulated depreciation	265
Buildings	225
Cash	215
Common stock (at par)	90
Cost of goods sold	2,500
Depreciation expense	45
Equipment	140
Furniture and fixtures	170
General expense	320
Inventories	375
Land	100
Long-term debts	420
Machinery	420
Marketable securities	75
Notes payable	475
Paid-in capital in excess of par	360
Preferred stock	100
Retained earnings	210
Sales revenue	3,600
Vehicles	25

LG1 **2–6 Impact of net income on a firm's balance sheet** Conrad Air, Inc., reported net income of $1,365,000 for the year ended December 31, 2003. Show the effect of these funds on the firm's balance sheet for the previous year (below) in each of the scenarios following the balance sheet.

Conrad Air, Inc.
Balance Sheet
as of December 31, 2003

Assets		**Liabilities and Stockholders' Equity**	
Cash	$ 120,000	Accounts payable	$ 70,000
Marketable securities	35,000	Short-term notes	55,000
Accounts receivable	45,000	Current liabilities	$ 125,000
Inventories	130,000	Long-term debt	$2,700,000
Current assets	$ 330,000	Total liabilities	$2,825,000
Equipment	$2,970,000	Common stock	$ 500,000
Buildings	1,600,000	Retained earnings	1,575,000
Fixed assets	$4,570,000	Stockholders' equity	$2,075,000
Total assets	$4,900,000	Total liabilities and equity	$4,900,000

a. Conrad paid no dividends during the year and invested the funds in marketable securities.
b. Conrad paid dividends totaling $500,000 and used the balance of the net income to retire (pay off) long-term debt.
c. Conrad paid dividends totaling $500,000 and invested the balance of the net income in building a new hangar.
d. Conrad paid out all $1,365,000 as dividends to its stockholders.

LG1 **2–7 Initial sale price of common stock** Beck Corporation has one issue of preferred stock and one issue of common stock outstanding. Given Beck's stockholders' equity account that follows, determine the original price per share at which the firm sold its single issue of common stock.

Stockholders' Equity ($000)	
Preferred stock	$ 125
Common stock ($0.75 par, 300,000 shares outstanding)	225
Paid-in capital in excess of par on common stock	2,625
Retained earnings	900
Total stockholders' equity	$3,875

LG1 **2–8 Statement of retained earnings** Hayes Enterprises began 2003 with a retained earnings balance of $928,000. During 2003, the firm earned $377,000 after taxes. From this amount, preferred stockholders were paid $47,000 in dividends. At year-end 2003, the firm's retained earnings totaled $1,048,000. The firm had 140,000 shares of common stock outstanding during 2003.

a. Prepare a statement of retained earnings for the year ended December 31, 2003, for Hayes Enterprises. (*Note:* Be sure to calculate and include the amount of cash dividends paid in 2003.)
b. Calculate the firm's 2003 earnings per share (EPS).
c. How large a per-share cash dividend did the firm pay on common stock during 2003?

LG1 **2–9 Changes in stockholders' equity** Listed are the equity sections of balance sheets for years 2002 and 2003 as reported by Mountain Air Ski Resorts, Inc. The overall value of stockholders' equity has risen from $2,000,000 to $7,500,000. Use the statements to discover how and why this happened.

Mountain Air Ski Resorts, Inc.
Balance Sheets (partial)

Stockholders' Equity	2002	2003
Common stock ($1.00 par)		
Authorized—5,000,000 shares		
Outstanding—1,500,000 shares 2003		$1,500,000
— 500,000 shares 2002	$ 500,000	
Paid-in capital in excess of par	500,000	4,500,000
Retained earnings	1,000,000	1,500,000
Total stockholders' equity	$2,000,000	$7,500,000

The company paid total dividends of $200,000 during fiscal 2003.
a. What was Mountain Air's net income for fiscal 2003?
b. How many new shares did the corporation issue and sell during the year?
c. At what average price per share did the new stock sold during 2003 sell?
d. At what price per share did Mountain Air's original 500,000 shares sell?

LG2 LG3 LG4 LG5 **2–10 Ratio comparisons** Robert Arias recently inherited a stock portfolio from his uncle. Wishing to learn more about the companies that he is now invested in, Robert performs a ratio analysis on each one and decides to compare them to each other. Some of his ratios are listed below.

Ratio	Island Electric Utility	Burger Heaven	Fink Software	Roland Motors
Current ratio	1.10	1.3	6.8	4.5
Quick ratio	0.90	0.82	5.2	3.7
Debt ratio	0.68	0.46	0	0.35
Net profit margin	6.2%	14.3%	28.5%	8.4%

Assuming that his uncle was a wise investor who assembled the portfolio with care, Robert finds the wide differences in these ratios confusing. Help him out.

a. What problems might Robert encounter in comparing these companies to one another on the basis of their ratios?
b. Why might the current and quick ratios for the electric utility and the fast-food stock be so much lower than the same ratios for the other companies?
c. Why might it be all right for the electric utility to carry a large amount of debt, but not the software company?
d. Why wouldn't investors invest all of their money in software companies instead of in less profitable companies? (Focus on risk and return.)

LG3 **2–11** **Liquidity management** Bauman Company's total current assets, total current liabilities, and inventory for each of the past 4 years follow:

Item	2000	2001	2002	2003
Total current assets	$16,950	$21,900	$22,500	$27,000
Total current liabilities	9,000	12,600	12,600	17,400
Inventory	6,000	6,900	6,900	7,200

a. Calculate the firm's current and quick ratios for each year. Compare the resulting time series for these measures of liquidity.
b. Comment on the firm's liquidity over the 2000–2003 period.
c. If you were told that Bauman Company's inventory turnover for each year in the 2000–2003 period and the industry averages were as follows, would this information support or conflict with your evaluation in part **b?** Why?

Inventory turnover	2000	2001	2002	2003
Bauman Company	6.3	6.8	7.0	6.4
Industry average	10.6	11.2	10.8	11.0

LG3 **2–12** **Inventory management** Wilkins Manufacturing has sales of $4 million and a gross profit margin of 40%. Its *end-of-quarter inventories* are

Quarter	Inventory
1	$ 400,000
2	800,000
3	1,200,000
4	200,000

a. Find the average quarterly inventory and use it to calculate the firm's inventory turnover and the average age of inventory.
b. Assuming that the company is in an industry with an average inventory turnover of 2.0, how would you evaluate the activity of Wilkins' inventory?

LG3 **2–13 Accounts receivable management** An evaluation of the books of Blair Supply, which follows, gives the end-of-year accounts receivable balance, which is believed to consist of amounts originating in the months indicated. The company had annual sales of $2.4 million. The firm extends 30-day credit terms.

Month of origin	Amounts receivable
July	$ 3,875
August	2,000
September	34,025
October	15,100
November	52,000
December	193,000
Year-end accounts receivable	$300,000

a. Use the year-end total to evaluate the firm's collection system.
b. If 70% of the firm's sales occur between July and December, would this affect the validity of your conclusion in part **a**? Explain.

LG3 **2–14 Interpreting liquidity and activity ratios** The new owners of Bluegrass Natural Foods, Inc., have hired you to help them diagnose and cure problems that the company has had in maintaining adequate liquidity. As a first step, you perform a liquidity analysis. You then do an analysis of the company's short-term activity ratios. Your calculations and appropriate industry norms are listed.

Ratio	Bluegrass	Industry norm
Current ratio	4.5	4.0
Quick ratio	2.0	3.1
Inventory turnover	6.0	10.4
Average collection period	73 days	52 days
Average payment period	31 days	40 days

a. What recommendations relative to the amount and the handling of inventory could you make to the new owners?
b. What recommendations relative to amount and handling of accounts receivable could you make to the new owners?
c. What recommendations relative to amount and handling of accounts payable could you make to the new owners?
d. What results, overall, would you hope your recommendations would achieve? Why might your recommendations not be effective?

LG4 **2–15 Debt analysis** Springfield Bank is evaluating Creek Enterprises, which has requested a $4,000,000 loan, to assess the firm's financial leverage and financial risk. On the basis of the debt ratios for Creek, along with the industry averages and Creek's recent financial statements (which follow), evaluate and recommend appropriate action on the loan request.

Creek Enterprises
Income Statement
for the Year Ended December 31, 2003

Sales revenue		$30,000,000
Less: Cost of goods sold		21,000,000
Gross profits		$ 9,000,000
Less: Operating expenses		
Selling expense	$3,000,000	
General and administrative expenses	1,800,000	
Lease expense	200,000	
Depreciation expense	1,000,000	
Total operating expense		6,000,000
Operating profits		$ 3,000,000
Less: Interest expense		1,000,000
Net profits before taxes		$ 2,000,000
Less: Taxes (rate = 40%)		800,000
Net profits after taxes		$ 1,200,000
Less: Preferred stock dividends		100,000
Earnings available for common stockholders		$ 1,100,000

Creek Enterprises
Balance Sheet
December 31, 2003

Assets		Liabilities and Stockholders' Equity	
Current assets		Current liabilities	
Cash	$ 1,000,000	Accounts payable	$ 8,000,000
Marketable securities	3,000,000	Notes payable	8,000,000
Accounts receivable	12,000,000	Accruals	500,000
Inventories	7,500,000	Total current liabilities	$16,500,000
Total current assets	$23,500,000	Long-term debt (includes financial leases)[b]	$20,000,000
Gross fixed assets (at cost)[a]		Stockholders' equity	
Land and buildings	$11,000,000	Preferred stock (25,000 shares,	
Machinery and equipment	20,500,000	$4 dividend)	$ 2,500,000
Furniture and fixtures	8,000,000	Common stock (1 million shares at $5 par)	5,000,000
Gross fixed assets	$39,500,000	Paid-in capital in excess of par value	4,000,000
Less: Accumulated depreciation	13,000,000	Retained earnings	2,000,000
Net fixed assets	$26,500,000	Total stockholders' equity	$13,500,000
Total assets	$50,000,000	Total liabilities and stockholders' equity	$50,000,000

[a]The firm has a 4-year financial lease requiring annual beginning-of-year payments of $200,000. Three years of the lease have yet to run.
[b]Required annual principal payments are $800,000.

Note: Industry averages appear at the top of the following page.

Industry averages	
Debt ratio	0.51
Times interest earned ratio	7.30
Fixed-payment coverage ratio	1.85

LG5 **2–16 Common-size statement analysis** A common-size income statement for Creek Enterprises' 2002 operations follows. Using the firm's 2003 income statement presented in Problem 2–15, develop the 2003 common-size income statement and compare it to the 2002 statement. Which areas require further analysis and investigation?

Creek Enterprises Common-size Income Statement for the Year Ended December 31, 2002		
Sales revenue ($35,000,000)		100.0%
Less: Cost of goods sold		65.9
Gross profits		34.1%
Less: Operating expenses		
Selling expense	12.7%	
General and administrative expenses	6.3	
Lease expense	0.6	
Depreciation expense	3.6	
Total operating expense		23.2
Operating profits		10.9%
Less: Interest expense		1.5
Net profits before taxes		9.4%
Less: Taxes (rate = 40%)		3.8
Net profits after taxes		5.6%
Less: Preferred stock dividends		0.1
Earnings available for common stockholders		5.5%

LG4 LG5 **2–17 The relationship between financial leverage and profitability** Pelican Paper, Inc., and Timberland Forest, Inc., are rivals in the manufacture of craft papers. Some financial statement values for each company follow. Use them in a ratio analysis that compares their financial leverage and profitability.

Item	Pelican Paper, Inc.	Timberland Forest, Inc.
Total assets	$10,000,000	$10,000,000
Total equity (all common)	9,000,000	5,000,000
Total debt	1,000,000	5,000,000
Annual interest	100,000	500,000
Total sales	$25,000,000	$25,000,000
EBIT	6,250,000	6,250,000
Net income	3,690,000	3,450,000

a. Calculate the following debt and coverage ratios for the two companies. Discuss their financial risk and ability to cover the costs in relation to each other.
(1) Debt ratio
(2) Times interest earned ratio

b. Calculate the following profitability ratios for the two companies. Discuss their profitability relative to each other.
(1) Operating profit margin
(2) Net profit margin
(3) Return on total assets
(4) Return on common equity

c. In what way has the larger debt of Timberland Forest made it more profitable than Pelican Paper? What are the risks that Timberland's investors undertake when they choose to purchase its stock instead of Pelican's?

LG6 **2–18** **Ratio proficiency** McDougal Printing, Inc., had sales totaling $40,000,000 in fiscal year 2003. Some ratios for the company are listed below. Use this information to determine the dollar values of various income statement and balance sheet accounts as requested.

McDougal Printing, Inc. Year Ended December 31, 2003	
Sales	$40,000,000
Gross profit margin	80%
Operating profit margin	35%
Net profit margin	8%
Return on total assets	16%
Return on common equity	20%
Total asset turnover	2
Average collection period	62.2 days

Calculate values for the following:

a. Gross profits
b. Cost of goods sold
c. Operating profits
d. Operating expenses
e. Earnings available for common stockholders
f. Total assets
g. Total common stock equity
h. Accounts receivable

LG6 **2–19** **Cross-sectional ratio analysis** Use the following financial statements for Fox Manufacturing Company for the year ended December 31, 2003, along with the industry average ratios also given in what follows, to:

a. Prepare and interpret a complete ratio analysis of the firm's 2003 operations.
b. Summarize your findings and make recommendations.

Fox Manufacturing Company Income Statement for the Year Ended December 31, 2003		
Sales revenue		$600,000
Less: Cost of goods sold		460,000
Gross profits		$140,000
Less: Operating expenses		
General and administrative expenses	$30,000	
Depreciation expense	30,000	
Total operating expense		60,000
Operating profits		$ 80,000
Less: Interest expense		10,000
Net profits before taxes		$ 70,000
Less: Taxes		27,100
Net profits after taxes (earnings available for common stockholders)		$ 42,900
Earnings per share (EPS)		$2.15

Fox Manufacturing Company Balance Sheet December 31, 2003	
Assets	
Cash	$ 15,000
Marketable securities	7,200
Accounts receivable	34,100
Inventories	82,000
Total current assets	$138,300
Net fixed assets	$270,000
Total assets	$408,300
Liabilities and Stockholders' Equity	
Accounts payable	$ 57,000
Notes payable	13,000
Accruals	5,000
Total current liabilities	$ 75,000
Long-term debt	$150,000
Stockholders' equity	
Common stock equity (20,000 shares outstanding)	$110,200
Retained earnings	73,100
Total stockholders' equity	$183,300
Total liabilities and stockholders' equity	$408,300

Note: Industry averages appear at the top of the following page.

Ratio	Industry average, 2003
Current ratio	2.35
Quick ratio	0.87
Inventory turnover[a]	4.55
Average collection period[a]	35.3 days
Total asset turnover	1.09
Debt ratio	0.300
Times interest earned ratio	12.3
Gross profit margin	0.202
Operating profit margin	0.135
Net profit margin	0.091
Return on total assets (ROA)	0.099
Return on common equity (ROE)	0.167
Earnings per share (EPS)	$3.10

[a]Based on a 360-day year and on end-of-year figures.

LG6 **2–20 Financial statement analysis** The financial statements of Zach Industries for the year ended December 31, 2003, follow.

Zach Industries
Income Statement
for the Year Ended December 31, 2003

Sales revenue	$160,000
Less: Cost of goods sold	106,000
Gross profits	$ 54,000
Less: Operating expenses	
Selling expense	$ 16,000
General and administrative expenses	10,000
Lease expense	1,000
Depreciation expense	10,000
Total operating expense	$ 37,000
Operating profits	$ 17,000
Less: Interest expense	6,100
Net profits before taxes	$ 10,900
Less: Taxes	4,360
Net profits after taxes	$ 6,540

Zach Industries
Balance Sheet
December 31, 2003

Assets	
Cash	$ 500
Marketable securities	1,000
Accounts receivable	25,000
Inventories	45,500
Total current assets	$ 72,000
Land	$ 26,000
Buildings and equipment	90,000
Less: Accumulated depreciation	38,000
Net fixed assets	$ 78,000
Total assets	$150,000
Liabilities and Stockholders' Equity	
Accounts payable	$ 22,000
Notes payable	47,000
Total current liabilities	$ 69,000
Long-term debt	$ 22,950
Common stock[a]	$ 31,500
Retained earnings	$ 26,550
Total liabilities and stockholders' equity	$150,000

[a]The firm's 3,000 outstanding shares of common stock closed 2003 at a price of $25 per share.

a. Use the preceding financial statements to complete the following table. Assume that the industry averages given in the table are applicable for both 2002 and 2003.

Ratio	Industry average	Actual 2002	Actual 2003
Current ratio	1.80	1.84	______
Quick ratio	0.70	0.78	______
Inventory turnover[a]	2.50	2.59	______
Average collection period[a]	37 days	36 days	______
Debt ratio	65%	67%	______
Times interest earned ratio	3.8	4.0	______
Gross profit margin	38%	40%	______
Net profit margin	3.5%	3.6%	______
Return on total assets	4.0%	4.0%	______
Return on common equity	9.5%	8.0%	______
Market/book ratio	1.1	1.2	______

[a]Based on a 360-day year and on end-of-year figures.

b. Analyze Zach Industries' financial condition as it is related to (1) liquidity, (2) activity, (3) debt, (4) profitability, and (5) market. Summarize the company's overall financial condition.

LG6 **2–21** **Integrative—Complete ratio analysis** Given the following financial statements, historical ratios, and industry averages, calculate Sterling Company's financial ratios for the most recent year. Analyze its overall financial situation from both a cross-sectional and a time-series viewpoint. Break your analysis into evaluations of the firm's liquidity, activity, debt, profitability, and market.

Sterling Company
Income Statement
for the Year Ended December 31, 2003

Sales revenue		$10,000,000
Less: Cost of goods sold		7,500,000
Gross profits		$ 2,500,000
Less: Operating expenses		
Selling expense	$300,000	
General and administrative expenses	650,000	
Lease expense	50,000	
Depreciation expense	200,000	
Total operating expense		1,200,000
Operating profits		$ 1,300,000
Less: Interest expense		200,000
Net profits before taxes		$ 1,100,000
Less: Taxes (rate = 40%)		440,000
Net profits after taxes		$ 660,000
Less: Preferred stock dividends		50,000
Earnings available for common stockholders		$ 610,000
Earnings per share (EPS)		$3.05

Sterling Company
Balance Sheet
December 31, 2003

Assets			**Liabilities and Stockholders' Equity**	
Current assets			Current liabilities	
Cash		$ 200,000	Accounts payable[b]	$ 900,000
Marketable securities		50,000	Notes payable	200,000
Accounts receivable		800,000	Accruals	100,000
Inventories		950,000	Total current liabilities	$ 1,200,000
Total current assets		$ 2,000,000	Long-term debt (includes financial leases)[c]	$ 3,000,000
Gross fixed assets (at cost)[a]	$12,000,000		Stockholders' equity	
Less: Accumulated depreciation	3,000,000		Preferred stock (25,000 shares, $2 dividend)	$ 1,000,000
Net fixed assets		$ 9,000,000	Common stock (200,000 shares at $3 par)[d]	600,000
Other assets		$ 1,000,000	Paid-in capital in excess of par value	5,200,000
Total assets		$12,000,000	Retained earnings	1,000,000
			Total stockholders' equity	$ 7,800,000
			Total liabilities and stockholders' equity	$12,000,000

[a]The firm has an 8-year financial lease requiring annual beginning-of-year payments of $50,000. Five years of the lease have yet to run.
[b]Annual credit purchases of $6,200,000 were made during the year.
[c]The annual principal payment on the long-term debt is $100,000.
[d]On December 31, 2003, the firm's common stock closed at $39.50 per share.

Historical and Industry Average Ratios for Sterling Company

Ratio	Actual 2001	Actual 2002	Industry average, 2003
Current ratio	1.40	1.55	1.85
Quick ratio	1.00	0.92	1.05
Inventory turnover	9.52	9.21	8.60
Average collection period	45.0 days	36.4 days	35.0 days
Average payment period	58.5 days	60.8 days	45.8 days
Total asset turnover	0.74	0.80	0.74
Debt ratio	0.20	0.20	0.30
Times interest earned ratio	8.2	7.3	8.0
Fixed-payment coverage ratio	4.5	4.2	4.2
Gross profit margin	0.30	0.27	0.25
Operating profit margin	0.12	0.12	0.10
Net profit margin	0.062	0.062	0.053
Return on total assets (ROA)	0.045	0.050	0.040
Return on common equity (ROE)	0.061	0.067	0.066
Earnings per share (EPS)	$1.75	$2.20	$1.50
Price/earnings (P/E) ratio	12.0	10.5	11.2
Market/book (M/B) ratio	1.20	1.05	1.10

LG6 **2–22 Dupont system of analysis** Use the following ratio information for Johnson International and the industry averages for Johnson's line of business to:

a. Construct the DuPont system of analysis for both Johnson and the industry.

b. Evaluate Johnson (and the industry) over the 3-year period.

c. Indicate in which areas Johnson requires further analysis. Why?

	2001	2002	2003
Johnson			
Financial leverage multiplier	1.75	1.75	1.85
Net profit margin	0.059	0.058	0.049
Total asset turnover	2.11	2.18	2.34
Industry Averages			
Financial leverage multiplier	1.67	1.69	1.64
Net profit margin	0.054	0.047	0.041
Total asset turnover	2.05	2.13	2.15

LG6 **2–23 Complete ratio analysis, recognizing significant differences** Home Health, Inc., has come to Jane Ross for a yearly financial checkup. As a first step, Jane has prepared a complete set of ratios for fiscal years 2002 and 2003. She will use them to look for significant changes in the company's situation from one year to the next.

Home Health, Inc.
Financial Ratios

Ratio	2002	2003
Current ratio	3.25	3.00
Quick ratio	2.50	2.20
Inventory turnover	12.80	10.30
Average collection period	42 days	31 days
Total asset turnover	1.40	2.00
Debt ratio	0.45	0.62
Times interest earned ratio	4.00	3.85
Gross profit margin	68%	65%
Operating profit margin	14%	16%
Net profit margin	8.3%	8.1%
Return on total assets	11.6%	16.2%
Return on common equity	21.1%	42.6%
Price/earnings ratio	10.7	9.8
Market/book ratio	1.40	1.25

a. In order to focus on the degree of change, calculate the year-to-year proportional change by subtracting the year 2002 ratio from the year 2003 ratio, then dividing the difference by the year 2002 ratio. Multiply the result by 100. Preserve the positive or negative sign. The result is the percentage change in the ratio from 2002 to 2003. Calculate the proportional change for the ratios shown here.

b. For any ratio that shows a year-to-year difference of 10% or more, state whether the difference is in the company's favor or not.

c. For the most significant changes (25% or more), look at the other ratios and cite at least one other change that may have contributed to the change in the ratio that you are discussing.

CHAPTER 2 CASE Assessing Martin Manufacturing's Current Financial Position

Terri Spiro, an experienced budget analyst at Martin Manufacturing Company, has been charged with assessing the firm's financial performance during 2003 and its financial position at year-end 2003. To complete this assignment, she gathered the firm's 2003 financial statements, which follow. In addition, Terri obtained the firm's ratio values for 2001 and 2002, along with the 2003 industry average ratios (also applicable to 2001 and 2002). These are presented in the table on page 94.

Martin Manufacturing Company
Income Statement
for the Year Ended December 31, 2003

Sales revenue		$5,075,000
Less: Cost of goods sold		3,704,000
Gross profits		$1,371,000
Less: Operating expenses		
Selling expense	$650,000	
General and administrative expenses	416,000	
Depreciation expense	152,000	
Total operating expense		1,218,000
Operating profits		$ 153,000
Less: Interest expense		93,000
Net profits before taxes		$ 60,000
Less: Taxes (rate = 40%)		24,000
Net profits after taxes		$ 36,000
Less: Preferred stock dividends		3,000
Earnings available for common stockholders		$ 33,000
Earnings per share (EPS)		$0.33

Martin Manufacturing Company
Balance Sheets

	December 31	
Assets	**2003**	**2002**
Current assets		
Cash	$ 25,000	$ 24,100
Accounts receivable	805,556	763,900
Inventories	700,625	763,445
Total current assets	$1,531,181	$1,551,445
Gross fixed assets (at cost)	$2,093,819	$1,691,707
Less: Accumulated depreciation	500,000	348,000
Net fixed assets	$1,593,819	$1,343,707
Total assets	$3,125,000	$2,895,152
Liabilities and Stockholders' Equity		
Current liabilities		
Accounts payable	$ 230,000	$ 400,500
Notes payable	311,000	370,000
Accruals	75,000	100,902
Total current liabilities	$ 616,000	$ 871,402
Long-term debt	$1,165,250	$ 700,000
Total liabilities	$1,781,250	$1,571,402
Stockholders' equity		
Preferred stock (2,500 shares, $1.20 dividend)	$ 50,000	$ 50,000
Common stock (100,000 shares at $4 par)[a]	400,000	400,000
Paid-in capital in excess of par value	593,750	593,750
Retained earnings	300,000	280,000
Total stockholders' equity	$1,343,750	$1,323,750
Total liabilities and stockholders' equity	$3,125,000	$2,895,152

[a]The firm's 100,000 outstanding shares of common stock closed 2003 at a price of $11.38 per share.

Note: Industry historical ratios appear at the top of the following page.

Martin Manufacturing Company
Historical ratios

Ratio	Actual 2001	Actual 2002	Actual 2003	Industry average 2003
Current ratio	1.7	1.8	______	1.5
Quick ratio	1.0	0.9	______	1.2
Inventory turnover (times)	5.2	5.0	______	10.2
Average collection period	50 days	55 days	______	46 days
Total asset turnover (times)	1.5	1.5	______	2.0
Debt ratio	45.8%	54.3%	______	24.5%
Times interest earned ratio	2.2	1.9	______	2.5
Gross profit margin	27.5%	28.0%	______	26.0%
Net profit margin	1.1%	1.0%	______	1.2%
Return on total assets (ROA)	1.7%	1.5%	______	2.4%
Return on common equity (ROE)	3.1%	3.3%	______	3.2%
Price/earnings (P/E) ratio	33.5	38.7	______	43.4
Market/book (M/B) ratio	1.0	1.1	______	1.2

Required

a. Calculate the firm's 2003 financial ratios, and then fill in the preceding table.
b. Analyze the firm's current financial position from both a cross-sectional and a time-series viewpoint. Break your analysis into evaluations of the firm's liquidity, activity, debt, profitability, and market.
c. Summarize the firm's overall financial position on the basis of your findings in part **b.**

WEB EXERCISE

Go to Web site *www.yahoo.com*. On the left side of the Yahoo! home page screen, click on the Finance category under **Business and Economy.** On the next screen click on **Y! Finance.**

Using this screen, click on **Symbol Lookup** and find the symbol for Southwest Airlines. Click on this symbol to find the latest trading data for Southwest Airlines.

1. What was the selling price for the last sale of Southwest's common stock? How much in dollars per share was the change?
2. What was the number of shares sold in this trade?

In the **More Info** box, you will see **Profile.** Click on it, and scroll down to **Statistics at a Glance.**

3. What was the amount of Southwest's sales? What was its after-tax income?
4. What were Southwest's earnings per share? What was its book value per share?

5. How many shares of stock does Southwest have outstanding?
6. What were the values of the following ratios for Southwest?
   a. Current ratio
   b. Operating profit margin
   c. Debt/equity ratio
   d. Return on equity
   e. What other information would you need to evaluate Southwest's financial performance on the basis of these ratios?
7. Find **More from Market Guide** and click on **Ratio Comparisons.** Using these data, summarize Southwest's performance.

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

CHAPTER

3

CASH FLOW AND FINANCIAL PLANNING

LEARNING GOALS

LG1 Understand the effect of depreciation on the firm's cash flows, the depreciable value of an asset, its depreciable life, and tax depreciation methods.

LG2 Discuss the firm's statement of cash flows, operating cash flow, and free cash flow.

LG3 Understand the financial planning process, including long-term (strategic) financial plans and short-term (operating) financial plans.

LG4 Discuss the cash-planning process and the preparation, evaluation, and use of the cash budget.

LG5 Explain the simplified procedures used to prepare and evaluate the pro forma income statement and the pro forma balance sheet.

LG6 Cite the weaknesses of the simplified approaches to pro forma financial statement preparation and the common uses of pro forma statements.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand how depreciation is used for both tax and financial reporting purposes; how to develop the statement of cash flows; the primacy of cash flows, rather than accruals, in financial decision making; and how pro forma financial statements are used within the firm.

Information systems: You need to understand the data that must be kept to record depreciation for tax and financial reporting; the information needs for strategic and operating plans; and what data are needed as inputs for cash-planning and profit-planning modules.

Management: You need to understand the difference between strategic and operating plans, and the role of each; the importance of focusing on the firm's cash flows; and how use of pro forma statements can head off trouble for the firm.

Marketing: You need to understand the central role that marketing plays in formulating the firm's long-term, strategic plans, and the importance of the sales forecast as the key input for both cash planning and profit planning.

Operations: You need to understand how depreciation affects the value of the firm's plant assets; how the results of operations are captured in the statement of cash flows; that operations are monitored primarily in the firm's short-term financial plans; and the distinction between fixed and variable operating costs.

BEST BUY

PLANNING THAT "BEST BUY"

It's tempting for companies to focus on short-term profitability, especially when Wall Street is watching earnings reports, looking for any signs of weakness that could send the stock plummeting. This was the dilemma facing the executive team at **Best Buy,** a specialty retailer of consumer electronics, home office equipment, entertainment software, and appliances. After four straight years of profits in this competitive retail business, revenues and quarterly earnings were falling as the economy started to downshift in fall 2000. On the planning boards was an expansion strategy that included acquiring the Musicland chain, using Best Buy stock to do so. As the stock price fell, some top managers urged founder and CEO Richard Schulze to retrench and focus on the chain's over 400 existing stores.

Instead of putting Best Buy's growth on hold, Schulze went forward as planned. He was convinced that this was the best long-term strategy for the company, which was financially sound. Careful planning had given Best Buy a $1 billion "war chest," so Schulze could buy Musicland with cash and the assumption of its debt. Best Buy also bought a Seattle chain, Magnolia Hi-Fi, for cash. Some company officers were concerned about buying Musicland when the company's stock price was down. "It doesn't change why we think this is a good deal," Schulze pointed out.

The acquisition was important to Best Buy's future plans. Musicland, which also owned the Sam Goody chain, had 1,300 stores. Most were smaller than the typical Best Buy "big-box" store. Their mall and small-town locations brought a different customer base to the company, providing a way to reach new types of customers and gain further leverage with suppliers.

Nor did the company neglect short-term planning. To boost productivity and reduce labor costs during the downturn, Best Buy cut sales staff during off-peak hours. It found ways to improve inventory management as well. With these plans in place, earnings were up in the fourth quarter of 2000, and the company reported record sales and a 20 percent increase in gross margin.

Despite the risks involved in taking this aggressive path, Schulze is more concerned with positioning Best Buy for the future. Opening new stores means higher expenses in the short term. But he is confident that he made the right decision in sticking with the company's long-term strategy to become the world's biggest consumer electronics chain. "Acquisitions and new strategies need to be developed even when the economy is a little soft," says Schulze. "You have to keep investing in yourself, and that's what we're doing."

This chapter focuses on the concept of cash flows and their use in the financial planning process.

LG1 LG2 3.1 Analyzing the Firm's Cash Flow

Cash flow, the lifeblood of the firm, is the primary focus of the financial manager both in managing day-to-day finances and in planning and making strategic decisions aimed at creation of shareholder value. An important factor affecting a firm's cash flow is depreciation (and any other noncash charges). From an accounting perspective, a firm's cash flows can be summarized in the statement of cash flows, which was described in Chapter 2. From a strict financial perspective, firms often focus on both *operating cash flow,* which is used in managerial decision making, and *free cash flow,* which is closely watched by participants in the capital market. We begin our analysis of cash flow by considering the key aspects of depreciation, which is closely related to the firm's cash flow.

Depreciation

depreciation
The systematic charging of a portion of the costs of fixed assets against annual revenues over time.

Business firms are permitted for tax and financial reporting purposes to charge a portion of the costs of fixed assets systematically against annual revenues. This allocation of historical cost over time is called **depreciation.** For tax purposes, the depreciation of business assets is regulated by the Internal Revenue Code. Because the objectives of financial reporting are sometimes different from those of tax legislation, firms often use different depreciation methods for financial reporting than those required for tax purposes. Tax laws are used to accomplish economic goals such as providing incentives for business investment in certain types of assets, whereas the objectives of financial reporting are of course quite different. Keeping two different sets of records for these two different purposes is legal.

modified accelerated cost recovery system (MACRS)
System used to determine the depreciation of assets for tax purposes.

Depreciation for tax purposes is determined by using the **modified accelerated cost recovery system (MACRS);** a variety of depreciation methods are available for financial reporting purposes. Before we discuss the methods of depreciating an asset, you must understand the depreciable value of an asset and the depreciable life of an asset.

Depreciable Value of an Asset

Under the basic MACRS procedures, the depreciable value of an asset (the amount to be depreciated) is its *full* cost, including outlays for installation.[1] No adjustment is required for expected salvage value.

EXAMPLE

Baker Corporation acquired a new machine at a cost of $38,000, with installation costs of $2,000. Regardless of its expected salvage value, the depreciable value of the machine is $40,000: $38,000 cost + $2,000 installation cost.

Depreciable Life of an Asset

depreciable life
Time period over which an asset is depreciated.

The time period over which an asset is depreciated—its **depreciable life**—can significantly affect the pattern of cash flows. The shorter the depreciable life, the more quickly the cash flow created by the depreciation write-off will be received. Given the financial manager's preference for faster receipt of cash flows, a shorter

1. Land values are *not* depreciable. Therefore, to determine the depreciable value of real estate, the value of the land is subtracted from the cost of real estate. In other words, only buildings and other improvements are depreciable.

TABLE 3.1 First Four Property Classes Under MACRS

Property class (recovery period)	Definition
3 years	Research equipment and certain special tools.
5 years	Computers, typewriters, copiers, duplicating equipment, cars, light-duty trucks, qualified technological equipment, and similar assets.
7 years	Office furniture, fixtures, most manufacturing equipment, railroad track, and single-purpose agricultural and horticultural structures.
10 years	Equipment used in petroleum refining or in the manufacture of tobacco products and certain food products.

depreciable life is preferred to a longer one. However, the firm must abide by certain Internal Revenue Service (IRS) requirements for determining depreciable life. These MACRS standards, which apply to both new and used assets, require the taxpayer to use as an asset's depreciable life the appropriate MACRS **recovery period.**[2] There are six MACRS recovery periods—3, 5, 7, 10, 15, and 20 years—excluding real estate. It is customary to refer to the property classes, in accordance with their recovery periods, as 3-, 5-, 7-, 10-, 15-, and 20-year property. The first four property classes—those routinely used by business—are defined in Table 3.1.

recovery period
The appropriate depreciable life of a particular asset as determined by MACRS.

Depreciation Methods

For *financial reporting purposes,* a variety of depreciation methods (straight-line, double-declining balance, and sum-of-the-years'-digits[3]) can be used. For *tax purposes,* using MACRS recovery periods, assets in the first four property classes are depreciated by the double-declining balance (200 percent) method, using the half-year convention and switching to straight-line when advantageous. Although tables of depreciation percentages are not provided by law, the *approximate percentages* (rounded to the nearest whole percent) written off each year for the first four property classes are shown in Table 3.2. Rather than using the percentages in the table, the firm can either use straight-line depreciation over the asset's recovery period with the half-year convention or use the alternative depreciation system. For purposes of this text, we will use the MACRS depreciation percentages, because they generally provide for the fastest write-off and therefore the best cash flow effects for the profitable firm.

Because MACRS requires use of the half-year convention, assets are assumed to be acquired in the middle of the year, and therefore only one-half of the first year's depreciation is recovered in the first year. As a result, the final half-year of depreciation is recovered in the year immediately following the asset's stated recovery period. In Table 3.2, the depreciation percentages for an n-year class asset are given for $n+1$ years. For example, a 5-year asset is depreciated over 6 recovery years. The application of the tax depreciation percentages given in Table 3.2 can be demonstrated by a simple example.

2. An exception occurs in the case of assets depreciated under the *alternative depreciation system*. For convenience, in this text we ignore the depreciation of assets under this system.

3. For a review of these depreciation methods as well as other aspects of financial reporting, see any recently published financial accounting text.

TABLE 3.2 Rounded Depreciation Percentages by Recovery Year Using MACRS for First Four Property Classes

	Percentage by recovery year[a]			
Recovery year	3 years	5 years	7 years	10 years
1	33%	20%	14%	10%
2	45	32	25	18
3	15	19	18	14
4	7	12	12	12
5		12	9	9
6		5	9	8
7			9	7
8			4	6
9				6
10				6
11				4
Totals	100%	100%	100%	100%

[a]These percentages have been rounded to the nearest whole percent to simplify calculations while retaining realism. To calculate the *actual* depreciation for tax purposes, be sure to apply the actual unrounded percentages or directly apply double-declining balance (200%) depreciation using the half-year convention.

EXAMPLE Baker Corporation acquired, for an installed cost of $40,000, a machine having a recovery period of 5 years. Using the applicable percentages from Table 3.2, Baker calculates the depreciation in each year as follows:

Year	Cost (1)	Percentages (from Table 3.2) (2)	Depreciation [(1) × (2)] (3)
1	$40,000	20%	$ 8,000
2	40,000	32	12,800
3	40,000	19	7,600
4	40,000	12	4,800
5	40,000	12	4,800
6	40,000	5	2,000
Totals		100%	$40,000

Column 3 shows that the full cost of the asset is written off over 6 recovery years.

Because financial managers focus primarily on cash flows, *only tax depreciation methods will be utilized throughout this textbook*.

Developing the Statement of Cash Flows

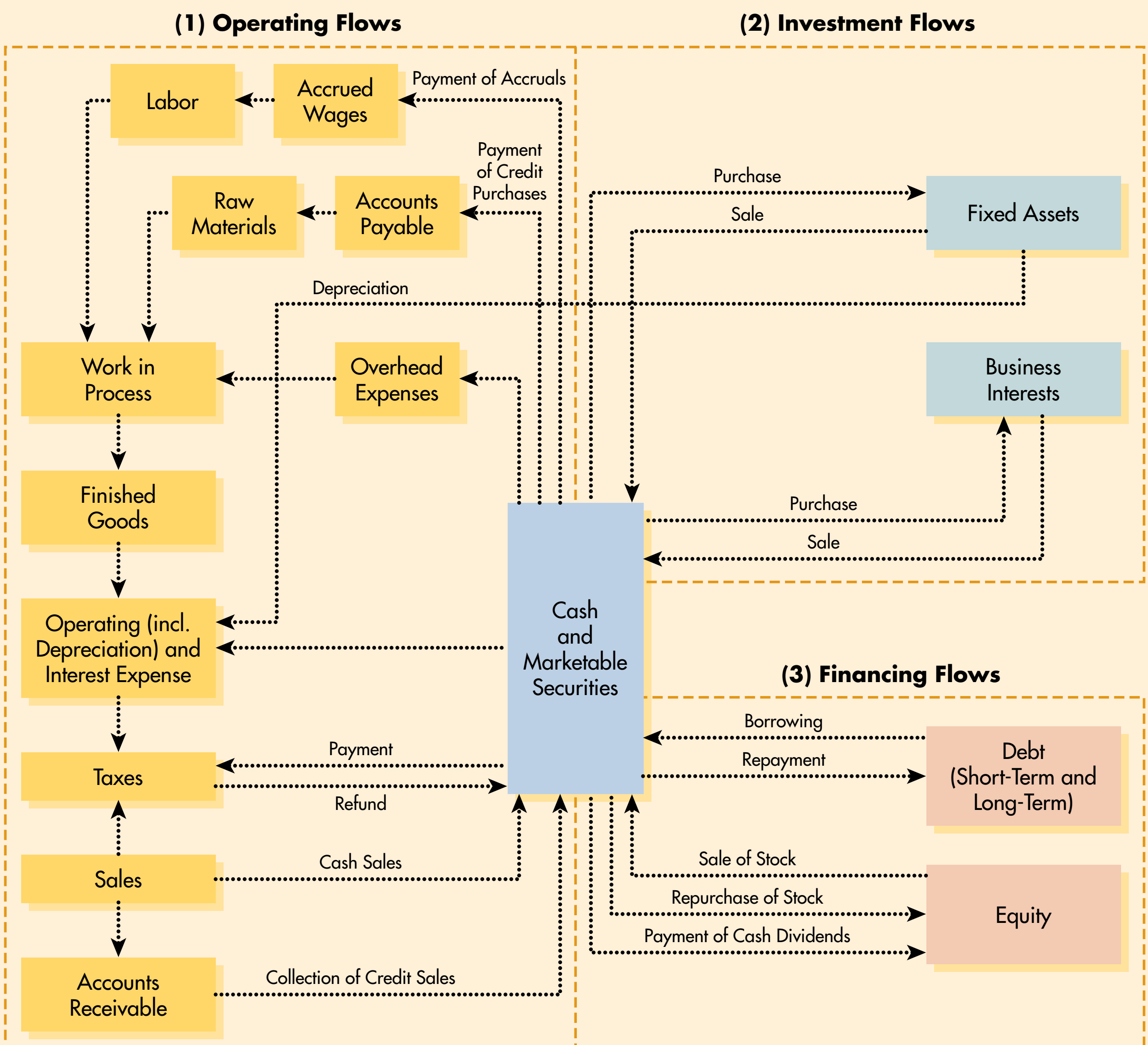
The *statement of cash flows,* introduced in Chapter 2, summarizes the firm's cash flow over a given period of time. Before discussing the statement and its interpretation, we will review the cash flow through the firm and the classification of inflows and outflows of cash.

Hint Remember that in finance, cash is king. Income statement profits are good, but they don't pay the bills, nor do asset owners accept them in place of cash.

The Firm's Cash Flows

Figure 3.1 illustrates the firm's cash flows. Note that marketable securities are considered the same as cash because of their highly liquid nature. Both cash and marketable securities represent a reservoir of liquidity that is *increased by cash*

FIGURE 3.1 **Cash Flows**
The firm's cash flows



operating flows
Cash flows directly related to sale and production of the firm's products and services.

investment flows
Cash flows associated with purchase and sale of both fixed assets and business interests.

financing flows
Cash flows that result from debt and equity financing transactions; includes incurrence and repayment of debt, cash inflow from the sale of stock, and cash outflows to pay cash dividends or repurchase stock.

inflows and *decreased by cash outflows*. Also note that the firm's cash flows can be divided into (1) operating flows, (2) investment flows, and (3) financing flows. The **operating flows** are cash inflows and outflows directly related to sale and production of the firm's products and services. **Investment flows** are cash flows associated with purchase and sale of both fixed assets and business interests. Clearly, purchase transactions would result in cash outflows, whereas sales transactions would generate cash inflows. The **financing flows** result from debt and equity financing transactions. Incurring (or repaying) either short-term or long-term debt would result in a corresponding cash inflow (or outflow). Similarly, the sale of stock would result in a cash inflow; the payment of cash dividends or repurchase of stock would result in a financing outflow. In combination, the firm's operating, investment, and financing cash flows during a given period affect the firm's cash and marketable securities balances.

Classifying Inflows and Outflows of Cash

The statement of cash flows in effect summarizes the inflows and outflows of cash during a given period. Table 3.3 classifies the basic inflows (sources) and outflows (uses) of cash. For example, if a firm's accounts payable increased by $1,000 during the year, the change would be an *inflow of cash*. If the firm's inventory increased by $2,500, the change would be an *outflow of cash*.

A few additional points can be made with respect to the classification scheme in Table 3.3:

noncash charge
An expense deducted on the income statement but does not involve the actual outlay of cash during the period; includes depreciation, amortization, and depletion.

1. A *decrease* in an asset, such as the firm's cash balance, is an *inflow of cash,* because cash that has been tied up in the asset is released and can be used for some other purpose, such as repaying a loan. On the other hand, an *increase* in the firm's cash balance is an *outflow of cash,* because additional cash is being tied up in the firm's cash balance.
2. Depreciation (like amortization and depletion) is a **noncash charge**—an expense that is deducted on the income statement but does not involve the actual outlay of cash during the period. Because it shields the firm from taxes by lowering taxable income, the noncash charge is considered a cash inflow. From a strict accounting perspective, adding depreciation back to the firm's net profits after taxes gives cash flow from operations:

$$\text{Cash flow from operations} = \text{Net profits after taxes} + \text{Depreciation and other noncash charges} \quad (3.1)$$

TABLE 3.3 The Inflows and Outflows of Cash

Inflows (sources)	Outflows (uses)
Decrease in any asset	Increase in any asset
Increase in any liability	Decrease in any liability
Net profits after taxes	Net loss
Depreciation and other noncash charges	Dividends paid
Sale of stock	Repurchase or retirement of stock

Note that a firm can have a *net loss* (negative net profits after taxes) and still have positive cash flow from operations when depreciation (and other noncash charges) during the period are greater than the net loss. In the statement of cash flows, net profits after taxes (or net losses) and depreciation (and other noncash charges) are therefore treated as separate entries.

3. Because depreciation is treated as a separate cash inflow, only *gross* rather than *net* changes in fixed assets appear on the statement of cash flows. This treatment avoids the potential double counting of depreciation.
4. Direct entries of changes in retained earnings are not included on the statement of cash flows. Instead, entries for items that affect retained earnings appear as net profits or losses after taxes and dividends paid.

Preparing the Statement of Cash Flows

The statement of cash flows for a given period is developed using the income statement for the period, along with the beginning- and end-of-period balance sheets. The income statement for the year ended December 31, 2003, and the December 31 balance sheets for 2002 and 2003 for Baker Corporation are given in Tables 3.4 and 3.5, respectively. The statement of cash flows for the year

TABLE 3.4 Baker Corporation Income Statement ($000) for the Year Ended December 31, 2003

Sales revenue	$1,700
Less: Cost of goods sold	1,000
Gross profits	$ 700
Less: Operating expenses	
Selling expense	$ 70
General and administrative expense	120
Lease expense[a]	40
Depreciation expense	100
Total operating expense	330
Earnings before interest and taxes (EBIT)	$ 370
Less: Interest expense	70
Net profits before taxes	$ 300
Less: Taxes (rate = 40%)	120
Net profits after taxes	$ 180
Less: Preferred stock dividends	10
Earnings available for common stockholders	$ 170
Earnings per share (EPS)[b]	$1.70

[a]Lease expense is shown here as a separate item rather than included as interest expense as specified by the FASB for financial-reporting purposes. The approach used here is consistent with tax-reporting rather than financial-reporting procedures.

[b]Calculated by dividing the earnings available for common stockholders by the number of shares of common stock outstanding ($170,000 ÷ 100,000 shares = $1.70 per share).

TABLE 3.5 Baker Corporation Balance Sheets ($000)

	December 31	
Assets	**2003**	**2002**
Current assets		
Cash	$ 400	$ 300
Marketable securities	600	200
Accounts receivable	400	500
Inventories	600	900
Total current assets	$2,000	$1,900
Gross fixed assets (at cost)		
Land and buildings	$1,200	$1,050
Machinery and equipment	850	800
Furniture and fixtures	300	220
Vehicles	100	80
Other (includes certain leases)	50	50
Total gross fixed assets (at cost)	$2,500	$2,200
Less: Accumulated depreciation	1,300	1,200
Net fixed assets	$1,200	$1,000
Total assets	$3,200	$2,900
Liabilities and Stockholders' Equity		
Current liabilities		
Accounts payable	$ 700	$ 500
Notes payable	600	700
Accruals	100	200
Total current liabilities	$1,400	$1,400
Long-term debt	$ 600	$ 400
Total liabilities	$2,000	$1,800
Stockholders' equity		
Preferred stock	$ 100	$ 100
Common stock—$1.20 par, 100,000 shares outstanding in 2003 and 2002	120	120
Paid-in capital in excess of par on common stock	380	380
Retained earnings	600	500
Total stockholders' equity	$1,200	$1,100
Total liabilities and stockholders' equity	$3,200	$2,900

ended December 31, 2003, for Baker Corporation is presented in Table 3.6. Note that all cash inflows as well as net profits after taxes and depreciation are treated as positive values. All cash outflows, any losses, and dividends paid are treated as negative values. The items in each category—operating, investment, and financing—are totaled, and the three totals are added to get the "Net increase (decrease) in cash and marketable securities" for the period. As a

TABLE 3.6 Baker Corporation Statement of Cash Flows ($000) for the Year Ended December 31, 2003

Cash Flow from Operating Activities		
Net profits after taxes	$180	
Depreciation	100	
Decrease in accounts receivable	100	
Decrease in inventories	300	
Increase in accounts payable	200	
Decrease in accruals	(100)[a]	
Cash provided by operating activities		$780
Cash Flow from Investment Activities		
Increase in gross fixed assets	($300)	
Changes in business interests	0	
Cash provided by investment activities		(300)
Cash Flow from Financing Activities		
Decrease in notes payable	($100)	
Increase in long-term debts	200	
Changes in stockholders' equity[b]	0	
Dividends paid	(80)	
Cash provided by financing activities		20
Net increase in cash and marketable securities		$500

[a]As is customary, parentheses are used to denote a negative number, which in this case is a cash outflow.

[b]Retained earnings are excluded here, because their change is actually reflected in the combination of the "Net profits after taxes" and "Dividends paid" entries.

check, this value should reconcile with the actual change in cash and marketable securities for the year, which is obtained from the beginning- and end-of-period balance sheets.

Interpreting the Statement

The statement of cash flows allows the financial manager and other interested parties to analyze the firm's cash flow. The manager should pay special attention both to the major categories of cash flow and to the individual items of cash inflow and outflow, to assess whether any developments have occurred that are contrary to the company's financial policies. In addition, the statement can be used to evaluate progress toward projected goals or to isolate inefficiencies. For example, increases in accounts receivable or inventories resulting in major cash outflows may signal credit or inventory problems, respectively. The financial manager also can prepare a statement of cash flows developed from projected financial statements. This approach can be used to determine whether planned actions are desirable in view of the resulting cash flows.

An understanding of the basic financial principles presented throughout this text is absolutely essential to the effective interpretation of the statement of cash flows.

Operating Cash Flow

operating cash flow (OCF)
The cash flow a firm generates from its normal operations; calculated as EBIT − taxes + depreciation.

A firm's **operating cash flow (OCF)** is the cash flow it generates from its normal operations—producing and selling its output of goods or services. A variety of definitions of OCF can be found in the financial literature. Equation 3.1 introduced the simple accounting definition of cash flow from operations. Here we refine this definition to estimate cash flows more accurately. Unlike the earlier definition, this one excludes interest and taxes in order to focus on the true cash flow resulting from operations without regard to financing costs and taxes. Operating cash flow (OCF) is defined in Equation 3.2.

$$\text{OCF} = \text{EBIT} - \text{Taxes} + \text{Depreciation} \tag{3.2}$$

EXAMPLE Substituting the values for Baker Corporation from its income statement (Table 3.4) into Equation 3.2, we get

$$\text{OCF} = \$370 - \$120 + \$100 = \$350$$

Baker Corporation during 2003 generated $350,000 of cash flow from producing and selling its output. Because Baker's operating cash flow is positive, we can conclude that the firm's operations are generating positive cash flows.

Comparing Equations 3.1 and 3.2 reveals that the key difference between the accounting and finance definitions of operating cash flow is that the finance definition excludes interest as an operating flow, whereas the accounting definition in effect includes it as an operating flow. In the unlikely case that a firm had no interest expense, the accounting (Equation 3.1) and finance (Equation 3.2) definitions of operating cash flow would be the same.

Free Cash Flow

free cash flow (FCF)
The amount of cash flow available to investors (creditors and owners) after the firm has met all operating needs and paid for investments in net fixed assets and net current assets.

The firm's **free cash flow (FCF)** represents the amount of cash flow available to investors—the providers of debt (creditors) and equity (owners)—after the firm has met all operating needs and paid for investments in net fixed assets and net current assets. It represents the summation of the net amount of cash flow available to creditors and owners during the period. Free cash flow can be defined by Equation 3.3.

$$\text{FCF} = \text{OCF} - \text{Net fixed asset investment (NFAI)} - \text{Net current asset investment (NCAI)} \tag{3.3}$$

The *net fixed asset investment* (*NFAI*) can be calculated as shown in Equation 3.4.

$$\text{NFAI} = \text{Change in net fixed assets} + \text{Depreciation} \tag{3.4}$$

EXAMPLE Using the Baker Corporation's balance sheets in Table 3.5, we see that its change in net fixed assets between 2002 and 2003 was +$200 ($1,200 in 2003 − $1,000 in 2002). Substituting this value and the $100 of depreciation for 2003 into Equation 3.4, we get Baker's net fixed asset investment (NFAI) for 2003:

$$\text{NFAI} = \$200 + \$100 = \$300$$

Baker Corporation therefore invested a net $300,000 in fixed assets during 2003. This amount would, of course, represent a net cash outflow to acquire fixed assets during 2003.

Looking at Equation 3.4, we can see that if the depreciation during a year is less than the *decrease* during that year in net fixed assets, the NFAI would be negative. A negative NFAI represents a net cash *inflow* attributable to the fact that the firm sold more assets than it acquired during the year.

The *net current asset investment (NCAI)* represents the net investment made by the firm in its current (operating) assets. "Net" refers to the difference between current assets and spontaneous current liabilities, which typically include accounts payable and accruals. Because they are a negotiated source of short-term financing, notes payable are not included in the NCAI calculation. Instead, they serve as a creditor claim on the firm's free cash flow. Equation 3.5 shows the NCAI calculation.

$$\text{NCAI} = \text{Change in current assets} - \text{Change in spontaneous current liabilities (Accounts payable + Accruals)} \quad (3.5)$$

EXAMPLE

Looking at the Baker Corporation's balance sheets for 2002 and 2003 in Table 3.5, we see that the change in current assets between 2002 and 2003 is +\$100 (\$2,000 in 2003 − \$1,900 in 2002). The difference between Baker's accounts payable plus accruals of \$800 in 2003 (\$700 in accounts payable + \$100 in accruals) and of \$700 in 2002 (\$500 in accounts payable + \$200 in accruals) is +\$100 (\$800 in 2003 − \$700 in 2002). Substituting into Equation 3.5 the change in current assets and the change in the sum of accounts payable plus accruals for Baker Corporation, we get its 2003 NCAI:

$$\text{NCAI} = \$100 - \$100 = \$0$$

This means that during 2003 Baker Corporation made no investment (\$0) in its current assets net of spontaneous current liabilities.

Now we can substitute Baker Corporation's 2003 operating cash flow (OCF) of \$350, its net fixed asset investment (NFAI) of \$300, and its net current asset investment (NCAI) of \$0 into Equation 3.3 to find its free cash flow (FCF):

$$\text{FCF} = \$350 - \$300 - \$0 = \$50$$

We can see that during 2003 Baker generated \$50,000 of free cash flow, which it can use to pay its investors—creditors (payment of interest) and owners (payment of dividends). Thus, the firm generated adequate cash flow to cover all of its operating costs and investments and had free cash flow available to pay investors.

Further analysis of free cash flow is beyond the scope of this initial introduction to cash flow. Clearly, cash flow is the lifeblood of the firm. We next consider various aspects of financial planning for cash flow and profit.

Review Questions

3–1 Briefly describe the first four modified accelerated cost recovery system (MACRS) property classes and recovery periods. Explain how the depreciation percentages are determined by using the MACRS recovery periods.

3–2 Describe the overall cash flow through the firm in terms of operating flows, investments flows, and financing flows.

3–3 Explain why a decrease in cash is classified as a *cash inflow (source)* and why an increase in cash is classified as a *cash outflow (use)* in preparing the statement of cash flows.

3–4 Why is depreciation (as well as amortization and depletion) considered a *noncash charge?* How do accountants estimate *cash flow from operations?*

3–5 Describe the general format of the statement of cash flows. How are cash inflows differentiated from cash outflows on this statement?

3–6 From a strict financial perspective, define and differentiate between a firm's *operating cash flow (OCF)* and its *free cash flow (FCF)*.

LG3 3.2 The Financial Planning Process

Financial planning is an important aspect of the firm's operations because it provides road maps for guiding, coordinating, and controlling the firm's actions to achieve its objectives. Two key aspects of the financial planning process are *cash planning* and *profit planning*. Cash planning involves preparation of the firm's cash budget. Profit planning involves preparation of pro forma statements. Both the cash budget and the pro forma statements are useful for internal financial planning; they also are routinely required by existing and prospective lenders.

financial planning process
Planning that begins with long-term, or *strategic,* financial plans that in turn guide the formulation of short-term, or *operating,* plans and budgets.

The **financial planning process** begins with long-term, or *strategic,* financial plans. These in turn guide the formulation of short-term, or *operating,* plans and budgets. Generally, the short-term plans and budgets implement the firm's long-term strategic objectives. Although the remainder of this chapter places primary emphasis on short-term financial plans and budgets, a few preliminary comments on long-term financial plans are in order.

Long-Term (Strategic) Financial Plans

long-term (strategic) financial plans
Lay out a company's planned financial actions and the anticipated impact of those actions over periods ranging from 2 to 10 years.

Long-term (strategic) financial plans lay out a company's planned financial actions and the anticipated impact of those actions over periods ranging from 2 to 10 years. Five-year strategic plans, which are revised as significant new information becomes available, are common. Generally, firms that are subject to high degrees of operating uncertainty, relatively short production cycles, or both, tend to use shorter planning horizons.

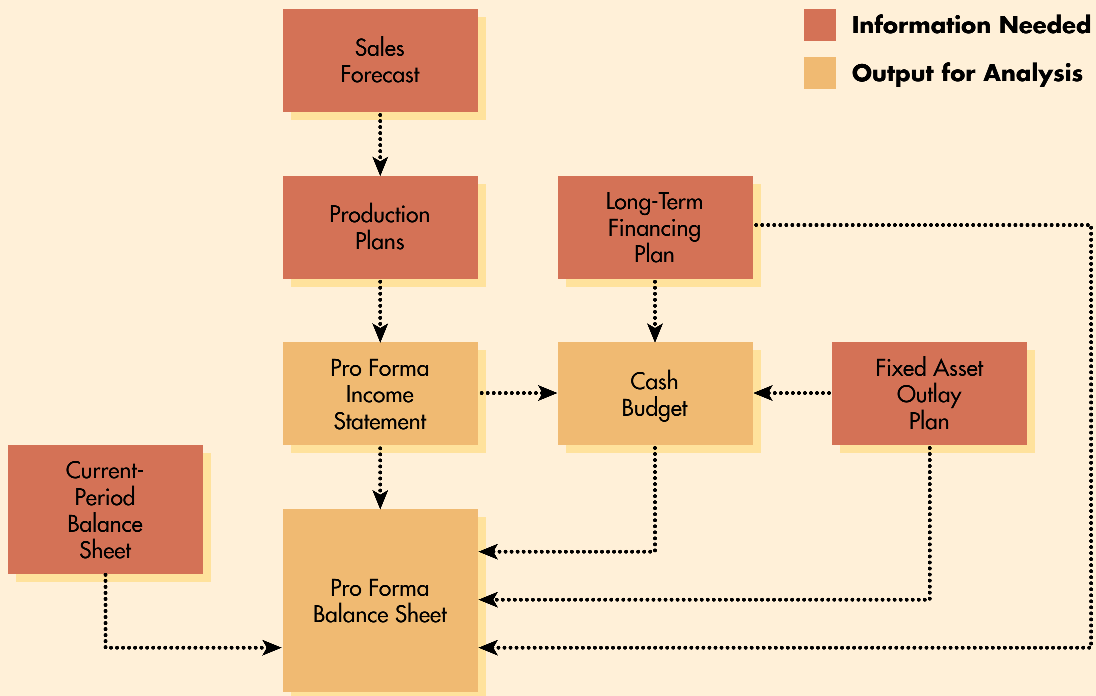
Long-term financial plans are part of an integrated strategy that, along with production and marketing plans, guides the firm toward strategic goals. Those long-term plans consider proposed outlays for fixed assets, research and development activities, marketing and product development actions, capital structure, and major sources of financing. Also included would be termination of existing projects, product lines, or lines of business; repayment or retirement of outstanding debts; and any planned acquisitions. Such plans tend to be supported by a series of annual budgets and profit plans.

Short-Term (Operating) Financial Plans

short-term (operating) financial plans
Specify short-term financial actions and the anticipated impact of those actions.

Short-term (operating) financial plans specify short-term financial actions and the anticipated impact of those actions. These plans most often cover a 1- to 2-year period. Key inputs include the sales forecast and various forms of operating and financial data. Key outputs include a number of operating budgets, the cash bud-

FIGURE 3.2 **Short-Term Financial Planning**
The short-term (operating) financial planning process



get, and pro forma financial statements. The entire short-term financial planning process is outlined in Figure 3.2.

Hint Electronic spreadsheets such as Excel and Lotus 1–2–3 are widely used to streamline the process of preparing and evaluating these short-term financial planning statements.

Short-term financial planning begins with the sales forecast. From it, production plans are developed that take into account lead (preparation) times and include estimates of the required raw materials. Using the production plans, the firm can estimate direct labor requirements, factory overhead outlays, and operating expenses. Once these estimates have been made, the firm's pro forma income statement and cash budget can be prepared. With the basic inputs (pro forma income statement, cash budget, fixed asset outlay plan, long-term financing plan, and current-period balance sheet), the pro forma balance sheet can finally be developed.

Throughout the remainder of this chapter, we will concentrate on the key outputs of the short-term financial planning process: the cash budget, the pro forma income statement, and the pro forma balance sheet.

Review Questions

3–7 What is the *financial planning process?* Contrast *long-term (strategic) financial plans* and *short-term (operating) financial plans.*

3–8 Which three statements result as part of the short-term (operating) financial planning process?

LG4 3.3 Cash Planning: Cash Budgets

cash budget (cash forecast)
A statement of the firm's planned inflows and outflows of cash that is used to estimate its short-term cash requirements.

The **cash budget,** or **cash forecast,** is a statement of the firm's planned inflows and outflows of cash. It is used by the firm to estimate its short-term cash requirements, with particular attention to planning for surplus cash and for cash shortages.

Typically, the cash budget is designed to cover a 1-year period, divided into smaller time intervals. The number and type of intervals depend on the nature of the business. The more seasonal and uncertain a firm's cash flows, the greater the number of intervals. Because many firms are confronted with a seasonal cash flow pattern, the cash budget is quite often presented on a monthly basis. Firms with stable patterns of cash flow may use quarterly or annual time intervals.

The Sales Forecast

sales forecast
The prediction of the firm's sales over a given period, based on external and/or internal data; used as the key input to the short-term financial planning process.

The key input to the short-term financial planning process is the firm's **sales forecast.** This prediction of the firm's sales over a given period is ordinarily prepared by the marketing department. On the basis of the sales forecast, the financial manager estimates the monthly cash flows that will result from projected sales receipts and from outlays related to production, inventory, and sales. The manager also determines the level of fixed assets required and the amount of financing, if any, needed to support the forecast level of sales and production. In practice, obtaining good data is the most difficult aspect of forecasting.[4] The sales forecast may be based on an analysis of external data, internal data, or a combination of the two.

external forecast
A sales forecast based on the relationships observed between the firm's sales and certain key external economic indicators.

An **external forecast** is based on the relationships observed between the firm's sales and certain key external economic indicators such as the gross domestic product (GDP), new housing starts, consumer confidence, and disposable personal income. Forecasts containing these indicators are readily available. Because the firm's sales are often closely related to some aspect of overall national economic activity, a forecast of economic activity should provide insight into future sales.

internal forecast
A sales forecast based on a buildup, or consensus, of sales forecasts through the firm's own sales channels.

Internal forecasts are based on a buildup, or consensus, of sales forecasts through the firm's own sales channels. Typically, the firm's salespeople in the field are asked to estimate how many units of each type of product they expect to sell in the coming year. These forecasts are collected and totaled by the sales manager, who may adjust the figures using knowledge of specific markets or of the salesperson's forecasting ability. Finally, adjustments may be made for additional internal factors, such as production capabilities.

Hint The firm needs to spend a great deal of time and effort to make the sales forecast as precise as possible. An "after-the-fact" analysis of the prior year's forecast can help the firm determine which approach or combination of approaches will give it the most accurate forecasts.

Firms generally use a combination of external and internal forecast data to make the final sales forecast. The internal data provide insight into sales expectations, and the external data provide a means of adjusting these expectations to take into account general economic factors. The nature of the firm's product also often affects the mix and types of forecasting methods used.

4. Calculation of the various forecasting techniques, such as regression, moving averages, and exponential smoothing, is not included in this text. For a description of the technical side of forecasting, refer to a basic statistics, econometrics, or management science text.

TABLE 3.7 The General Format of the Cash Budget

	Jan.	Feb.	. . .	Nov.	Dec.
Cash receipts	$XXX	$XXG		$XXM	$XXT
Less: Cash disbursements	XXA	XXH	. . .	XXN	XXU
Net cash flow	$XXB	$XXI		$XXO	$XXV
Add: Beginning cash	XXC	XXD	XXJ	XXP	XXQ
Ending cash	$XXD	$XXJ		$XXQ	$XXW
Less: Minimum cash balance	XXE	XXK	. . .	XXR	XXY
Required total financing		$XXL		$XXS	
Excess cash balance	$XXF				$XXZ

Preparing the Cash Budget

The general format of the cash budget is presented in Table 3.7. We will discuss each of its components individually.

Cash Receipts

cash receipts
All of a firm's inflows of cash in a given financial period.

Cash receipts include all of a firm's inflows of cash in a given financial period. The most common components of cash receipts are cash sales, collections of accounts receivable, and other cash receipts.

EXAMPLE

Coulson Industries, a defense contractor, is developing a cash budget for October, November, and December. Coulson's sales in August and September were $100,000 and $200,000, respectively. Sales of $400,000, $300,000, and $200,000 have been forecast for October, November, and December, respectively. Historically, 20% of the firm's sales have been for cash, 50% have generated accounts receivable collected after 1 month, and the remaining 30% have generated accounts receivable collected after 2 months. Bad-debt expenses (uncollectible accounts) have been negligible.[5] In December, the firm will receive a $30,000 dividend from stock in a subsidiary. The schedule of expected cash receipts for the company is presented in Table 3.8. It contains the following items:

Forecast sales This initial entry is *merely informational*. It is provided as an aid in calculating other sales-related items.

Cash sales The cash sales shown for each month represent 20% of the total sales forecast for that month.

Collections of A/R These entries represent the collection of accounts receivable (A/R) resulting from sales in earlier months.

5. Normally, it would be expected that the collection percentages would total slightly less than 100%, because some of the accounts receivable would be uncollectible. In this example, the sum of the collection percentages is 100% (20% + 50% + 30%), which reflects the fact that all sales are assumed to be collected.

TABLE 3.8 A Schedule of Projected Cash Receipts for Coulson Industries ($000)

Forecast sales	Aug. $100	Sept. $200	Oct. $400	Nov. $300	Dec. $200
Cash sales (0.20)	$20	$40	$ 80	$ 60	$ 40
Collections of A/R:					
Lagged 1 month (0.50)		50	100	200	150
Lagged 2 months (0.30)			30	60	120
Other cash receipts					30
Total cash receipts			$210	$320	$340

Lagged 1 month These figures represent sales made in the preceding month that generated accounts receivable collected in the current month. Because 50% of the current month's sales are collected 1 month later, the collections of A/R with a 1-month lag shown for September represent 50% of the sales in August, collections for October represent 50% of September sales, and so on.

Lagged 2 months These figures represent sales made 2 months earlier that generated accounts receivable collected in the current month. Because 30% of sales are collected 2 months later, the collections with a 2-month lag shown for October represent 30% of the sales in August, and so on.

Other cash receipts These are cash receipts expected from sources other than sales. Interest received, dividends received, proceeds from the sale of equipment, stock and bond sale proceeds, and lease receipts may show up here. For Coulson Industries, the only other cash receipt is the $30,000 dividend due in December.

Total cash receipts This figure represents the total of all the cash receipts listed for each month. For Coulson Industries, we are concerned only with October, November, and December, as shown in Table 3.8.

Cash Disbursements

cash disbursements
All outlays of cash by the firm during a given financial period.

Cash disbursements include all outlays of cash by the firm during a given financial period. The most common cash disbursements are

Cash purchases	Fixed-asset outlays
Payments of accounts payable	Interest payments
Rent (and lease) payments	Cash dividend payments
Wages and salaries	Principal payments (loans)
Tax payments	Repurchases or retirements of stock

It is important to recognize that *depreciation and other noncash charges are NOT included in the cash budget,* because they merely represent a scheduled write-off of an earlier cash outflow. The impact of depreciation, as we noted earlier, is reflected in the reduced cash outflow for tax payments.

In Practice

FOCUS ON PRACTICE Cash Forecasts Needed, "Rain or Shine"

Given the importance of cash to sound financial management, it is surprising how many companies ignore the cash-forecasting process. Three reasons come up most often: Cash forecasts are always wrong, they're hard to do, and managers don't see the benefits of these forecasts unless the company is already in a cash crunch. In addition, each company has its own methodology for cash forecasting. If the firm's cash inflows and outflows don't form a pattern that managers can graph, it's tough to develop successful forecasts.

Yet the reasons to forecast cash are equally compelling: Cash forecasts provide for reliable liquidity, enable a company to minimize borrowing costs or maximize investment income, and help financial executives manage currency exposures more accurately. In times of tight credit, lenders expect borrowers to monitor cash carefully and will favor a company that prepares good cash forecasts. When cash needs and the forecasted cash position don't match, financial managers can plan for borrowed funds to close the gap.

New York City–based men's apparel manufacturer **Salant Corp.** closely integrates its financial plans and forecasts. "Our biggest challenge is to keep the cash forecast and the projected profit and loss in sync with the balance sheet and vice versa," says William R. Bennett, vice president and treasurer. "We learned that the hard way and developed our own spreadsheet-based model." Although complicated to build, the model is easy for managers to use.

Salant is a capital-intensive operation, so its liquidity is linked to its assets. Bennett uses the forecast of inventory and receivables as the forecast for borrowing capacity required to meet its operating needs.

Like Salant, many companies are using technology to demystify cash forecasts. Software can apply statistical techniques, graph historical data, or build models based on each customer's payment patterns. It can also tap corporate databases for the firm's purchases and associated payment information and order shipments to customers and the associated payment terms. These data increase forecast accuracy.

Sources: Adapted from Richard H. Gamble, "Cash Forecast: Cloudy But Clearing," *Business Finance* (May 2001), downloaded from *www.businessfinancemag.com;* "Profile: Salant Corp.," *Yahoo! Finance, www.biz.yahoo.com,* downloaded November 19, 2001.

EXAMPLE Coulson Industries has gathered the following data needed for the preparation of a cash disbursements schedule for October, November, and December.

Purchases The firm's purchases represent 70% of sales. Of this amount, 10% is paid in cash, 70% is paid in the month immediately following the month of purchase, and the remaining 20% is paid 2 months following the month of purchase.[6]

Rent payments Rent of $5,000 will be paid each month.

Wages and salaries Fixed salary cost for the year is $96,000, or $8,000 per month. In addition, wages are estimated as 10% of monthly sales.

Tax payments Taxes of $25,000 must be paid in December.

Fixed-asset outlays New machinery costing $130,000 will be purchased and paid for in November.

Interest payments An interest payment of $10,000 is due in December.

6. Unlike the collection percentages for sales, the total of the payment percentages should equal 100%, because it is expected that the firm will pay off all of its accounts payable.

Cash dividend payments Cash dividends of $20,000 will be paid in October.

Principal payments (loans) A $20,000 principal payment is due in December.

Repurchases or retirements of stock No repurchase or retirement of stock is expected between October and December.

The firm's cash disbursements schedule, using the preceding data, is shown in Table 3.9. Some items in the table are explained in greater detail below.

Purchases This entry is *merely informational*. The figures represent 70% of the forecast sales for each month. They have been included to facilitate calculation of the cash purchases and related payments.

Cash purchases The cash purchases for each month represent 10% of the month's purchases.

Payments of A/P These entries represent the payment of accounts payable (A/P) resulting from purchases in earlier months.

Lagged 1 month These figures represent purchases made in the preceding month that are paid for in the current month. Because 70% of the firm's purchases are paid for 1 month later, the payments with a 1-month lag shown for September represent 70% of the August purchases, payments for October represent 70% of September purchases, and so on.

Lagged 2 months These figures represent purchases made 2 months earlier that are paid for in the current month. Because 20% of the firm's purchases are paid for 2 months later, the payments with a 2-month lag for October represent 20% of the August purchases, and so on.

TABLE 3.9 **A Schedule of Projected Cash Disbursements for Coulson Industries ($000)**

Purchases (0.70 × sales)	Aug. $70	Sept. $140	Oct. $280	Nov. $210	Dec. $140
Cash purchases (0.10)	$7	$14	$ 28	$ 21	$ 14
Payments of A/P:					
Lagged 1 month (0.70)		49	98	196	147
Lagged 2 months (0.20)			14	28	56
Rent payments			5	5	5
Wages and salaries			48	38	28
Tax payments					25
Fixed-asset outlays				130	
Interest payments					10
Cash dividend payments			20		
Principal payments					20
Total cash disbursements			$213	$418	$305

Wages and salaries These amounts were obtained by adding $8,000 to 10% of the *sales* in each month. The $8,000 represents the salary component; the rest represents wages.

The remaining items on the cash disbursements schedule are self-explanatory.

net cash flow
The mathematical difference between the firm's cash receipts and its cash disbursements in each period.

ending cash
The sum of the firm's beginning cash and its net cash flow for the period.

required total financing
Amount of funds needed by the firm if the ending cash for the period is less than the desired minimum cash balance; typically represented by notes payable.

Net Cash Flow, Ending Cash, Financing, and Excess Cash

Look back at the general-format cash budget in Table 3.7. We have inputs for the first two entries, and we now continue calculating the firm's cash needs. The firm's **net cash flow** is found by subtracting the cash disbursements from cash receipts in each period. Then we add beginning cash to the firm's net cash flow to determine the **ending cash** for each period. Finally, we subtract the desired minimum cash balance from ending cash to find the **required total financing** or the **excess cash balance.** If the ending cash is less than the minimum cash balance, *financing* is required. Such financing is typically viewed as short-term and is therefore represented by notes payable. If the ending cash is greater than the minimum cash balance, *excess cash* exists. Any excess cash is assumed to be invested in a liquid, short-term, interest-paying vehicle—that is, in marketable securities.

EXAMPLE

Table 3.10 presents Coulson Industries' cash budget, based on the data already developed. At the end of September, Coulson's cash balance was $50,000, and its notes payable and marketable securities equaled $0.[7] The company wishes to maintain, as a reserve for unexpected needs, a minimum cash balance of $25,000.

excess cash balance
The (excess) amount available for investment by the firm if the period's ending cash is greater than the desired minimum cash balance; assumed to be invested in marketable securities.

TABLE 3.10 A Cash Budget for Coulson Industries ($000)

	Oct.	Nov.	Dec.
Total cash receipts[a]	$210	$320	$340
Less: Total cash disbursements[b]	213	418	305
Net cash flow	($ 3)	($ 98)	$ 35
Add: Beginning cash	50	47	(51)
Ending cash	$ 47	($ 51)	($ 16)
Less: Minimum cash balance	25	25	25
Required total financing (notes payable)[c]	—	$ 76	$ 41
Excess cash balance (marketable securities)[d]	$ 22	—	—

[a]From Table 3.8.

[b]From Table 3.9.

[c]Values are placed in this line when the ending cash is less than the desired minimum cash balance. These amounts are typically financed short-term and therefore are represented by notes payable.

[d]Values are placed in this line when the ending cash is greater than the desired minimum cash balance. These amounts are typically assumed to be invested short-term and therefore are represented by marketable securities.

7. If Coulson either had outstanding notes payable or held marketable securities at the end of September, its "beginning cash" value would be misleading. It could be either overstated or understated, depending on whether the firm had notes payable or marketable securities on its books at that time. For simplicity, the cash budget discussions and problems presented in this chapter assume that the firm's notes payable and marketable securities equal $0 at the beginning of the period of concern.

For Coulson Industries to maintain its required $25,000 ending cash balance, it will need total borrowing of $76,000 in November and $41,000 in December. In October the firm will have an excess cash balance of $22,000, which can be held in an interest-earning marketable security. The required total financing figures in the cash budget refer to *how much will be owed at the end of the month;* they do *not* represent the monthly changes in borrowing.

The monthly changes in borrowing and in excess cash can be found by further analyzing the cash budget. In October the $50,000 beginning cash, which becomes $47,000 after the $3,000 net cash outflow, results in a $22,000 excess cash balance once the $25,000 minimum cash is deducted. In November the $76,000 of required total financing resulted from the $98,000 net cash outflow less the $22,000 of excess cash from October. The $41,000 of required total financing in December resulted from reducing November's $76,000 of required total financing by the $35,000 of net cash inflow during December. Summarizing, the financial activities for each month would be as follows:

October: Invest the $22,000 excess cash balance in marketable securities.

November: Liquidate the $22,000 of marketable securities and borrow $76,000 (notes payable).

December: Repay $35,000 of notes payable to leave $41,000 of outstanding required total financing.

Hint Not only is the cash budget a great tool to let management know when it has cash shortages or excesses, but it may be a document required by potential creditors. It communicates to them what the money is going to be used for, and how and when their loan will be repaid.

Evaluating the Cash Budget

The cash budget indicates whether a cash shortage or surplus is expected in each of the months covered by the forecast. Each month's figure is based on the internally imposed requirement of a minimum cash balance and *represents the total balance at the end of the month*.

At the end of each of the 3 months, Coulson expects the following balances in cash, marketable securities, and notes payable:

	End-of-month balance ($000)		
Account	Oct.	Nov.	Dec.
Cash	$25	$25	$25
Marketable securities	22	0	0
Notes payable	0	76	41

Note that the firm is assumed first to liquidate its marketable securities to meet deficits and then to borrow with notes payable if additional financing is needed. As a result, it will not have marketable securities and notes payable on its books at the same time.

Hint Because of the uncertainty of the ending cash values, the financial manager will usually seek to borrow more than the maximum financing indicated in the cash budget.

Because it may be necessary to borrow up to $76,000 for the 3-month period, the financial manager should be certain that some arrangement is made to ensure the availability of these funds.

Coping with Uncertainty in the Cash Budget

Aside from careful estimation of cash budget inputs, there are two ways of coping with the uncertainty of the cash budget.[8] One is to prepare several cash budgets—based on pessimistic, most likely, and optimistic forecasts. From this range of cash flows, the financial manager can determine the amount of financing necessary to cover the most adverse situation. The use of several cash budgets, based on differing assumptions, also should give the financial manager a sense of the riskiness of various alternatives. This *sensitivity analysis,* or "what if" approach, is often used to analyze cash flows under a variety of circumstances. Computers and electronic spreadsheets simplify the process of performing sensitivity analysis.

EXAMPLE Table 3.11 presents the summary of Coulson Industries' cash budget prepared for each month of concern using pessimistic, most likely, and optimistic estimates of total cash receipts and disbursements. The most likely estimate is based on the expected outcomes presented earlier.

During October, Coulson will, at worst, need a maximum of $15,000 of financing and, at best, will have a $62,000 excess cash balance. During November, its financing requirement will be between $0 and $185,000, or it could experience an excess cash balance of $5,000. The December projections show maximum borrowing of $190,000 with a possible excess cash balance of

TABLE 3.11 A Sensitivity Analysis of Coulson Industries' Cash Budget ($000)

	October			November			December		
	Pessimistic	Most likely	Optimistic	Pessimistic	Most likely	Optimistic	Pessimistic	Most likely	Optimistic
Total cash receipts	$160	$210	$285	$210	$320	$ 410	$275	$340	$422
Less: Total cash disbursements	200	213	248	380	418	467	280	305	320
Net cash flow	($ 40)	($ 3)	$ 37	($170)	($ 98)	($ 57)	($ 5)	$ 35	$102
Add: Beginning cash	50	50	50	10	47	87	(160)	(51)	30
Ending cash	$ 10	$ 47	$ 87	($160)	($ 51)	$ 30	($165)	($ 16)	$132
Less: Minimum cash balance	25	25	25	25	25	25	25	25	25
Required total financing	$ 15	—	—	$185	$ 76	—	$190	$ 41	—
Excess cash balance	—	$ 22	$ 62	—	—	$ 5	—	—	$107

8. The term *uncertainty* is used here to refer to the variability of the cash flow outcomes that may actually occur.

$107,000. By considering the extreme values in the pessimistic and optimistic outcomes, Coulson Industries should be better able to plan its cash requirements. For the 3-month period, the peak borrowing requirement under the worst circumstances would be $190,000, which happens to be considerably greater than the most likely estimate of $76,000 for this period.

A second and much more sophisticated way of coping with uncertainty in the cash budget is *simulation* (discussed in Chapter 10). By simulating the occurrence of sales and other uncertain events, the firm can develop a probability distribution of its ending cash flows for each month. The financial decision maker can then use the probability distribution to determine the amount of financing needed to protect the firm adequately against a cash shortage.

Cash Flow Within the Month

Because the cash budget shows cash flows only on a total monthly basis, the information provided by the cash budget is not necessarily adequate for ensuring solvency. A firm must look more closely at its pattern of daily cash receipts and cash disbursements to ensure that adequate cash is available for paying bills as they come due. For an example related to this topic, see the book's Web site at www.aw.com/gitman.

The synchronization of cash flows in the cash budget at month-end does not ensure that the firm will be able to meet daily cash requirements. Because a firm's cash flows are generally quite variable when viewed on a daily basis, effective cash planning requires a look *beyond* the cash budget. The financial manager must therefore plan and monitor cash flow more frequently than on a monthly basis. The greater the variability of cash flows from day to day, the greater the attention required.

Review Questions

3–9 What is the purpose of the *cash budget?* What role does the sales forecast play in its preparation?

3–10 Briefly describe the basic format of the cash budget.

3–11 How can the two "bottom lines" of the cash budget be used to determine the firm's short-term borrowing and investment requirements?

3–12 What is the cause of uncertainty in the cash budget, and what two techniques can be used to cope with this uncertainty?

LG5 3.4 Profit Planning: Pro Forma Statements

pro forma statements
Projected, or forecast, income statements and balance sheets.

Whereas cash planning focuses on forecasting cash flows, *profit planning* relies on accrual concepts to project the firm's profit and overall financial position. Shareholders, creditors, and the firm's management pay close attention to the **pro forma statements,** which are projected, or forecast, income statements and balance sheets. The basic steps in the short-term financial planning process were shown in the flow diagram of Figure 3.2. Various approaches for estimating the pro forma statements are based on the belief that the financial relationships reflected in the firm's past financial statements will not change in the coming period. The commonly used simplified approaches are presented in subsequent discussions.

Hint A key point in understanding pro forma statements is that they reflect the goals and objectives of the firm for the planning period. In order for these goals and objectives to be achieved, operational plans will have to be developed. Financial plans can be realized only if the correct actions are implemented.

Two inputs are required for preparing pro forma statements: (1) financial statements for the preceding year and (2) the sales forecast for the coming year. A variety of assumptions must also be made. The company that we will use to illustrate the simplified approaches to pro forma preparation is Vectra Manufacturing, which manufactures and sells one product. It has two basic product models—X and Y—which are produced by the same process but require different amounts of raw material and labor.

Preceding Year's Financial Statements

The income statement for the firm's 2003 operations is given in Table 3.12. It indicates that Vectra had sales of \$100,000, total cost of goods sold of \$80,000, net profits before taxes of \$9,000, and net profits after taxes of \$7,650. The firm paid \$4,000 in cash dividends, leaving \$3,650 to be transferred to retained earnings. The firm's balance sheet for 2003 is given in Table 3.13.

TABLE 3.12 Vectra Manufacturing's Income Statement for the Year Ended December 31, 2003

Sales revenue		
Model X (1,000 units at \$20/unit)	\$20,000	
Model Y (2,000 units at \$40/unit)	80,000	
Total sales		\$100,000
Less: Cost of goods sold		
Labor	\$28,500	
Material A	8,000	
Material B	5,500	
Overhead	38,000	
Total cost of goods sold		80,000
Gross profits		\$ 20,000
Less: Operating expenses		10,000
Operating profits		\$ 10,000
Less: Interest expense		1,000
Net profits before taxes		\$ 9,000
Less: Taxes ($0.15 \times \$9,000$)		1,350
Net profits after taxes		\$ 7,650
Less: Common stock dividends		4,000
To retained earnings		\$ 3,650

TABLE 3.13 Vectra Manufacturing's Balance Sheet, December 31, 2003

Assets		Liabilities and Stockholders' Equity	
Cash	$ 6,000	Accounts payable	$ 7,000
Marketable securities	4,000	Taxes payable	300
Accounts receivable	13,000	Notes payable	8,300
Inventories	16,000	Other current liabilities	3,400
Total current assets	$39,000	Total current liabilities	$19,000
Net fixed assets	$51,000	Long-term debt	$18,000
Total assets	$90,000	Stockholders' equity	
		Common stock	$30,000
		Retained earnings	$23,000
		Total liabilities and stockholders' equity	$90,000

Sales Forecast

Just as for the cash budget, the key input for pro forma statements is the sales forecast. Vectra Manufacturing's sales forecast for the coming year, based on both external and internal data, is presented in Table 3.14. The unit sale prices of the products reflect an increase from $20 to $25 for model X and from $40 to $50 for model Y. These increases are necessary to cover anticipated increases in costs.

Review Question

3–13 What is the purpose of *pro forma statements?* What inputs are required for preparing them using the simplified approaches?

TABLE 3.14 2004 Sales Forecast for Vectra Manufacturing

Unit sales	
Model X	1,500
Model Y	1,950
Dollar sales	
Model X ($25/unit)	$ 37,500
Model Y ($50/unit)	97,500
Total	$135,000

LG5 3.5 Preparing the Pro Forma Income Statement

percent-of-sales method
A simple method for developing the pro forma income statement; it forecasts sales and then expresses the various income statement items as percentages of projected sales.

A simple method for developing a pro forma income statement is the **percent-of-sales method.** It forecasts sales and then expresses the various income statement items as percentages of projected sales. The percentages used are likely to be the percentages of sales for those items in the previous year. By using dollar values taken from Vectra's 2003 income statement (Table 3.12), we find that these percentages are

$$\frac{\text{Cost of goods sold}}{\text{Sales}} = \frac{\$80{,}000}{\$100{,}000} = 80.0\%$$

$$\frac{\text{Operating expenses}}{\text{Sales}} = \frac{\$10{,}000}{\$100{,}000} = 10.0\%$$

$$\frac{\text{Interest expense}}{\text{Sales}} = \frac{\$1{,}000}{\$100{,}000} = 1.0\%$$

Applying these percentages to the firm's forecast sales of $135,000 (developed in Table 3.14), we get the 2004 pro forma income statement shown in Table 3.15. We have assumed that Vectra will pay $4,000 in common stock dividends, so the expected contribution to retained earnings is $6,327. This represents a considerable increase over $3,650 in the preceding year (see Table 3.12).

Considering Types of Costs and Expenses

The technique that is used to prepare the pro forma income statement in Table 3.15 assumes that all the firm's costs and expenses are *variable*. That is, we assumed that for a given percentage increase in sales, the same percentage increase

TABLE 3.15 A Pro Forma Income Statement, Using the Percent-of-Sales Method, for Vectra Manufacturing for the Year Ended December 31, 2004

Sales revenue	$135,000
Less: Cost of goods sold (0.80)	108,000
Gross profits	$ 27,000
Less: Operating expenses (0.10)	13,500
Operating profits	$ 13,500
Less: Interest expense (0.01)	1,350
Net profits before taxes	$ 12,150
Less: Taxes (0.15 × $12,150)	1,823
Net profits after taxes	$ 10,327
Less: Common stock dividends	4,000
To retained earnings	$ 6,327

in cost of goods sold, operating expenses, and interest expense would result. For example, as Vectra's sales increased by 35 percent (from $100,000 in 2003 to $135,000 projected for 2004), we assumed that its costs of goods sold also increased by 35 percent (from $80,000 in 2003 to $108,000 in 2004). On the basis of this assumption, the firm's net profits before taxes also increased by 35 percent (from $9,000 in 2003 to $12,150 projected for 2004).

This approach implies that the firm will not receive the benefits that result from fixed costs when sales are increasing.[9] Clearly, though, if the firm has fixed costs, these costs do not change when sales increase; the result is increased profits. But by remaining unchanged when sales decline, these costs tend to lower profits. Therefore, the use of past cost and expense ratios generally *tends to understate profits when sales are increasing.* (Likewise, it *tends to overstate profits when sales are decreasing.*) The best way to adjust for the presence of fixed costs when preparing a pro forma income statement is to break the firm's historical costs and expenses into *fixed* and *variable* components.[10]

EXAMPLE Vectra Manufacturing's 2003 actual and 2004 pro forma income statements, broken into fixed and variable cost and expense components, follow:

Vectra Manufacturing
Income Statements

	2003 Actual	2004 Pro forma
Sales revenue	$100,000	$135,000
Less: Cost of good sold		
Fixed cost	40,000	40,000
Variable cost (0.40 × sales)	40,000	54,000
Gross profits	$ 20,000	$ 41,000
Less: Operating expenses		
Fixed expense	5,000	5,000
Variable expense (0.05 × sales)	5,000	6,750
Operating profits	$ 10,000	$ 29,250
Less: Interest expense (all fixed)	1,000	1,000
Net profits before taxes	$ 9,000	$ 28,250
Less: Taxes (0.15 × net profits before taxes)	1,350	4,238
Net profits after taxes	$ 7,650	$ 24,012

9. The potential returns as well as risks resulting from use of fixed (operating and financial) costs to create "leverage" are discussed in Chapter 12. The key point to recognize here is that when the firm's revenue is *increasing*, fixed costs can magnify returns.

10. The application of *regression analysis*—a statistically based technique for measuring the relationship between variables—to past cost data as they relate to past sales could be used to develop equations that recognize the fixed and variable nature of each cost. Such equations could be employed when preparing the pro forma income statement from the sales forecast. The use of the regression approach in pro forma income statement preparation is widespread, and many computer software packages for use in pro forma preparation rely on this technique. Expanded discussions of the application of this technique can be found in most second-level managerial finance texts.

In Practice

FOCUS ON ETHICS Critical Ethical Lapse at Critical Path

Critical Path provides a fascinating study in how managers can seem to be maximizing shareholder wealth by making financial projections that primarily benefit the managers themselves. This Silicon Valley dot-com publicized wildly optimistic sales projections for its leading-edge corporate e-mail services at a time when its CEO was privately trying to sell the company at a price well above the current stock price. As the fiscal year-end neared and no buyer took the bait, sales personnel and accountants were pressured into doing whatever was necessary to try to approach the projected numbers. *Business Week* quoted a former sales manager: "The line between right and wrong wasn't just blurred—it was wiped out."

Could Critical Path stockholders have benefited if an acquisition had been completed before the actual results were reported? Possibly—although ensuing lawsuits and an SEC investigation into accounting irregularities leave that open to doubt. But there is no doubt that the new acquirer's stockholders would have been shortchanged. So much for maximizing shareholder wealth within ethical constraints!

This isn't just a case of wishful thinking. Managers who anticipated personal profits after taking a public company private through a "leveraged buyout" have occasionally *underestimated* sales and profits so that they would pay a lower price to existing shareholders. The phenomenal trust that stockholders put in financial managers can be easily abused through either misuse of funds or manipulation of the better information that managers possess.

Don't laws and the SEC offer enough protection against publicizing unrealistic financial forecasts? The Private Securities Litigation Reform Act of 1995 requires that companies disclose risks and uncertainties that may cause public "forward-looking statements" not to materialize. Accordingly, **Fifth Third Bankcorp** was careful to note six reasons why the anticipated benefits from its acquisition of **Old Kent Financial** might not come to pass, including changes in bank competition, interest rates, and the general economy. Furthermore, to keep companies from selectively disclosing key developments to Wall Street securities analysts but not to the general public, the SEC adopted Regulation FD (for Fair Disclosure) in 2000. Unfortunately, though, companies do not have to release revisions of forecasts, and this loophole leaves room for the ethical lapses seen at Critical Path.

Breaking Vectra's costs and expenses into fixed and variable components provides a more accurate projection of its pro forma profit. By assuming that *all* costs are variable (as shown in Table 3.15), we find that projected net profits before taxes would continue to equal 9 percent of sales (in 2003, \$9,000 net profits before taxes ÷ \$100,000 sales). Therefore, the 2004 net profits before taxes would have been \$12,150 (0.09 × \$135,000 projected sales) instead of the \$28,250 obtained by using the firm's fixed-cost–variable-cost breakdown.

Clearly, when using a simplified approach to prepare a pro forma income statement, we should break down costs and expenses into fixed and variable components.

Review Questions

3–14 How is the *percent-of-sales method* used to prepare pro forma income statements?

3–15 Why does the presence of fixed costs cause the percent-of-sales method of pro forma income statement preparation to fail? What is a better method?

LG5 3.6 Preparing the Pro Forma Balance Sheet

judgmental approach
A simplified approach for preparing the pro forma balance sheet under which the values of certain balance sheet accounts are estimated and the firm's external financing is used as a balancing, or "plug," figure.

A number of simplified approaches are available for preparing the pro forma balance sheet. Probably the best and most popular is the **judgmental approach,**[11] under which the values of certain balance sheet accounts are estimated and the firm's external financing is used as a balancing, or "plug," figure. To apply the judgmental approach to prepare Vectra Manufacturing's 2004 pro forma balance sheet, a number of assumptions must be made about levels of various balance sheet accounts:

1. A minimum cash balance of $6,000 is desired.
2. Marketable securities are assumed to remain unchanged from their current level of $4,000.
3. Accounts receivable on average represent 45 days of sales. Because Vectra's annual sales are projected to be $135,000, accounts receivable should average $16,875 (1/8 × $135,000). (Forty-five days expressed fractionally is one-eighth of a year: 45/360 = 1/8.)
4. The ending inventory should remain at a level of about $16,000, of which 25 percent (approximately $4,000) should be raw materials and the remaining 75 percent (approximately $12,000) should consist of finished goods.
5. A new machine costing $20,000 will be purchased. Total depreciation for the year is $8,000. Adding the $20,000 acquisition to the existing net fixed assets of $51,000 and subtracting the depreciation of $8,000 yield net fixed assets of $63,000.
6. Purchases are expected to represent approximately 30% of annual sales, which in this case is approximately $40,500 (0.30 × $135,000). The firm estimates that it can take 72 days on average to satisfy its accounts payable. Thus accounts payable should equal one-fifth (72 days ÷ 360 days) of the firm's purchases, or $8,100 (1/5 × $40,500).
7. Taxes payable are expected to equal one-fourth of the current year's tax liability, which equals $455 (one-fourth of the tax liability of $1,823 shown in the pro forma income statement in Table 3.15).
8. Notes payable are assumed to remain unchanged from their current level of $8,300.
9. No change in other current liabilities is expected. They remain at the level of the previous year: $3,400.
10. The firm's long-term debt and its common stock are expected to remain unchanged at $18,000 and $30,000, respectively; no issues, retirements, or repurchases of bonds or stocks are planned.
11. Retained earnings will increase from the beginning level of $23,000 (from the balance sheet dated December 31, 2003, in Table 3.13) to $29,327. The increase of $6,327 represents the amount of retained earnings calculated in the year-end 2004 pro forma income statement in Table 3.15.

external financing required ("plug" figure)
Under the judgmental approach for developing a pro forma balance sheet, the amount of external financing needed to bring the statement into balance.

A 2004 pro forma balance sheet for Vectra Manufacturing based on these assumptions is presented in Table 3.16. A **"plug" figure—**called the **external fi-**

11. The judgmental approach represents an improved version of the often discussed *percent-of-sales approach* to pro forma balance sheet preparation. Because the judgmental approach requires only slightly more information and should yield better estimates than the somewhat naive percent-of-sales approach, it is presented here.

TABLE 3.16 A Pro Forma Balance Sheet, Using the Judgmental Approach, for Vectra Manufacturing (December 31, 2004)

Assets			Liabilities and Stockholders' Equity	
Cash		$ 6,000	Accounts payable	$ 8,100
Marketable securities		4,000	Taxes payable	455
Accounts receivable		16,875	Notes payable	8,300
Inventories			Other current liabilities	3,400
Raw materials	$ 4,000		Total current liabilities	$ 20,255
Finished goods	12,000		Long-term debt	$ 18,000
Total inventory		16,000	Stockholders' equity	
Total current assets		$ 42,875	Common stock	$ 30,000
Net fixed assets		$ 63,000	Retained earnings	$ 29,327
Total assets		$105,875	Total	$ 97,582
			External financing required[a]	$ 8,293
			Total liabilities and stockholders' equity	$105,875

[a]The amount of external financing needed to force the firm's balance sheet to balance. Because of the nature of the judgmental approach, the balance sheet is not expected to balance without some type of adjustment.

nancing required—of $8,293 is needed to bring the statement into balance. This means that the firm will have to obtain about $8,293 of additional external financing to support the increased sales level of $135,000 for 2004.

A *positive* value for "external financing required," like that shown in Table 3.16, means that to support the forecast level of operation, the firm must raise funds externally using debt and/or equity financing or by reducing dividends. Once the form of financing is determined, the pro forma balance sheet is modified to replace "external financing required" with the planned increases in the debt and/or equity accounts.

A *negative* value for "external financing required" indicates that the firm's forecast financing is in excess of its needs. In this case, funds are available for use in repaying debt, repurchasing stock, or increasing dividends. Once the specific actions are determined, "external financing required" is replaced in the pro forma balance sheet with the planned reductions in the debt and/or equity accounts. Obviously, besides being used to prepare the pro forma balance sheet, the judgmental approach is also frequently used specifically to estimate the firm's financing requirements.

Review Questions

3–16 Describe the *judgmental approach* for simplified preparation of the pro forma balance sheet.

3–17 What is the significance of the "plug" figure, *external financing required?* Differentiate between strategies associated with positive and with negative values for external financing required.

LG6 3.7 Evaluation of Pro Forma Statements

It is difficult to forecast the many variables involved in preparing pro forma statements. As a result, investors, lenders, and managers frequently use the techniques presented in this chapter to make rough estimates of pro forma financial statements. However, it is important to recognize the basic weaknesses of these simplified approaches. The weaknesses lie in two assumptions: (1) that the firm's past financial condition is an accurate indicator of its future, and (2) that certain variables (such as cash, accounts receivable, and inventories) can be forced to take on certain "desired" values. These assumptions cannot be justified solely on the basis of their ability to simplify the calculations involved. However, despite their weaknesses, the simplified approaches to pro forma statement preparation are likely to remain popular because of their relative simplicity. Eventually, the use of computers to streamline financial planning will become the norm.

However pro forma statements are prepared, analysts must understand how to use them to make financial decisions. Both financial managers and lenders can use pro forma statements to analyze the firm's inflows and outflows of cash, as well as its liquidity, activity, debt, profitability, and market value. Various ratios can be calculated from the pro forma income statement and balance sheet to evaluate performance. Cash inflows and outflows can be evaluated by preparing a pro forma statement of cash flows. After analyzing the pro forma statements, the financial manager can take steps to adjust planned operations to achieve short-term financial goals. For example, if projected profits on the pro forma income statement are too low, a variety of pricing and/or cost-cutting actions might be initiated. If the projected level of accounts receivable on the pro forma balance sheet is too high, changes in credit or collection policy may be called for. Pro forma statements are therefore of great importance in solidifying the firm's financial plans for the coming year.

Review Questions

3–18 What are the two key weaknesses of the simplified approaches to preparing pro forma statements?

3–19 What is the financial manager's objective in evaluating pro forma statements?

Summary

FOCUS ON VALUE

Cash flow, the lifeblood of the firm, is a key determinant of the value of the firm. The financial manager must plan and manage—create, allocate, conserve, and monitor—the firm's cash flow. The goal is to ensure the firm's solvency by meeting financial obligations in a timely manner and to generate positive cash flow for the firm's owners. Both the magnitude and the risk of the cash flows generated on behalf of the owners determine the firm's value.

In order to carry out the responsibility **to create value for owners,** the financial manager uses tools such as cash budgets and pro forma financial statements as part of the process of generating positive cash flow. Good financial plans should result in large free cash flows that fully satisfy creditor claims and produce positive cash flows on behalf of owners. Clearly, the financial manager must use deliberate and careful planning and management of the firm's cash flows in order to achieve the firm's goal of maximizing share price.

REVIEW OF LEARNING GOALS

LG1 **Understand the effect of depreciation on the firm's cash flows, the depreciable value of an asset, its depreciable life, and tax depreciation methods.** Depreciation is an important factor affecting a firm's cash flow. The depreciable value of an asset and its depreciable life are determined by using the modified accelerated cost recovery system (MACRS) standards in the federal tax code. MACRS groups assets (excluding real estate) into six property classes based on length of recovery period—3, 5, 7, 10, 15, and 20 years—and can be applied over the appropriate period by using a schedule of yearly depreciation percentages for each period.

LG2 **Discuss the firm's statement of cash flows, operating cash flow, and free cash flow.** The statement of cash flows is divided into operating, investment, and financing flows. It reconciles changes in the firm's cash flows with changes in cash and marketable securities for the period. Interpreting the statement of cash flows requires an understanding of basic financial principles and involves both the major categories of cash flow and the individual items of cash inflow and outflow. From a strict financial point of view, a firm's operating cash flows, the cash flow it generates from normal operations, is defined to exclude interest and taxes; the simpler accounting view does not make these exclusions. Of greater importance is a firm's free cash flow, which is the amount of cash flow available to investors—the providers of debt (creditors) and equity (owners).

LG3 **Understand the financial planning process, including long-term (strategic) financial plans and short-term (operating) financial plans.** The two key aspects of the financial planning process are cash planning and profit planning. Cash planning involves the cash budget or cash forecast. Profit planning relies on the pro forma income statement and balance sheet. Long-term (strategic) financial plans act as a guide for preparing short-term (operating) financial plans. Long-term plans tend to cover periods ranging from 2 to 10 years and are updated periodically. Short-term plans most often cover a 1- to 2-year period.

LG4 **Discuss the cash-planning process and the preparation, evaluation, and use of the cash budget.** The cash planning process uses the cash budget, based on a sales forecast, to estimate short-term cash surpluses and shortages. The cash budget is typically prepared for a 1-year period divided into months. It nets cash receipts and disbursements for each period to calculate net cash flow. Ending cash is estimated by adding beginning cash to the net cash flow. By subtracting the desired minimum cash balance from the ending cash, the financial manager can determine required total financing (typically borrowing with notes payable) or the excess cash balance (typically investing in marketable securities). To cope with uncertainty in the cash budget, sensitivity analysis or simulation can be used. A firm must also consider its pattern of daily cash receipts and cash disbursements.

LG5 **Explain the simplified procedures used to prepare and evaluate the pro forma income statement and the pro forma balance sheet.** A pro forma income statement can be developed by calculating past percentage relationships between certain cost and expense items and the firm's sales and then applying these percentages to forecasts. Because this approach implies that all costs and expenses are variable, it tends to understate profits when sales are increasing and to overstate profits when sales are decreasing. This problem can be avoided by breaking down costs and expenses into fixed and variable components. In this case, the fixed components remain unchanged from the most recent year, and the variable costs and expenses are forecast on a percent-of-sales basis.

Under the judgmental approach, the values of certain balance sheet accounts are estimated and others are calculated, frequently on the basis of their relationship to sales. The firm's external financing is used as a balancing, or "plug," figure. A positive value for "external financing required" means that the firm must raise funds externally or reduce dividends; a negative value indicates that funds are available for use in repaying debt, repurchasing stock, or increasing dividends.

LG6 **Cite the weaknesses of the simplified approaches to pro forma financial statement preparation and the common uses of pro forma statements.** Simplified approaches for preparing pro forma statements, although popular, can be criticized for assuming that the firm's past financial condition is an accurate indicator of the future and that certain variables can be forced to take on certain "desired" values. Pro forma statements are commonly used to forecast and analyze the firm's level of profitability and overall financial performance so that adjustments can be made to planned operations in order to achieve short-term financial goals.

SELF-TEST PROBLEMS (Solutions in Appendix B)

LG1 LG2 **ST 3–1 Depreciation and cash flow** A firm expects to have earnings before interest and taxes (EBIT) of $160,000 in each of the next 6 years. It pays annual interest of $1,500. The firm is considering the purchase of an asset that costs $140,000, requires $10,000 in installation cost, and has a recovery period of 5 years. It will be the firm's only asset, and the asset's depreciation is already reflected in its EBIT estimates.

a. Calculate the annual depreciation for the asset purchase using the MACRS depreciation percentages in Table 3.2 on page 100.

b Calculate the annual operating cash flows for each of the 6 years, using both the accounting and the finance definitions of *operating cash flow*. Assume that the firm is subject to a 40% ordinary tax rate.

c. Say the firm's net fixed assets, current assets, accounts payable, and accruals had the following values at the start and end of the final year (year 6). Calculate the firm's free cash flow (FCF) for that year.

Account	Year 6 Start	Year 6 End
Net fixed assets	$ 7,500	$ 0
Current assets	90,000	110,000
Accounts payable	40,000	45,000
Accruals	8,000	7,000

d. Compare and discuss the significance of each value calculated in parts **b** and **c.**

LG4 LG5 **ST 3–2 Cash budget and pro forma balance sheet inputs** Jane McDonald, a financial analyst for Carroll Company, has prepared the following sales and cash disbursement estimates for the period February–June of the current year.

Month	Sales	Cash disbursements
February	$500	$400
March	600	300
April	400	600
May	200	500
June	200	200

Ms. McDonald notes that historically, 30% of sales have been for cash. Of *credit sales,* 70% are collected 1 month after the sale, and the remaining 30% are collected 2 months after the sale. The firm wishes to maintain a minimum ending balance in its cash account of $25. Balances above this amount would be invested in short-term government securities (marketable securities), whereas any deficits would be financed through short-term bank borrowing (notes payable). The beginning cash balance at April 1 is $115.

a. Prepare a cash budget for April, May, and June.

b. How much financing, if any, at a maximum would Carroll Company require to meet its obligations during this 3-month period?

c. A pro forma balance sheet dated at the end of June is to be prepared from the information presented. Give the size of each of the following: cash, notes payable, marketable securities, and accounts receivable.

LG5 **ST 3–3** **Pro forma income statement** Euro Designs, Inc., expects sales during 2004 to rise from the 2003 level of $3.5 million to $3.9 million. Because of a scheduled large loan payment, the interest expense in 2004 is expected to drop to $325,000. The firm plans to increase its cash dividend payments during 2004 to $320,000. The company's year-end 2003 income statement follows.

Euro Designs, Inc. Income Statement for the Year Ended December 31, 2003	
Sales revenue	$3,500,000
Less: Cost of goods sold	1,925,000
Gross profits	$1,575,000
Less: Operating expenses	420,000
Operating profits	$1,155,000
Less: Interest expense	400,000
Net profits before taxes	$ 755,000
Less: Taxes (rate = 40%)	302,000
Net profits after taxes	$ 453,000
Less: Cash dividends	250,000
To retained earnings	$ 203,000

a. Use the *percent-of-sales method* to prepare a 2004 pro forma income statement for Euro Designs, Inc.

b. Explain why the statement may underestimate the company's actual 2004 pro forma income.

PROBLEMS

LG1 **3–1 Depreciation** On March 20, 2003, Norton Systems acquired two new assets. Asset A was research equipment costing \$17,000 and having a 3-year recovery period. Asset B was duplicating equipment having an installed cost of \$45,000 and a 5-year recovery period. Using the MACRS depreciation percentages in Table 3.2 on page 100, prepare a depreciation schedule for each of these assets.

LG2 **3–2 Accounting cash flow** A firm had earnings after taxes of \$50,000 in 2003. Depreciation charges were \$28,000, and a \$2,000 charge for amortization of a bond discount was incurred. What was the firm's accounting *cash flow from operations* (see Equation 3.1) during 2003?

LG1 LG2 **3–3 MACRS depreciation expense and accounting cash flow** Pavlovich Instruments, Inc., a maker of precision telescopes, expects to report pre-tax income of \$430,000 this year. The company's financial manager is considering the timing of a purchase of new computerized lens grinders. The grinders will have an installed cost of \$80,000 and a cost recovery period of 5 years. They will be depreciated using the MACRS schedule.

a. If the firm purchases the grinders before year end, what depreciation expense will it be able to claim this year? (Use Table 3.2 on page 100.)

b. If the firm reduces its reported income by the amount of the depreciation expense calculated in part **a,** what tax savings will result?

c. Assuming that Pavlovich does purchase the grinders this year and that they are its only depreciable asset, use the accounting definition given in Equation 3.1 to find the firm's *cash flow from operations* for the year.

LG1 LG2 **3–4 Depreciation and accounting cash flow** A firm in the third year of depreciating its only asset, which originally cost \$180,000 and has a 5-year MACRS recovery period, has gathered the following data relative to the current year's operations.

Accruals	\$ 15,000
Current assets	120,000
Interest expense	15,000
Sales revenue	400,000
Inventory	70,000
Total costs before depreciation, interest, and taxes	290,000
Tax rate on ordinary income	40%

a. Use the *relevant data* to determine the accounting *cash flow from operations* (see Equation 3.1) for the current year.

b. Explain the impact that depreciation, as well as any other noncash charges, has on a firm's cash flows.

LG2 **3–5 Classifying inflows and outflows of cash** Classify each of the following items as an inflow (I) or an outflow (O) of cash, or as neither (N).

Item	Change ($)	Item	Change ($)
Cash	+100	Accounts receivable	−700
Accounts payable	−1,000	Net profits	+600
Notes payable	+500	Depreciation	+100
Long-term debt	−2,000	Repurchase of stock	+600
Inventory	+200	Cash dividends	+800
Fixed assets	+400	Sale of stock	+1,000

LG2 **3–6 Finding operating and free cash flows** Consider the balance sheets and selected data from the income statement of Keith Corporation that follow.

a. Calculate the firm's accounting *cash flow from operations* for the year ended December 31, 2003, using Equation 3.1.

b. Calculate the firm's *operating cash flow* (*OCF*) for the year ended December 31, 2003, using Equation 3.2.

c. Calculate the firm's *free cash flow* (*FCF*) for the year ended December 31, 2003, using Equation 3.3.

d. Interpret, compare, and contrast your cash flow estimates in parts **a, b,** and **c.**

Keith Corporation
Balance Sheets

	December 31	
Assets	**2003**	**2002**
Cash	$ 1,500	$ 1,000
Marketable securities	1,800	1,200
Accounts receivable	2,000	1,800
Inventories	2,900	2,800
Total current assets	$ 8,200	$ 6,800
Gross fixed assets	$29,500	$28,100
Less: Accumulated depreciation	14,700	13,100
Net fixed assets	$14,800	$15,000
Total assets	$23,000	$21,800
Liabilities and Stockholders' Equity		
Accounts payable	$ 1,600	$ 1,500
Notes payable	2,800	2,200
Accruals	200	300
Total current liabilities	$ 4,600	$ 4,000
Long-term debt	$ 5,000	$ 5,000
Common stock	$10,000	$10,000
Retained earnings	3,400	2,800
Total stockholders' equity	$13,400	$12,800
Total liabilities and stockholders' equity	$23,000	$21,800
Income Statement Data (2003)		
Depreciation expense	$11,600	
Earnings before interest and taxes (EBIT)	2,700	
Taxes	933	
Net profits after taxes	1,400	

LG4 **3–7 Cash receipts** A firm has actual sales of $65,000 in April and $60,000 in May. It expects sales of $70,000 in June and $100,000 in July and in August. Assuming that sales are the only source of cash inflows and that half of them are for cash and the remainder are collected evenly over the following 2 months, what are the firm's expected cash receipts for June, July, and August?

LG4 **3–8 Cash disbursements schedule** Maris Brothers, Inc., needs a cash disbursement schedule for the months of April, May, and June. Use the format of Table 3.9 and the following information in its preparation.

Sales: February = $500,000; March = $500,000; April = $560,000; May = $610,000; June = $650,000; July = $650,000

Purchases: Purchases are calculated as 60% of the next month's sales, 10% of purchases are made in cash, 50% of purchases are paid for 1 month after purchase, and the remaining 40% of purchases are paid for 2 months after purchase.

Rent: The firm pays rent of $8,000 per month.

Wages and salaries: Base wage and salary costs are fixed at $6,000 per month plus a variable cost of 7% of the current month's sales.

Taxes: A tax payment of $54,500 is due in June.

Fixed asset outlays: New equipment costing $75,000 will be bought and paid for in April.

Interest payments: An interest payment of $30,000 is due in June.

Cash dividends: Dividends of $12,500 will be paid in April.

Principal repayments and retirements: No principal repayments or retirements are due during these months.

LG4 **3–9 Cash budget—Basic** Grenoble Enterprises had sales of $50,000 in March and $60,000 in April. Forecast sales for May, June, and July are $70,000, $80,000, and $100,000, respectively. The firm has a cash balance of $5,000 on May 1 and wishes to maintain a minimum cash balance of $5,000. Given the following data, prepare and interpret a cash budget for the months of May, June, and July.

(1) The firm makes 20% of sales for cash, 60% are collected in the next month, and the remaining 20% are collected in the second month following sale.
(2) The firm receives other income of $2,000 per month.
(3) The firm's actual or expected purchases, all made for cash, are $50,000, $70,000, and $80,000 for the months of May through July, respectively.
(4) Rent is $3,000 per month.
(5) Wages and salaries are 10% of the previous month's sales.
(6) Cash dividends of $3,000 will be paid in June.
(7) Payment of principal and interest of $4,000 is due in June.
(8) A cash purchase of equipment costing $6,000 is scheduled in July.
(9) Taxes of $6,000 are due in June.

LG4 **3–10 Cash budget—Advanced** The actual sales and purchases for Xenocore, Inc., for September and October 2003, along with its forecast sales and purchases for the period November 2003 through April 2004, follow.

Year	Month	Sales	Purchases
2003	September	$210,000	$120,000
2003	October	250,000	150,000
2003	November	170,000	140,000
2003	December	160,000	100,000
2004	January	140,000	80,000
2004	February	180,000	110,000
2004	March	200,000	100,000
2004	April	250,000	90,000

The firm makes 20% of all sales for cash and collects on 40% of its sales in each of the 2 months following the sale. Other cash inflows are expected to be $12,000 in September and April, $15,000 in January and March, and $27,000 in February. The firm pays cash for 10% of its purchases. It pays for 50% of its purchases in the following month and for 40% of its purchases 2 months later.

Wages and salaries amount to 20% of the preceding month's sales. Rent of $20,000 per month must be paid. Interest payments of $10,000 are due in January and April. A principal payment of $30,000 is also due in April. The firm expects to pay cash dividends of $20,000 in January and April. Taxes of $80,000 are due in April. The firm also intends to make a $25,000 cash purchase of fixed assets in December.

a. Assuming that the firm has a cash balance of $22,000 at the beginning of November, determine the end-of-month cash balances for each month, November through April.

b. Assuming that the firm wishes to maintain a $15,000 minimum cash balance, determine the required total financing or excess cash balance for each month, November through April.

c. If the firm were requesting a line of credit to cover needed financing for the period November to April, how large would this line have to be? Explain your answer.

LG4 **3–11 Cash flow concepts** The following represent financial transactions that Johnsfield & Co. will be undertaking in the next planning period. For each transaction, check the statement or statements that will be affected immediately.

	Statement		
Transaction	Cash budget	Pro forma income statement	Pro forma balance sheet
Cash sale			
Credit sale			
Accounts receivable are collected			
Asset with 5-year life is purchased			
Depreciation is taken			
Amortization of goodwill is taken			
Sale of common stock			
Retirement of outstanding bonds			
Fire insurance premium is paid for the next 3 years			

LG4 **3–12 Cash budget—Sensitivity analysis** Trotter Enterprises, Inc., has gathered the following data in order to plan for its cash requirements and short-term investment opportunities for October, November, and December. All amounts are shown in thousands of dollars.

	October			November			December		
	Pessimistic	Most likely	Optimistic	Pessimistic	Most likely	Optimistic	Pessimistic	Most likely	Optimistic
Total cash receipts	$260	$342	$462	$200	$287	$366	$191	$294	$353
Total cash disbursements	285	326	421	203	261	313	287	332	315

a. Prepare a sensitivity analysis of Trotter's cash budget using −$20,000 as the beginning cash balance for October and a minimum required cash balance of $18,000.

b. Use the analysis prepared in part **a** to predict Trotter's financing needs and investment opportunities over the months of October, November, and December. Discuss how knowledge of the timing and amounts involved can aid the planning process.

LG4 **3–13 Multiple cash budgets—Sensitivity analysis** Brownstein, Inc., expects sales of $100,000 during each of the next 3 months. It will make monthly purchases of $60,000 during this time. Wages and salaries are $10,000 per month plus 5% of sales. Brownstein expects to make a tax payment of $20,000 in the next month and a $15,000 purchase of fixed assets in the second month and to receive $8,000 in cash from the sale of an asset in the third month. All sales and purchases are for cash. Beginning cash and the minimum cash balance are assumed to be zero.

a. Construct a cash budget for the next 3 months.

b. Brownstein is unsure of the sales levels, but all other figures are certain. If the most pessimistic sales figure is $80,000 per month and the most optimistic is $120,000 per month, what are the monthly minimum and maximum ending cash balances that the firm can expect for each of the 1-month periods?

c. Briefly discuss how the financial manager can use the data in parts **a** and **b** to plan for financing needs.

LG5 **3–14 Pro forma income statement** The marketing department of Metroline Manufacturing estimates that its sales in 2004 will be $1.5 million. Interest expense is expected to remain unchanged at $35,000, and the firm plans to pay $70,000 in cash dividends during 2004. Metroline Manufacturing's income statement for the year ended December 31, 2003, is given below, along with a breakdown of the firm's cost of goods sold and operating expenses into their fixed and variable components.

Metroline Manufacturing Income Statement for the Year Ended December 31, 2003	
Sales revenue	$1,400,000
Less: Cost of goods sold	910,000
Gross profits	$ 490,000
Less: Operating expenses	120,000
Operating profits	$ 370,000
Less: Interest expense	35,000
Net profits before taxes	$ 335,000
Less: Taxes (rate = 40%)	134,000
Net profits after taxes	$ 201,000
Less: Cash dividends	66,000
To retained earnings	$ 135,000

Metroline Manufacturing Breakdown of Costs and Expenses into Fixed and Variable Components for the Year Ended December 31, 2003	
Cost of goods sold	
Fixed cost	$210,000
Variable cost	700,000
Total cost	$910,000
Operating expenses	
Fixed expenses	$ 36,000
Variable expenses	84,000
Total expenses	$120,000

a. Use the *percent-of-sales method* to prepare a pro forma income statement for the year ended December 31, 2004.
b. Use *fixed and variable cost data* to develop a pro forma income statement for the year ended December 31, 2004.
c. Compare and contrast the statements developed in parts **a** and **b.** Which statement probably provides the better estimate of 2004 income? Explain why.

LG5 **3–15 Pro forma income statement—Sensitivity analysis** Allen Products, Inc., wants to do a sensitivity analysis for the coming year. The pessimistic prediction for sales is $900,000; the most likely amount of sales is $1,125,000; and the optimistic prediction is $1,280,000. Allen's income statement for the most recent year follows.

Allen Products, Inc. Income Statement for the Year Ended December 31, 2003	
Sales revenue	$937,500
Less: Cost of goods sold	421,875
Gross profits	$515,625
Less: Operating expenses	234,375
Operating profits	$281,250
Less: Interest expense	30,000
Net profits before taxes	$251,250
Less: Taxes (rate = 25%)	62,813
Net profits after taxes	$188,437

a. Use the *percent-of-sales method*, the income statement for December 31, 2003, and the sales revenue estimates to develop pessimistic, most likely, and optimistic pro forma income statements for the coming year.

b. Explain how the percent-of-sales method could result in an overstatement of profits for the pessimistic case and an understatement of profits for the most likely and optimistic cases.

c. Restate the pro forma income statements prepared in part **a** to incorporate the following assumptions about costs:

$250,000 of the cost of goods sold is fixed; the rest is variable.
$180,000 of the operating expenses is fixed; the rest is variable.
All of the interest expense is fixed.

d. Compare your findings in part **c** to your findings in part **a.** Do your observations confirm your explanation in part **b?**

LG5 **3–16 Pro forma balance sheet—Basic** Leonard Industries wishes to prepare a pro forma balance sheet for December 31, 2004. The firm expects 2004 sales to total $3,000,000. The following information has been gathered.

(1) A minimum cash balance of $50,000 is desired.
(2) Marketable securities are expected to remain unchanged.
(3) Accounts receivable represent 10% of sales.
(4) Inventories represent 12% of sales.
(5) A new machine costing $90,000 will be acquired during 2004. Total depreciation for the year will be $32,000.
(6) Accounts payable represent 14% of sales.
(7) Accruals, other current liabilities, long-term debt, and common stock are expected to remain unchanged.
(8) The firm's net profit margin is 4%, and it expects to pay out $70,000 in cash dividends during 2004.
(9) The December 31, 2003, balance sheet follows.

Leonard Industries
Balance Sheet
December 31, 2003

Assets		**Liabilities and Stockholders' Equity**	
Cash	$ 45,000	Accounts payable	$ 395,000
Marketable securities	15,000	Accruals	60,000
Accounts receivable	255,000	Other current liabilities	30,000
Inventories	340,000	Total current liabilities	$ 485,000
Total current assets	$ 655,000	Long-term debt	$ 350,000
Net fixed assets	$ 600,000	Common stock	$ 200,000
Total assets	$1,255,000	Retained earnings	$ 220,000
		Total liabilities and stockholders' equity	$1,255,000

a. Use the *judgmental approach* to prepare a pro forma balance sheet dated December 31, 2004, for Leonard Industries.

b. How much, if any, additional financing will Leonard Industries require in 2004? Discuss.

c. Could Leonard Industries adjust its planned 2004 dividend to avoid the situation described in part **b**? Explain how.

LG5 **3–17** **Pro forma balance sheet** Peabody & Peabody has 2003 sales of $10 million. It wishes to analyze expected performance and financing needs for 2005—2 years ahead. Given the following information, respond to parts **a** and **b**.

(1) The percents of sales for items that vary directly with sales are as follows:
   Accounts receivable, 12%
   Inventory, 18%
   Accounts payable, 14%
   Net profit margin, 3%
(2) Marketable securities and other current liabilities are expected to remain unchanged.
(3) A minimum cash balance of $480,000 is desired.
(4) A new machine costing $650,000 will be acquired in 2004, and equipment costing $850,000 will be purchased in 2005. Total depreciation in 2004 is forecast as $290,000, and in 2005 $390,000 of depreciation will be taken.
(5) Accruals are expected to rise to $500,000 by the end of 2005.
(6) No sale or retirement of long-term debt is expected.
(7) No sale or repurchase of common stock is expected.
(8) The dividend payout of 50% of net profits is expected to continue.
(9) Sales are expected to be $11 million in 2004 and $12 million in 2005.
(10) The December 31, 2003, balance sheet follows.

Peabody & Peabody
Balance Sheet
December 31, 2003
($000)

Assets		**Liabilities and Stockholders' Equity**	
Cash	$ 400	Accounts payable	$1,400
Marketable securities	200	Accruals	400
Accounts receivable	1,200	Other current liabilities	80
Inventories	1,800	Total current liabilities	$1,880
Total current assets	$3,600	Long-term debt	$2,000
Net fixed assets	$4,000	Common equity	$3,720
Total assets	$7,600	Total liabilities and stockholders' equity	$7,600

a. Prepare a pro forma balance sheet dated December 31, 2005.
b. Discuss the financing changes suggested by the statement prepared in part **a.**

LG5 **3–18** **Integrative—Pro forma statements** Red Queen Restaurants wishes to prepare financial plans. Use the financial statements and the other information provided in what follows to prepare the financial plans.

Red Queen Restaurants Income Statement for the Year Ended December 31, 2003	
Sales revenue	$800,000
Less: Cost of goods sold	600,000
Gross profits	$200,000
Less: Operating expenses	100,000
Net profits before taxes	$100,000
Less: Taxes (rate = 40%)	40,000
Net profits after taxes	$ 60,000
Less: Cash dividends	20,000
To retained earnings	$ 40,000

Red Queen Restaurants
Balance Sheet
December 31, 2003

Assets		Liabilities and Stockholders' Equity	
Cash	$ 32,000	Accounts payable	$100,000
Marketable securities	18,000	Taxes payable	20,000
Accounts receivable	150,000	Other current liabilities	5,000
Inventories	100,000	Total current liabilities	$125,000
Total current assets	$300,000	Long-term debt	$200,000
Net fixed assets	$350,000	Common stock	$150,000
Total assets	$650,000	Retained earnings	$175,000
		Total liabilities and stockholders' equity	$650,000

The following financial data are also available:

(1) The firm has estimated that its sales for 2004 will be $900,000.
(2) The firm expects to pay $35,000 in cash dividends in 2004.
(3) The firm wishes to maintain a minimum cash balance of $30,000.
(4) Accounts receivable represent approximately 18% of annual sales.
(5) The firm's ending inventory will change directly with changes in sales in 2004.
(6) A new machine costing $42,000 will be purchased in 2004. Total depreciation for 2004 will be $17,000.
(7) Accounts payable will change directly in response to changes in sales in 2004.
(8) Taxes payable will equal one-fourth of the tax liability on the pro forma income statement.
(9) Marketable securities, other current liabilities, long-term debt, and common stock will remain unchanged.

a. Prepare a pro forma income statement for the year ended December 31, 2004, using the *percent-of-sales method*.

b. Prepare a pro forma balance sheet dated December 31, 2004, using the *judgmental approach*.

c. Analyze these statements, and discuss the resulting *external financing required*.

LG5 **3–19** **Integrative—Pro forma statements** Provincial Imports, Inc., has assembled statements and information to prepare financial plans for the coming year.

Provincial Imports, Inc. Income Statement for the Year Ended December 31, 2003	
Sales revenue	$5,000,000
Less: Cost of goods sold	2,750,000
Gross profits	$2,250,000
Less: Operating expenses	850,000
Operating profits	$1,400,000
Less: Interest expense	200,000
Net profits before taxes	$1,200,000
Less: Taxes (rate = 40%)	480,000
Net profits after taxes	$ 720,000
Less: Cash dividends	288,000
To retained earnings	$ 432,000

Provincial Imports, Inc.
Balance Sheet
December 31, 2003

Assets		Liabilities and Stockholders' Equity	
Cash	$ 200,000	Accounts payable	$ 700,000
Marketable securities	275,000	Taxes payable	95,000
Accounts receivable	625,000	Notes payable	200,000
Inventories	500,000	Other current liabilities	5,000
Total current assets	$1,600,000	Total current liabilities	$1,000,000
Net fixed assets	$1,400,000	Long-term debt	$ 500,000
Total assets	$3,000,000	Common stock	$ 75,000
		Retained earnings	$1,375,000
		Total liabilities and equity	$3,000,000

Information related to financial projections for the year 2004:

(1) Projected sales are $6,000,000.
(2) Cost of goods sold includes $1,000,000 in fixed costs.
(3) Operating expense includes $250,000 in fixed costs.
(4) Interest expense will remain unchanged.
(5) The firm will pay cash dividends amounting to 40% of net profits after taxes.
(6) Cash and inventories will double.
(7) Marketable securities, notes payable, long-term debt, and common stock will remain unchanged.

(8) Accounts receivable, accounts payable, and other current liabilities will change in direct response to the change in sales.
(9) A new computer system costing $356,000 will be purchased during the year. Total depreciation expense for the year will be $110,000.

a. Prepare a pro forma income statement for the year ended December 31, 2004, using the information given and the *percent-of-sales method*.
b. Prepare a pro forma balance sheet as of December 31, 2004, using the information given and the *judgmental approach*. Include a reconciliation of the retained earnings account.
c. Analyze these statements, and discuss the resulting *external financing required*.

CHAPTER 3 CASE Preparing Martin Manufacturing's 2004 Pro Forma Financial Statements

To improve its competitive position, Martin Manufacturing is planning to implement a major equipment modernization program. Included will be replacement and modernization of key manufacturing equipment at a cost of $400,000 in 2004. The planned program is expected to lower the variable cost per unit of finished product. Terri Spiro, an experienced budget analyst, has been charged with preparing a forecast of the firm's 2004 financial position, assuming replacement and modernization of manufacturing equipment. She plans to use the 2003 financial statements presented on pages 92 and 93, along with the key projected financial data summarized in the following table.

Martin Manufacturing Company
Key Projected Financial Data (2004)

Data item	Value
Sales revenue	$6,500,000
Minimum cash balance	$25,000
Inventory turnover (times)	7.0
Average collection period	50 days
Fixed-asset purchases	$400,000
Dividend payments	$20,000
Depreciation expense	$185,000
Interest expense	$97,000
Accounts payable increase	20%
Accruals and long-term debt	Unchanged
Notes payable, preferred and common stock	Unchanged

Required

a. Use the historical and projected financial data provided to prepare a pro forma income statement for the year ended December 31, 2004. (*Hint:* Use the *percent-of-sales method* to estimate all values *except* depreciation expense and interest expense, which have been estimated by management and included in the table.)

b. Use the projected financial data along with relevant data from the pro forma income statement prepared in part **a** to prepare the pro forma balance sheet at December 31, 2004. (*Hint:* Use the *judgmental approach*.)

c. Will Martin Manufacturing Company need to obtain *external financing* to fund the proposed equipment modernization program? Explain.

WEB EXERCISE

Go to the **Best Depreciation Calculator** at the Fixed Asset Info. site, *www.fixedassetinfo.com/defaultCalc.asp*. Use this calculator to determine the straight-line, declining balance (using 200%), and MACRS depreciation schedules for the following items, using half-year averaging (the half-year convention).

Item	Date placed in service	Cost
Office furnishings	2/15/2002	$22,500
Laboratory equipment	5/27/2001	$14,375
Fleet vehicles	9/5/2000	$45,863

Make a chart comparing the depreciation amounts that these three methods yield for the years 2002 to 2007. Discuss the implications of these differences.

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

INTEGRATIVE CASE 1

Track Software, Inc.

Seven years ago, after 15 years in public accounting, Stanley Booker, CPA, resigned his position as Manager of Cost Systems for Davis, Cohen, and O'Brien Public Accountants and started Track Software, Inc. In the 2 years preceding his departure from Davis, Cohen, and O'Brien, Stanley had spent nights and weekends developing a sophisticated cost-accounting software program that became Track's initial product offering. As the firm grew, Stanley planned to develop and expand the software product offerings—all of which would be related to streamlining the accounting processes of medium- to large-sized manufacturers.

Although Track experienced losses during its first 2 years of operation—1997 and 1998—its profit has increased steadily from 1999 to the present (2003). The firm's profit history, including dividend payments and contributions to retained earnings, is summarized in Table 1.

Stanley started the firm with a $100,000 investment—his savings of $50,000 as equity and a $50,000 long-term loan from the bank. He had hoped to maintain his initial 100 percent ownership in the corporation,

Table 1

Track Software, Inc.
Profit, Dividends, and Retained Earnings, 1997–2003

Year	Net profits after taxes (1)	Dividends paid (2)	Contribution to retained earnings [(1) − (2)] (3)
1997	($50,000)	$ 0	($50,000)
1998	(20,000)	0	(20,000)
1999	15,000	0	15,000
2000	35,000	0	35,000
2001	40,000	1,000	39,000
2002	43,000	3,000	40,000
2003	48,000	5,000	43,000

but after experiencing a $50,000 loss during the first year of operation (1997), he sold 60 percent of the stock to a group of investors to obtain needed funds. Since then, no other stock transactions have taken place. Although he owns only 40 percent of the firm, Stanley actively manages all aspects of its activities; the other stockholders are not active in management of the firm. The firm's stock closed at $4.50 per share in 2002 and at $5.28 per share in 2003.

Stanley has just prepared the firm's 2003 income statement, balance sheet, and statement of retained earnings, shown in Tables 2, 3, and 4 (on pages 143–145), along with the 2002 balance sheet. In addition, he has compiled the 2002 ratio values and industry average ratio values for 2003, which are applicable to both 2002 and 2003 and are summarized in Table 5 (on page 145). He is quite pleased to have achieved record earnings of $48,000 in 2003, but he is concerned about the firm's cash flows. Specifically, he is finding it more and more difficult to pay the firm's bills in a timely manner and generate cash flows to investors—both creditors and owners. To gain insight into these cash flow problems, Stanley is planning to determine the firm's 2003 operating cash flow (OCF) and free cash flow (FCF).

Table 2

Track Software, Inc.
Income Statement ($000)
for the Year Ended December 31, 2003

Sales revenue		$1,550
Less: Cost of goods sold		1,030
Gross profits		$ 520
Less: Operating expenses		
Selling expense	$150	
General and administrative expense	270	
Depreciation expense	11	
Total operating expense		431
Operating profits (EBIT)		$ 89
Less: Interest expense		29
Net profits before taxes		$ 60
Less: Taxes (20%)		12
Net profits after taxes		$ 48

Table 3

Track Software, Inc.
Balance Sheets ($000)

Assets	December 31 2003	2002
Current assets		
Cash	$ 12	$ 31
Marketable securities	66	82
Accounts receivable	152	104
Inventories	191	145
Total current assets	$421	$362
Gross fixed assets	$195	$180
Less: Accumulated depreciation	63	52
Net fixed assets	$132	$128
Total assets	$553	$490
Liabilities and Stockholders' Equity		
Current liabilities		
Accounts payable	$136	$126
Notes payable	200	190
Accruals	27	25
Total current liabilities	$363	$341
Long-term debt	$ 38	$ 40
Total liabilities	$401	$381
Stockholders' equity		
Common stock (50,000 shares outstanding at $0.40 par value)	$ 20	$ 20
Paid-in capital in excess of par	30	30
Retained earnings	102	59
Total stockholders' equity	$152	$109
Total liabilities and stockholders' equity	$553	$490

Table 4

Track Software, Inc. Statement of Retained Earnings ($000) for the Year Ended December 31, 2003	
Retained earnings balance (January 1, 2003)	$ 59
Plus: Net profits after taxes (for 2003)	48
Less: Cash dividends on common stock (paid during 2003)	(5)
Retained earnings balance (December 31, 2003)	$102

Table 5

Ratio	Actual 2002	Industry average 2003
Current ratio	1.06	1.82
Quick ratio	0.63	1.10
Inventory turnover	10.40	12.45
Average collection period	29.6 days	20.2 days
Total asset turnover	2.66	3.92
Debt ratio	0.78	0.55
Times interest earned ratio	3.0	5.6
Gross profit margin	32.1%	42.3%
Operating profit margin	5.5%	12.4%
Net profit margin	3.0%	4.0%
Return on total assets (ROA)	8.0%	15.6%
Return on common equity (ROE)	36.4%	34.7%
Price/earnings (P/E) ratio	5.2	7.1
Market/book (M/B) ratio	2.1	2.2

Stanley is further frustrated by the firm's inability to afford to hire a software developer to complete development of a cost estimation package that is believed to have "blockbuster" sales potential. Stanley began development of this package 2 years ago, but the firm's growing complexity has forced him to devote more of his time to administrative duties, thereby halting the development of this product. Stanley's reluctance to fill this position stems from his concern that the added $80,000 per year in salary and benefits for the position would certainly lower the firm's earnings per share (EPS) over the next couple of years. Although the project's success is in no way guaranteed, Stanley believes that if the money were spent to hire the software developer, the firm's sales and earnings would significantly rise once the 2- to 3-year development, production, and marketing process was completed.

With all of these concerns in mind, Stanley set out to review the various data to develop strategies that would help to ensure a bright future for Track Software. Stanley believed that as part of this process, a thorough ratio analysis of the firm's 2003 results would provide important additional insights.

Required

a. (1) Upon what financial goal does Stanley seem to be focusing? Is it the correct goal? Why or why not?
(2) Could a potential agency problem exist in this firm? Explain.

b. Calculate the firm's earnings per share (EPS) for each year, recognizing that the number of shares of common stock outstanding has remained *unchanged* since the firm's inception. Comment on the EPS performance in view of your response in part **a.**

c. Use the financial data presented to determine Track's operating cash flow (OCF) and free cash flow (FCF) in 2003. Evaluate your findings in light of Track's current cash flow difficulties.

d. Analyze the firm's financial condition in 2003 as it relates to (1) liquidity, (2) activity, (3) debt, (4) profitability, and (5) market, using the financial statements provided in Tables 2 and 3 and the ratio data included in Table 5. Be sure to *evaluate* the firm on both a cross-sectional and a time-series basis.

e. What recommendation would you make to Stanley regarding hiring a new software developer? Relate your recommendation here to your responses in part **a.**

PART 2

Important Financial Concepts

CHAPTERS IN THIS PART

CHAPTER

4 TIME VALUE OF MONEY

LEARNING GOALS

LG1 Discuss the role of time value in finance, the use of computational tools, and the basic patterns of cash flow.

LG2 Understand the concepts of future and present value, their calculation for single amounts, and the relationship of present value to future value.

LG3 Find the future value and the present value of both an ordinary annuity and an annuity due, and find the present value of a perpetuity.

LG4 Calculate both the future value and the present value of a mixed stream of cash flows.

LG5 Understand the effect that compounding interest more frequently than annually has on future value and on the effective annual rate of interest.

LG6 Describe the procedures involved in (1) determining deposits to accumulate a future sum, (2) loan amortization, (3) finding interest or growth rates, and (4) finding an unknown number of periods.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand time-value-of-money calculations in order to account for certain transactions such as loan amortization, lease payments, and bond interest rates.

Information systems: You need to understand time-value-of-money calculations in order to design systems that optimize the firm's cash flows.

Management: You need to understand time-value-of-money calculations so that you can plan cash collections and disbursements in a way that will enable the firm to get the greatest value from its money.

Marketing: You need to understand time value of money because funding for new programs and products must be justified financially using time-value-of-money techniques.

Operations: You need to understand time value of money because investments in new equipment, in inventory, and in production quantities will be affected by time-value-of-money techniques.

LCV

It All Starts with Time (Value)

How do managers decide which customers offer the highest profit potential? Should marketing programs focus on new customer acquisitions? Or is it better to increase repeat purchases by existing customers or to implement programs aimed at specific target markets? Time-value-of-money calculations can be a key part of such decisions. A technique called **lifetime customer valuation (LCV)** calculates the value today (present value) of profits that new or existing customers are expected to generate in the future. After comparing the cost to acquire or retain customers to the profit stream from those customers, managers have the information they need to allocate marketing expenditures accordingly.

In most cases, existing customers warrant the greatest investment. Research shows that increasing customer retention 5 percent raised the value of the average customer from 25 percent to 95 percent, depending on the industry.

Many dot-com retailers ignored this important finding as they rushed to get to the Web first. As new companies, they had to spend to attract customers. But in the frenzy of the moment, they didn't monitor costs and compare those costs to sales. Their high customer acquisition costs often exceeded what customers spent at the e-tailers' Web sites—and the result was often bankruptcy.

Business-to-business (B2B) companies are now joining consumer product companies like **Lexus Motors** and credit card issuer **MBNA** in using LCV. The technique has been updated to include intangible factors, such as outsourcing potential and partnership quality. Even though intangible factors complicate the methodology, the underlying principle is the same: Identify the most profitable clients and allocate more resources to them. "It actually makes a lot of sense," says Bob Lento, senior vice president of sales at **Convergys,** a customer service and billing services provider. Which is more valuable and deserves more of the firm's resources—a company with whom Convergys does $20 million in business each year, with no expectation of growing that business, or one with current business of $10 million that might develop into a $100-million client? Convergys's management instituted an LCV program several years ago to answer this question. After engaging in a trial-and-error process to refine its formula, Convergys chose to include traditional LCV items such as repeat business and whether the customer bases purchasing decisions solely on cost. Then it factors in such intangibles as the level within the customer company of a salesperson's contact (higher is better) and whether the customer perceives Convergys as a strategic partner or a commodity service provider (strategic is better).

Thanks to LCV, Convergys's Customer Management Group increased its operating income by winning new business from old customers. The firm's CFO, Steve Rolls, believes in LCV. "This long-term view of customers gives us a much better picture of what we're going after," he says.

LG1 4.1 The Role of Time Value in Finance

Hint The time value of money is one of the most important concepts in finance. Money that the firm has in its possession today is more valuable than future payments because the money it now has can be invested and earn positive returns.

Financial managers and investors are always confronted with opportunities to earn positive rates of return on their funds, whether through investment in attractive projects or in interest-bearing securities or deposits. Therefore, the timing of cash outflows and inflows has important economic consequences, which financial managers explicitly recognize as the *time value of money*. Time value is based on the belief that a dollar today is worth more than a dollar that will be received at some future date. We begin our study of time value in finance by considering the two views of time value—future value and present value, the computational tools used to streamline time value calculations, and the basic patterns of cash flow.

Future Value versus Present Value

Financial values and decisions can be assessed by using either future value or present value techniques. Although these techniques will result in the same decisions, they view the decision differently. Future value techniques typically measure cash flows at the *end* of a project's life. Present value techniques measure cash flows at the *start* of a project's life (time zero). *Future value* is cash you will receive at a given future date, and *present value* is just like cash in hand today.

time line
A horizontal line on which time zero appears at the leftmost end and future periods are marked from left to right; can be used to depict investment cash flows.

A **time line** can be used to depict the cash flows associated with a given investment. It is a horizontal line on which time zero appears at the leftmost end and future periods are marked from left to right. A line covering five periods (in this case, years) is given in Figure 4.1. The cash flow occurring at time zero and that at the end of each year are shown above the line; the negative values represent *cash outflows* ($10,000 at time zero) and the positive values represent *cash inflows* ($3,000 inflow at the end of year 1, $5,000 inflow at the end of year 2, and so on).

Because money has a time value, all of the cash flows associated with an investment, such as those in Figure 4.1, must be measured at the same point in time. Typically, that point is either the end or the beginning of the investment's life. The future value technique uses *compounding* to find the *future value* of each cash flow at the end of the investment's life and then sums these values to find the investment's future value. This approach is depicted above the time line in Figure 4.2. The figure shows that the future value of each cash flow is measured

FIGURE 4.1

Time Line

Time line depicting an investment's cash flows

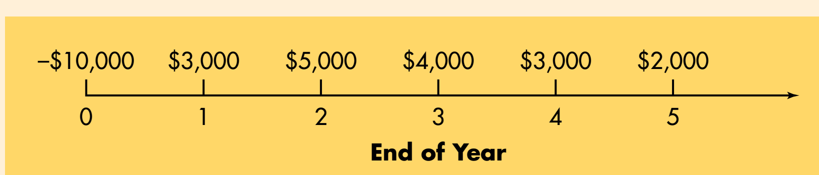
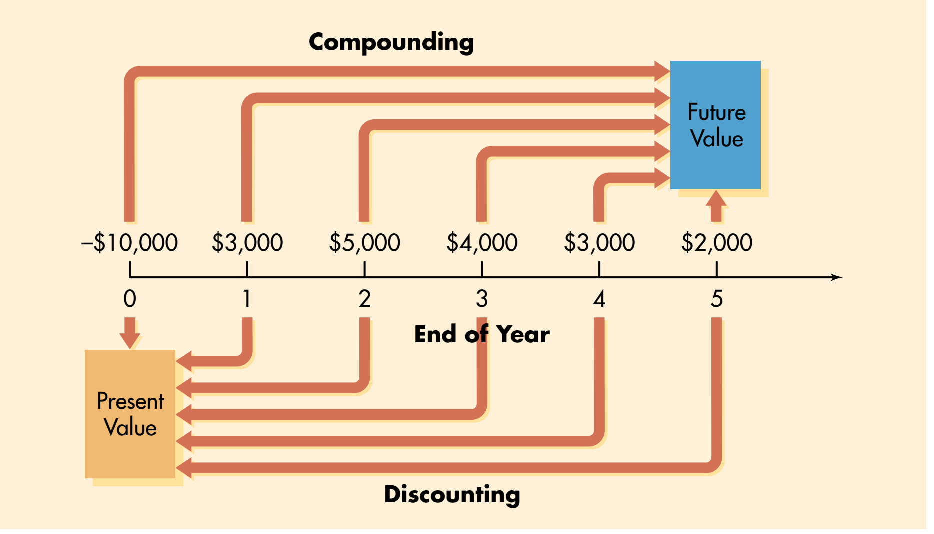


FIGURE 4.2

Compounding and Discounting
Time line showing compounding to find future value and discounting to find present value



at the end of the investment's 5-year life. Alternatively, the present value technique uses *discounting* to find the *present value* of each cash flow at time zero and then sums these values to find the investment's value today. Application of this approach is depicted below the time line in Figure 4.2.

The meaning and mechanics of compounding to find future value and of discounting to find present value are covered in this chapter. Although future value and present value result in the same decisions, *financial managers—because they make decisions at time zero—tend to rely primarily on present value techniques.*

Computational Tools

Time-consuming calculations are often involved in finding future and present values. Although you should understand the concepts and mathematics underlying these calculations, the application of time value techniques can be streamlined. We focus on the use of financial tables, hand-held financial calculators, and computers and spreadsheets as aids in computation.

Financial Tables

Financial tables include various future and present value interest factors that simplify time value calculations. The values shown in these tables are easily developed from formulas, with various degrees of rounding. The tables are typically indexed by the interest rate (in columns) and the number of periods (in rows). Figure 4.3 shows this general layout. The interest factor at a 20 percent interest rate for 10 years would be found at the intersection of the 20% column and the 10-period row, as shown by the dark blue box. A full set of the four basic financial tables is included in Appendix A at the end of the book. These tables are described more fully later in the chapter.

FIGURE 4.3

Financial Tables
Layout and use of a financial table

	Interest Rate							
Period	1%	2%	…	10%	…	**20%**	…	50%
1			…		…	⋮	…	
2			…		…	⋮	…	
3			…		…	⋮	…	
⋮	⋮	⋮	…	⋮	…	⋮	…	⋮
→ **10**	…	…	…	…	…	**X.XXX**	…	…
⋮	⋮	⋮	…	⋮	…	⋮	…	⋮
20			…		…		…	
⋮	⋮	⋮	…	⋮	…	⋮	…	⋮
50			…		…		…	

Financial Calculators

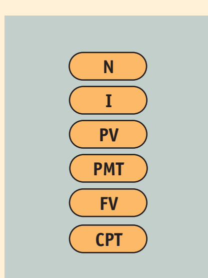
Financial calculators also can be used for time value computations. Generally, *financial calculators* include numerous preprogrammed financial routines. This chapter and those that follow show the keystrokes for calculating interest factors and making other financial computations. For convenience, we use the important financial keys, labeled in a fashion consistent with most major financial calculators.

We focus primarily on the keys pictured and defined in Figure 4.4. We typically use four of the first five keys shown in the left column, along with the compute (**CPT**) key. One of the four keys represents the unknown value being calculated. (Occasionally, all five of the keys are used, with one representing the unknown value.) The keystrokes on some of the more sophisticated calculators are menu-driven: After you select the appropriate routine, the calculator prompts you to input each value; on these calculators, a compute key is not needed to obtain a solution. Regardless, any calculator with the basic future and present value functions can be used in lieu of financial tables. The keystrokes for other financial calculators are explained in the reference guides that accompany them.

Once you understand the basic underlying concepts, you probably will want to use a calculator to streamline routine financial calculations. With a little prac-

FIGURE 4.4

Calculator Keys
Important financial keys on the typical calculator



N — Number of periods
I — Interest rate per period
PV — Present value
PMT — Amount of payment (used only for annuities)
FV — Future value
CPT — Compute key used to initiate financial calculation once all values are input

tice, you can increase both the speed and the accuracy of your financial computations. Note that because of a calculator's greater precision, slight differences are likely to exist between values calculated by using financial tables and those found with a financial calculator. Remember that *conceptual understanding of the material is the objective*. An ability to solve problems with the aid of a calculator does not necessarily reflect such an understanding, so don't just settle for answers. Work with the material until you are sure you also understand the concepts.

Computers and Spreadsheets

Hint **Anyone familiar with electronic spreadsheets, such as Lotus or Excel, realizes that most of the time-value-of-money calculations can be done expeditiously by using the special functions contained in the spreadsheet.**

Like financial calculators, computers and spreadsheets have built-in routines that simplify time value calculations. We provide in the text a number of spreadsheet solutions that identify the cell entries for calculating time values. The value for each variable is entered in a cell in the spreadsheet, and the calculation is programmed using an equation that links the individual cells. If values of the variables are changed, the solution automatically changes as a result of the equation linking the cells. In the spreadsheet solutions in this book, the equation that determines the calculation is shown at the bottom of the spreadsheet.

It is important that you become familiar with the use of spreadsheets for several reasons.

- Spreadsheets go far beyond the computational abilities of calculators. They offer a host of routines for important financial and statistical relationships. They perform complex analyses, for example, that evaluate the probabilities of success and the risks of failure for management decisions.
- Spreadsheets have the ability to program logical decisions. They make it possible to automate the choice of the best option from among two or more alternatives. We give several examples of this ability to identify the optimal selection among alternative investments and to decide what level of credit to extend to customers.
- Spreadsheets display not only the calculated values of solutions but also the input conditions on which solutions are based. The linkage between a spreadsheet's cells makes it possible to do sensitivity analysis—that is, to evaluate the impacts of changes in conditions on the values of the solutions. Managers, after all, are seldom interested simply in determining a single value for a given set of conditions. Conditions change, and managers who are not prepared to react quickly to take advantage of changes must suffer their consequences.
- Spreadsheets encourage teamwork. They assemble details from different corporate divisions and consolidate them into a firm's financial statements and cash budgets. They integrate information from marketing, manufacturing, and other functional organizations to evaluate capital investments. Laptop computers provide the portability to transport these abilities and use spreadsheets wherever one might be—attending an important meeting at a firm's headquarters or visiting a distant customer or supplier.
- Spreadsheets enhance learning. Creating spreadsheets promotes one's understanding of a subject. Because spreadsheets are interactive, one gets an

immediate response to one's entries. The interplay between computer and user becomes a game that many find both enjoyable and instructive.

- Finally, spreadsheets communicate as well as calculate. Their output includes tables and charts that can be incorporated into reports. They interplay with immense databases that corporations use for directing and controlling global operations. They are the nearest thing we have to a universal business language.

The ability to use spreadsheets has become a prime skill for today's managers. As the saying goes, "Get aboard the bandwagon, or get run over." The spreadsheet solutions we present in this book will help you climb up onto that bandwagon!

Basic Patterns of Cash Flow

The cash flow—both inflows and outflows—of a firm can be described by its general pattern. It can be defined as a single amount, an annuity, or a mixed stream.

Single amount: A lump-sum amount either currently held or expected at some future date. Examples include $1,000 today and $650 to be received at the end of 10 years.

Annuity: A level periodic stream of cash flow. For our purposes, we'll work primarily with *annual* cash flows. Examples include either paying out or receiving $800 at the end of each of the next 7 years.

Mixed stream: A stream of cash flow that is *not* an annuity; a stream of unequal periodic cash flows that reflect no particular pattern. Examples include the following two cash flow streams A and B.

	Mixed cash flow stream	
End of year	**A**	**B**
1	$ 100	−$ 50
2	800	100
3	1,200	80
4	1,200	− 60
5	1,400	
6	300	

Note that neither cash flow stream has equal, periodic cash flows and that A is a 6-year mixed stream and B is a 4-year mixed stream.

In the next three sections of this chapter, we develop the concepts and techniques for finding future and present values of single amounts, annuities, and mixed streams, respectively. Detailed demonstrations of these cash flow patterns are included.

Review Questions

4–1 What is the difference between *future value* and *present value?* Which approach is generally preferred by financial managers? Why?

4–2 Define and differentiate among the three basic patterns of cash flow: (1) a single amount, (2) an annuity, and (3) a mixed stream.

LG2 4.2 Single Amounts

The most basic future value and present value concepts and computations concern single amounts, either present or future amounts. We begin by considering the future value of present amounts. Then we will use the underlying concepts to learn how to determine the present value of future amounts. You will see that although future value is more intuitively appealing, present value is more useful in financial decision making.

Future Value of a Single Amount

Imagine that at age 25 you began making annual purchases of $2,000 of an investment that earns a guaranteed 5 percent annually. At the end of 40 years, at age 65, you would have invested a total of $80,000 (40 years × $2,000 per year). Assuming that all funds remain invested, how much would you have accumulated at the end of the fortieth year? $100,000? $150,000? $200,000? No, your $80,000 would have grown to $242,000! Why? Because the time value of money allowed your investments to generate returns that built on each other over the 40 years.

compound interest
Interest that is earned on a given deposit and has become part of the principal at the end of a specified period.

principal
The amount of money on which interest is paid.

future value
The value of a present amount at a future date, found by applying *compound interest* over a specified period of time.

The Concept of Future Value

We speak of **compound interest** to indicate that the amount of interest earned on a given deposit has become part of the principal at the end of a specified period. The term **principal** refers to the amount of money on which the interest is paid. Annual compounding is the most common type.

The **future value** of a present amount is found by applying *compound interest* over a specified period of time. Savings institutions advertise compound interest returns at a rate of *x* percent, or *x* percent interest, compounded annually, semiannually, quarterly, monthly, weekly, daily, or even continuously. The concept of future value with annual compounding can be illustrated by a simple example.

EXAMPLE

If Fred Moreno places $100 in a savings account paying 8% interest compounded annually, at the end of 1 year he will have $108 in the account—the initial principal of $100 plus 8% ($8) in interest. The future value at the end of the first year is calculated by using Equation 4.1:

$$\text{Future value at end of year 1} = \$100 \times (1 + 0.08) = \$108 \tag{4.1}$$

If Fred were to leave this money in the account for another year, he would be paid interest at the rate of 8% on the new principal of $108. At the end of this second year there would be \$116.64 in the account. This amount would represent the principal at the beginning of year 2 (\$108) plus 8% of the \$108 (\$8.64) in interest. The future value at the end of the second year is calculated by using Equation 4.2:

$$\begin{aligned}\text{Future value at end of year 2} &= \$108 \times (1 + 0.08) \\ &= \$116.64\end{aligned} \tag{4.2}$$

Substituting the expression between the equals signs in Equation 4.1 for the \$108 figure in Equation 4.2 gives us Equation 4.3:

$$\begin{aligned}\text{Future value at end of year 2} &= \$100 \times (1 + 0.08) \times (1 + 0.08) \\ &= \$100 \times (1 + 0.08)^2 \\ &= \$116.64\end{aligned} \tag{4.3}$$

The equations in the preceding example lead to a more general formula for calculating future value.

The Equation for Future Value

The basic relationship in Equation 4.3 can be generalized to find the future value after any number of periods. We use the following notation for the various inputs:

FV_n = future value at the end of period n
PV = initial principal, or present value
i = annual rate of interest paid. (*Note:* On financial calculators, **I** is typically used to represent this rate.)
n = number of periods (typically years) that the money is left on deposit

The general equation for the future value at the end of period n is

$$FV_n = PV \times (1 + i)^n \tag{4.4}$$

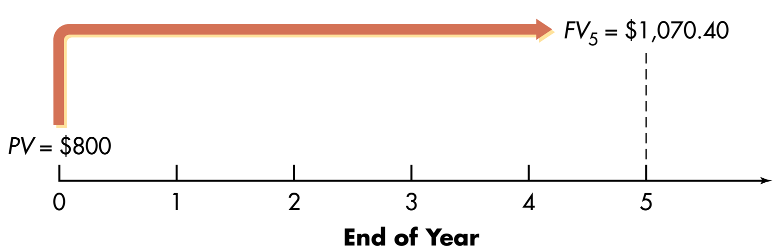
A simple example will illustrate how to apply Equation 4.4.

EXAMPLE Jane Farber places \$800 in a savings account paying 6% interest compounded annually. She wants to know how much money will be in the account at the end of 5 years. Substituting $PV = \$800$, $i = 0.06$, and $n = 5$ into Equation 4.4 gives the amount at the end of year 5.

$$FV_5 = \$800 \times (1 + 0.06)^5 = \$800 \times (1.338) = \$1{,}070.40$$

This analysis can be depicted on a time line as follows:

Time line for future value of a single amount (\$800 initial principal, earning 6%, at the end of 5 years)



Using Computational Tools to Find Future Value

Solving the equation in the preceding example involves raising 1.06 to the fifth power. Using a future value interest table or a financial calculator or a computer and spreadsheet greatly simplifies the calculation. A table that provides values for $(1+i)^n$ in Equation 4.4 is included near the back of the book in Appendix Table A–1. The value in each cell of the table is called the **future value interest factor.** This factor is the multiplier used to calculate, at a specified interest rate, the future value of a present amount as of a given time. The future value interest factor for an initial principal of $1 compounded at i percent for n periods is referred to as $FVIF_{i,n}$.

future value interest factor
The multiplier used to calculate, at a specified interest rate, the future value of a present amount as of a given time.

$$\text{Future value interest factor} = FVIF_{i,n} = (1+i)^n \tag{4.5}$$

By finding the intersection of the annual interest rate, i, and the appropriate periods, n, you will find the future value interest factor that is relevant to a particular problem.[1] Using $FVIF_{i,n}$ as the appropriate factor, we can rewrite the general equation for future value (Equation 4.4) as follows:

$$FV_n = PV \times (FVIF_{i,n}) \tag{4.6}$$

This expression indicates that to find the future value at the end of period n of an initial deposit, we have merely to multiply the initial deposit, PV, by the appropriate future value interest factor.[2]

EXAMPLE

In the preceding example, Jane Farber placed $800 in her savings account at 6% interest compounded annually and wishes to find out how much will be in the account at the end of 5 years.

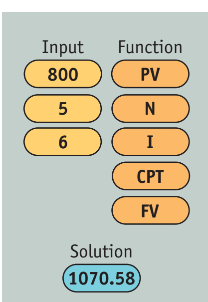


Table Use The future value interest factor for an initial principal of $1 on deposit for 5 years at 6% interest compounded annually, $FVIF_{6\%,\,5\text{yrs}}$, found in Table A–1, is 1.338. Using Equation 4.6, $\$800 \times 1.338 = \$1{,}070.40$. Therefore, the future value of Jane's deposit at the end of year 5 will be $1,070.40.

Calculator Use[3] The financial calculator can be used to calculate the future value directly.[4] First punch in $800 and depress **PV;** next punch in 5 and depress **N;** then punch in 6 and depress **I** (which is equivalent to "i" in our notation)[5]; finally, to calculate the future value, depress **CPT** and then **FV.** The future value of $1,070.58 should appear on the calculator display as shown at the left. On

1. Although we commonly deal with years rather than periods, financial tables are frequently presented in terms of periods to provide maximum flexibility.

2. Occasionally, you may want to estimate roughly how long a given sum must earn at a given annual rate to double the amount. The *Rule of 72* is used to make this estimate; dividing the annual rate of interest into 72 results in the approximate number of periods it will take to double one's money at the given rate. For example, to double one's money at a 10% annual rate of interest will take about 7.2 years ($72 \div 10 = 7.2$). Looking at Table A–1, we can see that the future value interest factor for 10% and 7 years is slightly below 2 (1.949); this approximation therefore appears to be reasonably accurate.

3. Many calculators allow the user to set the number of payments per year. Most of these calculators are preset for monthly payments—12 payments per year. Because we work primarily with annual payments—one payment per year—it is important *to be sure that your calculator is set for one payment per year.* And although most calculators are preset to recognize that all payments occur at the end of the period, it is important to *make sure that your calculator is correctly set on the END mode.* Consult the reference guide that accompanies your calculator for instructions for setting these values.

4. To avoid including previous data in current calculations, *always clear all registers of your calculator before inputting values and making each computation.*

5. The known values *can be punched into the calculator in any order;* the order specified in this as well as other demonstrations of calculator use included in this text merely reflects convenience and personal preference.

many calculators, this value will be preceded by a minus sign (−1,070.58). *If a minus sign appears on your calculator, ignore it here as well as in all other "Calculator Use" illustrations in this text.*[6]

Because the calculator is more accurate than the future value factors, which have been rounded to the nearest 0.001, a slight difference—in this case, $0.18—will frequently exist between the values found by these alternative methods. Clearly, the improved accuracy and ease of calculation tend to favor the use of the calculator. (*Note:* In future examples of calculator use, we will use only a display similar to that shown on the preceding page. If you need a reminder of the procedures involved, go back and review the preceding paragraph.)

Spreadsheet Use The future value of the single amount also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	FUTURE VALUE OF A SINGLE AMOUNT	
2	Present value	$800
3	Interest rate, pct per year compounded annually	6%
4	Number of years	5
5	Future value	$1,070.58

Entry in Cell B5 is =FV(B3,B4,0,–B2,0).
The minus sign appears before B2 because the present value is an outflow (i.e., a deposit made by Jane Farber).

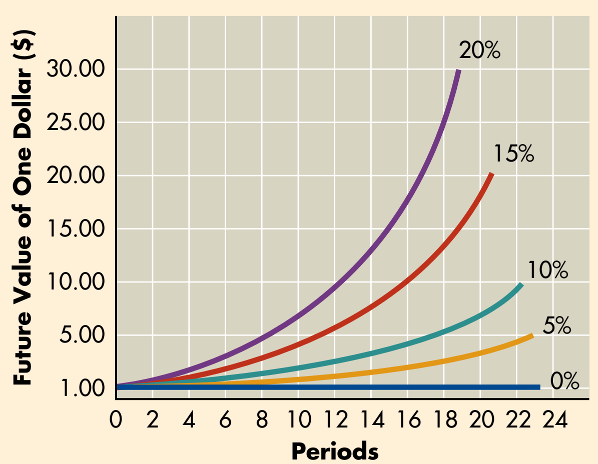
A Graphical View of Future Value

Remember that we measure future value at the *end* of the given period. Figure 4.5 illustrates the relationship among various interest rates, the number of periods interest is earned, and the future value of one dollar. The figure shows that (1) the

FIGURE 4.5

Future Value Relationship

Interest rates, time periods, and future value of one dollar



6. The calculator differentiates inflows from outflows by preceding the outflows with a negative sign. For example, in the problem just demonstrated, the $800 present value (PV), because it was keyed as a positive number (800), is considered an inflow or deposit. Therefore, the calculated future value (FV) of −1,070.58 is preceded by a minus sign to show that it is the resulting outflow or withdrawal. Had the $800 present value been keyed in as a negative number (−800), the future value of $1,070.58 would have been displayed as a positive number (1,070.58). Simply stated, *the cash flows—present value* (PV) *and future value* (FV)*—will have opposite signs.*

higher the interest rate, the higher the future value, and (2) the longer the period of time, the higher the future value. Note that for an interest rate of 0 percent, the future value always equals the present value ($1.00). But for any interest rate greater than zero, the future value is greater than the present value of $1.00.

Present Value of a Single Amount

present value
The current dollar value of a future amount—the amount of money that would have to be invested today at a given interest rate over a specified period to equal the future amount.

It is often useful to determine the value today of a future amount of money. For example, how much would I have to deposit today into an account paying 7 percent annual interest in order to accumulate $3,000 at the end of 5 years? **Present value** is the current dollar value of a future amount—the amount of money that would have to be invested today at a given interest rate over a specified period to equal the future amount. Present value depends largely on the investment opportunities and the point in time at which the amount is to be received. This section explores the present value of a single amount.

The Concept of Present Value

discounting cash flows
The process of finding present values; the inverse of compounding interest.

The process of finding present values is often referred to as **discounting cash flows.** It is concerned with answering the following question: "If I can earn i percent on my money, what is the most I would be willing to pay now for an opportunity to receive FV_n dollars n periods from today?"

This process is actually the inverse of compounding interest. Instead of finding the future value of present dollars invested at a given rate, discounting determines the present value of a future amount, assuming an opportunity to earn a certain return on the money. This annual rate of return is variously referred to as the *discount rate, required return, cost of capital,* and *opportunity cost*.[7] These terms will be used interchangeably in this text.

EXAMPLE

Paul Shorter has an opportunity to receive $300 one year from now. If he can earn 6% on his investments in the normal course of events, what is the most he should pay now for this opportunity? To answer this question, Paul must determine how many dollars he would have to invest at 6% today to have $300 one year from now. Letting PV equal this unknown amount and using the same notation as in the future value discussion, we have

$$PV \times (1 + 0.06) = \$300 \tag{4.7}$$

Solving Equation 4.7 for PV gives us Equation 4.8:

$$PV = \frac{\$300}{(1 + 0.06)} \tag{4.8}$$
$$= \$283.02$$

The value today ("present value") of $300 received one year from today, given an opportunity cost of 6%, is $283.02. That is, investing $283.02 today at the 6% opportunity cost would result in $300 at the end of one year.

7. The theoretical underpinning of this "required return" is introduced in Chapter 5 and further refined in subsequent chapters.

The Equation for Present Value

The present value of a future amount can be found mathematically by solving Equation 4.4 for PV. In other words, the present value, PV, of some future amount, FV_n, to be received n periods from now, assuming an opportunity cost of i, is calculated as follows:

$$PV = \frac{FV_n}{(1+i)^n} = FV_n \times \left[\frac{1}{(1+i)^n}\right] \qquad (4.9)$$

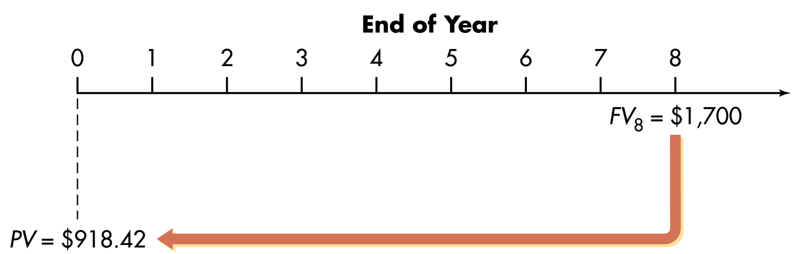
Note the similarity between this general equation for present value and the equation in the preceding example (Equation 4.8). Let's use this equation in an example.

EXAMPLE Pam Valenti wishes to find the present value of \$1,700 that will be received 8 years from now. Pam's opportunity cost is 8%. Substituting $FV_8 = \$1{,}700$, $n = 8$, and $i = 0.08$ into Equation 4.9 yields Equation 4.10:

$$PV = \frac{\$1{,}700}{(1+0.08)^8} = \frac{\$1{,}700}{1.851} = \$918.42 \qquad (4.10)$$

The following time line shows this analysis.

Time line for present value of a single amount (\$1,700 future amount, discounted at 8%, from the end of 8 years)



Using Computational Tools to Find Present Value

present value interest factor
The multiplier used to calculate, at a specified discount rate, the present value of an amount to be received in a future period.

The present value calculation can be simplified by using a **present value interest factor.** This factor is the multiplier used to calculate, at a specified discount rate, the present value of an amount to be received in a future period. The present value interest factor for the present value of \$1 discounted at i percent for n periods is referred to as $PVIF_{i,n}$.

$$\text{Present value interest factor} = PVIF_{i,n} = \frac{1}{(1+i)^n} \qquad (4.11)$$

Appendix Table A–2 presents present value interest factors for \$1. By letting $PVIF_{i,n}$ represent the appropriate factor, we can rewrite the general equation for present value (Equation 4.9) as follows:

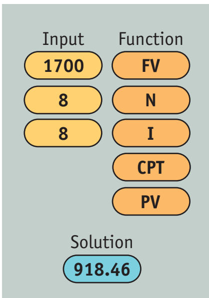
$$PV = FV_n \times (PVIF_{i,n}) \qquad (4.12)$$

This expression indicates that to find the present value of an amount to be received in a future period, n, we have merely to multiply the future amount, FV_n, by the appropriate present value interest factor.

EXAMPLE

As noted, Pam Valenti wishes to find the present value of $1,700 to be received 8 years from now, assuming an 8% opportunity cost.

Table Use The present value interest factor for 8% and 8 years, $PVIF_{8\%, 8\text{ yrs}}$, found in Table A–2, is 0.540. Using Equation 4.12, $\$1{,}700 \times 0.540 = \$918$. The present value of the $1,700 Pam expects to receive in 8 years is $918.



Calculator Use Using the calculator's financial functions and the inputs shown at the left, you should find the present value to be $918.46. The value obtained with the calculator is more accurate than the values found using the equation or the table, although for the purposes of this text, these differences are insignificant.

Spreadsheet Use The present value of the single future amount also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	PRESENT VALUE OF A SINGLE FUTURE AMOUNT	
2	Future value	$1,700
3	Interest rate, pct per year compounded annually	8%
4	Number of years	8
5	Present value	$918.46
	Entry in Cell B5 is =–PV(B3,B4,0,B2). The minus sign appears before PV to change the present value to a positive amount.	

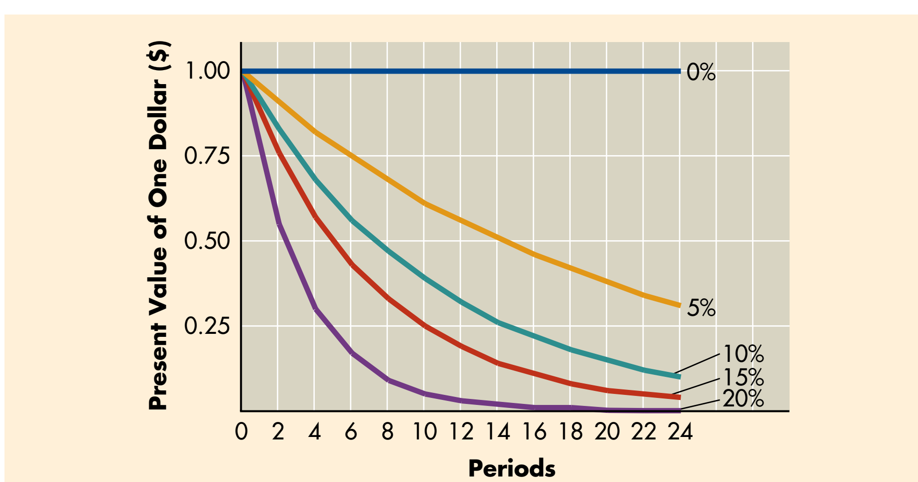
A Graphical View of Present Value

Remember that present value calculations assume that the future values are measured at the *end* of the given period. The relationships among the factors in a present value calculation are illustrated in Figure 4.6. The figure clearly shows that, everything else being equal, (1) the higher the discount rate, the lower the

FIGURE 4.6

Present Value Relationship

Discount rates, time periods, and present value of one dollar



present value, and (2) the longer the period of time, the lower the present value. Also note that given a discount rate of 0 percent, the present value always equals the future value ($1.00). But for any discount rate greater than zero, the present value is less than the future value of $1.00.

Comparing Present Value and Future Value

We will close this section with some important observations about present values. One is that the expression for the present value interest factor for i percent and n periods, $1/(1+i)^n$, is the *inverse* of the future value interest factor for i percent and n periods, $(1+i)^n$. You can confirm this very simply: Divide a present value interest factor for i percent and n periods, $PVIF_{i,n}$, given in Table A–2, into 1.0, and compare the resulting value to the future value interest factor given in Table A–1 for i percent and n periods, $FVIF_{i,n}$. The two values should be equivalent.

Second, because of the relationship between present value interest factors and future value interest factors, we can find the present value interest factors given a table of future value interest factors, and vice versa. For example, the future value interest factor (from Table A–1) for 10 percent and 5 periods is 1.611. Dividing this value into 1.0 yields 0.621, which is the present value interest factor (given in Table A–2) for 10 percent and 5 periods.

Review Questions

4–3 How is the *compounding process* related to the payment of interest on savings? What is the general equation for future value?

4–4 What effect would a *decrease* in the interest rate have on the future value of a deposit? What effect would an *increase* in the holding period have on future value?

4–5 What is meant by "the present value of a future amount"? What is the general equation for present value?

4–6 What effect does *increasing* the required return have on the present value of a future amount? Why?

4–7 How are present value and future value calculations related?

LG3 4.3 Annuities

How much will you have at the end of 5 years if your employer withholds and invests $1,000 of your year-end bonus at the end of *each* of the next 5 years, guaranteeing you a 9 percent annual rate of return? How much would you pay today, given that you can earn 7 percent on low-risk investments, to receive a guaranteed $3,000 at the end of *each* of the next 20 years? To answer these questions, you need to understand the application of the time value of money to *annuities*.

annuity
A stream of equal periodic cash flows, over a specified time period. These cash flows can be *inflows* of returns earned on investments or *outflows* of funds invested to earn future returns.

An **annuity** is a stream of equal periodic cash flows, over a specified time period. These cash flows are usually annual but can occur at other intervals, such as monthly (rent, car payments). The cash flows in an annuity can be *inflows* (the

ordinary annuity
An annuity for which the cash flow occurs at the *end* of each period.

annuity due
An annuity for which the cash flow occurs at the *beginning* of each period.

$3,000 received at the end of each of the next 20 years) or *outflows* (the $1,000 invested at the end of each of the next 5 years).

Types of Annuities

There are two basic types of annuities. For an **ordinary annuity,** the cash flow occurs at the *end* of each period. For an **annuity due,** the cash flow occurs at the *beginning* of each period.

EXAMPLE

Fran Abrams is choosing which of two annuities to receive. Both are 5-year, $1,000 annuities; annuity A is an ordinary annuity, and annuity B is an annuity due. To better understand the difference between these annuities, she has listed their cash flows in Table 4.1. Note that the amount of each annuity totals $5,000. The two annuities differ in the timing of their cash flows: The cash flows are received sooner with the annuity due than with the ordinary annuity.

Although the cash flows of both annuities in Table 4.1 total $5,000, the annuity due would have a higher future value than the ordinary annuity, because each of its five annual cash flows can earn interest for one year more than each of the ordinary annuity's cash flows. In general, as will be demonstrated later in this chapter, *both the future value and the present value of an annuity due are always greater than the future value and the present value, respectively, of an otherwise identical ordinary annuity*.

Because ordinary annuities are more frequently used in finance, *unless otherwise specified, the term* annuity *is intended throughout this book to refer to ordinary annuities*.

Finding the Future Value of an Ordinary Annuity

The calculations required to find the future value of an ordinary annuity are illustrated in the following example.

TABLE 4.1 Comparison of Ordinary Annuity and Annuity Due Cash Flows ($1,000, 5 Years)

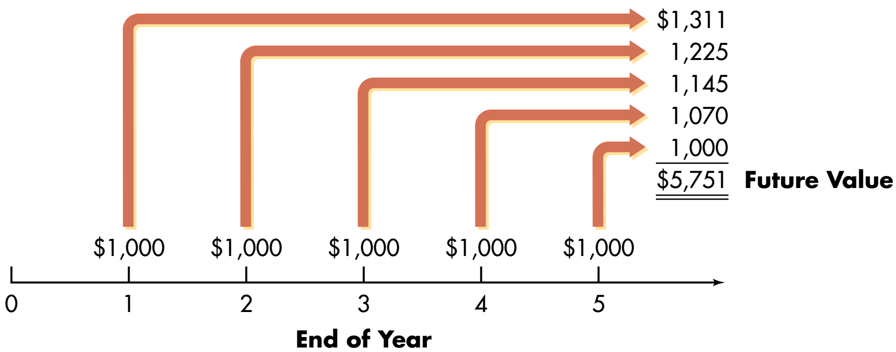
	Annual cash flows	
End of year[a]	Annuity A (*ordinary*)	Annuity B (*annuity due*)
0	$ 0	$1,000
1	1,000	1,000
2	1,000	1,000
3	1,000	1,000
4	1,000	1,000
5	1,000	0
Totals	$5,000	$5,000

[a]The ends of years 0, 1, 2, 3, 4, and 5 are equivalent to the beginnings of years 1, 2, 3, 4, 5, and 6, respectively.

EXAMPLE

Fran Abrams wishes to determine how much money she will have at the end of 5 years if he chooses annuity A, the ordinary annuity. It represents deposits of $1,000 annually, at the *end of each* of the next 5 years, into a savings account paying 7% annual interest. This situation is depicted on the following time line:

Time line for future value of an ordinary annuity ($1,000 end-of-year deposit, earning 7%, at the end of 5 years)



As the figure shows, at the end of year 5, Fran will have $5,751 in her account. Note that because the deposits are made at the end of the year, the first deposit will earn interest for 4 years, the second for 3 years, and so on.

Using Computational Tools to Find the Future Value of an Ordinary Annuity

future value interest factor for an ordinary annuity
The multiplier used to calculate the future value of an *ordinary annuity* at a specified interest rate over a given period of time.

Annuity calculations can be simplified by using an interest table or a financial calculator or a computer and spreadsheet. A table for the future value of a $1 *ordinary annuity* is given in Appendix Table A–3. The factors in the table are derived by summing the future value interest factors for the appropriate number of years. For example, the factor for the annuity in the preceding example is the sum of the factors for the five years (years 4 through 0): $1.311 + 1.225 + 1.145 + 1.070 + 1.000 = 5.751$. Because the deposits occur at the end of each year, they will earn interest from the end of the year in which each occurs to the end of year 5. Therefore, the first deposit earns interest for 4 years (end of year 1 through end of year 5), and the last deposit earns interest for zero years. The future value interest factor for zero years at any interest rate, $FVIF_{i,0}$, is 1.000, as we have noted. The formula for the **future value interest factor for an ordinary annuity** when interest is compounded annually at i percent for n periods, $FVIFA_{i,n}$, is[8]

$$FVIFA_{i,n} = \sum_{t=1}^{n} (1+i)^{t-1} \tag{4.13}$$

8. A mathematical expression that can be applied to calculate the future value interest factor for an ordinary annuity more efficiently is

$$FVIFA_{i,n} = \frac{1}{i} \times [(1+i)^n - 1] \tag{4.13a}$$

The use of this expression is especially attractive in the absence of the appropriate financial tables and of any financial calculator or personal computer and spreadsheet.

This factor is the multiplier used to calculate the future value of an *ordinary annuity* at a specified interest rate over a given period of time.

Using FVA_n for the future value of an n-year annuity, PMT for the amount to be deposited annually at the *end* of each year, and $FVIFA_{i,n}$ for the appropriate *future value interest factor for a one-dollar ordinary annuity compounded at* i *percent for* n *years,* we can express the relationship among these variables alternatively as

$$FVA_n = PMT \times (FVIFA_{i,n}) \tag{4.14}$$

The following example illustrates this calculation using a table, a calculator, and a spreadsheet.

EXAMPLE

As noted earlier, Fran Abrams wishes to find the future value (FVA_n) at the end of 5 years (n) of an annual *end-of-year deposit* of \$1,000 (PMT) into an account paying 7% annual interest (i) during the next 5 years.

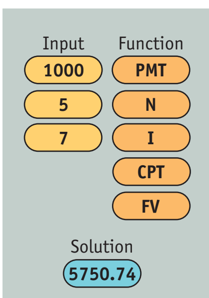


Table Use The future value interest factor for an ordinary 5-year annuity at 7% ($FVIFA_{7\%,5\text{yrs}}$), found in Table A–3, is 5.751. Using Equation 4.14, the \$1,000 deposit $\times$ 5.751 results in a future value for the annuity of \$5,751.

Calculator Use Using the calculator inputs shown at the left, you will find the future value of the ordinary annuity to be \$5,750.74, a slightly more precise answer than that found using the table.

Spreadsheet Use The future value of the ordinary annuity also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	**FUTURE VALUE OF AN ORDINARY ANNUITY**	
2	Annual payment	\$1,000
3	Annual rate of interest, compounded annually	7%
4	Number of years	5
5	Future value of an ordinary annuity	\$5,750.74
	Entry in Cell B5 is =FV(B3,B4,–B2) The minus sign appears before B2 because the annual payment is a cash outflow.	

Finding the Present Value of an Ordinary Annuity

Quite often in finance, there is a need to find the present value of a *stream* of cash flows to be received in future periods. An annuity is, of course, a stream of equal periodic cash flows. (We'll explore the case of mixed streams of cash flows in a later section.) The method for finding the present value of an ordinary annuity is similar to the method just discussed. There are long and short methods for making this calculation.

EXAMPLE Braden Company, a small producer of plastic toys, wants to determine the most it should pay to purchase a particular ordinary annuity. The annuity consists of cash flows of \$700 at the end of each year for 5 years. The firm requires the annuity to provide a minimum return of 8%. This situation is depicted on the following time line:

Time line for present value of an ordinary annuity (\$700 end-of-year cash flows, discounted at 8%, over 5 years)

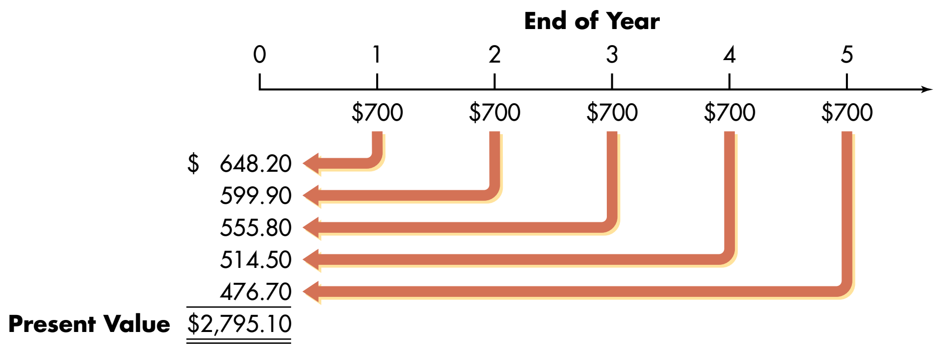


Table 4.2 shows the long method for finding the present value of the annuity. This method involves finding the present value of each payment and summing them. This procedure yields a present value of \$2,795.10.

Using Computational Tools to Find the Present Value of an Ordinary Annuity

Annuity calculations can be simplified by using an interest table for the present value of an annuity, a financial calculator, or a computer and spreadsheet. The values for the present value of a \$1 ordinary annuity are given in Appendix Table A–4. The factors in the table are derived by summing the present value interest

TABLE 4.2 The Long Method for Finding the Present Value of an Ordinary Annuity

Year (n)	Cash flow (1)	$PVIF_{8\%,n}$[a] (2)	Present value [(1) × (2)] (3)
1	\$700	0.926	\$ 648.20
2	700	0.857	599.90
3	700	0.794	555.80
4	700	0.735	514.50
5	700	0.681	476.70
		Present value of annuity	\$2,795.10

[a]Present value interest factors at 8% are from Table A–2.

present value interest factor for an ordinary annuity
The multiplier used to calculate the present value of an *ordinary annuity* at a specified discount rate over a given period of time.

factors (in Table A–2) for the appropriate number of years at the given discount rate. The formula for the **present value interest factor for an ordinary annuity** with cash flows that are discounted at i percent for n periods, $PVIFA_{i,n}$, is[9]

$$PVIFA_{i,n} = \sum_{t=1}^{n} \frac{1}{(1+i)^t} \tag{4.15}$$

This factor is the multiplier used to calculate the present value of an *ordinary annuity* at a specified discount rate over a given period of time.

By letting PVA_n equal the present value of an n-year *ordinary annuity*, letting PMT equal the amount to be received annually at the *end* of each year, and letting $PVIFA_{i,n}$ represent the appropriate *present value interest factor for a one-dollar ordinary annuity discounted at* i *percent for* n *years,* we can express the relationship among these variables as

$$PVA_n = PMT \times (PVIFA_{i,n}) \tag{4.16}$$

The following example illustrates this calculation using a table, a calculator, and a spreadsheet.

EXAMPLE

Braden Company, as we have noted, wants to find the present value of a 5-year ordinary annuity of $700, assuming an 8% opportunity cost.

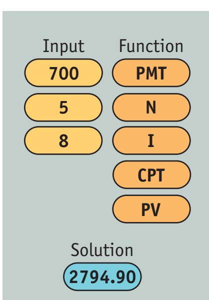


Table Use The present value interest factor for an ordinary annuity at 8% for 5 years ($PVIFA_{8\%,5\text{yrs}}$), found in Table A–4, is 3.993. If we use Equation 4.16, \$700 annuity $\times$ 3.993 results in a present value of \$2,795.10.

Calculator Use Using the calculator's inputs shown at the left, you will find the present value of the ordinary annuity to be $2,794.90. The value obtained with the calculator is more accurate than those found using the equation or the table.

Spreadsheet Use The present value of the ordinary annuity also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	**PRESENT VALUE OF AN ORDINARY ANNUITY**	
2	Annual payment	$700
3	Annual rate of interest, compounded annually	8%
4	Number of years	5
5	Present value of an ordinary annuity	$2,794.90
	Entry in Cell B5 is =PV(B3,B4,–B2). The minus sign appears before B2 because the annual payment is a cash outflow.	

9. A mathematical expression that can be applied to calculate the present value interest factor for an ordinary annuity more efficiently is

$$PVIFA_{i,n} = \frac{1}{i} \times \left[1 - \frac{1}{(1+i)^n}\right] \tag{4.15a}$$

The use of this expression is especially attractive in the absence of the appropriate financial tables and of any financial calculator or personal computer and spreadsheet.

In Practice

FOCUS ON PRACTICE Farewell to the Good "Olds" Days

For almost 3,000 car dealers, December 2000 marked the end of a 103-year era. **General Motors** announced that it would phase out the unprofitable Oldsmobile brand with the production of the 2004 model year—or sooner if demand dropped too low. GM entered into a major negotiation with owners of Oldsmobile dealerships to determine the value of the brand's dealerships and how to compensate franchise owners for their investment. Closing out the Oldsmobile name over the 4-year period could cost GM $2 billion or more, depending on real estate values, the future value of lost profits, and leasehold improvements.

As they waited to see what would happen, many Olds dealers voiced concern about recent expenditures to upgrade their facilities to comply with GM standards. They also wondered about the franchise's viability during the phase-out. After all, how many customers will want to buy Oldsmobiles, knowing the brand is being discontinued?

In a letter to dealers, William J. Lovejoy, GM's North American group sales vice president, says GM will repurchase all unsold Olds vehicles regardless of model year, as well as unused and undamaged parts; will remove and buy back all signage; and will buy back essential tools but let dealers retain tools exclusively designed for Olds products. By mid-2001, GM had offered Olds dealers cash to surrender franchises, up to about $2,900 per Olds sold during the best year between 1998 and 2000.

Cal Woodward, a CPA with expertise in dealership accounting, worked with the negotiating team to develop an appropriate list of requests. He recommended that they include reimbursement for the present value of future profits they will lose as a result of the closing of their Oldsmobile franchises and for reduced profits or losses in the interim period. Mr. Woodward suggested that they use a 9 percent interest factor to calculate the present value of 10 years of incremental franchise profits.

Sources: Adapted from James R. Healey and Earle Eldridge, "Good Olds Days Are Numbered," *USA Today* (September 10, 2001), p. 6B; Maynard M. Gordon, "What's an Olds Franchise Worth?" *Ward's Dealer Business* (February 1, 2001), p. 40; Al Rothenberg, "No More Merry Oldsmobile," *Ward's Auto World* (March 1, 2001), p. 86.

Finding the Future Value of an Annuity Due

We now turn our attention to annuities due. Remember that the cash flows of an annuity due occur at the *start of the period*. A simple conversion is applied to use the future value interest factors for an ordinary annuity (in Table A–3) with annuities due. Equation 4.17 presents this conversion:

$$FVIFA_{i,n}\,(\text{annuity due}) = FVIFA_{i,n} \times (1+i) \tag{4.17}$$

This equation says that the future value interest factor for an annuity due can be found merely by multiplying the future value interest factor for an ordinary annuity at the same percent and number of periods by $(1+i)$. Why is this adjustment necessary? Because each cash flow of an annuity due earns interest for one year more than an ordinary annuity (from the start to the end of the year). Multiplying $FVIFA_{i,n}$ by $(1+i)$ simply adds an additional year's interest to *each* annuity cash flow. The following example demonstrates how to find the future value of an annuity due.

EXAMPLE

Remember from an earlier example that Fran Abrams wanted to choose between an ordinary annuity and an annuity due, both offering similar terms except for the timing of cash flows. We calculated the future value of the ordinary annuity in the example on page 164. We now will calculate the future value of the annuity due, using the cash flows represented by annuity B in Table 4.1 (page 163).

Table Use Substituting $i = 7\%$ and $n = 5$ years into Equation 4.17, with the aid of the appropriate interest factor from Table A–3, we get

$$FVIFA_{7\%,5\text{yrs}}\,(\text{annuity due}) = FVIFA_{7\%,5\text{yrs}} \times (1 + 0.07)$$
$$= 5.751 \times 1.07 = 6.154$$

Then, substituting $PMT = \$1{,}000$ and $FVIFA_{7\%,\,5\text{ yrs}}$ (annuity due) $= 6.154$ into Equation 4.14, we get a future value for the annuity due:

$$FVA_5 = \$1{,}000 \times 6.154 = \$6{,}154$$

Note: Switch calculator to BEGIN mode.

Input	Function
1000	PMT
5	N
7	I
	CPT
	FV

Solution
6153.29

Calculator Use Before using your calculator to find the future value of an annuity due, depending on the specific calculator, you must either switch it to BEGIN mode or use the DUE key. Then, using the inputs shown at the left, you will find the future value of the annuity due to be \$6,153.29. (*Note:* Because we nearly always assume end-of-period cash flows, *be sure to switch your calculator back to* END *mode when you have completed your annuity-due calculations.*)

Spreadsheet Use The future value of the annuity due also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	**FUTURE VALUE OF AN ANNUITY DUE**	
2	Annual payment	\$1,000
3	Annual rate of interest, compounded annually	7%
4	Number of years	5
5	Future value of an annuity due	\$6,153.29

Entry in Cell B5 is =FV(B3,B4,–B2,0,1).
The minus sign appears before B2 because the annual payment is a cash outflow.

Comparison of an Annuity Due with an Ordinary Annuity Future Value

The future value of an annuity due is *always greater* than the future value of an otherwise identical ordinary annuity. We can see this by comparing the future values at the end of year 5 of Fran Abrams's two annuities:

Ordinary annuity = \$5,750.74 Annuity due = \$6,153.29

Because the cash flow of the annuity due occurs at the beginning of the period rather than at the end, its future value is greater. In the example, Fran would earn about \$400 more with the annuity due.

Finding the Present Value of an Annuity Due

We can also find the present value of an annuity due. This calculation can be easily performed by adjusting the ordinary annuity calculation. Because the cash flows of an annuity due occur at the beginning rather than the end of the period, to find their present value, each annuity due cash flow is discounted back one less year than for an ordinary annuity. A simple conversion can be applied to use the present value interest factors for an ordinary annuity (in Table A–4) with annuities due.

$$PVIFA_{i,n}\,(\text{annuity due}) = PVIFA_{i,n} \times (1 + i) \tag{4.18}$$

The equation indicates that the present value interest factor for an annuity due can be obtained by multiplying the present value interest factor for an ordinary annuity at the same percent and number of periods by $(1 + i)$. This conversion adjusts for the fact that each cash flow of an annuity due is discounted back one less year than a comparable ordinary annuity Multiplying $PVIFA_{i,n}$ by $(1 + i)$ effectively adds back one year of interest to *each* annuity cash flow. Adding back one year of interest to each cash flow in effect reduces by 1 the number of years *each* annuity cash flow is discounted.

EXAMPLE

In the earlier example of Braden Company on page 166, we found the present value of Braden's \$700, 5-year ordinary annuity discounted at 8% to be about \$2,795. If we now assume that Braden's \$700 annual cash flow occurs at the *start* of each year and is thereby an annuity due, we can calculate its present value using a table, a calculator, or a spreadsheet.

Table Use Substituting $i = 8\%$ and $n = 5$ years into Equation 4.18, with the aid of the appropriate interest factor from Table A–4, we get

$$PVIFA_{8\%,5\text{yrs}}\,(\text{annuity due}) = PVIFA_{8\%,5\text{yrs}} \times (1 + 0.08)$$
$$= 3.993 \times 1.08 = 4.312$$

Then, substituting $PMT = \$700$ and $PVIFA_{8\%,5\text{yrs}}\,(\text{annuity due}) = 4.312$ into Equation 4.16, we get a present value for the annuity due:

$$PVA_5 = \$700 \times 4.312 = \$3{,}018.40$$

Note: Switch calculator to BEGIN mode.

Input	Function
700	PMT
5	N
8	I
	CPT
	PV

Solution
3018.49

Calculator Use Before using your calculator to find the present value of an annuity due, depending on the specifics of your calculator, you must either switch it to BEGIN mode or use the DUE key. Then, using the inputs shown at the left, you will find the present value of the annuity due to be \$3,018.49. (*Note:* Because we nearly always assume end-of-period cash flows, *be sure to switch your calculator back to END mode when you have completed your annuity-due calculations.*)

Spreadsheet Use The present value of the annuity due also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	PRESENT VALUE OF AN ANNUITY DUE	
2	Annual payment	\$700
3	Annual rate of interest, compounded annually	8%
4	Number of years	5
5	Present value of an annuity due	\$3,018.49

Entry in Cell B5 is =PV(B3,B4,–B2,0,1).
The minus sign appears before B2 because the annual payment is a cash outflow.

Comparison of an Annuity Due with an Ordinary Annuity Present Value

The present value of an annuity due is always greater than the present value of an otherwise identical ordinary annuity. We can see this by comparing the present values of the Braden Company's two annuities:

$$\text{Ordinary annuity} = \$2{,}794.90 \qquad \text{Annuity due} = \$3{,}018.49$$

Because the cash flow of the annuity due occurs at the beginning of the period rather than at the end, its present value is greater. In the example, Braden Company would realize about $200 more in present value with the annuity due.

Finding the Present Value of a Perpetuity

perpetuity
An annuity with an infinite life, providing continual annual cash flow.

A **perpetuity** is an annuity with an infinite life—in other words, an annuity that never stops providing its holder with a cash flow at the end of each year (for example, the right to receive $500 at the end of each year forever).

It is sometimes necessary to find the present value of a perpetuity. The present value interest factor for a perpetuity discounted at the rate i is

$$PVIFA_{i,\infty} = \frac{1}{i} \tag{4.19}$$

As the equation shows, the appropriate factor, $PVIFA_{i,\infty}$, is found simply by dividing the discount rate, i (stated as a decimal), into 1. The validity of this method can be seen by looking at the factors in Table A–4 for 8, 10, 20, and 40 percent: As the number of periods (typically years) approaches 50, these factors approach the values calculated using Equation 4.19: $1 \div 0.08 = 12.50$; $1 \div 0.10 = 10.00$; $1 \div 0.20 = 5.00$; and $1 \div 0.40 = 2.50$.

EXAMPLE

Ross Clark wishes to endow a chair in finance at his alma mater. The university indicated that it requires $200,000 per year to support the chair, and the endowment would earn 10% per year. To determine the amount Ross must give the university to fund the chair, we must determine the present value of a $200,000 perpetuity discounted at 10%. The appropriate present value interest factor can be found by dividing 1 by 0.10, as noted in Equation 4.19. Substituting the resulting factor, 10, and the amount of the perpetuity, $PMT = \$200{,}000$, into Equation 4.16 results in a present value of $2,000,000 for the perpetuity. In other words, to generate $200,000 every year for an indefinite period requires $2,000,000 today if Ross Clark's alma mater can earn 10% on its investments. If the university earns 10% interest annually on the $2,000,000, it can withdraw $200,000 a year indefinitely without touching the initial $2,000,000, which would never be drawn upon.

Review Questions

4–8 What is the difference between an *ordinary annuity* and an *annuity due?* Which always has greater future value and present value for identical annuities and interest rates? Why?

4–9 What are the most efficient ways to calculate the present value of an ordinary annuity? What is the relationship between the *PVIF* and *PVIFA* interest factors given in Tables A–2 and A–4, respectively?

4–10 How can the future value interest factors for an ordinary annuity be modified to find the future value of an annuity due?

4–11 How can the present value interest factors for an ordinary annuity be modified to find the present value of an annuity due?

4–12 What is a *perpetuity?* How can the present value interest factor for such a stream of cash flows be determined?

4.4 Mixed Streams

mixed stream
A stream of unequal periodic cash flows that reflect no particular pattern.

Two basic types of cash flow streams are possible: the annuity and the mixed stream. Whereas an *annuity* is a pattern of equal periodic cash flows, a **mixed stream** is a stream of unequal periodic cash flows that reflect no particular pattern. Financial managers frequently need to evaluate opportunities that are expected to provide mixed streams of cash flows. Here we consider both the future value and the present value of mixed streams.

Future Value of a Mixed Stream

Determining the future value of a mixed stream of cash flows is straightforward. We determine the future value of each cash flow at the specified future date and then add all the individual future values to find the total future value.

EXAMPLE

Shrell Industries, a cabinet manufacturer, expects to receive the following mixed stream of cash flows over the next 5 years from one of its small customers.

End of year	Cash flow
1	$11,500
2	14,000
3	12,900
4	16,000
5	18,000

If Shrell expects to earn 8% on its investments, how much will it accumulate by the end of year 5 if it immediately invests these cash flows when they are received? This situation is depicted on the following time time:

Time line for future value of a mixed stream (end-of-year cash flows, compounded at 8% to the end of year 5)

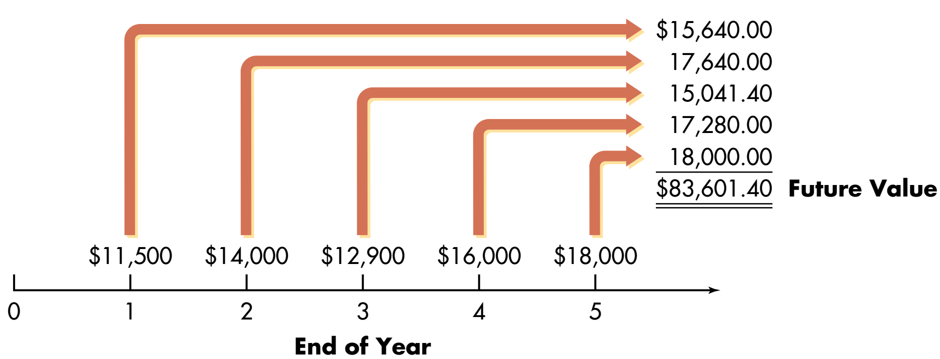


Table Use To solve this problem, we determine the future value of each cash flow compounded at 8% for the appropriate number of years. Note that the first cash flow of $11,500, received at the end of year 1, will earn interest for 4 years (end of year 1 through end of year 5); the second cash flow of $14,000, received at the end of year 2, will earn interest for 3 years (end of year 2 through end of year 5); and so on. The sum of the individual end-of-year-5 future values is the future value of the mixed cash flow stream. The future value interest factors required are

TABLE 4.3 Future Value of a Mixed Stream of Cash Flows

Year	Cash flow (1)	Number of years earning interest (n) (2)	$FVIF_{8\%,n}$[a] (2)	Future value [(1) × (3)] (4)
1	$11,500	$5 - 1 = 4$	1.360	$15,640.00
2	14,000	$5 - 2 = 3$	1.260	17,640.00
3	12,900	$5 - 3 = 2$	1.166	15,041.40
4	16,000	$5 - 4 = 1$	1.080	17,280.00
5	18,000	$5 - 5 = 0$	1.000[b]	18,000.00
			Future value of mixed stream	$83,601.40

[a]Future value interest factors at 8% are from Table A–1.

[b]The future value of the end-of-year-5 deposit at the end of year 5 is its present value because it earns interest for zero years and $(1 + 0.08)^0 = 1.000$.

those shown in Table A–1. Table 4.3 presents the calculations needed to find the future value of the cash flow stream, which turns out to be $83,601.40.

Calculator Use You can use your calculator to find the future value of each individual cash flow, as demonstrated earlier (page 157), and then sum the future values, to get the future value of the stream. Unfortunately, unless you can program your calculator, most calculators lack a function that would allow you to input *all of the cash flows,* specify the interest rate, and directly calculate the future value of the entire cash flow stream. Had you used your calculator to find the individual cash flow future values and then summed them, the future value of Shrell Industries' cash flow stream at the end of year 5 would have been $83,608.15, a more precise value than the one obtained by using a financial table.

Spreadsheet Use The future value of the mixed stream also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	FUTURE VALUE OF A MIXED STREAM	
2	Interest rate, pct/year	8%
3	Year	Year-End Cash Flow
4	1	$11,500
5	2	$14,000
6	3	$12,900
7	4	$16,000
8	5	$18,000
9	Future value	$83,608.15

Entry in Cell B9 is =–FV(B2,A8,0,NPV(B2,B4:B8)).
The minus sign appears before FV to convert the future value to a positive amount.

If Shrell Industries invests at 8% interest the cash flows received from its customer over the next 5 years, the company will accumulate about $83,600 by the end of year 5.

Present Value of a Mixed Stream

Finding the present value of a mixed stream of cash flows is similar to finding the future value of a mixed stream. We determine the present value of each future amount and then add all the individual present values together to find the total present value.

EXAMPLE Frey Company, a shoe manufacturer, has been offered an opportunity to receive the following mixed stream of cash flows over the next 5 years:

End of year	Cash flow
1	$400
2	800
3	500
4	400
5	300

If the firm must earn at least 9% on its investments, what is the most it should pay for this opportunity? This situation is depicted on the following time line:

Time line for present value of a mixed stream (end-of-year cash flows, discounted at 9% over the corresponding number of years)

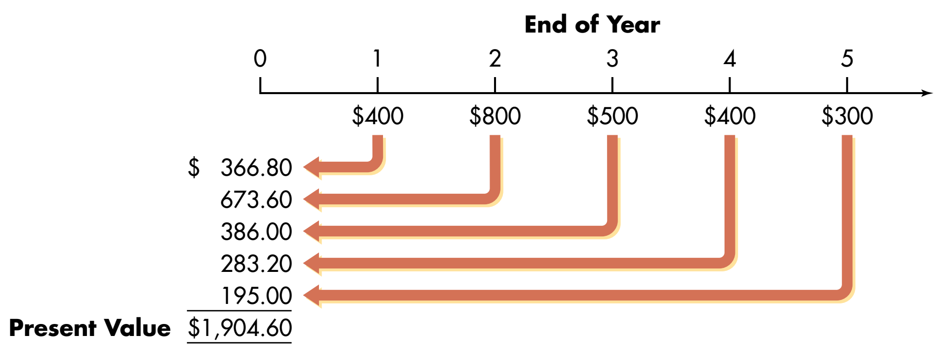


Table Use To solve this problem, determine the present value of each cash flow discounted at 9% for the appropriate number of years. The sum of these individual values is the present value of the total stream. The present value interest factors required are those shown in Table A–2. Table 4.4 presents the calculations needed to find the present value of the cash flow stream, which turns out to be $1,904.60.

Calculator Use You can use a calculator to find the present value of each individual cash flow, as demonstrated earlier (page 161), and then sum the present values, to get the present value of the stream. However, most financial calculators have a function that allows you to punch in *all cash flows,* specify the discount rate, and then directly calculate the present value of the entire cash flow stream. Because calculators provide solutions more precise than those based on rounded

TABLE 4.4 Present Value of a Mixed Stream of Cash Flows

Year (n)	Cash flow (1)	$PVIF_{9\%,n}$[a] (2)	Present value [(1) × (2)] (3)
1	$400	0.917	$ 366.80
2	800	0.842	673.60
3	500	0.772	386.00
4	400	0.708	283.20
5	300	0.650	195.00
		Present value of mixed stream	$1,904.60

[a]Present value interest factors at 9% are from Table A–2.

table factors, the present value of Frey Company's cash flow stream found using a calculator is $1,904.76, which is close to the $1,904.60 value calculated before.

Spreadsheet Use The present value of the mixed stream of future cash flows also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	PRESENT VALUE OF A MIXED STREAM OF FUTURE CASH FLOWS	
2	Interest Rate, pct/year	9%
3	Year	Year-End Cash Flow
4	1	$400
5	2	$800
6	3	$500
7	4	$400
8	5	$300
9	Present value	$1,904.76
	Entry in Cell B9 is =NPV(B2,B4:B8).	

Paying about $1,905 would provide exactly a 9% return. Frey should pay no more than that amount for the opportunity to receive these cash flows.

Review Question

4–13 How is the future value of a mixed stream of cash flows calculated? How is the present value of a mixed stream of cash flows calculated?

LG5

4.5 Compounding Interest More Frequently Than Annually

Interest is often compounded more frequently than once a year. Savings institutions compound interest semiannually, quarterly, monthly, weekly, daily, or even continuously. This section discusses various issues and techniques related to these more frequent compounding intervals.

Semiannual Compounding

semiannual compounding
Compounding of interest over two periods within the year.

Semiannual compounding of interest involves two compounding periods within the year. Instead of the stated interest rate being paid once a year, one-half of the stated interest rate is paid twice a year.

EXAMPLE

Fred Moreno has decided to invest $100 in a savings account paying 8% interest *compounded semiannually*. If he leaves his money in the account for 24 months (2 years), he will be paid 4% interest compounded over four periods, each of which is 6 months long. Table 4.5 uses interest factors to show that at the end of 12 months (1 year) with 8% semiannual compounding, Fred will have $108.16; at the end of 24 months (2 years), he will have $116.99.

Quarterly Compounding

quarterly compounding
Compounding of interest over four periods within the year.

Quarterly compounding of interest involves four compounding periods within the year. One-fourth of the stated interest rate is paid four times a year.

EXAMPLE

Fred Moreno has found an institution that will pay him 8% interest *compounded quarterly*. If he leaves his money in this account for 24 months (2 years), he will be paid 2% interest compounded over eight periods, each of which is 3 months long. Table 4.6 uses interest factors to show the amount Fred will have at the end of each period. At the end of 12 months (1 year), with 8% quarterly compounding, Fred will have $108.24; at the end of 24 months (2 years), he will have $117.16.

TABLE 4.5 The Future Value from Investing $100 at 8% Interest Compounded Semiannually Over 24 Months (2 Years)

Period	Beginning principal (1)	Future value interest factor (2)	Future value at end of period [(1) × (2)] (3)
6 months	$100.00	1.04	$104.00
12 months	104.00	1.04	108.16
18 months	108.16	1.04	112.49
24 months	112.49	1.04	116.99

TABLE 4.6 The Future Value from Investing \$100 at 8% Interest Compounded Quarterly Over 24 Months (2 Years)

Period	Beginning principal (1)	Future value interest factor (2)	Future value at end of period [(1) × (2)] (3)
3 months	\$100.00	1.02	\$102.00
6 months	102.00	1.02	104.04
9 months	104.04	1.02	106.12
12 months	106.12	1.02	108.24
15 months	108.24	1.02	110.40
18 months	110.40	1.02	112.61
21 months	112.61	1.02	114.86
24 months	114.86	1.02	117.16

TABLE 4.7 The Future Value at the End of Years 1 and 2 from Investing \$100 at 8% Interest, Given Various Compounding Periods

	Compounding period		
End of year	Annual	Semiannual	Quarterly
1	\$108.00	\$108.16	\$108.24
2	116.64	116.99	117.16

Table 4.7 compares values for Fred Moreno's \$100 at the end of years 1 and 2 given annual, semiannual, and quarterly compounding periods at the 8 percent rate. As shown, *the more frequently interest is compounded, the greater the amount of money accumulated*. This is true for *any interest rate* for *any period of time*.

A General Equation for Compounding More Frequently Than Annually

The formula for annual compounding (Equation 4.4) can be rewritten for use when compounding takes place more frequently. If m equals the number of times per year interest is compounded, the formula for annual compounding can be rewritten as

$$FV_n = PV \times \left(1 + \frac{i}{m}\right)^{m \times n} \qquad (4.20)$$

If $m = 1$, Equation 4.20 reduces to Equation 4.4. Thus, if interest is compounded annually (once a year), Equation 4.20 will provide the same result as Equation 4.4. The general use of Equation 4.20 can be illustrated with a simple example.

EXAMPLE The preceding examples calculated the amount that Fred Moreno would have at the end of 2 years if he deposited \$100 at 8% interest compounded semiannually and compounded quarterly. For semiannual compounding, m would equal 2 in Equation 4.20; for quarterly compounding, m would equal 4. Substituting the appropriate values for semiannual and quarterly compounding into Equation 4.20, we find that

1. *For semiannual compounding:*

$$FV_2 = \$100 \times \left(1 + \frac{0.08}{2}\right)^{2\times 2} = \$100 \times (1 + 0.04)^4 = \$116.99$$

2. *For quarterly compounding:*

$$FV_2 = \$100 \times \left(1 + \frac{0.08}{4}\right)^{4\times 2} = \$100 \times (1 + 0.02)^8 = \$117.16$$

These results agree with the values for FV_2 in Tables 4.5 and 4.6.

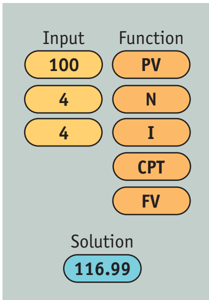
If the interest were compounded monthly, weekly, or daily, m would equal 12, 52, or 365, respectively.

Using Computational Tools for Compounding More Frequently Than Annually

We can use the future value interest factors for one dollar, given in Table A–1, when interest is compounded m times each year. Instead of indexing the table for i percent and n years, as we do when interest is compounded annually, we index it for $(i \div m)$ percent and $(m \times n)$ periods. However, the table is less useful, because it includes only selected rates for a limited number of periods. Instead, a financial calculator or a computer and spreadsheet is typically required.

EXAMPLE Fred Moreno wished to find the future value of \$100 invested at 8% interest compounded both semiannually and quarterly for 2 years. The number of compounding periods, m, the interest rate, and the number of periods used in each case, along with the future value interest factor, are as follows:

Compounding period	m	Interest rate $(i \div m)$	Periods $(m \times n)$	Future value interest factor from Table A–1
Semiannual	2	$8\% \div 2 = 4\%$	$2 \times 2 = 4$	1.170
Quarterly	4	$8\% \div 4 = 2\%$	$4 \times 2 = 8$	1.172



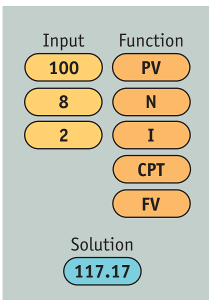


Table Use Multiplying each of the future value interest factors by the initial \$100 deposit results in a value of \$117.00 (1.170 × \$100) for semiannual compounding and a value of \$117.20 (1.172 × \$100) for quarterly compounding.

Calculator Use If the calculator were used for the semiannual compounding calculation, the number of periods would be 4 and the interest rate would be 4%. The future value of \$116.99 will appear on the calculator display as shown at the top left.

For the quarterly compounding case, the number of periods would be 8 and the interest rate would be 2%. The future value of \$117.17 will appear on the calculator display as shown in the second display at the left.

Spreadsheet Use The future value of the single amount with semiannual and quarterly compounding also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	FUTURE VALUE OF A SINGLE AMOUNT WITH SEMIANNUAL AND QUARTERLY COMPOUNDING	
2	Present value	\$100
3	Interest rate, pct per year compounded semiannually	8%
4	Number of years	2
5	Future value with semiannual compounding	\$116.99
6	Present value	\$100
7	Interest rate, pct per year compounded quarterly	8%
8	Number of years	2
9	Future value with quarterly compounding	\$117.17

Entry in Cell B5 is =FV(B3/2,B4*2,0,–B2,0).
Entry in Cell B9 is =FV(B7/4,B8*4,0,–B2,0).
The minus sign appears before B2 because the present value is a cash outflow (i.e., a deposit made by Fred Moreno).

Comparing the calculator, table, and spreadsheet values, we can see that the calculator and spreadsheet values agree generally with the values in Table 4.7 but are more precise because the table factors have been rounded.

Continuous Compounding

continuous compounding
Compounding of interest an infinite number of times per year at intervals of microseconds.

In the extreme case, interest can be compounded continuously. **Continuous compounding** involves compounding over every microsecond—the smallest time period imaginable. In this case, m in Equation 4.20 would approach infinity. Through the use of calculus, we know that as m approaches infinity, the equation becomes

$$FV_n \text{ (continuous compounding)} = PV \times (e^{i \times n}) \tag{4.21}$$

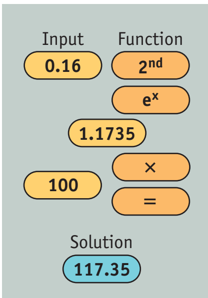
where e is the exponential function[10], which has a value of 2.7183. The future value interest factor for continuous compounding is therefore

$$FVIF_{i,n} \text{ (continuous compounding)} = e^{i \times n} \tag{4.22}$$

10. Most calculators have the exponential function, typically noted by e^x, built into them. The use of this key is especially helpful in calculating future value when interest is compounded continuously.

EXAMPLE To find the value at the end of 2 years ($n = 2$) of Fred Moreno's \$100 deposit ($PV = \$100$) in an account paying 8% annual interest ($i = 0.08$) compounded continuously, we can substitute into Equation 4.21:

$$\begin{aligned} FV_2 \text{ (continuous compounding)} &= \$100 \times e^{0.08 \times 2} \\ &= \$100 \times 2.7183^{0.16} \\ &= \$100 \times 1.1735 = \$117.35 \end{aligned}$$



Calculator Use To find this value using the calculator, you need first to find the value of $e^{0.16}$ by punching in 0.16 and then pressing **2nd** and then **e^x** to get 1.1735. Next multiply this value by \$100 to get the future value of \$117.35 as shown at the left. (*Note:* On some calculators, you may not have to press **2nd** before pressing **e^x**.)

Spreadsheet Use The future value of the single amount with continuous compounding also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	**FUTURE VALUE OF A SINGLE AMOUNT WITH CONTINUOUS COMPOUNDING**	
2	Present value	\$100
3	Annual rate of interest, compounded continuously	8%
4	Number of years	2
5	Future value with continuous compounding	\$117.35
	Entry in Cell B5 is =B2*EXP(B3*B4).	

The future value with continuous compounding therefore equals \$117.35. As expected, the continuously compounded value is larger than the future value of interest compounded semiannually (\$116.99) or quarterly (\$117.16). Continuous compounding offers the largest amount that would result from compounding interest more frequently than annually.

Nominal and Effective Annual Rates of Interest

Both businesses and investors need to make objective comparisons of loan costs or investment returns over different compounding periods. In order to put interest rates on a common basis, to allow comparison, we distinguish between nominal and effective annual rates. The **nominal, or stated, annual rate** is the contractual annual rate of interest charged by a lender or promised by a borrower. The **effective, or true, annual rate (EAR)** is the annual rate of interest actually paid or earned. The effective annual rate reflects the impact of compounding frequency, whereas the nominal annual rate does not.

nominal (stated) annual rate
Contractual annual rate of interest charged by a lender or promised by a borrower.

effective (true) annual rate (EAR)
The annual rate of interest actually paid or earned.

Using the notation introduced earlier, we can calculate the effective annual rate, EAR, by substituting values for the nominal annual rate, i, and the compounding frequency, m, into Equation 4.23:

$$EAR = \left(1 + \frac{i}{m}\right)^m - 1 \qquad (4.23)$$

We can apply this equation using data from preceding examples.

EXAMPLE

Fred Moreno wishes to find the effective annual rate associated with an 8% nominal annual rate ($i = 0.08$) when interest is compounded (1) annually ($m = 1$); (2) semiannually ($m = 2$); and (3) quarterly ($m = 4$). Substituting these values into Equation 4.23, we get

1. *For annual compounding:*

$$EAR = \left(1 + \frac{0.08}{1}\right)^1 - 1 = (1 + 0.08)^1 - 1 = 1 + 0.08 - 1 = 0.08 = 8\%$$

2. *For semiannual compounding:*

$$EAR = \left(1 + \frac{0.08}{2}\right)^2 - 1 = (1 + 0.04)^2 - 1 = 1.0816 - 1 = 0.0816 = 8.16\%$$

3. *For quarterly compounding:*

$$EAR = \left(1 + \frac{0.08}{4}\right)^4 - 1 = (1 + 0.02)^4 - 1 = 1.0824 - 1 = 0.0824 = 8.24\%$$

These values demonstrate two important points: The first is that nominal and effective annual rates are equivalent for annual compounding. The second is that the effective annual rate increases with increasing compounding frequency, up to a limit that occurs with *continuous compounding*.[11]

annual percentage rate (APR)
The *nominal annual rate* of interest, found by multiplying the periodic rate by the number of periods in 1 year, that must be disclosed to consumers on credit cards and loans as a result of "truth-in-lending laws."

annual percentage yield (APY)
The *effective annual rate* of interest that must be disclosed to consumers by banks on their savings products as a result of "truth-in-savings laws."

At the consumer level, "truth-in-lending laws" require disclosure on credit card and loan agreements of the **annual percentage rate (APR).** The APR is the *nominal annual rate* found by multiplying the periodic rate by the number of periods in one year. For example, a bank credit card that charges 1 1/2 percent per month (the periodic rate) would have an APR of 18% (1.5% per month × 12 months per year).

"Truth-in-savings laws," on the other hand, require banks to quote the **annual percentage yield (APY)** on their savings products. The APY is the *effective annual rate* a savings product pays. For example, a savings account that pays 0.5 percent per month would have an APY of 6.17 percent $[(1.005)^{12} - 1]$.

Quoting loan interest rates at their lower nominal annual rate (the APR) and savings interest rates at the higher effective annual rate (the APY) offers two advantages: It tends to standardize disclosure to consumers, and it enables financial institutions to quote the most attractive interest rates: low loan rates and high savings rates.

11. The effective annual rate for this extreme case can be found by using the following equation:

$$\text{EAR (continuous compounding)} = e^k - 1 \tag{4.23a}$$

For the 8% nominal annual rate ($k = 0.08$), substitution into Equation 4.23a results in an effective annual rate of

$$e^{0.08} - 1 = 1.0833 - 1 = 0.0833 = 8.33\%$$

in the case of continuous compounding. This is the highest effective annual rate attainable with an 8% nominal rate.

Review Questions

4–14 What effect does compounding interest more frequently than annually have on (**a**) future value and (**b**) the *effective annual rate (EAR)*? Why?

4–15 How does the future value of a deposit subject to continuous compounding compare to the value obtained by annual compounding?

4–16 Differentiate between a *nominal annual rate* and an *effective annual rate (EAR)*. Define *annual percentage rate (APR)* and *annual percentage yield (APY)*.

LG6

4.6 Special Applications of Time Value

Future value and present value techniques have a number of important applications in finance. We'll study four of them in this section: (1) deposits needed to accumulate a future sum, (2) loan amortization, (3) interest or growth rates, and (4) finding an unknown number of periods.

Deposits Needed to Accumulate a Future Sum

Suppose you want to buy a house 5 years from now, and you estimate that an initial down payment of \$20,000 will be required at that time. To accumulate the 20,000, you will wish to make equal annual end-of-year deposits into an account paying annual interest of 6 percent. The solution to this problem is closely related to the process of finding the future value of an annuity. You must determine what size annuity will result in a single amount equal to \$20,000 at the end of year 5.

Earlier in the chapter we found the future value of an n-year ordinary annuity, FVA_n, by multiplying the annual deposit, PMT, by the appropriate interest factor, $FVIFA_{i,n}$. The relationship of the three variables was defined by Equation 4.14, which is repeated here as Equation 4.24:

$$FVA_n = PMT \times (FVIFA_{i,n}) \tag{4.24}$$

We can find the annual deposit required to accumulate FVA_n dollars by solving Equation 4.24 for PMT. Isolating PMT on the left side of the equation gives us

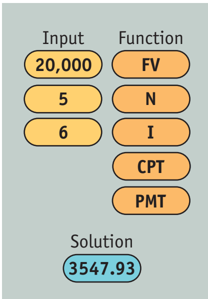
$$PMT = \frac{FVA_n}{FVIFA_{i,n}} \tag{4.25}$$

Once this is done, we have only to substitute the known values of FVA_n and $FVIFA_{i,n}$ into the right side of the equation to find the annual deposit required.

EXAMPLE As just stated, you want to determine the equal annual end-of-year deposits required to accumulate \$20,000 at the end of 5 years, given an interest rate of 6%.

Table Use Table A–3 indicates that the future value interest factor for an ordinary annuity at 6% for 5 years ($FVIFA_{6\%,5\text{yrs}}$) is 5.637. Substituting

$FVA_5 = \$20{,}000$ and $FVIFA_{6\%,5\text{yrs}} = 5.637$ into Equation 4.25 yields an annual required deposit, *PMT,* of \$3,547.99. Thus if \$3,547.99 is deposited at the end of each year for 5 years at 6% interest, there will be \$20,000 in the account at the end of the 5 years.



Calculator Use Using the calculator inputs shown at the left, you will find the annual deposit amount to be \$3,547.93. Note that this value, except for a slight rounding difference, agrees with the value found by using Table A–3.

Spreadsheet Use The annual deposit needed to accumulate the future sum also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	ANNUAL DEPOSIT NEEDED TO ACCUMULATE A FUTURE SUM	
2	Future value	\$20,000
3	Number of years	5
4	Annual rate of interest	6%
5	Annual deposit	\$3,547.93

Entry in Cell B5 is =–PMT(B4,B3,0,B2).
The minus sign appears before PMT because the annual deposits are cash outflows.

Loan Amortization

loan amortization
The determination of the equal periodic loan payments necessary to provide a lender with a specified interest return and to repay the loan principal over a specified period.

loan amortization schedule
A schedule of equal payments to repay a loan. It shows the allocation of each loan payment to interest and principal.

The term **loan amortization** refers to the computation of equal periodic loan payments. These payments provide a lender with a specified interest return and repay the loan principal over a specified period. The loan amortization process involves finding the future payments, over the term of the loan, whose present value at the loan interest rate equals the amount of initial principal borrowed. Lenders use a **loan amortization schedule** to determine these payment amounts and the allocation of each payment to interest and principal. In the case of home mortgages, these tables are used to find the equal *monthly* payments necessary to *amortize,* or pay off, the mortgage at a specified interest rate over a 15- to 30-year period.

Amortizing a loan actually involves creating an annuity out of a present amount. For example, say you borrow \$6,000 at 10 percent and agree to make equal annual end-of-year payments over 4 years. To find the size of the payments, the lender determines the amount of a 4-year annuity discounted at 10 percent that has a present value of \$6,000. This process is actually the inverse of finding the present value of an annuity.

Earlier in the chapter, we found the present value, PVA_n, of an n-year annuity by multiplying the annual amount, *PMT,* by the present value interest factor for an annuity, $PVIFA_{i,n}$. This relationship, which was originally expressed as Equation 4.16, is repeated here as Equation 4.26:

$$PVA_n = PMT \times (PVIFA_{i,n}) \tag{4.26}$$

In Practice

FOCUS ON PRACTICE Time Is on Your Side

For many years, the 30-year fixed-rate mortgage was the traditional choice of home buyers. In recent years, however, more homeowners are choosing fixed-rate mortgages with a 15-year term when they buy a new home or refinance their current residence. They are often pleasantly surprised to discover that they can pay off the loan in half the time with a monthly payment that is only about 25 percent higher. Not only will they own the home free and clear sooner, but they pay considerably less interest over the life of the loan.

For example, assume you need a $200,000 mortgage and can borrow at fixed rates. The shorter loan would carry a lower rate (because it presents less risk for the lender). The accompanying table shows how the two mortgages compare: The extra $431 a month, or a total of $77,580, saves $157,765 in interest payments over the life of the loan, for net savings of $80,185!

Term	Rate	Monthly principal and interest	Total interest paid over the term of the loan
15 years	6.50%	$1,742	$113,625
30 years	6.85%	$1,311	$271,390

Why isn't everyone rushing to take out a shorter mortgage? Many homeowners either can't afford the higher monthly payment or would rather have the extra spending money now. Others hope to do even better by investing the difference themselves. Suppose you invested $431 each month in a mutual fund with an average annual return of 7 percent. At the end of 15 years, your $77,580 investment would have grown to $136,611, or $59,031 more than you contributed! However, many people lack the self-discipline to save rather than spend that money. For them, the 15-year mortgage represents forced savings.

Yet another option is to make additional principal payments whenever possible. This shortens the life of the loan without committing you to the higher payments. By paying just $100 more each month, you can shorten the life of a 30-year mortgage to 24 1/4 years, with attendant interest savings.

Sources: Daniela Deane, "Adding Up Pros, Cons of 15-Year Loans," *Washington Post* (October 13, 2001), p. H7; Henry Savage, "Is 15-Year Loan Right for You?" *Washington Times* (June 22, 2001), p. F22; Carlos Tejada, "Sweet Fifteen: Shorter Mortgages Are Gaining Support," *Wall Street Journal* (September 17, 1998), p. C1; Ann Tergesen, "It's Time to Refinance . . . Again," *Business Week* (November 2, 1998), pp. 134–135.

To find the equal annual payment required to pay off, or amortize, the loan, PVA_n, over a certain number of years at a specified interest rate, we need to solve Equation 4.26 for PMT. Isolating PMT on the left side of the equation gives us

$$PMT = \frac{PVA_n}{PVIFA_{i,n}} \tag{4.27}$$

Once this is done, we have only to substitute the known values into the righthand side of the equation to find the annual payment required.

EXAMPLE As just stated, you want to determine the equal annual end-of-year payments necessary to amortize fully a $6,000, 10% loan over 4 years.

Table Use Table A–4 indicates that the present value interest factor for an annuity corresponding to 10% and 4 years ($PVIFA_{10\%,4yrs}$) is 3.170. Substituting $PVA_4 = \$6{,}000$ and $PVIFA_{10\%,4yrs} = 3.170$ into Equation 4.27 and solving for PMT yield an annual loan payment of $1,892.74. Thus to repay the interest and principal on a $6,000, 10%, 4-year loan, equal annual end-of-year payments of $1,892.74 are necessary.

Input	Function
6000	PV
4	N
10	I
	CPT
	PMT

Solution
1892.82

Calculator Use Using the calculator inputs shown at the left, you will find the annual payment amount to be $1,892.82. Except for a slight rounding difference, this value agrees with the table solution.

The allocation of each loan payment to interest and principal can be seen in columns 3 and 4 of the *loan amortization schedule* in Table 4.8 at the top of page 186. The portion of each payment that represents interest (column 3) declines over the repayment period, and the portion going to principal repayment (column 4) increases. This pattern is typical of amortized loans; as the principal is reduced, the interest component declines, leaving a larger portion of each subsequent loan payment to repay principal.

Spreadsheet Use The annual payment to repay the loan also can be calculated as shown on the first Excel spreadsheet. The amortization schedule allocating each loan payment to interest and principal also can be calculated precisely as shown on the second spreadsheet.

	A	B
1	ANNUAL PAYMENT TO REPAY A LOAN	
2	Loan principal (present value)	$6,000
3	Annual rate of interest	10%
4	Number of years	4
5	Annual payment	$1,892.82

Entry in Cell B5 is =–PMT(B3,B4,B2).
The minus sign appears before PMT because the annual payments are cash outflows.

	A	B	C	D	E
1	LOAN AMORTIZATION SCHEDULE				
2		Data: Loan principal		$6,000	
3		Annual rate of interest		10%	
4		Number of years		4	
5		Annual Payments			
6	Year	Total	To Interest	To Principal	Year-End Principal
7	0				$ 6,000.00
8	1	$1,892.82	$600.00	$1,292.82	4,707.18
9	2	$1,892.82	$470.72	$1,422.11	3,285.07
10	3	$1,892.82	$328.51	$1,564.32	1,720.75
11	4	$1,892.82	$172.07	$1,720.75	0.00

Key Cell Entries
Cell B8: =–PMT(D3,D4,D2), copy to B9:B11
Cell C8: =–CUMIPMT(D3,D4,D2,A8,A8,0), copy to C9:C11
Cell D8: =–CUMPRINC(D3,D4,D2,A8,A8,0), copy to D9:D11
Cell E8: =E7–D8, copy to E9:E11
The minus signs appear before the entries in Cells B8, C8, and D8 because these are cash outflows.

TABLE 4.8 Loan Amortization Schedule ($6,000 Principal, 10% Interest, 4-Year Repayment Period)

			Payments		
End of year	Beginning-of-year principal (1)	Loan payment (2)	Interest [0.10 × (2)] (3)	Principal [(1) − (3)] (4)	End-of-year principal [(2) − (4)] (5)
1	$6,000.00	$1,892.74	$600.00	$1,292.74	$4,707.26
2	4,707.26	1,892.74	470.73	1,422.01	3,285.25
3	3,285.25	1,892.74	328.53	1,564.21	1,721.04
4	1,721.04	1,892.74	172.10	1,720.64	—[a]

[a]Because of rounding, a slight difference ($0.40) exists between the beginning-of-year-4 principal (in column 1) and the year-4 principal payment (in column 4).

Interest or Growth Rates

It is often necessary to calculate the compound annual interest or *growth rate* (that is, the annual rate of change in values) of a series of cash flows. Examples include finding the interest rate on a loan, the rate of growth in sales, and the rate of growth in earnings. In doing this, we can use either future value or present value interest factors. The use of present value interest factors is described in this section. The simplest situation is one in which a person wishes to find the rate of interest or growth in a *series of cash flows*.[12]

EXAMPLE Ray Noble wishes to find the rate of interest or growth reflected in the stream of cash flows he received from a real estate investment over the period 1999 through 2003. The following table lists those cash flows:

Year	Cash flow	
2003	$1,520	
		4
2002	1,440	
		3
2001	1,370	
		2
2000	1,300	
		1
1999	1,250	

By using the first year (1999) as a base year, we see that interest has been earned (or growth experienced) for 4 years.

Table Use The first step in finding the interest or growth rate is to divide the amount received in the earliest year (PV) by the amount received in the latest year (FV_n). Looking back at Equation 4.12, we see that this results in the present value

12. Because the calculations required for finding interest rates and growth rates, given the series of cash flows, are the same, this section refers to the calculations as those required to find interest *or* growth rates.

interest factor for a *single amount* for 4 years, $PVIF_{i,4\text{yrs}}$, which is 0.822 (\$1,250 ÷ \$1,520). The interest rate in Table A–2 associated with the factor closest to 0.822 for 4 years is the interest or growth rate of Ray's cash flows. In the row for year 4 in Table A–2, the factor for 5 percent is 0.823—almost exactly the 0.822 value. Therefore, the interest or growth rate of the given cash flows is approximately (to the nearest whole percent) 5%.[13]

Input	Function
1250	PV
−1520	FV
4	N
	CPT
	I
Solution	
5.01	

Calculator Use Using the calculator, we treat the earliest value as a present value, *PV*, and the latest value as a future value, FV_n. (*Note:* Most calculators require *either* the *PV* or the *FV* value to be input as a negative number to calculate an unknown interest or growth rate. That approach is used here.) Using the inputs shown at the left, you will find the interest or growth rate to be 5.01%, which is consistent with, but more precise than, the value found using Table A–2.

Spreadsheet Use The interest or growth rate for the series of cash flows also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	INTEREST OR GROWTH RATE – SERIES OF CASH FLOWS	
2	Year	Cash Flow
3	2003	\$1,520
4	2002	\$1,440
5	2001	\$1,370
6	2000	\$1,300
7	1999	\$1,250
8	Annual growth rate	5.01%

Entry in Cell B8 is
=RATE((A3–A7),0,B7,–B3,0).
The expression A3–A7 in the entry
calculates the number of years of growth.
The minus sign appears before B3 because
the investment in 2003
is treated as a cash outflow.

Another type of interest-rate problem involves finding the interest rate associated with an *annuity,* or equal-payment loan.

EXAMPLE

Jan Jacobs can borrow \$2,000 to be repaid in equal annual end-of-year amounts of \$514.14 for the next 5 years. She wants to find the interest rate on this loan.

Table Use Substituting $PVA_5 = \$2{,}000$ and $PMT = \$514.14$ into Equation 4.26 and rearranging the equation to solve for $PVIFA_{i,5\text{yrs}}$, we get

$$PVIFA_{i,5yrs} = \frac{PVA_5}{PMT} = \frac{\$2{,}000}{\$514.14} = 3.890 \tag{4.28}$$

13. To obtain more precise estimates of interest or growth rates, *interpolation*—a mathematical technique for estimating unknown intermediate values—can be applied. For information on how to interpolate a more precise answer in this example, see the book's home page at www.aw.com/gitman.

Input	Function
514.14	PMT
−2000	PV
5	N
	CPT
	I

Solution
9.00

The interest rate for 5 years associated with the annuity factor closest to 3.890 in Table A–4 is 9%. Therefore, the interest rate on the loan is approximately (to the nearest whole percent) 9%.

Calculator Use (*Note:* Most calculators require *either* the *PMT* or the *PV* value to be input as a negative number in order to calculate an unknown interest rate on an equal-payment loan. That approach is used here.) Using the inputs shown at the left, you will find the interest rate to be 9.00%, which is consistent with the value found using Table A–4.

Spreadsheet Use The interest or growth rate for the annuity also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	INTEREST OR GROWTH RATE – ANNUITY	
2	Present value (loan principal)	$2,000
3	Number of years	5
4	Annual payment	$514.14
5	Annual interest rate	9.00%
	Entry in Cell B5 is =RATE(B3,B4,–B2). The minus sign appears before B2 because the loan principal is treated as a cash outflow.	

Finding an Unknown Number of Periods

Sometimes it is necessary to calculate the number of time periods needed to generate a given amount of cash flow from an initial amount. Here we briefly consider this calculation for both single amounts and annuities. This simplest case is when a person wishes to determine the number of periods, n, it will take for an initial deposit, PV, to grow to a specified future amount, FV_n, given a stated interest rate, i.

EXAMPLE

Ann Bates wishes to determine the number of years it will take for her initial $1,000 deposit, earning 8% annual interest, to grow to equal $2,500. Simply stated, at an 8% annual rate of interest, how many years, n, will it take for Ann's $1,000, PV, to grow to $2,500, FV_n?

Table Use In a manner similar to our approach above to finding an unknown interest or growth rate in a series of cash flows, we begin by dividing the amount deposited in the earliest year by the amount received in the latest year. This results in the present value interest factor for 8% and n years, $PVIF_{8\%,n}$, which is 0.400 ($1,000 ÷ $2,500). The number of years (periods) in Table A–2 associated with the factor closest to 0.400 for an 8% interest rate is the number of years required for $1,000 to grow into $2,500 at 8%. In the 8% column of Table A–2, the factor for 12 years is 0.397—almost exactly the 0.400 value. Therefore, the number of years necessary for the $1,000 to grow to a future value of $2,500 at 8% is approximately (to the nearest year) 12.

Input	Function
1000	PV
−2500	FV
8	I
	CPT
	N

Solution
11.91

Calculator Use Using the calculator, we treat the initial value as the present value, *PV*, and the latest value as the future value, FV_n. (*Note:* Most calculators require *either* the *PV* or the *FV* value to be input as a negative number to calculate an unknown number of periods. That approach is used here.) Using the inputs shown at the left, we find the number of periods to be 11.91 years, which is consistent with, but more precise than, the value found above using Table A–2.

Spreadsheet Use The number of years for the present value to grow to a specified future value also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	YEARS FOR A PRESENT VALUE TO GROW TO A SPECIFIED FUTURE VALUE	
2	Present value (deposit)	$1,000
3	Annual rate of interest, compounded annually	8%
4	Future value	$2,500
5	Number of years	11.91

Entry in Cell B5 is =NPER(B3,0,B2,–B4).
The minus sign appears before B4 because
the future value is treated as a cash outflow.

Another type of number-of-periods problem involves finding the number of periods associated with an *annuity*. Occasionally we wish to find the unknown life, *n*, of an annuity, *PMT*, that is intended to achieve a specific objective, such as repaying a loan of a given amount, PVA_n, with a stated interest rate, *i*.

EXAMPLE

Bill Smart can borrow $25,000 at an 11% annual interest rate; equal, annual end-of-year payments of $4,800 are required. He wishes to determine how long it will take to fully repay the loan. In other words, he wishes to determine how many years, *n*, it will take to repay the $25,000, 11% loan, PVA_n, if the payments of $4,800, *PMT*, are made at the end of each year.

Table Use Substituting $PVA_n = \$25{,}000$ and $PMT = \$4{,}800$ into Equation 4.26 and rearranging the equation to solve $PVIFA_{11\%,n\,yrs}$, we get

$$PVIFA_{11\%,n\,yrs} = \frac{PVA_n}{PMT} = \frac{\$25{,}000}{\$4{,}800} = 5.208 \tag{4.29}$$

Input	Function
−4800	PMT
25000	PV
11	I
	CPT
	N

Solution
8.15

The number of periods for an 11% interest rate associated with the annuity factor closest to 5.208 in Table A–4 is 8 years. Therefore, the number of periods necessary to repay the loan fully is approximately (to the nearest year) 8 years.

Calculator Use (*Note:* Most calculators require *either* the *PV* or the *PMT* value to be input as a negative number in order to calculate an unknown number of periods. That approach is used here.) Using the inputs shown at the left, you will find the number of periods to be 8.15, which is consistent with the value found using Table A–4.

Spreadsheet Use The number of years to pay off the loan also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	**YEARS TO PAY OFF A LOAN**	
2	Annual payment	$4,800
3	Annual rate of interest, compounded annually	11%
4	Present value (loan principal)	$25,000
5	Number of years to pay off the loan	8.15

Entry in Cell B5 is =NPER(B3,–B2,B4).
The minus sign appears before B2 because the payments are treated as cash outflows.

Review Questions

4–17 How can you determine the size of the equal annual end-of-period deposits necessary to accumulate a certain future sum at the end of a specified future period at a given annual interest rate?

4–18 Describe the procedure used to amortize a loan into a series of equal periodic payments.

4–19 Which present value interest factors would be used to find (**a**) the growth rate associated with a series of cash flows and (**b**) the interest rate associated with an equal-payment loan?

4–20 How can you determine the unknown number of periods when you know the present and future values—single amount or annuity—and the applicable rate of interest?

Summary

FOCUS ON VALUE

Time value of money is an important tool that financial managers and other market participants use to assess the impact of proposed actions. Because firms have long lives and their important decisions affect their long-term cash flows, the effective application of time-value-of-money techniques is extremely important. Time value techniques enable financial managers to evaluate cash flows occurring at different times in order to combine, compare, and evaluate them and link them to the firm's **overall goal of share price maximization.** It will become clear in Chapters 6 and 7 that the application of time value techniques is a key part of the value determination process. Using them, we can measure the firm's value and evaluate the impact that various events and decisions might have on it. Clearly, an understanding of time-value-of-money techniques and an ability to apply them are needed in order to make intelligent value-creating decisions.

REVIEW OF LEARNING GOALS

LG1 **Discuss the role of time value in finance, the use of computational tools, and the basic patterns of cash flow.** Financial managers and investors use time-value-of-money techniques when assessing the value of the expected cash flow streams associated with investment alternatives. Alternatives can be assessed by either compounding to find future value or discounting to find present value. Because they are at time zero when making decisions, financial managers rely primarily on present value techniques. Financial tables, financial calculators, and computers and spreadsheets can streamline the application of time value techniques. The cash flow of a firm can be described by its pattern—single amount, annuity, or mixed stream.

LG2 **Understand the concepts of future and present value, their calculation for single amounts, and the relationship of present value to future value.** Future value relies on compound interest to measure future amounts: The initial principal or deposit in one period, along with the interest earned on it, becomes the beginning principal of the following period. The present value of a future amount is the amount of money today that is equivalent to the given future amount, considering the return that can be earned on the current money. Present value is the inverse future value. The interest factor formulas and basic equations for both the future value and the present value of a single amount are given in Table 4.9.

LG3 **Find the future value and the present value of both an ordinary annuity and an annuity due, and find the present value of a perpetuity.** An annuity is a pattern of equal periodic cash flows. For an ordinary annuity, the cash flows occur at the end of the period. For an annuity due, cash flows occur at the beginning of the period. The future value of an ordinary annuity can be found by using the future value interest factor for an annuity; the present value of an ordinary annuity can be found by using the present value interest factor for an annuity. A simple conversion can be applied to use the future value and present value interest factors for an ordinary annuity to find, respectively, the future value and the present value of an annuity due. The present value of a perpetuity—an infinite-lived annuity—is found using 1 divided by the discount rate to represent the present value interest factor. The interest factor formulas and basic equations for the future value and the present value of both an ordinary annuity and an annuity due, and the present value of a perpetuity, are given in Table 4.9.

LG4 **Calculate both the future value and the present value of a mixed stream of cash flows.** A mixed stream of cash flows is a stream of unequal periodic cash flows that reflect no particular pattern. The future value of a mixed stream of cash flows is the sum of the future values of each individual cash flow. Similarly, the present value of a mixed stream of cash flows is the sum of the present values of the individual cash flows.

LG5 **Understand the effect that compounding interest more frequently than annually has on future value and on the effective annual rate of interest.** Interest can be compounded at intervals ranging from annually to daily, and even continuously. The more often interest is compounded, the larger the future amount that will be accumulated, and the higher the effective, or true, annual rate (EAR). The annual percentage rate (APR)—a nominal annual rate—is quoted on credit cards and loans. The annual percentage yield (APY)—an effective annual rate—is quoted on savings products. The interest factor formulas for compounding more frequently than annually are given in Table 4.9.

LG6 **Describe the procedures involved in (1) determining deposits to accumulate a future sum, (2) loan amortization, (3) finding interest or growth rates, and (4) finding an unknown number of periods.** The periodic deposit to accumulate a given future sum can be found by solving the equation for the future value of an annuity for the annual payment. A loan can be amortized into equal periodic payments by solving the equation for the present value of an annuity for the periodic payment. Interest or growth rates can be estimated by finding the unknown interest rate in the equation for the present value of a single amount or an annuity. Similarly, an unknown number of periods can be estimated by finding the unknown number of periods in the equation for the present value of a single amount or an annuity.

TABLE 4.9 Summary of Key Definitions, Formulas, and Equations for Time Value of Money

Definitions of variables

e = exponential function = 2.7183
EAR = effective annual rate
FV_n = future value or amount at the end of period n
FVA_n = future value of an n-year annuity
i = annual rate of interest
m = number of times per year interest is compounded
n = number of periods—typically years—over which money earns a return
PMT = amount deposited or received annually at the end of each year
PV = initial principal or present value
PVA_n = present value of an n-year annuity
t = period number index

Interest factor formulas

Future value of a single amount with annual compounding:

$$FVIF_{i,n} = (1+i)^n$$ [Eq. 4.5; factors in Table A–1]

Present value of a single amount:

$$PVIF_{i,n} = \frac{1}{(1+i)^n}$$ [Eq. 4.11; factors in Table A–2]

Future value of an ordinary annuity:

$$FVIFA_{i,n} = \sum_{t=1}^{n} (1+i)^{t-1}$$ [Eq. 4.13; factors in Table A–3]

Present value of an ordinary annuity:

$$PVIFA_{i,n} = \sum_{t=1}^{n} \frac{1}{(1+i)^t}$$ [Eq. 4.15; factors in Table A–4]

Future value of an annuity due:

$$FVIFA_{i,n} \text{ (annuity due)} = FVIFA_{i,n} \times (1+i)$$ [Eq. 4.17]

Present value of an annuity due:

$$PVIFA_{i,n} \text{ (annuity due)} = PVIFA_{i,n} \times (1+i)$$ [Eq. 4.18]

Present value of a perpetuity:

$$PVIFA_{i,\infty} = \frac{1}{i}$$ [Eq. 4.19]

Future value with compounding more frequently than annually:

$$FVIF_{i,n} = \left(1 + \frac{i}{m}\right)^{m \times n}$$ [Eq. 4.20]

for continuous compounding, $m = \infty$:

$$FVIF_{i,n} \text{ (continuous compounding)} = e^{i \times n}$$ [Eq. 4.22]

to find the effective annual rate:

$$EAR = \left(1 + \frac{i}{m}\right)^{m} - 1$$ [Eq. 4.23]

Basic equations

Future value (single amount):	$FV_n = PV \times (FVIF_{i,n})$	[Eq. 4.6]
Present value (single amount):	$PV = FV_n \times (PVIF_{i,n})$	[Eq. 4.12]
Future value (annuity):	$FVA_n = PMT \times (FVIFA_{i,n})$	[Eq. 4.14]
Present value (annuity):	$PVA_n = PMT \times (PVIFA_{i,n})$	[Eq. 4.16]

SELF-TEST PROBLEMS (Solutions in Appendix B)

LG2 LG5

ST 4–1 **Future values for various compounding frequencies** Delia Martin has $10,000 that she can deposit in any of three savings accounts for a 3-year period. Bank A compounds interest on an annual basis, bank B compounds interest twice each year, and bank C compounds interest each quarter. All three banks have a stated annual interest rate of 4%.

a. What amount would Ms. Martin have at the end of the third year, leaving all interest paid on deposit, in each bank?

b. What *effective annual rate* (*EAR*) would she earn in each of the banks?

c. On the basis of your findings in parts **a** and **b,** which bank should Ms. Martin deal with? Why?

d. If a fourth bank (bank D), also with a 4% stated interest rate, compounds interest continuously, how much would Ms. Martin have at the end of the third year? Does this alternative change your recommendation in part **c**? Explain why or why not.

LG3

ST 4–2 **Future values of annuities** Ramesh Abdul wishes to choose the better of two equally costly cash flow streams: annuity X and annuity Y. X is an *annuity due* with a cash inflow of $9,000 for each of 6 years. Y is an *ordinary annuity* with a cash inflow of $10,000 for each of 6 years. Assume that Ramesh can earn 15% on his investments.

a. On a purely subjective basis, which annuity do you think is more attractive? Why?

b. Find the future value at the end of year 6, FVA_6, for both annuity X and annuity Y.

c. Use your finding in part **b** to indicate which annuity is more attractive. Why? Compare your finding to your subjective response in part **a.**

LG2 LG3 LG4

ST 4–3 **Present values of single amounts and streams** You have a choice of accepting either of two 5-year cash flow streams or single amounts. One cash flow stream is an ordinary annuity, and the other is a mixed stream. You may accept alternative A or B—either as a cash flow stream or as a single amount. Given the cash flow stream and single amounts associated with each (see the accompanying table), and assuming a 9% opportunity cost, which alternative (A or B) and in which form (cash flow stream or single amount) would you prefer?

	Cash flow stream	
End of year	Alternative A	Alternative B
1	$700	$1,100
2	700	900
3	700	700
4	700	500
5	700	300
	Single amount	
At time zero	$2,825	$2,800

LG6 **ST 4–4** **Deposits needed to accumulate a future sum** Judi Janson wishes to accumulate $8,000 by the end of 5 years by making equal annual end-of-year deposits over the next 5 years. If Judi can earn 7% on her investments, how much must she deposit at the *end of each year* to meet this goal?

PROBLEMS

LG1 **4–1** **Using a time line** The financial manager at Starbuck Industries is considering an investment that requires an initial outlay of $25,000 and is expected to result in cash inflows of $3,000 at the end of year 1, $6,000 at the end of years 2 and 3, $10,000 at the end of year 4, $8,000 at the end of year 5, and $7,000 at the end of year 6.

a. Draw and label a time line depicting the cash flows associated with Starbuck Industries' proposed investment.

b. Use arrows to demonstrate, on the time line in part **a,** how compounding to find future value can be used to measure all cash flows at the end of year 6.

c. Use arrows to demonstrate, on the time line in part **b,** how discounting to find present value can be used to measure all cash flows at time zero.

d. Which of the approaches—future value or present value—do financial managers rely on most often for decision making? Why?

LG2 **4–2** **Future value calculation** *Without referring to tables or to the preprogrammed function on your financial calculator,* use the basic formula for future value along with the given interest rate, *i,* and the number of periods, *n,* to calculate the future value interest factor in each of the cases shown in the following table. Compare the calculated value to the value in Appendix Table A–1.

Case	Interest rate, i	Number of periods, n
A	12%	2
B	6	3
C	9	2
D	3	4

LG2 **4–3** **Future value tables** Use the future value interest factors in Appendix Table A–1 in each of the cases shown in the following table to estimate, to the nearest year, how long it would take an initial deposit, assuming no withdrawals,

a. To double.

b. To quadruple.

Case	Interest rate
A	7%
B	40
C	20
D	10

LG2 **4–4 Future values** For each of the cases shown in the following table, calculate the future value of the single cash flow deposited today that will be available at the end of the deposit period if the interest is compounded annually at the rate specified over the given period.

Case	Single cash flow	Interest rate	Deposit period (years)
A	$ 200	5%	20
B	4,500	8	7
C	10,000	9	10
D	25,000	10	12
E	37,000	11	5
F	40,000	12	9

LG2 **4–5 Future value** You have $1,500 to invest today at 7% interest compounded annually.

a. Find how much you will have accumulated in the account at the end of (1) 3 years, (2) 6 years, and (3) 9 years.
b. Use your findings in part **a** to calculate the amount of interest earned in (1) the first 3 years (years 1 to 3), (2) the second 3 years (years 4 to 6), and (3) the third 3 years (years 7 to 9).
c. Compare and contrast your findings in part **b.** Explain why the amount of interest earned increases in each succeeding 3-year period.

LG2 **4–6 Inflation and future value** As part of your financial planning, you wish to purchase a new car exactly 5 years from today. The car you wish to purchase costs $14,000 today, and your research indicates that its price will increase by 2% to 4% per year over the next 5 years.

a. Estimate the price of the car at the end of 5 years if inflation is (1) 2% per year, and (2) 4% per year.
b. How much more expensive will the car be if the rate of inflation is 4% rather than 2%?

LG2 **4–7 Future value and time** You can deposit $10,000 into an account paying 9% annual interest either today or exactly 10 years from today. How much better off will you be at the end of 40 years if you decide to make the initial deposit today rather than 10 years from today?

LG2 **4–8 Future value calculation** Misty need to have $15,000 at the end of 5 years in order to fulfill her goal of purchasing a small sailboat. She is willing to invest the funds as a single amount today but wonders what sort of investment return she will need to earn. Use your calculator or the time value tables to figure out the approximate annually compounded rate of return needed in each of these cases:

a. Misty can invest $10,200 today.
b. Misty can invest $8,150 today.
c. Misty can invest $7,150 today.

LG2 **4–9 Single-payment loan repayment** A person borrows $200 to be repaid in 8 years with 14% annually compounded interest. The loan may be repaid at the end of any earlier year with no prepayment penalty.

a. What amount will be due if the loan is repaid at the end of year 1?

b. What is the repayment at the end of year 4?

c. What amount is due at the end of the eighth year?

LG2 **4–10 Present value calculation** *Without referring to tables or to the preprogrammed function on your financial calculator,* use the basic formula for present value, along with the given opportunity cost, i, and the number of periods, n, to calculate the present value interest factor in each of the cases shown in the accompanying table. Compare the calculated value to the table value.

Case	Opportunity cost, i	Number of periods, n
A	2%	4
B	10	2
C	5	3
D	13	2

LG2 **4–11 Present values** For each of the cases shown in the following table, calculate the present value of the cash flow, discounting at the rate given and assuming that the cash flow is received at the end of the period noted.

Case	Single cash flow	Discount rate	End of period (years)
A	$ 7,000	12%	4
B	28,000	8	20
C	10,000	14	12
D	150,000	11	6
E	45,000	20	8

LG2 **4–12 Present value concept** Answer each of the following questions.

a. What single investment made today, earning 12% annual interest, will be worth $6,000 at the end of 6 years?

b. What is the present value of $6,000 to be received at the end of 6 years if the discount rate is 12%?

c. What is the most you would pay today for a promise to repay you $6,000 at the end of 6 years if your opportunity cost is 12%?

d. Compare, contrast, and discuss your findings in parts **a** through **c.**

LG2 **4–13 Present value** Jim Nance has been offered a future payment of $500 three years from today. If his opportunity cost is 7% compounded annually, what value should he place on this opportunity today? What is the most he should pay to purchase this payment today?

LG2 **4–14 Present value** An Iowa state savings bond can be converted to $100 at maturity 6 years from purchase. If the state bonds are to be competitive with U.S. Savings Bonds, which pay 8% annual interest (compounded annually), at what price must the state sell its bonds? Assume no cash payments on savings bonds prior to redemption.

LG2 **4–15 Present value and discount rates** You just won a lottery that promises to pay you $1,000,000 exactly 10 years from today. Because the $1,000,000 payment is guaranteed by the state in which you live, opportunities exist to sell the claim today for an immediate single cash payment.

a. What is the least you will sell your claim for if you can earn the following rates of return on similar-risk investments during the 10-year period?
(1) 6%
(2) 9%
(3) 12%

b. Rework part **a** under the assumption that the $1,000,000 payment will be received in 15 rather than 10 years.

c. On the basis of your findings in parts **a** and **b,** discuss the effect of both the size of the rate of return and the time until receipt of payment on the present value of a future sum.

LG2 **4–16 Present value comparisons of single amounts** In exchange for a $20,000 payment today, a well-known company will allow you to choose *one* of the alternatives shown in the following table. Your opportunity cost is 11%.

Alternative	Single amount
A	$28,500 at end of 3 years
B	$54,000 at end of 9 years
C	$160,000 at end of 20 years

a. Find the value today of each alternative.
b. Are all the alternatives acceptable, i.e., worth $20,000 today?
c. Which alternative, if any, will you take?

LG2 **4–17 Cash flow investment decision** Tom Alexander has an opportunity to purchase any of the investments shown in the following table. The purchase price, the amount of the single cash inflow, and its year of receipt are given for each investment. Which purchase recommendations would you make, assuming that Tom can earn 10% on his investments?

Investment	Price	Single cash inflow	Year of receipt
A	$18,000	$30,000	5
B	600	3,000	20
C	3,500	10,000	10
D	1,000	15,000	40

LG3 **4–18 Future value of an annuity** For each case in the accompanying table, answer the questions that follow.

Case	Amount of annuity	Interest rate	Deposit period (years)
A	$ 2,500	8%	10
B	500	12	6
C	30,000	20	5
D	11,500	9	8
E	6,000	14	30

a. Calculate the future value of the annuity assuming that it is
(1) an ordinary annuity.
(2) an annuity due.

b. Compare your findings in parts **a**(1) and **a**(2). All else being identical, which type of annuity—ordinary or annuity due—is preferable? Explain why.

LG3 **4–19 Present value of an annuity** Consider the following cases.

Case	Amount of annuity	Interest rate	Period (years)
A	$ 12,000	7%	3
B	55,000	12	15
C	700	20	9
D	140,000	5	7
E	22,500	10	5

a. Calculate the present value of the annuity assuming that it is
(1) an ordinary due.
(2) an annuity due.

b. Compare your findings in parts **a**(1) and **a**(2). All else being identical, which type of annuity—ordinary or annuity due—is preferable? Explain why.

LG3 **4–20 Ordinary annuity versus annuity due** Marian Kirk wishes to select the better of two 10-year annuities, C and D. Annuity C is an ordinary annuity of $2,500 per year for 10 years. Annuity D is an annuity due of $2,200 per year for 10 years.

a. Find the *future value* of both annuities at the end of year 10, assuming that Marian can earn (1) 10% annual interest and (2) 20% annual interest.

b. Use your findings in part **a** to indicate which annuity has the greater future value at the end of year 10 for both the (1) 10% and (2) 20% interest rates.

c. Find the *present value* of both annuities, assuming that Marian can earn (1) 10% annual interest and (2) 20% annual interest.

d. Use your findings in part **c** to indicate which annuity has the greater present value for both (1) 10% and (2) 20% interest rates.

e. Briefly compare, contrast, and explain any differences between your findings using the 10% and 20% interest rates in parts **b** and **d**.

LG3 **4–21 Future value of a retirement annuity** Hal Thomas, a 25-year-old college graduate, wishes to retire at age 65. To supplement other sources of retirement income, he can deposit $2,000 each year into a tax-deferred individual retirement arrangement (IRA). The IRA will be invested to earn an annual return of 10%, which is assumed to be attainable over the next 40 years.

a. If Hal makes annual end-of-year $2,000 deposits into the IRA, how much will he have accumulated by the end of his 65th year?

b. If Hal decides to wait until age 35 to begin making annual end-of-year $2,000 deposits into the IRA, how much will he have accumulated by the end of his 65th year?

c. Using your findings in parts **a** and **b**, discuss the impact of delaying making deposits into the IRA for 10 years (age 25 to age 35) on the amount accumulated by the end of Hal's 65th year.

d. Rework parts **a, b,** and **c,** assuming that Hal makes all deposits at the beginning, rather than the end, of each year. Discuss the effect of beginning-of-year deposits on the future value accumulated by the end of Hal's 65th year.

LG3 **4–22 Present value of a retirement annuity** An insurance agent is trying to sell you an immediate-retirement annuity, which for a single amount paid today will provide you with $12,000 at the end of each year for the next 25 years. You currently earn 9% on low-risk investments comparable to the retirement annuity. Ignoring taxes, what is the most you would pay for this annuity?

LG2 LG3 **4–23 Funding your retirement** You plan to retire in exactly 20 years. Your goal is to create a fund that will allow you to receive $20,000 at the end of each year for the 30 years between retirement and death (a psychic told you would die after 30 years). You know that you will be able to earn 11% per year during the 30-year retirement period.

a. How large a fund will you need *when you retire* in 20 years to provide the 30-year, $20,000 retirement annuity?

b. How much will you need *today* as a single amount to provide the fund calculated in part **a** if you earn only 9% per year during the 20 years preceding retirement?

c. What effect would an increase in the rate you can earn both during and prior to retirement have on the values found in parts **a** and **b?** Explain.

LG2 LG3 **4–24 Present value of an annuity versus a single amount** Assume that you just won the state lottery. Your prize can be taken either in the form of $40,000 at the end of each of the next 25 years (i.e., $1,000,000 over 25 years) or as a single amount of $500,000 paid immediately.

a. If you expect to be able to earn 5% annually on your investments over the next 25 years, ignoring taxes and other considerations, which alternative should you take? Why?

b. Would your decision in part **a** change if you could earn 7% rather than 5% on your investments over the next 25 years? Why?

c. On a strictly economic basis, at approximately what earnings rate would you be indifferent between the two plans?

LG3 **4–25 Perpetuities** Consider the data in the following table.

Perpetuity	Annual amount	Discount rate
A	$ 20,000	8%
B	100,000	10
C	3,000	6
D	60,000	5

Determine, for each of the perpetuities:

a. The appropriate present value interest factor.

b. The present value.

LG3 **4–26 Creating an endowment** Upon completion of her introductory finance course, Marla Lee was so pleased with the amount of useful and interesting knowledge she gained that she convinced her parents, who were wealthy alums of the university she was attending, to create an endowment. The endowment is to allow three needy students to take the introductory finance course each year in perpetuity. The guaranteed annual cost of tuition and books for the course is $600 per student. The endowment will be created by making a single payment to the university. The university expects to earn exactly 6% per year on these funds.

a. How large an initial single payment must Marla's parents make to the university to fund the endowment?

b. What amount would be needed to fund the endowment if the university could earn 9% rather than 6% per year on the funds?

LG4 **4–27 Future value of a mixed stream** For each of the mixed streams of cash flows shown in the following table, determine the future value at the end of the final year if deposits are made into an account paying annual interest of 12%, assuming that no withdrawals are made during the period and that the deposits are made:

a. At the *end* of each year.

b. At the *beginning* of each year.

	Cash flow stream		
Year	A	B	C
1	$ 900	$30,000	$1,200
2	1,000	25,000	1,200
3	1,200	20,000	1,000
4		10,000	1,900
5		5,000	

LG4 **4–28 Future value of a single amount versus a mixed stream** Gina Vitale has just contracted to sell a small parcel of land that she inherited a few years ago. The buyer is willing to pay $24,000 at the closing of the transaction or will pay the amounts shown in the following table at the *beginning* of each of the next

5 years. Because Gina doesn't really need the money today, she plans to let it accumulate in an account that earns 7% annual interest. Given her desire to buy a house at the end of 5 years after closing on the sale of the lot, she decides to choose the payment alternative—$24,000 single amount or the mixed stream of payments in the following table—that provides the higher future value at the end of 5 years. Which alternative will she choose?

Mixed stream	
Beginning of year	Cash flow
1	$ 2,000
2	4,000
3	6,000
4	8,000
5	10,000

LG4 **4–29 Present value—Mixed streams** Find the present value of the streams of cash flows shown in the following table. Assume that the firm's opportunity cost is 12%.

A		B		C	
Year	Cash flow	Year	Cash flow	Year	Cash flow
1	−$2,000	1	$10,000	1–5	$10,000/yr
2	3,000	2–5	5,000/yr	6–10	8,000/yr
3	4,000	6	7,000		
4	6,000				
5	8,000				

LG4 **4–30 Present value—Mixed streams** Consider the mixed streams of cash flows shown in the following table.

	Cash flow stream	
Year	A	B
1	$ 50,000	$ 10,000
2	40,000	20,000
3	30,000	30,000
4	20,000	40,000
5	10,000	50,000
Totals	$150,000	$150,000

a. Find the present value of each stream using a 15% discount rate.
b. Compare the calculated present values and discuss them in light of the fact that the undiscounted cash flows total $150,000 in each case.

LG1 LG4 **4–31 Present value of a mixed stream** Harte Systems, Inc., a maker of electronic surveillance equipment, is considering selling to a well-known hardware chain the rights to market its home security system. The proposed deal calls for payments of \$30,000 and \$25,000 at the end of years 1 and 2 and for annual year-end payments of \$15,000 in years 3 through 9. A final payment of \$10,000 would be due at the end of year 10.

a. Lay out the cash flows involved in the offer on a time line.
b. If Harte applies a required rate of return of 12% to them, what is the present value of this series of payments?
c. A second company has offered Harte a one-time payment of \$100,000 for the rights to market the home security system. Which offer should Harte accept?

LG4 **4–32 Funding budget shortfalls** As part of your personal budgeting process, you have determined that in each of the next 5 years you will have budget shortfalls. In other words, you will need the amounts shown in the following table at the end of the given year to balance your budget—that is, to make inflows equal outflows. You expect to be able to earn 8% on your investments during the next 5 years and wish to fund the budget shortfalls over the next 5 years with a single amount.

End of year	Budget shortfall
1	\$ 5,000
2	4,000
3	6,000
4	10,000
5	3,000

a. How large must the single deposit today into an account paying 8% annual interest be to provide for full coverage of the anticipated budget shortfalls?
b. What effect would an increase in your earnings rate have on the amount calculated in part **a?** Explain.

LG4 **4–33 Relationship between future value and present value—Mixed stream** Using *only* the information in the accompanying table, answer the questions that follow.

Year (t)	Cash flow	Future value interest factor at 5% ($FVIF_{5\%,t}$)
1	\$ 800	1.050
2	900	1.102
3	1,000	1.158
4	1,500	1.216
5	2,000	1.276

a. Determine the *present value* of the mixed stream of cash flows using a 5% discount rate.
b. How much would you be willing to pay for an opportunity to buy this stream, assuming that you can at best earn 5% on your investments?
c. What effect, if any, would a 7% rather than a 5% opportunity cost have on your analysis? (Explain verbally.)

LG5 **4–34 Changing compounding frequency** Using annual, semiannual, and quarterly compounding periods, for each of the following: (1) Calculate the future value if $5,000 is initially deposited, and (2) determine the *effective annual rate* (*EAR*).
a. At 12% annual interest for 5 years.
b. At 16% annual interest for 6 years.
c. At 20% annual interest for 10 years.

LG5 **4–35 Compounding frequency, future value, and effective annual rates** For each of the cases in the following table:
a. Calculate the future value at the end of the specified deposit period.
b. Determine the *effective annual rate, EAR*.
c. Compare the nominal annual rate, *i*, to the effective annual rate, EAR. What relationship exists between compounding frequency and the nominal and effective annual rates.

Case	Amount of initial deposit	Nominal annual rate, *i*	Compounding frequency, *m* (times/year)	Deposit period (years)
A	$ 2,500	6%	2	5
B	50,000	12	6	3
C	1,000	5	1	10
D	20,000	16	4	6

LG5 **4–36 Continuous compounding** For each of the cases in the following table, find the future value at the end of the deposit period, assuming that interest is compounded continuously at the given nominal annual rate.

Case	Amount of initial deposit	Nominal annual rate, *i*	Deposit period (years), *n*
A	$1,000	9%	2
B	600	10	10
C	4,000	8	7
D	2,500	12	4

LG5 **4–37 Compounding frequency and future value** You plan to invest $2,000 in an individual retirement arrangement (IRA) today at a *nominal annual rate* of 8%, which is expected to apply to all future years.

a. How much will you have in the account at the end of 10 years if interest is compounded (1) annually? (2) semiannually? (3) daily (assume a 360-day year)? (4) continuously?

b. What is the *effective annual rate, EAR,* for each compounding period in part **a?**

c. How much greater will your IRA account balance be at the end of 10 years if interest is compounded continuously rather than annually?

d. How does the compounding frequency affect the future value and effective annual rate for a given deposit? Explain in terms of your findings in parts **a** through **c.**

LG5 **4–38 Comparing compounding periods** René Levin wishes to determine the future value at the end of 2 years of a $15,000 deposit made today into an account paying a nominal annual rate of 12%.

a. Find the future value of René's deposit, assuming that interest is compounded (1) annually, (2) quarterly, (3) monthly, and (4) continuously.

b. Compare your findings in part **a,** and use them to demonstrate the relationship between compounding frequency and future value.

c. What is the maximum future value obtainable given the $15,000 deposit, the 2-year time period, and the 12% nominal annual rate? Use your findings in part **a** to explain.

LG3 LG5 **4–39 Annuities and compounding** Janet Boyle intends to deposit $300 per year in a credit union for the next 10 years, and the credit union pays an annual interest rate of 8%.

a. Determine the future value that Janet will have at the end of 10 years, given that end-of-period deposits are made and no interest is withdrawn, if

(1) $300 is deposited annually and the credit union pays interest annually.

(2) $150 is deposited semiannually and the credit union pays interest semiannually.

(3) $75 is deposited quarterly and the credit union pays interest quarterly.

b. Use your finding in part **a** to discuss the effect of more frequent deposits and compounding of interest on the future value of an annuity.

LG6 **4–40 Deposits to accumulate future sums** For each of the cases shown in the following table, determine the amount of the equal annual end-of-year deposits necessary to accumulate the given sum at the end of the specified period, assuming the stated annual interest rate.

Case	Sum to be accumulated	Accumulation period (years)	Interest rate
A	$ 5,000	3	12%
B	100,000	20	7
C	30,000	8	10
D	15,000	12	8

LG6 **4–41 Creating a retirement fund** To supplement your planned retirement in exactly 42 years, you estimate that you need to accumulate $220,000 by the end of

42 years from today. You plan to make equal annual end-of-year deposits into an account paying 8% annual interest.

a. How large must the annual deposits be to create the $220,000 fund by the end of 42 years?

b. If you can afford to deposit only $600 per year into the account, how much will you have accumulated by the end of the 42nd year?

LG6 **4–42** **Accumulating a growing future sum** A retirement home at Deer Trail Estates now costs $85,000. Inflation is expected to cause this price to increase at 6% per year over the 20 years before C. L. Donovan retires. How large an equal annual end-of-year deposit must be made each year into an account paying an annual interest rate of 10% for Donovan to have the cash to purchase a home at retirement?

LG3 LG6 **4–43** **Deposits to create a perpetuity** You have decided to endow your favorite university with a scholarship. It is expected to cost $6,000 per year to attend the university into perpetuity. You expect to give the university the endowment in 10 years and will accumulate it by making annual (end-of-year) deposits into an account. The rate of interest is expected to be 10% for all future time periods.

a. How large must the endowment be?

b. How much must you deposit at the end of each of the next 10 years to accumulate the required amount?

LG2 LG3 LG6 **4–44** **Inflation, future value, and annual deposits** While vacationing in Florida, John Kelley saw the vacation home of his dreams. It was listed with a sale price of $200,000. The only catch is that John is 40 years old and plans to continue working until he is 65. Still, he believes that prices generally increase at the overall rate of inflation. John believes that he can earn 9% annually after taxes on his investments. He is willing to invest a fixed amount at the end of each of the next 25 years to fund the cash purchase of such a house (one that can be purchased today for $200,000) when he retires.

a. Inflation is expected to average 5% a year for the next 25 years. What will John's dream house cost when he retires?

b. How much must John invest at the end of each of the next 25 years in order to have the cash purchase price of the house when he retires?

c. If John invests at the beginning instead of at the end of each of the next 25 years, how much must he invest each year?

LG6 **4–45** **Loan payment** Determine the equal annual end-of-year payment required each year, over the life of the loans shown in the following table, to repay them fully during the stated term of the loan.

Loan	Principal	Interest rate	Term of loan (years)
A	$12,000	8%	3
B	60,000	12	10
C	75,000	10	30
D	4,000	15	5

LG6 **4–46 Loan amortization schedule** Joan Messineo borrowed $15,000 at a 14% annual rate of interest to be repaid over 3 years. The loan is amortized into three equal annual end-of-year payments.

a. Calculate the annual end-of-year loan payment.

b. Prepare a loan amortization schedule showing the interest and principal breakdown of each of the three loan payments.

c. Explain why the interest portion of each payment declines with the passage of time.

LG6 **4–47 Loan interest deductions** Liz Rogers just closed a $10,000 business loan that is to be repaid in three equal annual end-of-year payments. The interest rate on the loan is 13%. As part of her firm's detailed financial planning, Liz wishes to determine the annual interest deduction attributable to the loan. (Because it is a business loan, the interest portion of each loan payment is tax-deductible to the business.)

a. Determine the firm's annual loan payment.

b. Prepare an amortization schedule for the loan.

c. How much interest expense will Liz's firm have in *each* of the next 3 years as a result of this loan?

LG6 **4–48 Monthly loan payments** Tim Smith is shopping for a used car. He has found one priced at $4,500. The dealer has told Tim that if he can come up with a down payment of $500, the dealer will finance the balance of the price at a 12% annual rate over 2 years (24 months).

a. Assuming that Tim accepts the dealer's offer, what will his *monthly* (end-of-month) payment amount be?

b. Use a financial calculator or Equation 4.15a (found in footnote 9) to help you figure out what Tim's *monthly* payment would be if the dealer were willing to finance the balance of the car price at a 9% yearly rate.

LG6 **4–49 Growth rates** You are given the series of cash flows shown in the following table.

	Cash flows		
Year	A	B	C
1	$500	$1,500	$2,500
2	560	1,550	2,600
3	640	1,610	2,650
4	720	1,680	2,650
5	800	1,760	2,800
6		1,850	2,850
7		1,950	2,900
8		2,060	
9		2,170	
10		2,280	

a. Calculate the compound annual growth rate associated with each cash flow stream.

b. If year-1 values represent initial deposits in a savings account paying annual interest, what is the annual rate of interest earned on each account?

c. Compare and discuss the growth rate and interest rate found in parts **a** and **b**, respectively.

LG6 **4–50 Rate of return** Rishi Singh has $1,500 to invest. His investment counselor suggests an investment that pays no stated interest but will return $2,000 at the end of 3 years.

a. What annual rate of return will Mr. Singh earn with this investment?

b. Mr. Singh is considering another investment, of equal risk, that earns an annual return of 8%. Which investment should he make, and why?

LG6 **4–51 Rate of return and investment choice** Clare Jaccard has $5,000 to invest. Because she is only 25 years old, she is not concerned about the length of the investment's life. What she is sensitive to is the rate of return she will earn on the investment. With the help of her financial advisor, Clare has isolated the four equally risky investments, each providing a single amount at the end of its life, as shown in the following table. All of the investments require an initial $5,000 payment.

Investment	Single amount	Investment life (years)
A	$ 8,400	6
B	15,900	15
C	7,600	4
D	13,000	10

a. Calculate, to the nearest 1%, the rate of return on each of the four investments available to Clare.

b. Which investment would you recommend to Clare, given her goal of maximizing the rate of return?

LG6 **4–52 Rate of return—Annuity** What is the rate of return on an investment of $10,606 if the company will receive $2,000 each year for the next 10 years?

LG6 **4–53 Choosing the best annuity** Raina Herzig wishes to choose the best of four immediate-retirement annuities available to her. In each case, in exchange for paying a single premium today, she will receive equal annual end-of-year cash benefits for a specified number of years. She considers the annuities to be equally risky and is not concerned about their differing lives. Her decision will be based solely on the rate of return she will earn on each annuity. The key terms of each of the four annuities are shown in the following table.

Annuity	Premium paid today	Annual benefit	Life (years)
A	$30,000	$3,100	20
B	25,000	3,900	10
C	40,000	4,200	15
D	35,000	4,000	12

a. Calculate to the nearest 1% the rate of return on each of the four annuities Raina is considering.
b. Given Raina's stated decision criterion, which annuity would you recommend?

LG6 **4–54 Interest rate for an annuity** Anna Waldheim was seriously injured in an industrial accident. She sued the responsible parties and was awarded a judgment of \$2,000,000. Today, she and her attorney are attending a settlement conference with the defendants. The defendants have made an initial offer of \$156,000 per year for 25 years. Anna plans to counteroffer at \$255,000 per year for 25 years. Both the offer and the counteroffer have a present value of \$2,000,000, the amount of the judgment. Both assume payments at the end of each year.
a. What interest rate assumption have the defendants used in their offer (rounded to the nearest whole percent)?
b. What interest rate assumption have Anna and her lawyer used in their counteroffer (rounded to the nearest whole percent)?
c. Anna is willing to settle for an annuity that carries an interest rate assumption of 9%. What annual payment would be acceptable to her?

LG6 **4–55 Loan rates of interest** John Flemming has been shopping for a loan to finance the purchase of a used car. He has found three possibilities that seem attractive and wishes to select the one with the lowest interest rate. The information available with respect to each of the three \$5,000 loans is shown in the following table.

Loan	Principal	Annual payment	Term (years)
A	\$5,000	\$1,352.81	5
B	5,000	1,543.21	4
C	5,000	2,010.45	3

a. Determine the interest rate associated with each of the loans.
b. Which loan should Mr. Flemming take?

LG6 **4–56 Number of years—Single amounts** For each of the following cases, determine the number of years it will take for the initial deposit to grow to equal the future amount at the given interest rate.

Case	Initial deposit	Future amount	Interest rate
A	\$ 300	\$ 1,000	7%
B	12,000	15,000	5
C	9,000	20,000	10
D	100	500	9
E	7,500	30,000	15

LG6 **4–57 Time to accumulate a given sum** Manuel Rios wishes to determine how long it will take an initial deposit of $10,000 to double.

a. If Manuel earns 10% annual interest on the deposit, how long will it take for him to double his money?

b. How long will it take if he earns only 7% annual interest?

c. How long will it take if he can earn 12% annual interest?

d. Reviewing your findings in parts **a, b,** and **c,** indicate what relationship exists between the interest rate and the amount of time it will take Manuel to double his money?

LG6 **4–58 Number of years—Annuities** In each of the following cases, determine the number of years that the given annual *end-of-year* cash flow must continue in order to provide the given rate of return on the given initial amount.

Case	Initial amount	Annual cash flow	Rate of return
A	$ 1,000	$ 250	11%
B	150,000	30,000	15
C	80,000	10,000	10
D	600	275	9
E	17,000	3,500	6

LG6 **4–59 Time to repay installment loan** Mia Salto wishes to determine how long it will take to repay a loan with initial proceeds of $14,000 where annual *end-of-year* installment payments of $2,450 are required.

a. If Mia can borrow at a 12% annual rate of interest, how long will it take for her to repay the loan fully?

b. How long will it take if she can borrow at a 9% annual rate?

c. How long will it take if she has to pay 15% annual interest?

d. Reviewing your answers in parts **a, b,** and **c,** describe the general relationship between the interest rate and the amount of time it will take Mia to repay the loan fully.

CHAPTER 4 CASE Finding Jill Moran's Retirement Annuity

Sunrise Industries wishes to accumulate funds to provide a retirement annuity for its vice president of research, Jill Moran. Ms. Moran by contract will retire at the end of exactly 12 years. Upon retirement, she is entitled to receive an annual end-of-year payment of $42,000 for exactly 20 years. If she dies prior to the end of the 20-year period, the annual payments will pass to her heirs. During the 12-year "accumulation period" Sunrise wishes to fund the annuity by making equal annual end-of-year deposits into an account earning 9% interest. Once the 20-year "distribution period" begins, Sunrise plans to move the accumulated monies into an account earning a guaranteed 12% per year. At the end of the distribution period, the account balance will equal zero. Note that the first deposit will be made at the end of year 1 and that the first distribution payment will be received at the end of year 13.

Required

a. Draw a time line depicting all of the cash flows associated with Sunrise's view of the retirement annuity.

b. How large a sum must Sunrise accumulate by the end of year 12 to provide the 20-year, $42,000 annuity?

c. How large must Sunrise's equal annual end-of-year deposits into the account be over the 12-year accumulation period to fund fully Ms. Moran's retirement annuity?

d. How much would Sunrise have to deposit annually during the accumulation period if it could earn 10% rather than 9% during the accumulation period?

e. How much would Sunrise have to deposit annually during the accumulation period if Ms. Moran's retirement annuity were a perpetuity and all other terms were the same as initially described?

WEB EXERCISE

Go to Web site *www.arachnoid.com/lutusp/finance_old.html*. Page down to the portion of this screen that contains the financial calculator.

1. To determine the FV of a fixed amount, enter the following:

   Into **PV**, enter −1000; into **np**, enter 1; into **pmt**, enter 0; and, into **ir**, enter 8.

   Now click on **Calculate FV**, and 1080.00 should appear in the **FV** window.

2. Determine FV for each of the following compounding periods by changing *only* the following:
   a. **np** to 2, and **ir** to 8/2
   b. **np** to 12, and **ir** to 8/12
   c. **np** to 52, and **ir** to 8/52

3. To determine the PV of a fixed amount, enter the following:

   Into **FV**, 1080; into **np**, 1; into **pmt**, 0; and, into **ir**, 8. Now click on **Calculate PV**. What is the PV?

4. To determine the FV of an annuity, enter the following:

   Into **PV**, 0; into **FV**, 0; into **np**, 12; into **pmt**, 1000; and, into **ir**, 8. Now click on **Calculate FV**. What is the FV?

5. To determine the **PV** of an annuity, change only the **FV** setting to 0; keep the other entries the same as in question 4. Click on **Calculate PV**. What is the PV?
6. Check your answers for questions 4 and 5 by using the techniques discussed in this chapter.

Go to Web site *www.homeowners.com/*. Click on **Calculators** in the left column. Click on **Mortgage Calculator**.

7. Enter the following into the mortgage calculator: **Loan amount**, 100000; **duration in years**, 30; and **interest rate**, 10. Click on **compute payment**. What is the monthly payment?
8. Calculate the monthly payment for $100,000 loans for 30 years at 8%, 6%, 4%, and 2%.
9. Calculate the monthly payment for $100,000 loans at 8% for 30 years, 20 years, 10 years, and 5 years.

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

CHAPTER

5 RISK AND RETURN

LEARNING GOALS

LG1 Understand the meaning and fundamentals of risk, return, and risk preferences.

LG2 Describe procedures for assessing and measuring the risk of a single asset.

LG3 Discuss the measurement of return and standard deviation for a portfolio and the various types of correlation that can exist between series of numbers.

LG4 Understand the risk and return characteristics of a portfolio in terms of correlation and diversification, and the impact of international assets on a portfolio.

LG5 Review the two types of risk and the derivation and role of beta in measuring the relevant risk of both an individual security and a portfolio.

LG6 Explain the capital asset pricing model (CAPM), its relationship to the security market line (SML), and shifts in the SML caused by changes in inflationary expectations and risk aversion.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand the relationship between risk and return because of the effect that riskier projects will have on the firm's annual net income and on your efforts to stabilize net income.

Information systems: You need to understand how to do sensitivity and correlation analyses in order to build decision packages that help management analyze the risk and return of various business opportunities.

Management: You need to understand the relationship between risk and return, and how to measure that relationship in order to evaluate data that come from finance personnel and translate those data into decisions that increase the value of the firm.

Marketing: You need to understand that although higher-risk projects may produce higher returns, they may not be the best choice for the firm if they produce an erratic earnings pattern and do not optimize the value of the firm.

Operations: You need to understand how investments in plant assets and purchases of supplies will be measured by the firm and to recognize that decisions about such investments will be made by evaluating the effects of both risk and return on the value of the firm.

CITIGROUP

Citigroup Takes on New Associates

As they chased after hot new financial services businesses that boosted earnings quickly, many banks ignored a key principle of risk management: Diversification reduces risk. They expanded into risky areas such as investment banking, stock brokerage, wealth management, and equity investment, and they moved away from their traditional services such as mortgage banking, auto financing, and credit cards. Although adding new business lines is a way to diversify, the benefits of diversification come from balancing low-risk and high-risk activities. As the economy changed, banks ran into problems with these new, higher-risk services. Banks that had “hedged their bets” by continuing to offer a variety of services spread across the risk spectrum earned higher returns.

Citigroup is a case study for the benefits of diversification. The company, created in 1998 by the merger of Citicorp and Travelers Group, provides a broad range of financial products and services to 100 million consumers, corporations, governments, and institutions in over 100 countries. These offerings include consumer banking and credit, corporate and investment banking, commercial finance, leasing, insurance, securities brokerage, and asset management. Under the leadership of Citigroup CEO Sandy Weill, the company made acquisitions that reduced its dependence on corporate and investment banking. In September 2000, Citigroup bought **Associates First Capital Corp** for $31 billion.

With the acquisition of Associates, Citigroup shifted the balance of its business more toward consumers than toward institutions. Associates’s target market is the lower-middle economic class. Although these customers are riskier than the traditional bank customer, the rewards are greater too, because Associates can charge higher interest rates and fees to compensate itself for taking on the additional risk. The existing consumer finance businesses of both Associates and Citigroup know how to handle this type of lending and earn solid returns in the process.

A more diversified group of businesses with greater emphasis on the consumer side should reduce Citigroup’s earnings volatility and improve shareholder value. Commenting in spring 2001 on the corporation’s ability to weather the current economic downturn, Weill said, “The strength and diversity of our earnings by business, geography, and customer helped to deliver a strong bottom line in a period of market uncertainty.” Citigroup’s return on equity (ROE) for the first quarter 2001 was 22.5 percent, just above fiscal year 2000’s 22.4 percent and better than its average ROE of 19 percent for the period 1998 to 2000.

Citigroup and its consumer business units demonstrate several key fundamental financial concepts: Risk and return are linked, return should increase if risk increases, and diversification reduces risk. As this chapter will show, firms can use various tools and techniques to quantify and assess the risk and return for individual assets and for groups of assets.

LG1 5.1 Risk and Return Fundamentals

portfolio
A collection, or group, of assets.

To maximize share price, the financial manager must learn to assess two key determinants: risk and return.[1] Each financial decision presents certain risk and return characteristics, and the unique combination of these characteristics has an impact on share price. Risk can be viewed as it is related either to a single asset or to a **portfolio**—a collection, or group, of assets. We will look at both, beginning with the risk of a single asset. First, though, it is important to introduce some fundamental ideas about risk, return, and risk preferences.

Risk Defined

risk
The chance of financial loss or, more formally, the *variability of returns associated with a given asset.*

In the most basic sense, **risk** is the chance of financial loss. Assets having greater chances of loss are viewed as more risky than those with lesser chances of loss. More formally, the term *risk* is used interchangeably with *uncertainty* to refer to the *variability of returns associated with a given asset.* A $1,000 government bond that guarantees its holder $100 interest after 30 days has no risk, because there is no variability associated with the return. A $1,000 investment in a firm's common stock, which over the same period may earn anywhere from $0 to $200, is very risky because of the high variability of its return. The more nearly certain the return from an asset, the less variability and therefore the less risk.

Some risks directly affect both financial managers and shareholders. Table 5.1 briefly describes the common sources of risk that affect both firms and their shareholders. As you can see, business risk and financial risk are more firm-specific and therefore are of greatest interest to financial managers. Interest rate, liquidity, and market risks are more shareholder-specific and therefore are of greatest interest to stockholders. Event, exchange rate, purchasing-power, and tax risk directly affect both firms and shareholders. The nearby box focuses on another risk that affects both firms and shareholders—moral risk. A number of these risks are discussed in more detail later in this text. Clearly, both financial managers and shareholders must assess these and other risks as they make investment decisions.

Return Defined

return
The total gain or loss experienced on an investment over a given period of time; calculated by dividing the asset's cash distributions during the period, plus change in value, by its beginning-of-period investment value.

Obviously, if we are going to assess risk on the basis of variability of return, we need to be certain we know what *return* is and how to measure it. The **return** is the total gain or loss experienced on an investment over a given period of time. It is commonly measured as cash distributions during the period plus the change in value, expressed as a percentage of the beginning-of-period investment value. The expression for calculating the rate of return earned on any asset over period t, k_t, is commonly defined as

$$k_t = \frac{C_t + P_t - P_{t-1}}{P_{t-1}} \tag{5.1}$$

1. Two important points should be recognized here: (1) Although for convenience the publicly traded corporation is being discussed, the risk and return concepts presented apply to all firms; and (2) concern centers only on the wealth of common stockholders, because they are the "residual owners" whose returns are in no way specified in advance.

TABLE 5.1 Popular Sources of Risk Affecting Financial Managers and Shareholders

Source of risk	Description
Firm-Specific Risks	
Business risk	The chance that the firm will be unable to cover its operating costs. Level is driven by the firm's revenue stability and the structure of its operating costs (fixed vs. variable).
Financial risk	The chance that the firm will be unable to cover its financial obligations. Level is driven by the predictability of the firm's operating cash flows and its fixed-cost financial obligations.
Shareholder-Specific Risks	
Interest rate risk	The chance that changes in interest rates will adversely affect the value of an investment. Most investments lose value when the interest rate rises and increase in value when it falls.
Liquidity risk	The chance that an investment cannot be easily liquidated at a reasonable price. Liquidity is significantly affected by the size and depth of the market in which an investment is customarily traded.
Market risk	The chance that the value of an investment will decline because of market factors that are independent of the investment (such as economic, political, and social events). In general, the more a given investment's value responds to the market, the greater its risk; and the less it responds, the smaller its risk.
Firm and Shareholder Risks	
Event risk	The chance that a totally unexpected event will have a significant effect on the value of the firm or a specific investment. These infrequent events, such as government-mandated withdrawal of a popular prescription drug, typically affect only a small group of firms or investments.
Exchange rate risk	The exposure of future expected cash flows to fluctuations in the currency exchange rate. The greater the chance of undesirable exchange rate fluctuations, the greater the risk of the cash flows and therefore the lower the value of the firm or investment.
Purchasing-power risk	The chance that changing price levels caused by inflation or deflation in the economy will adversely affect the firm's or investment's cash flows and value. Typically, firms or investments with cash flows that move with general price levels have a low purchasing-power risk, and those with cash flows that do not move with general price levels have high purchasing-power risk.
Tax risk	The chance that unfavorable changes in tax laws will occur. Firms and investments with values that are sensitive to tax law changes are more risky.

where

$k_t =$ actual,expected, or required rate of return[2] during period t
$C_t =$ cash (flow) received from the asset investment in the time period $t-1$ to t
$P_t =$ price (value) of asset at time t
$P_{t-1} =$ price (value) of asset at time $t-1$

2. The terms *expected return* and *required return* are used interchangeably throughout this text, because in an efficient market (discussed later) they would be expected to be equal. The actual return is an *ex post* value, whereas expected and required returns are *ex ante* values. Therefore, the actual return may be greater than, equal to, or less than the expected/required return.

In Practice

FOCUS ON ETHICS What About Moral Risk?

The poster boy for "moral risk," the devastating effects of unethical behavior for a company's investors, has to be Nick Leeson. This 28-year-old trader violated his bank's investing rules while secretly placing huge bets on the direction of the Japanese stock market. When those bets proved to be wrong, the $1.24-billion losses resulted in the demise of the centuries-old **Barings Bank**.

More than any other single episode in world financial history, Leeson's misdeeds underscored the importance of character in the financial industry. Forty-one percent of surveyed CFOs admit ethical problems in their organizations (self-reported percents are probably low), and 48 percent of surveyed employees admit to engaging in unethical practices such as cheating on expense accounts and forging signatures. We are reminded again that shareholder wealth maximization has to be ethically constrained.

What can companies do to instill and maintain ethical corporate practices? They can start by building awareness through a code of ethics. Nearly all Fortune 500 companies and about half of all companies have an ethics code spelling out general principles of right and wrong conduct. Companies such as **Halliburton** and **Texas Instruments** have gone into specifics, because ethical codes are often faulted for being too vague and abstract.

Ethical organizations also reveal their commitments through the following activities: talking about ethical values periodically; including ethics in required training for mid-level managers (as at **Procter & Gamble**); modeling ethics throughout top management and the board (termed "tone at the top," especially notable at **Johnson & Johnson**); promoting openness for employees with concerns; weeding out employees who do not share the company's ethics values before those employees can harm the company's reputation or culture; assigning an individual the role of ethics director; and evaluating leaders' ethics in performance reviews (as at **Merck & Co.**).

The Leeson saga underscores the difficulty of dealing with the "moral hazard" problem, when the consequences of an individual's actions are largely borne by others. John Boatright argues in his book *Ethics in Finance* that the best antidote is to attract loyal, hardworking employees. Ethicists Rae and Wong tell us that debating issues is fruitless if we continue to ignore the character traits that empower people for moral behavior.

The return, k_t, reflects the combined effect of cash flow, C_t, and changes in value, $P_t - P_{t-1}$, over period t.[3]

Equation 5.1 is used to determine the rate of return over a time period as short as 1 day or as long as 10 years or more. However, in most cases, t is 1 year, and k therefore represents an annual rate of return.

EXAMPLE Robin's Gameroom, a high-traffic video arcade, wishes to determine the return on two of its video machines, Conqueror and Demolition. Conqueror was purchased 1 year ago for $20,000 and currently has a market value of $21,500. During the year, it generated $800 of after-tax cash receipts. Demolition was purchased 4 years ago; its value in the year just completed declined from $12,000 to $11,800. During the year, it generated $1,700 of after-tax cash receipts. Substi-

3. The beginning-of-period value, P_{t-1}, and the end-of-period value, P_t, are not necessarily *realized values*. They are often *unrealized*, which means that although the asset was *not* actually purchased at time $t-1$ and sold at time t, values P_{t-1} and P_t *could* have been realized had those transactions been made.

tuting into Equation 5.1, we can calculate the annual rate of return, k, for each video machine.

Conqueror (C):

$$k_C = \frac{\$800 + \$21{,}500 - \$20{,}000}{\$20{,}000} = \frac{\$2{,}300}{\$20{,}000} = \underline{\underline{11.5}}\%$$

Demolition (D):

$$k_D = \frac{\$1{,}700 + \$11{,}800 - \$12{,}000}{\$12{,}000} = \frac{\$1{,}500}{\$12{,}000} = \underline{\underline{12.5}}\%$$

Although the market value of Demolition declined during the year, its cash flow caused it to earn a higher rate of return than Conqueror earned during the same period. Clearly, the combined impact of cash flow and changes in value, measured by the rate of return, is important.

Historical Returns

Investment returns vary both over time and between different types of investments. By averaging historical returns over a long period of time, it is possible to eliminate the impact of market and other types of risk. This enables the financial decision maker to focus on the differences in return that are attributable primarily to the types of investment. Table 5.2 shows the average annual rates of return for a number of popular security investments (and inflation) over the 75-year period January 1, 1926, through December 31, 2000. Each rate represents the average annual rate of return an investor would have realized had he or she purchased the investment on January 1, 1926, and sold it on December 31, 2000. You can see that significant differences exist between the average annual rates of return realized on the various types of stocks, bonds, and bills shown. Later in this chapter, we will see how these differences in return can be linked to differences in the risk of each of these investments.

TABLE 5.2 Historical Returns for Selected Security Investments (1926–2000)

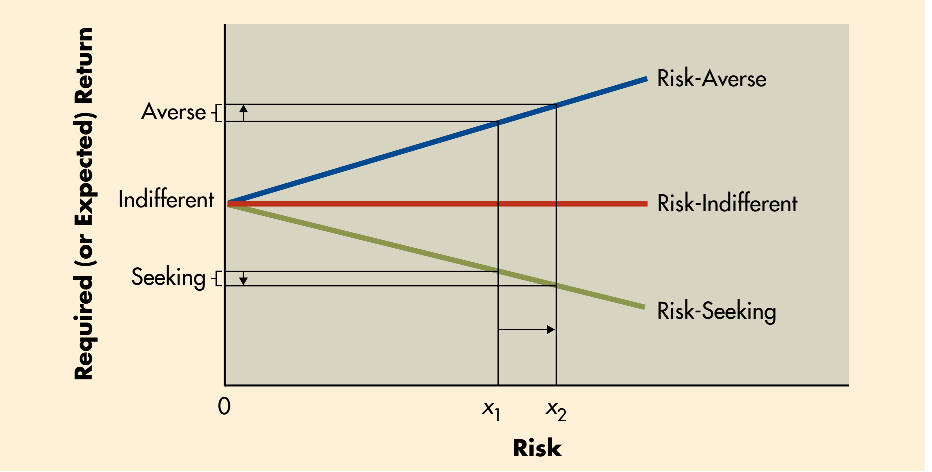
Investment	Average annual return
Large-company stocks	13.0%
Small-company stocks	17.3
Long-term corporate bonds	6.0
Long-term government bonds	5.7
U.S. Treasury bills	3.9
Inflation	3.2%

Source: Stocks, Bonds, Bills, and Inflation, 2001 Yearbook (Chicago: Ibbotson Associates, Inc., 2001).

FIGURE 5.1

Risk Preferences

Risk preference behaviors



Risk Preferences

Feelings about risk differ among managers (and firms).[4] Thus it is important to specify a generally acceptable level of risk. The three basic risk preference behaviors—risk-averse, risk-indifferent, and risk-seeking—are depicted graphically in Figure 5.1.

risk-indifferent
The attitude toward risk in which no change in return would be required for an increase in risk.

risk-averse
The attitude toward risk in which an increased return would be required for an increase in risk.

risk-seeking
The attitude toward risk in which a decreased return would be accepted for an increase in risk.

- For the **risk-indifferent** manager, the required return does not change as risk goes from x_1 to x_2. In essence, no change in return would be required for the increase in risk. Clearly, this attitude is nonsensical in almost any business context.
- For the **risk-averse** manager, the required return increases for an increase in risk. Because they shy away from risk, these managers require higher expected returns to compensate them for taking greater risk.
- For the **risk-seeking** manager, the required return decreases for an increase in risk. Theoretically, because they enjoy risk, these managers are willing to give up some return to take more risk. However, such behavior would not be likely to benefit the firm.

Hint Remember that most *shareholders* are also risk-averse. Like risk-averse managers, for a given increase in risk, they also require an increase in return on their investment in that firm.

Most managers are risk-averse; for a given increase in risk, they require an increase in return. They generally tend to be conservative rather than aggressive when accepting risk for their firm. Accordingly, a *risk-averse financial manager requiring higher returns for greater risk is assumed throughout this text.*

Review Questions

5–1 What is *risk* in the context of financial decision making?

5–2 Define *return,* and describe how to find the rate of return on an investment.

4. The risk preferences of the managers should in theory be consistent with the risk preferences of the firm. Although the *agency problem* suggests that in practice managers may not behave in a manner consistent with the firm's risk preferences, it is assumed here that they do. Therefore, the managers' risk preferences and those of the firm are assumed to be identical.

5–3 Compare the following risk preferences: (**a**) risk-averse, (**b**) risk-indifferent, and (**c**) risk-seeking. Which is most common among financial managers?

LG2 5.2 Risk of a Single Asset

The concept of risk can be developed by first considering a single asset held in isolation. We can look at expected-return behaviors to assess risk, and statistics can be used to measure it.

Risk Assessment

Sensitivity analysis and probability distributions can be used to assess the general level of risk embodied in a given asset.

sensitivity analysis
An approach for assessing risk that uses several possible-return estimates to obtain a sense of the variability among outcomes.

range
A measure of an asset's risk, which is found by subtracting the pessimistic (worst) outcome from the optimistic (best) outcome.

Sensitivity Analysis

Sensitivity analysis uses several possible-return estimates to obtain a sense of the variability among outcomes.[5] One common method involves making pessimistic (worst), most likely (expected), and optimistic (best) estimates of the returns associated with a given asset. In this case, the asset's risk can be measured by the range of returns. The **range** is found by subtracting the pessimistic outcome from the optimistic outcome. The greater the range, the more variability, or risk, the asset is said to have.

EXAMPLE

Norman Company, a custom golf equipment manufacturer, wants to choose the better of two investments, A and B. Each requires an initial outlay of $10,000, and each has a *most likely* annual rate of return of 15%. Management has made *pessimistic* and *optimistic* estimates of the returns associated with each. The three estimates for each asset, along with its range, are given in Table 5.3. Asset A appears to be less risky than asset B; its range of 4% (17% − 13%) is less than the range of 16% (23% − 7%) for asset B. The risk-averse decision maker would prefer asset A over asset B, because A offers the same most likely return as B (15%) with lower risk (smaller range).

TABLE 5.3 Assets A and B

	Asset A	Asset B
Initial investment	$10,000	$10,000
Annual rate of return		
Pessimistic	13%	7%
Most likely	15%	15%
Optimistic	17%	23%
Range	4%	16%

5. The term *sensitivity analysis* is intentionally used in a general rather than a technically correct fashion here to simplify this discussion. A more technical and precise definition and discussion of this technique and of "scenario analysis" are presented in Chapter 10.

Although the use of sensitivity analysis and the range is rather crude, it does give the decision maker a feel for the behavior of returns, which can be used to estimate the risk involved.

Probability Distributions

probability
The *chance* that a given outcome will occur.

Probability distributions provide a more quantitative insight into an asset's risk. The **probability** of a given outcome is its *chance* of occurring. An outcome with an 80 percent probability of occurrence would be expected to occur 8 out of 10 times. An outcome with a probability of 100 percent is certain to occur. Outcomes with a probability of zero will never occur.

EXAMPLE

Norman Company's past estimates indicate that the probabilities of the pessimistic, most likely, and optimistic outcomes are 25%, 50%, and 25%, respectively. Note that the sum of these probabilities must equal 100%; that is, they must be based on all the alternatives considered.

probability distribution
A model that relates probabilities to the associated outcomes.

bar chart
The simplest type of probability distribution; shows only a limited number of outcomes and associated probabilities for a given event.

continuous probability distribution
A probability distribution showing all the possible outcomes and associated probabilities for a given event.

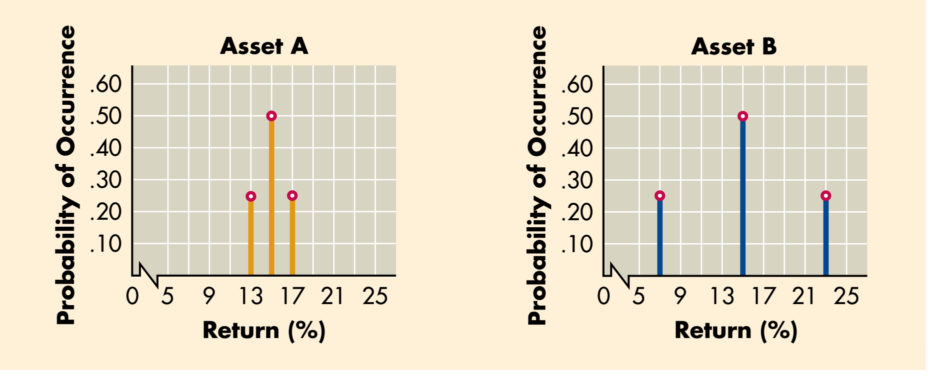
A **probability distribution** is a model that relates probabilities to the associated outcomes. The simplest type of probability distribution is the **bar chart,** which shows only a limited number of outcome–probability coordinates. The bar charts for Norman Company's assets A and B are shown in Figure 5.2. Although both assets have the same most likely return, the range of return is much greater, or more dispersed, for asset B than for asset A—16 percent versus 4 percent.

If we knew all the possible outcomes and associated probabilities, we could develop a **continuous probability distribution.** This type of distribution can be thought of as a bar chart for a very large number of outcomes.[6] Figure 5.3 presents continuous probability distributions for assets A and B.[7] Note that although assets A and B have the same most likely return (15 percent), the distribution of

FIGURE 5.2

Bar Charts

Bar charts for asset A's and asset B's returns



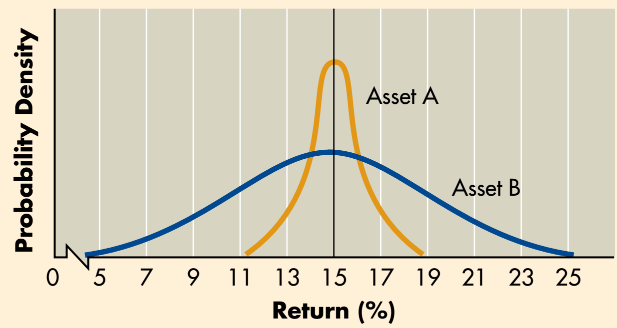
6. To develop a continuous probability distribution, one must have data on a large number of historical occurrences for a given event. Then, by developing a frequency distribution indicating how many times each outcome has occurred over the given time horizon, one can convert these data into a probability distribution. Probability distributions for risky events can also be developed by using *simulation*—a process discussed briefly in Chapter 10.

7. The continuous distribution's probabilities change because of the large number of additional outcomes considered. The area under each of the curves is equal to 1, which means that 100% of the outcomes, or all the possible outcomes, are considered.

FIGURE 5.3

Continuous Probability Distributions

Continuous probability distributions for asset A's and asset B's returns



returns for asset B has much greater *dispersion* than the distribution for asset A. Clearly, asset B is more risky than asset A.

Risk Measurement

In addition to considering its *range,* the risk of an asset can be measured quantitatively by using statistics. Here we consider two statistics—the standard deviation and the coefficient of variation—that can be used to measure the variability of asset returns.

Standard Deviation

standard deviation (σ_k)
The most common statistical indicator of an asset's risk; it measures the dispersion around the *expected value.*

expected value of a return ($\bar{k}$)
The most likely return on a given asset.

The most common statistical indicator of an asset's risk is the **standard deviation, σ_k,** which measures the dispersion around the *expected value.*[8] The **expected value of a return, $\bar{k}$,** is the most likely return on an asset. It is calculated as follows:[9]

$$\bar{k} = \sum_{j=1}^{n} k_j \times Pr_j \tag{5.2}$$

where

k_j = return for the jth outcome
Pr_j = probability of occurrence of the jth outcome
n = number of outcomes considered

8. Although risk is typically viewed as determined by the dispersion of outcomes around an expected value, many people believe that risk exists only when outcomes are below the expected value, because only returns below the expected value are considered bad. Nevertheless, the common approach is to view risk as determined by the variability on either side of the expected value, because the greater this variability, the less confident one can be of the outcomes associated with an investment.

9. The formula for finding the expected value of return, $\bar{k}$, when all of the outcomes, k_j, are known *and* their related probabilities are assumed to be equal, is a simple arithmetic average:

$$\bar{k} = \frac{\sum_{j=1}^{n} k_j}{n} \tag{5.2a}$$

where n is the number of observations. Equation 5.2 is emphasized in this chapter because returns and related probabilities are often available.

TABLE 5.4 Expected Values of Returns for Assets A and B

Possible outcomes	Probability (1)	Returns (2)	Weighted value [(1) × (2)] (3)
		Asset A	
Pessimistic	.25	13%	3.25%
Most likely	.50	15	7.50
Optimistic	.25	17	4.25
Total	1.00	Expected return	15.00%
		Asset B	
Pessimistic	.25	7%	1.75%
Most likely	.50	15	7.50
Optimistic	.25	23	5.75
Total	1.00	Expected return	15.00%

EXAMPLE The expected values of returns for Norman Company's assets A and B are presented in Table 5.4. Column 1 gives the Pr_j's and column 2 gives the k_j's. In each case n equals 3. The expected value for each asset's return is 15%.

The expression for the *standard deviation of returns,* σ_k, is[10]

$$\sigma_k = \sqrt{\sum_{j=1}^{n} (k_j - \overline{k})^2 \times Pr_j} \qquad (5.3)$$

In general, the higher the standard deviation, the greater the risk.

EXAMPLE Table 5.5 presents the standard deviations for Norman Company's assets A and B, based on the earlier data. The standard deviation for asset A is 1.41%, and the standard deviation for asset B is 5.66%. The higher risk of asset B is clearly reflected in its higher standard deviation.

Historical Returns and Risk We can now use the standard deviation as a measure of risk to assess the historical (1926–2000) investment return data in Table 5.2. Table 5.6 repeats the historical returns and shows the standard deviations associated with each of them. A close relationship can be seen between the investment returns and the standard deviations: Investments with higher returns have higher standard deviations. Because higher standard deviations are associated with greater risk, the historical data confirm the existence of a positive rela-

10. The formula that is commonly used to find the standard deviation of returns, σ_k, in a situation in which *all* outcomes are known *and* their related probabilities are assumed equal, is

$$\sigma_k = \sqrt{\frac{\sum_{j=1}^{n} (k_j - \overline{k})^2}{n - 1}} \qquad (5.3a)$$

where n is the number of observations. Equation 5.3 is emphasized in this chapter because returns and related probabilities are often available.

TABLE 5.5 The Calculation of the Standard Deviation of the Returns for Assets A and B[a]

i	k_j	$\overline{k}$	$k_j - \overline{k}$	$(k_j - \overline{k})^2$	Pr_j	$(k_j - \overline{k})^2 \times Pr_j$
			Asset A			
1	13%	15%	−2%	4%	.25	1%
2	15	15	0	0	.50	0
3	17	15	2	4	.25	1

$$\sum_{j=1}^{3}(k_j - \overline{k})^2 \times Pr_j = 2\%$$

$$\sigma_{k_A} = \sqrt{\sum_{j=1}^{3}(k_j - \overline{k})^2 \times Pr_j} = \sqrt{2\%} = \underline{\underline{1.41}}\%$$

i	k_j	$\overline{k}$	$k_j - \overline{k}$	$(k_j - \overline{k})^2$	Pr_j	$(k_j - \overline{k})^2 \times Pr_j$
			Asset B			
1	7%	15%	−8%	64%	.25	16%
2	15	15	0	0	.50	0
3	23	15	8	64	.25	16

$$\sum_{j=1}^{3}(k_j - \overline{k})^2 \times Pr_j = 32\%$$

$$\sigma_{k_B} = \sqrt{\sum_{j=1}^{3}(k_j - \overline{k})^2 \times Pr_j} = \sqrt{32\%} = \underline{\underline{5.66}}\%$$

[a]Calculations in this table are made in percentage form rather than decimal form—e.g., 13% rather than 0.13. As a result, some of the intermediate computations may appear to be inconsistent with those that would result from using decimal form. Regardless, the resulting standard deviations are correct and identical to those that would result from using decimal rather than percentage form.

tionship between risk and return. That relationship reflects *risk aversion* by market participants, who require higher returns as compensation for greater risk. The historical data in Table 5.6 clearly show that during the 1926–2000 period, investors were rewarded with higher returns on higher-risk investments.

TABLE 5.6 Historical Returns and Standard Deviations for Selected Security Investments (1926–2000)

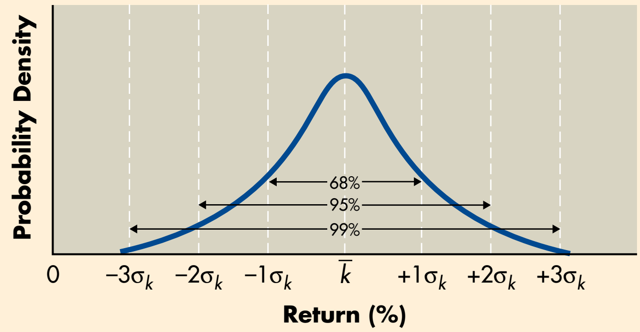
Investment	Average annual return	Standard deviation
Large-company stocks	13.0%	20.2%
Small-company stocks	17.3	33.4
Long-term corporate bonds	6.0	8.7
Long-term government bonds	5.7	9.4
U.S. Treasury bills	3.9	3.2
Inflation	3.2%	4.4%

Source: Stocks, Bonds, Bills, and Inflation, 2001 Yearbook (Chicago: Ibbotson Associates, Inc., 2001).

FIGURE 5.4

Bell-Shaped Curve

Normal probability distribution, with ranges



normal probability distribution
A symmetrical probability distribution whose shape resembles a "bell-shaped" curve.

Normal Distribution A **normal probability distribution,** depicted in Figure 5.4, always resembles a "bell-shaped" curve. It is symmetrical: From the peak of the graph, the curve's extensions are mirror images (reflections) of each other. The symmetry of the curve means that half the probability is associated with the values to the left of the peak and half with the values to the right. As noted on the figure, for normal probability distributions, 68 percent of the possible outcomes will lie between ±1 standard deviation from the expected value, 95 percent of all outcomes will lie between ±2 standard deviations from the expected value, and 99 percent of all outcomes will lie between ±3 standard deviations from the expected value.[11]

EXAMPLE

If we assume that the probability distribution of returns for the Norman Company is normal, 68% of the possible outcomes would have a return ranging between 13.59 and 16.41% for asset A and between 9.34 and 20.66% for asset B; 95% of the possible return outcomes would range between 12.18 and 17.82% for asset A and between 3.68 and 26.32% for asset B; and 99% of the possible return outcomes would range between 10.77 and 19.23% for asset A and between −1.98 and 31.98% for asset B. The greater risk of asset B is clearly reflected in its much wider range of possible returns for each level of confidence (68%, 95%, etc.).

Coefficient of Variation

coefficient of variation (*CV*)
A measure of relative dispersion that is useful in comparing the risks of assets with differing expected returns.

The **coefficient of variation, *CV*,** is a measure of relative dispersion that is useful in comparing the risks of assets with differing expected returns. Equation 5.4 gives the expression for the coefficient of variation:

$$CV = \frac{\sigma_k}{\bar{k}} \tag{5.4}$$

The higher the coefficient of variation, the greater the risk.

11. Tables of values indicating the probabilities associated with various deviations from the expected value of a normal distribution can be found in any basic statistics text. These values can be used to establish confidence limits and make inferences about possible outcomes. Such applications can be found in most basic statistics and upper-level managerial finance textbooks.

EXAMPLE When the standard deviations (from Table 5.5) and the expected returns (from Table 5.4) for assets A and B are substituted into Equation 5.4, the coefficients of variation for A and B are 0.094 (1.41% ÷ 15%) and 0.377 (5.66% ÷ 15%), respectively. Asset B has the higher coefficient of variation and is therefore more risky than asset A—which we already know from the standard deviation. (Because both assets have the same expected return, the coefficient of variation has not provided any new information.)

The real utility of the coefficient of variation comes in comparing the risks of assets that have *different* expected returns.

EXAMPLE A firm wants to select the less risky of two alternative assets—X and Y. The expected return, standard deviation, and coefficient of variation for each of these assets' returns are

Statistics	Asset X	Asset Y
(1) Expected return	12%	20%
(2) Standard deviation	9%[a]	10%
(3) Coefficient of variation [(2) ÷ (1)]	0.75	0.50[a]

[a]Preferred asset using the given risk measure.

Judging solely on the basis of their standard deviations, the firm would prefer asset X, which has a lower standard deviation than asset Y (9% versus 10%). However, management would be making a serious error in choosing asset X over asset Y, because the dispersion—the risk—of the asset, as reflected in the coefficient of variation, is lower for Y (0.50) than for X (0.75). Clearly, using the coefficient of variation to compare asset risk is effective because it also considers the relative size, or expected return, of the assets.

Review Questions

5–4 Explain how the *range* is used in sensitivity analysis.

5–5 What does a plot of the *probability distribution* of outcomes show a decision maker about an asset's risk?

5–6 What relationship exists between the size of the *standard deviation* and the degree of asset risk?

5–7 When is the *coefficient of variation* preferred over the standard deviation for comparing asset risk?

LG3 LG4 5.3 Risk of a Portfolio

In real-world situations, the risk of any single investment would not be viewed independently of other assets. (We did so for teaching purposes.) New investments must be considered in light of their impact on the risk and return of the

efficient portfolio
A portfolio that maximizes return for a given level of risk or minimizes risk for a given level of return.

portfolio of assets.[12] The financial manager's goal is to create an **efficient portfolio,** one that maximizes return for a given level of risk or minimizes risk for a given level of return. We therefore need a way to measure the return and the standard deviation of a portfolio of assets. Once we can do that, we will look at the statistical concept of *correlation,* which underlies the process of diversification that is used to develop an efficient portfolio.

Portfolio Return and Standard Deviation

The *return on a portfolio* is a weighted average of the returns on the individual assets from which it is formed. We can use Equation 5.5 to find the portfolio return, k_p:

$$k_p = (w_1 \times k_1) = (w_2 \times k_2) + \cdots + (w_n \times k_n) = \sum_{j=1}^{n} w_j \times k_j \qquad (5.5)$$

where

w_j = proportion of the portfolio's total dollar value represented by asset j
k_j = return on asset j

Of course, $\Sigma_{j=1}^{n} w_j = 1$, which means that 100 percent of the portfolio's assets must be included in this computation.

The *standard deviation of a portfolio's returns* is found by applying the formula for the standard deviation of a single asset. Specifically, Equation 5.3 is used when the probabilities of the returns are known, and Equation 5.3a (from footnote 10) is applied when the outcomes are known and their related probabilities of occurrence are assumed to be equal.

EXAMPLE

Assume that we wish to determine the expected value and standard deviation of returns for portfolio XY, created by combining equal portions (50%) of assets X and Y. The forecasted returns of assets X and Y for each of the next 5 years (2004–2008) are given in columns 1 and 2, respectively, in part A of Table 5.7. In column 3, the weights of 50% for both assets X and Y along with their respective returns from columns 1 and 2 are substituted into Equation 5.5. Column 4 shows the results of the calculation—an expected portfolio return of 12% for each year, 2004 to 2008.

Furthermore, as shown in part B of Table 5.7, the expected value of these portfolio returns over the 5-year period is also 12% (calculated by using Equation 5.2a, in footnote 9). In part C of Table 5.7, portfolio XY's standard deviation is calculated to be 0% (using Equation 5.3a, in footnote 10). This value should not be surprising because the expected return each year is the same—12%. No variability is exhibited in the expected returns from year to year.

12. The portfolio of a firm, which would consist of its total assets, is not differentiated from the portfolio of an owner, which would probably contain a variety of different investment vehicles (i.e., assets). The differing characteristics of these two types of portfolios should become clear upon completion of Chapter 10.

TABLE 5.7 Expected Return, Expected Value, and Standard Deviation of Returns for Portfolio XY

A. Expected portfolio returns

	Forecasted return			
Year	Asset X (1)	Asset Y (2)	Portfolio return calculation[a] (3)	Expected portfolio return, k_p (4)
2004	8%	16%	$(.50 \times 8\%) + (.50 \times 16\%) =$	12%
2005	10	14	$(.50 \times 10\%) + (.50 \times 14\%) =$	12
2006	12	12	$(.50 \times 12\%) + (.50 \times 12\%) =$	12
2007	14	10	$(.50 \times 14\%) + (.50 \times 10\%) =$	12
2008	16	8	$(.50 \times 16\%) + (.50 \times 8\%) =$	12

B. Expected value of portfolio returns, 2004–2008[b]

$$\bar{k}_p = \frac{12\% + 12\% + 12\% + 12\% + 12\%}{5} = \frac{60\%}{5} = \underline{\underline{12\%}}$$

C. Standard deviation of expected portfolio returns[c]

$$\sigma_{k_p} = \sqrt{\frac{(12\% - 12\%)^2 + (12\% - 12\%)^2 + (12\% - 12\%)^2 + (12\% - 12\%)^2 + (12\% - 12\%)^2}{5-1}}$$

$$= \sqrt{\frac{0\% + 0\% + 0\% + 0\% + 0\%}{4}}$$

$$= \sqrt{\frac{0}{4}}\% = \underline{\underline{0\%}}$$

[a]Using Equation 5.5.
[b]Using Equation 5.2a found in footnote 9.
[c]Using Equation 5.3a found in footnote 10.

correlation
A statistical measure of the relationship between any two series of numbers representing data of any kind.

positively correlated
Describes two series that move in the same direction.

negatively correlated
Describes two series that move in opposite directions.

Correlation

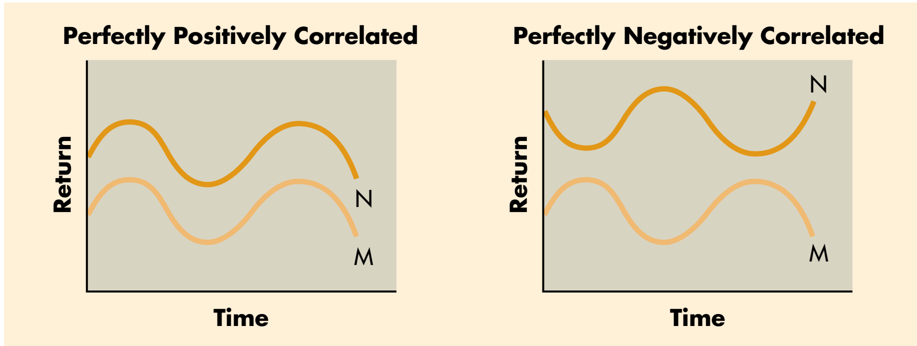
Correlation is a statistical measure of the relationship between any two series of numbers. The numbers may represent data of any kind, from returns to test scores. If two series move in the same direction, they are **positively correlated.** If the series move in opposite directions, they are **negatively correlated.**[13]

13. The general *long-term trends* of two series could be the same (both increasing or both decreasing) or different (one increasing, the other decreasing), and the correlation of their *short-term (point-to-point) movements* in both situations could be either positive or negative. In other words, the pattern of movement around the trends could be correlated independent of the actual relationship between the trends. Further clarification of this seemingly inconsistent behavior can be found in most basic statistics texts.

FIGURE 5.5

Correlations

The correlation between series M and series N



correlation coefficient
A measure of the degree of correlation between two series.

perfectly positively correlated
Describes two *positively correlated* series that have a *correlation coefficient* of +1.

perfectly negatively correlated
Describes two *negatively correlated* series that have a *correlation coefficient* of −1.

The degree of correlation is measured by the **correlation coefficient,** which ranges from +1 for **perfectly positively correlated** series to −1 for **perfectly negatively correlated** series. These two extremes are depicted for series M and N in Figure 5.5. The perfectly positively correlated series move exactly together; the perfectly negatively correlated series move in exactly opposite directions.

Diversification

The concept of correlation is essential to developing an efficient portfolio. To reduce overall risk, it is best to combine, or add to the portfolio, assets that have a negative (or a low positive) correlation. Combining negatively correlated assets can reduce the overall variability of returns. Figure 5.6 shows that a portfolio containing the negatively correlated assets F and G, both of which have the same expected return, $\bar{k}$, also has that same return $\bar{k}$ but has less risk (variability) than either of the individual assets. Even if assets are not negatively correlated, the lower the positive correlation between them, the lower the resulting risk.

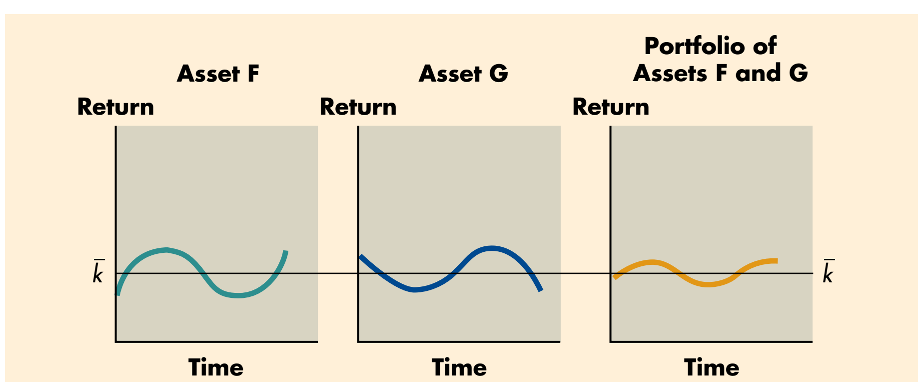
uncorrelated
Describes two series that lack any interaction and therefore have a *correlation coefficient* close to zero.

Some assets are **uncorrelated**—that is, there is no interaction between their returns. Combining uncorrelated assets can reduce risk, not so effectively as combining negatively correlated assets, but more effectively than combining positively correlated assets. The correlation coefficient for uncorrelated assets is close to zero and acts as the midpoint between perfect positive and perfect negative correlation.

FIGURE 5.6

Diversification

Combining negatively correlated assets to diversify risk



The creation of a portfolio that combines two assets with perfectly positively correlated returns results in overall portfolio risk that at minimum equals that of the least risky asset and at maximum equals that of the most risky asset. However, a portfolio combining two assets with less than perfectly positive correlation *can* reduce total risk to a level below that of either of the components, which in certain situations may be zero. For example, assume that you manufacture machine tools. The business is very *cyclical,* with high sales when the economy is expanding and low sales during a recession. If you acquired another machine-tool company, with sales positively correlated with those of your firm, the combined sales would still be cyclical and risk would remain the same. Alternatively, however, you could acquire a sewing machine manufacturer, whose sales are *countercyclical.* It typically has low sales during economic expansion and high sales during recession (when consumers are more likely to make their own clothes). Combination with the sewing machine manufacturer, which has negatively correlated sales, should reduce risk.

EXAMPLE Table 5.8 presents the forecasted returns from three different assets—X, Y, and Z—over the next 5 years, along with their expected values and standard deviations. Each of the assets has an expected value of return of 12% and a standard

TABLE 5.8 Forecasted Returns, Expected Values, and Standard Deviations for Assets X, Y, and Z and Portfolios XY and XZ

	Assets			Portfolios	
Year	X	Y	Z	XY[a] (50%X + 50%Y)	XZ[b] (50%X + 50%Z)
2004	8%	16%	8%	12%	8%
2005	10	14	10	12	10
2006	12	12	12	12	12
2007	14	10	14	12	14
2008	16	8	16	12	16
Statistics:[c]					
Expected value	12%	12%	12%	12%	12%
Standard deviation[d]	3.16%	3.16%	3.16%	0%	3.16%

[a]Portfolio XY, which consists of 50% of asset X and 50% of asset Y, illustrates *perfect negative correlation* because these two return streams behave in completely opposite fashion over the 5-year period. Its return values shown here were calculated in part A of Table 5.7.

[b]Portfolio XZ, which consists of 50% of asset X and 50% of asset Z, illustrates *perfect positive correlation* because these two return streams behave identically over the 5-year period. Its return values were calculated by using the same method demonstrated for portfolio XY in part A of Table 5.7.

[c]Because the probabilities associated with the returns are not given, the general equations, Equation 5.2a in footnote 9 and Equation 5.3a in footnote 10, were used to calculate expected values and standard deviations, respectively. Calculation of the expected value and standard deviation for portfolio XY is demonstrated in parts B and C, respectively, of Table 5.7.

[d]The portfolio standard deviations can be directly calculated from the standard deviations of the component assets with the following formula:

$$\sigma_{k_p} = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2r_{1,2}\sigma_1\sigma_2}$$

where w_1 and w_2 are the proportions of component assets 1 and 2, σ_1 and σ_2 are the standard deviations of component assets 1 and 2, and $r_{1,2}$ is the correlation coefficient between the returns of component assets 1 and 2.

deviation of 3.16%. The assets therefore have equal return and equal risk. The return patterns of assets X and Y are perfectly negatively correlated. They move in exactly opposite directions over time. The returns of assets X and Z are perfectly positively correlated. They move in precisely the same direction. (*Note:* The returns for X and Z are identical.)[14]

Portfolio XY Portfolio XY (shown in Table 5.8) is created by combining equal portions of assets X and Y, the perfectly negatively correlated assets.[15] (Calculation of portfolio XY's annual expected returns, their expected value, and the standard deviation of expected portfolio returns was demonstrated in Table 5.7.) The risk in this portfolio, as reflected by its standard deviation, is reduced to 0%, whereas the expected return remains at 12%. Thus the combination results in the complete elimination of risk. Whenever assets are perfectly negatively correlated, an optimal combination (similar to the 50–50 mix in the case of assets X and Y) exists for which the resulting standard deviation will equal 0.

Portfolio XZ Portfolio XZ (shown in Table 5.8) is created by combining equal portions of assets X and Z, the perfectly positively correlated assets. The risk in this portfolio, as reflected by its standard deviation, is unaffected by this combination. Risk remains at 3.16%, and the expected return value remains at 12%. Because assets X and Z have the same standard deviation, the minimum and maximum standard deviations are the same (3.16%).

Correlation, Diversification, Risk, and Return

Hint **Remember, low correlation between two series of numbers is less positive and more negative—indicating greater dissimilarity of behavior of the two series.**

In general, the lower the correlation between asset returns, the greater the potential diversification of risk. (This should be clear from the behaviors illustrated in Table 5.8.) For each pair of assets, there is a combination that will result in the lowest risk (standard deviation) possible. How much risk can be reduced by this combination depends on the degree of correlation. Many potential combinations (assuming divisibility) could be made, but only one combination of the infinite number of possibilities will minimize risk.

Three possible correlations—perfect positive, uncorrelated, and perfect negative—illustrate the effect of correlation on the diversification of risk and return. Table 5.9 summarizes the impact of correlation on the range of return and risk for various two-asset portfolio combinations. The table shows that as we move from perfect positive correlation to uncorrelated assets to perfect negative correlation, the ability to reduce risk is improved. Note that in no case will a portfolio of assets be riskier than the riskiest asset included in the portfolio.

14. Identical return streams are used in this example to permit clear illustration of the concepts, but it is *not* necessary for return streams to be identical for them to be perfectly positively correlated. Any return streams that move (i.e., vary) exactly together—regardless of the relative magnitude of the returns—are perfectly positively correlated.

15. For illustrative purposes it has been assumed that each of the assets—X, Y, and Z—can be divided up and combined with other assets to create portfolios. This assumption is made only to permit clear illustration of the concepts. The assets are not actually divisible.

TABLE 5.9 Correlation, Return, and Risk for Various Two-Asset Portfolio Combinations

Correlation coefficient	Range of return	Range of risk
+1 (perfect positive)	Between returns of two assets held in isolation	Between risk of two assets held in isolation
0 (uncorrelated)	Between returns of two assets held in isolation	Between risk of most risky asset and an amount less than risk of least risky asset but greater than 0
−1 (perfect negative)	Between returns of two assets held in isolation	Between risk of most risky asset and 0

EXAMPLE

A firm has calculated the expected return and the risk for each of two assets—R and S.

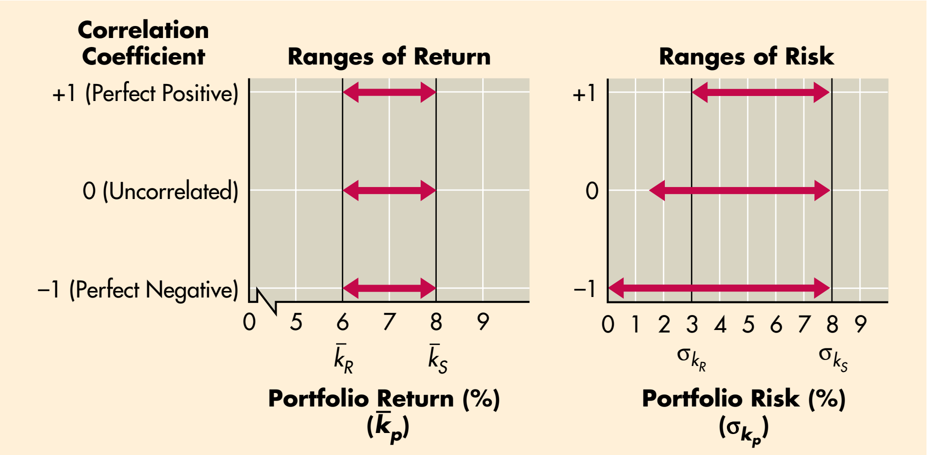
Asset	Expected return, $\bar{k}$	Risk (standard deviation), σ
R	6%	3%
S	8	8

Clearly, asset R is a lower-return, lower-risk asset than asset S.

To evaluate possible combinations, the firm considered three possible correlations—perfect positive, uncorrelated, and perfect negative. The results of the analysis are shown in Figure 5.7, using the ranges of return and risk noted above. In all cases, the return will range between the 6% return of R and the 8% return of S. The risk, on the other hand, ranges between the individual risks of R and S (from 3% to 8%) in the case of perfect positive correlation, from below 3% (the risk of R) and greater than 0% to 8% (the risk of S) in the uncorrelated case, and between 0% and 8% (the risk of S) in the perfectly negatively correlated case.

FIGURE 5.7

Possible Correlations
Range of portfolio return ($\bar{k}_p$) and risk (σ_{k_p}) for combinations of assets R and S for various correlation coefficients



Note that *only in the case of perfect negative correlation can the risk be reduced to 0*. Also note that as the correlation becomes less positive and more negative (moving from the top of the figure down), the ability to reduce risk improves. The amount of risk reduction achieved depends on the proportions in which the assets are combined. Although determining the risk-minimizing combination is beyond the scope of this discussion, it is an important issue in developing portfolios of assets.

International Diversification

The ultimate example of portfolio diversification involves including foreign assets in a portfolio. The inclusion of assets from countries with business cycles that are not highly correlated with the U.S. business cycle reduces the portfolio's responsiveness to market movements and to foreign currency fluctuations.

Returns from International Diversification

Over long periods, returns from internationally diversified portfolios tend to be superior to those of purely domestic ones. This is particularly so if the U.S. economy is performing relatively poorly and the dollar is depreciating in value against most foreign currencies. At such times, the dollar returns to U.S. investors on a portfolio of foreign assets can be very attractive. However, over any single short or intermediate period, international diversification can yield subpar returns, particularly during periods when the dollar is appreciating in value relative to other currencies. When the U.S. currency gains in value, the dollar value of a foreign-currency-denominated portfolio of assets declines. Even if this portfolio yields a satisfactory return in local currency, the return to U.S. investors will be reduced when translated into dollars. Subpar local currency portfolio returns, coupled with an appreciating dollar, can yield truly dismal dollar returns to U.S. investors.

Overall, though, the logic of international portfolio diversification assumes that these fluctuations in currency values and relative performance will average out over long periods. Compared to similar, purely domestic portfolios, an internationally diversified portfolio will tend to yield a comparable return at a lower level of risk.

Risks of International Diversification

political risk
Risk that arises from the possibility that a host government will take actions harmful to foreign investors or that political turmoil in a country will endanger investments there.

U.S. investors should also be aware of the potential dangers of international investing. In addition to the risk induced by currency fluctuations, several other financial risks are unique to international investing. Most important is **political risk,** which arises from the possibility that a host government will take actions harmful to foreign investors or that political turmoil in a country will endanger investments there. Political risks are particularly acute in developing countries, where unstable or ideologically motivated governments may attempt to block return of profits by foreign investors or even seize (nationalize) their assets in the host country. An example of political risk was the heightened concern after Desert Storm in the early 1990s that Saudi Arabian fundamentalists would take over and nationalize the U.S. oil facilities located there.

Even where governments do not impose exchange controls or seize assets, international investors may suffer if a shortage of hard currency prevents payment of dividends or interest to foreigners. When governments are forced to allocate scarce foreign exchange, they rarely give top priority to the interests of foreign investors. Instead, hard-currency reserves are typically used to pay for necessary imports such as food, medicine, and industrial materials and to pay interest on the government's debt. Because most of the debt of developing countries is held by banks rather than individuals, foreign investors are often badly harmed when a country experiences political or economic problems.

Review Questions

5–8 What is an *efficient portfolio?* How can the return and standard deviation of a portfolio be determined?

5–9 Why is the *correlation* between asset returns important? How does diversification allow risky assets to be combined so that the risk of the portfolio is less than the risk of the individual assets in it?

5–10 How does international diversification enhance risk reduction? When might international diversification result in subpar returns? What are *political risks,* and how do they affect international diversification?

LG5 LG6

5.4 Risk and Return: The Capital Asset Pricing Model (CAPM)

capital asset pricing model (CAPM)
The basic theory that links risk and return for all assets.

The most important aspect of risk is the *overall risk* of the firm as viewed by investors in the marketplace. Overall risk significantly affects investment opportunities and—even more important—the owners' wealth. The basic theory that links risk and return for all assets is the **capital asset pricing model (CAPM).**[16] We will use CAPM to understand the basic risk–return tradeoffs involved in all types of financial decisions.

Types of Risk

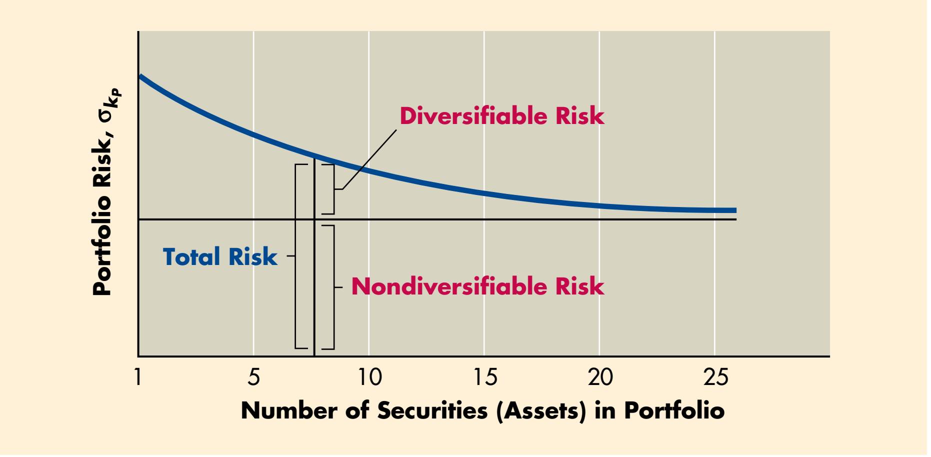
To understand the basic types of risk, consider what happens to the risk of a portfolio consisting of a single security (asset), to which we add securities randomly selected from, say, the population of all actively traded securities. Using

16. The initial development of this theory is generally attributed to William F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk," *Journal of Finance* 19 (September 1964), pp. 425–442, and John Lintner, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics* 47 (February 1965), pp 13–37. A number of authors subsequently advanced, refined, and tested this now widely accepted theory.

FIGURE 5.8

Risk Reduction

Portfolio risk and diversification



the standard deviation of return, σ_{k_p}, to measure the total portfolio risk, Figure 5.8 depicts the behavior of the total portfolio risk (y axis) as more securities are added (x axis). With the addition of securities, the total portfolio risk declines, as a result of the effects of diversification, and tends to approach a lower limit. Research has shown that, on average, most of the risk-reduction benefits of diversification can be gained by forming portfolios containing 15 to 20 randomly selected securities.[17]

total risk
The combination of a security's *nondiversifiable* and *diversifiable risk.*

The **total risk** of a security can be viewed as consisting of two parts:

$$\text{Total security risk} = \text{Nondiversifiable risk} + \text{Diversifiable risk} \qquad (5.6)$$

diversifiable risk
The portion of an asset's risk that is attributable to firm-specific, random causes; can be eliminated through diversification. Also called *unsystematic risk.*

nondiversifiable risk
The relevant portion of an asset's risk attributable to market factors that affect all firms; cannot be eliminated through diversification. Also called *systematic risk.*

Diversifiable risk (sometimes called *unsystematic risk*) represents the portion of an asset's risk that is associated with random causes that can be eliminated through diversification. It is attributable to firm-specific events, such as strikes, lawsuits, regulatory actions, and loss of a key account. **Nondiversifiable risk** (also called *systematic risk*) is attributable to market factors that affect all firms; it cannot be eliminated through diversification. (It is the shareholder-specific *market risk* described in Table 5.1.) Factors such as war, inflation, international incidents, and political events account for nondiversifiable risk.

Because any investor can create a portfolio of assets that will eliminate virtually all diversifiable risk, *the only relevant risk is nondiversifiable risk*. Any investor or firm therefore must be concerned solely with nondiversifiable risk. The measurement of nondiversifiable risk is thus of primary importance in selecting assets with the most desired risk–return characteristics.

17. See, for example, W. H. Wagner and S. C. Lau, "The Effect of Diversification on Risk," *Financial Analysts Journal* 26 (November–December 1971), pp. 48–53, and Jack Evans and Stephen H. Archer, "Diversification and the Reduction of Dispersion: An Empirical Analysis," *Journal of Finance* 23 (December 1968), pp. 761–767. A more recent study, Gerald D. Newbould and Percy S. Poon, "The Minimum Number of Stocks Needed for Diversification," *Financial Practice and Education* (Fall 1993), pp. 85–87, shows that because an investor holds but one of a large number of possible x-security portfolios, it is unlikely that he or she will experience the average outcome. As a consequence, the study suggests that a minimum of 40 stocks is needed to diversify a portfolio fully. This study tends to support the widespread popularity of mutual fund investments.

The Model: CAPM

The capital asset pricing model (CAPM) links nondiversifiable risk and return for all assets. We will discuss the model in five sections. The first deals with the beta coefficient, which is a measure of nondiversifiable risk. The second section presents an equation of the model itself, and the third graphically describes the relationship between risk and return. The fourth section discusses the effects of changes in inflationary expectations and risk aversion on the relationship between risk and return. The final section offers some comments on the CAPM.

Beta Coefficient

beta coefficient (*b*)
A relative measure of nondiversifiable risk. An *index* of the degree of movement of an asset's return in response to a change in the *market return.*

market return
The return on the market portfolio of all traded securities.

The **beta coefficient, *b*,** is a relative measure of nondiversifiable risk. It is an *index* of the degree of movement of an asset's return in response to a change in the *market return.* An asset's historical returns are used in finding the asset's beta coefficient. The **market return** is the return on the market portfolio of all traded securities. The *Standard & Poor's 500 Stock Composite Index* or some similar stock index is commonly used as the market return. Betas for actively traded stocks can be obtained from a variety of sources, but you should understand how they are derived and interpreted and how they are applied to portfolios.

Deriving Beta from Return Data An asset's historical returns are used in finding the asset's beta coefficient. Figure 5.9 plots the relationship between the returns of two assets—R and S—and the market return. Note that the horizontal (x) axis measures the historical market returns and that the vertical (y) axis measures the individual asset's historical returns. The first step in deriving beta involves plotting the coordinates for the market return and asset returns from various points in time. Such annual "market return–asset return" coordinates are shown *for asset S only* for the years 1996 through 2003. For example, in 2003, asset S's return was 20 percent when the market return was 10 percent. By use of statistical techniques, the "characteristic line" that best explains the relationship between the asset return and the market return coordinates is fit to the data points.[18] The slope of this line is *beta.* The beta for asset R is about .80 and that

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18. The empirical measurement of beta is approached by using *least-squares regression analysis* to find the regression coefficient (b_j) in the equation for the "characteristic line":

$$k_j = a_j + b_j k_m + e_j$$

where

k_j = return on asset j
a_j = intercept
b_j = beta coefficient, which equals $\dfrac{Cov\,(k_j, k_m)}{\sigma_m^2}$

where

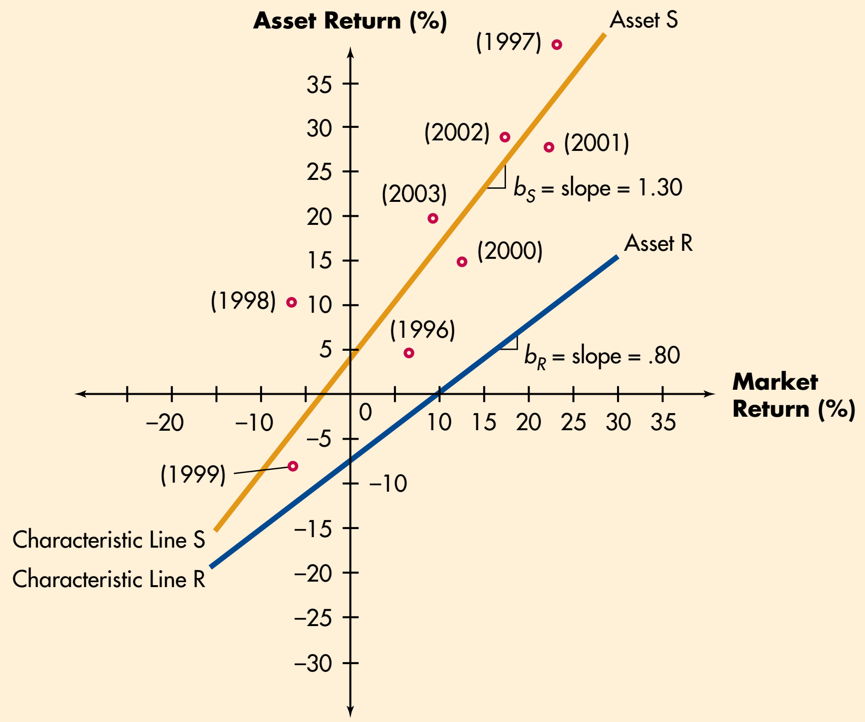
$Cov\,(k_j, k_m)$ = covariance of the return on asset j, k_j, and the return on the market portfolio, k_m
σ_m^2 = variance of the return on the market portfolio
k_m = required rate of return on the market portfolio of securities
e_j = random error term, which reflects the diversifiable, or unsystematic, risk of asset j

The calculations involved in finding betas are somewhat rigorous. If you want to know more about these calculations, consult an advanced managerial finance or investments text.

FIGURE 5.9

Beta Derivation[a]

Graphical derivation of beta for assets R and S



[a] All data points shown are associated with asset S. No data points are shown for asset R.

for asset S is about 1.30. Asset S's higher beta (steeper characteristic line slope) indicates that its return is more responsive to changing market returns. *Therefore asset S is more risky than asset R.*[19]

Hint Remember that published betas are calculated using historical data. When investors use beta for decision making, they should recognize that past performance relative to the market average may not accurately predict future performance.

Interpreting Betas The beta coefficient for the market is considered to be equal to 1.0. All other betas are viewed in relation to this value. Asset betas may be positive or negative, but positive betas are the norm. The majority of beta coefficients fall between .5 and 2.0. The return of a stock that is half as responsive as the market ($b = .5$) is expected to change by 1/2 percent for each 1 percent change in the return of the market portfolio. A stock that is twice as responsive as the market ($b = 2.0$) is expected to experience a 2 percent change in its return for each 1 percent change in the return of the market portfolio. Table 5.10 provides various beta values and their interpretations. Beta coefficients for actively traded stocks can be obtained from published sources such as *Value Line Investment Survey*, via the Internet, or through brokerage firms. Betas for some selected stocks are given in Table 5.11.

Portfolio Betas The beta of a portfolio can be easily estimated by using the betas of the individual assets it includes. Letting w_j represent the proportion of

19. The values of beta also depend on the time interval used for return calculations and on the number of returns used in the regression analysis. In other words, betas calculated using monthly returns would not necessarily be comparable to those calculated using a similar number of daily returns.

TABLE 5.10 Selected Beta Coefficients and Their Interpretations

Beta	Comment	Interpretation
2.0	Move in same direction as market	Twice as responsive as the market
1.0		Same response as the market
.5		Only half as responsive as the market
0		Unaffected by market movement
− .5	Move in opposite direction to market	Only half as responsive as the market
−1.0		Same response as the market
−2.0		Twice as responsive as the market

TABLE 5.11 Beta Coefficients for Selected Stocks (March 8, 2002)

Stock	Beta	Stock	Beta
Amazon.com	1.95	Int'l Business Machines	1.05
Anheuser-Busch	.60	Merrill Lynch & Co.	1.85
Bank One Corp.	1.25	Microsoft	1.20
Daimler Chrysler AG	1.25	NIKE, Inc.	.90
Disney	1.05	PepsiCo, Inc.	.70
eBay	2.20	Qualcomm	1.30
Exxon Mobil Corp.	.80	Sempra Energy	.60
Gap (The), Inc.	1.60	Wal-Mart Stores	1.15
General Electric	1.30	Xerox	1.25
Intel	1.30	Yahoo! Inc.	2.00

Source: Value Line Investment Survey (New York: Value Line Publishing, March 8, 2002).

the portfolio's total dollar value represented by asset j, and letting b_j equal the beta of asset j, we can use Equation 5.7 to find the portfolio beta, b_p:

$$b_p = (w_1 \times b_1) + (w_2 \times b_2) + \cdots + (w_n \times b_n) = \sum_{j=1}^{n} w_j \times b_j \qquad (5.7)$$

Of course, $\Sigma_{j=1}^{n} w_j = 1$, which means that 100 percent of the portfolio's assets must be included in this computation.

Hint Mutual fund managers are key users of the portfolio beta and return concepts. They are continually evaluating what would happen to the fund's beta and return if the securities of a particular firm were added to or deleted from the fund's portfolio.

Portfolio betas are interpreted in the same way as the betas of individual assets. They indicate the degree of responsiveness of the *portfolio's* return to changes in the market return. For example, when the market return increases by 10 percent, a portfolio with a beta of .75 will experience a 7.5 percent increase in its return (.75 × 10%); a portfolio with a beta of 1.25 will experience a 12.5 percent increase in its return (1.25 × 10%). Clearly, a portfolio containing mostly low-beta assets will have a low beta, and one containing mostly high-beta assets will have a high beta.

TABLE 5.12 Austin Fund's Portfolios V and W

	Portfolio V		Portfolio W	
Asset	Proportion	Beta	Proportion	Beta
1	.10	1.65	.10	.80
2	.30	1.00	.10	1.00
3	.20	1.30	.20	.65
4	.20	1.10	.10	.75
5	.20	1.25	.50	1.05
Totals	1.00		1.00	

EXAMPLE The Austin Fund, a large investment company, wishes to assess the risk of two portfolios it is considering assembling—V and W. Both portfolios contain five assets, with the proportions and betas shown in Table 5.12. The betas for the two portfolios, b_v and b_w, can be calculated by substituting data from the table into Equation 5.7:

$$b_v = (.10 \times 1.65) + (.30 \times 1.00) + (.20 \times 1.30) + (.20 \times 1.10) + (.20 \times 1.25)$$
$$= .165 + .300 + .260 + .220 + .250 = 1.195 \approx \underline{\underline{1.20}}$$

$$b_w = (.10 \times .80) + (.10 \times 1.00) + (.20 \times .65) + (.10 \times .75) + (.50 \times 1.05)$$
$$= .080 + .100 + .130 + .075 + .525 = \underline{\underline{.91}}$$

Portfolio V's beta is 1.20, and portfolio W's is .91. These values make sense, because portfolio V contains relatively high-beta assets, and portfolio W contains relatively low-beta assets. Clearly, portfolio V's returns are more responsive to changes in market returns and are therefore more risky than portfolio W's.

The Equation

Using the beta coefficient to measure nondiversifiable risk, the *capital asset pricing model (CAPM)* is given in Equation 5.8:

$$k_j = R_F + [b_j \times (k_m - R_F)] \tag{5.8}$$

where

k_j = required return on asset j
R_F = risk-free rate of return, commonly measured by the return on a U.S. Treasury bill
b_j = beta coefficient or index of nondiversifiable risk for asset j
k_m = market return; return on the market portfolio of assets

risk-free rate of interest, R_F
The required return on a *risk-free asset,* typically a 3-month *U.S. Treasury bill.*

U.S. Treasury bills (T-bills)
Short-term IOUs issued by the U.S. Treasury; considered the *risk-free asset.*

The CAPM can be divided into two parts: (1) **risk-free of interest, R_F,** which is the required return on a *risk-free asset,* typically a 3-month **U.S. Treasury bill (T-bill),** a short-term IOU issued by the U.S. Treasury, and (2) the *risk premium.* These are, respectively, the two elements on either side of the plus sign in Equation 5.8. The ($k_m - R_F$) portion of the risk premium is called the *market risk pre-*

mium, because it represents the premium the investor must receive for taking the average amount of risk associated with holding the market portfolio of assets.[20]

Historical Risk Premiums Using the historical return data for selected security investments for the 1926–2000 period shown in Table 5.2, we can calculate the risk premiums for each investment category. The calculation (consistent with Equation 5.8) involves merely subtracting the historical U.S. Treasury bill's average return from the historical average return for a given investment:

Investment	Risk premium[a]
Large-company stocks	13.0% − 3.9% = 9.1%
Small company stocks	17.3 − 3.9 = 13.4
Long-term corporate bonds	6.0 − 3.9 = 2.1
Long-term government bonds	5.7 − 3.9 = 1.8
U.S. Treasury bills	3.9 − 3.9 = 0.0

[a]Return values obtained from Table 5.2.

Reviewing the risk premiums calculated above, we can see that the risk premium is highest for small-company stocks, followed by large-company stocks, long-term corporate bonds, and long-term government bonds. This outcome makes sense intuitively because small-company stocks are riskier than large-company stocks, which are riskier than long-term corporate bonds (equity is riskier than debt investment). Long-term corporate bonds are riskier than long-term government bonds (because the government is less likely to renege on debt). And of course, U.S. Treasury bills, because of their lack of default risk and their very short maturity, are virtually risk-free, as indicated by their lack of any risk premium.

EXAMPLE Benjamin Corporation, a growing computer software developer, wishes to determine the required return on an asset Z, which has a beta of 1.5. The risk-free rate of return is 7%; the return on the market portfolio of assets is 11%. Substituting $b_z = 1.5$, $R_F = 7\%$, and $k_m = 11\%$ into the capital asset pricing model given in Equation 5.8 yields a required return of

$$k_z = 7\% + [1.5 \times (11\% - 7\%)] = 7\% + 6\% = \underline{\underline{13}}\%$$

The market risk premium of 4% (11% − 7%), when adjusted for the asset's index of risk (beta) of 1.5, results in a risk premium of 6% (1.5 × 4%). That risk premium, when added to the 7% risk-free rate, results in a 13% required return.

Other things being equal, *the higher the beta, the higher the required return, and the lower the beta, the lower the required return.*

20. Although CAPM has been widely accepted, a broader theory, *arbitrage pricing theory (APT),* first described by Stephen A. Ross, "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory* (December 1976), pp. 341–360, has received a great deal of attention in the financial literature. The theory suggests that the risk premium on securities may be better explained by a number of factors underlying and in place of the market return used in CAPM. The CAPM in effect can be viewed as being derived from APT. Although testing of APT theory confirms the importance of the market return, it has thus far failed to identify other risk factors clearly. As a result of this failure, as well as APT's lack of practical acceptance and usage, we concentrate our attention here on CAPM.

The Graph: The Security Market Line (SML)

security market line (SML)
The depiction of the *capital asset pricing model* (*CAPM*) as a graph that reflects the required return in the marketplace for each level of nondiversifiable risk (beta).

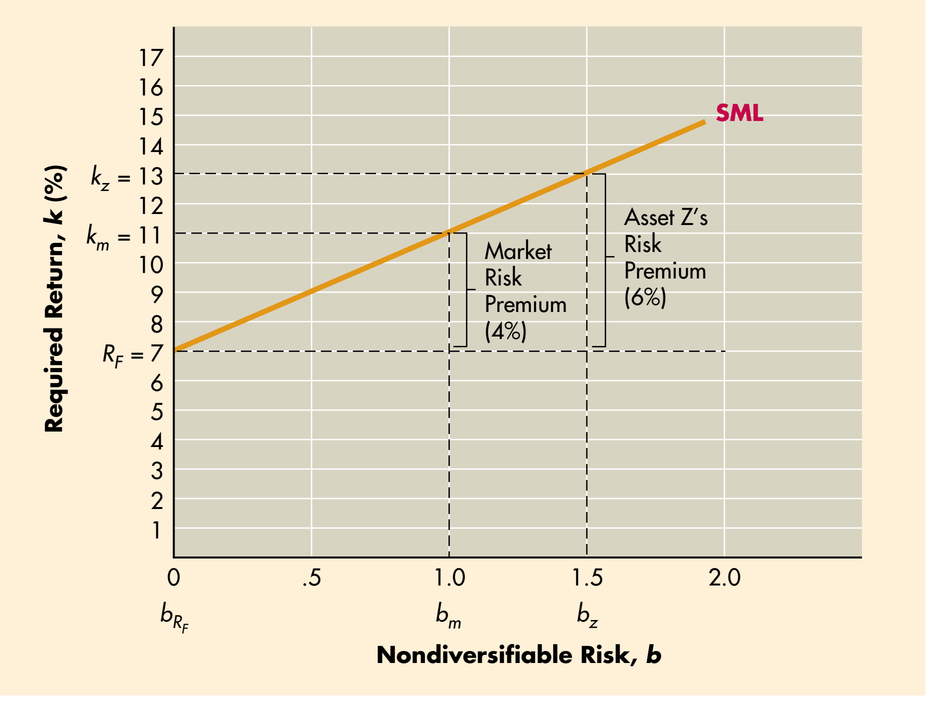
When the capital asset pricing model (Equation 5.8) is depicted graphically, it is called the **security market line (SML).** The SML will, in fact, be a straight line. It reflects the required return in the marketplace for each level of nondiversifiable risk (beta). In the graph, risk as measured by beta, b, is plotted on the x axis, and required returns, k, are plotted on the y axis. The risk–return tradeoff is clearly represented by the SML.

EXAMPLE

In the preceding example for Benjamin Corporation, the risk-free rate, R_F, was 7%, and the market return, k_m, was 11%. The SML can be plotted by using the two sets of coordinates for the betas associated with R_F and k_m, b_{R_F} and b_m (that is, $b_{R_F} = 0$,[21] $R_F = 7\%$; and $b_m = 1.0$, $k_m = 11\%$). Figure 5.10 presents the resulting security market line. As traditionally shown, the security market line in Figure 5.10 presents the required return associated with all positive betas. The market risk premium of 4% (k_m of 11% $-$ R_F of 7%) has been highlighted. For a beta for asset Z, b_z, of 1.5, its corresponding required return, k_z, is 13%. Also shown in the figure is asset Z's risk premium of 6% (k_z of 13% $-$ R_F of 7%). It should be clear that for assets with betas greater than 1, the risk premium is greater than that for the market; for assets with betas less than 1, the risk premium is less than that for the market.

FIGURE 5.10

Security Market Line
Security market line (SML) with Benjamin Corporation's asset Z data shown



21. Because R_F is the rate of return on a risk-free asset, the beta associated with the risk-free asset, b_{R_F}, would equal 0. The 0 beta on the risk-free asset reflects not only its absence of risk but also that the asset's return is unaffected by movements in the market return.

Shifts in the Security Market Line

The security market line is not stable over time, and shifts in the security market line can result in a change in required return. The position and slope of the SML are affected by two major forces—inflationary expectations and risk aversion—which are analyzed next.[22]

Changes in Inflationary Expectations Changes in inflationary expectations affect the risk-free rate of return, R_F. The equation for the risk-free rate of return is

$$R_F = k^* + IP \tag{5.9}$$

This equation shows that, assuming a constant real rate of interest, k^*, changes in inflationary expectations, reflected in an inflation premium, *IP*, will result in corresponding changes in the risk-free rate. Therefore, a change in inflationary expectations that results from events such as international trade embargoes or major changes in Federal Reserve policy will result in a shift in the SML. Because the risk-free rate is a basic component of all rates of return, any change in R_F will be reflected in *all* required rates of return.

Changes in inflationary expectations result in parallel shifts in the SML in direct response to the magnitude and direction of the change. This effect can best be illustrated by an example.

EXAMPLE

In the preceding example, using CAPM, the required return for asset *Z*, k_Z, was found to be 13%. Assuming that the risk-free rate of 7% includes a 2% real rate of interest, k^*, and a 5% inflation premium, *IP*, then Equation 5.9 confirms that

$$R_F = 2\% + 5\% = 7\%$$

Now assume that recent economic events have resulted in an *increase of 3% in inflationary expectations, raising the inflation premium* to 8% (IP_1). As a result, all returns likewise rise by 3%. In this case, the new returns (noted by subscript 1) are

$$R_{F_1} = 10\% \text{ (rises from 7\% to 10\%)}$$
$$k_{m_1} = 14\% \text{ (rises from 11\% to 14\%)}$$

Substituting these values, along with asset Z's beta (b_Z) of 1.5, into the CAPM (Equation 5.8), we find that asset Z's new required return (k_{Z_1}) can be calculated:

$$k_{Z_1} = 10\% + [1.5 \times (14\% - 10\%)] = 10\% + 6\% = \underline{\underline{16}}\%$$

Comparing k_{Z_1} of 16% to k_Z of 13%, we see that the change of 3% in asset Z's required return exactly equals the change in the inflation premium. The same 3% increase results for all assets.

22. A firm's beta can change over time as a result of changes in the firm's asset mix, in its financing mix, or in external factors not within management's control, such as earthquakes, toxic spills, and so on. The impacts of changes in beta on value are discussed in Chapter 7.

FIGURE 5.11

Inflation Shifts SML

Impact of increased inflationary expectations on the SML

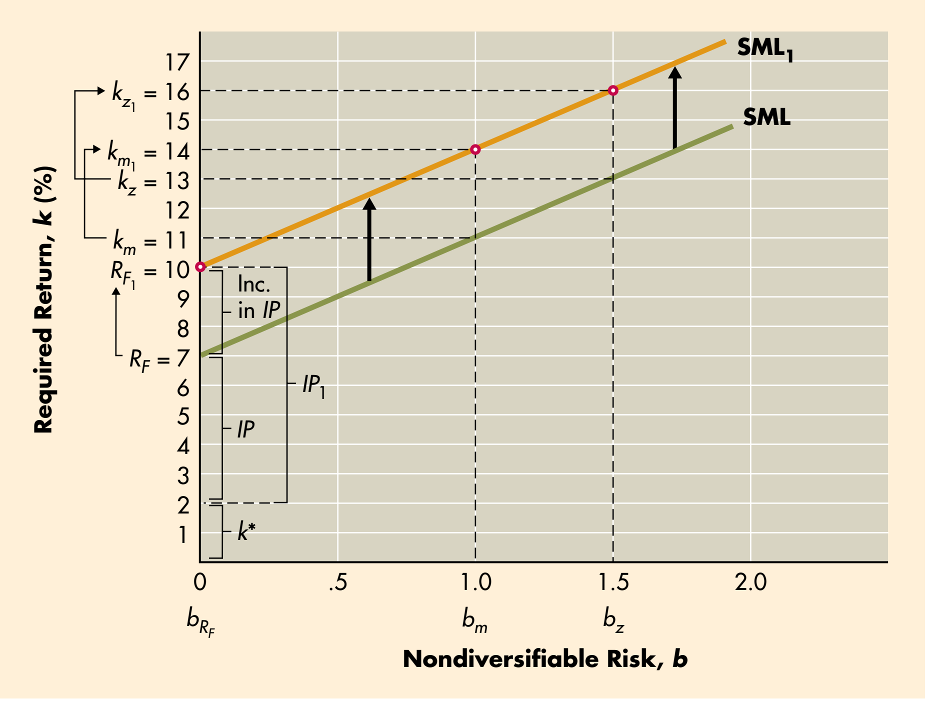


Figure 5.11 depicts the situation just described. It shows that the 3% increase in inflationary expectations results in a parallel shift upward of 3% in the SML. Clearly, the required returns on all assets rise by 3%. Note that the rise in the inflation premium from 5% to 8% (IP to IP_1) causes the risk-free rate to rise from 7% to 10% (R_F to R_{F_1}) and the market return to increase from 11% to 14% (k_m to k_{m_1}). The security market line therefore shifts upward by 3% (SML to SML_1), causing the required return on all risky assets, such as asset Z, to rise by 3%. It should now be clear that *a given change in inflationary expectations will be fully reflected in a corresponding change in the returns of all assets, as reflected graphically in a parallel shift of the SML.*

Changes in Risk Aversion The slope of the security market line reflects the general risk preferences of investors in the marketplace. As discussed earlier and shown in Figure 5.1, most investors are risk-averse—they require increased returns for increased risk. This positive relationship between risk and return is graphically represented by the SML, which depicts the relationship between nondiversifiable risk as measured by beta (x axis) and the required return (y axis). The slope of the SML reflects the degree of risk aversion: *the steeper its slope, the greater the degree of risk aversion,* because a higher level of return will be required for each level of risk as measured by beta. In other words, *risk premiums increase with increasing risk avoidance.*

Changes in risk aversion, and therefore shifts in the SML, result from changing preferences of investors, which generally result from economic, political, and social events. Examples of events that *increase* risk aversion include a stock market crash, assassination of a key political leader, and the outbreak of war. In general, widely accepted expectations of hard times ahead tend to cause investors to become more risk-averse, requiring higher returns as compensation for accepting a given level of risk. The impact of increased risk aversion on the SML can best be demonstrated by an example.

EXAMPLE

In the preceding examples, the SML in Figure 5.10 reflected a risk-free rate (R_F) of 7%, a market return (k_m) of 11%, a market risk premium ($k_m - R_F$) of 4%, and a required return on asset Z (k_Z) of 13% with a beta (b_Z) of 1.5. Assume that recent economic events have made investors more risk-averse, causing a new higher market return (k_{m_1}) of 14%. Graphically, this change would cause the SML to shift upward as shown in Figure 5.12, causing a new market risk premium ($k_{m_1} - R_F$) of 7%. As a result, the required return on all risky assets will increase. For asset Z, with a beta of 1.5, the new required return (k_{Z_1}) can be calculated by using CAPM (Equation 5.8):

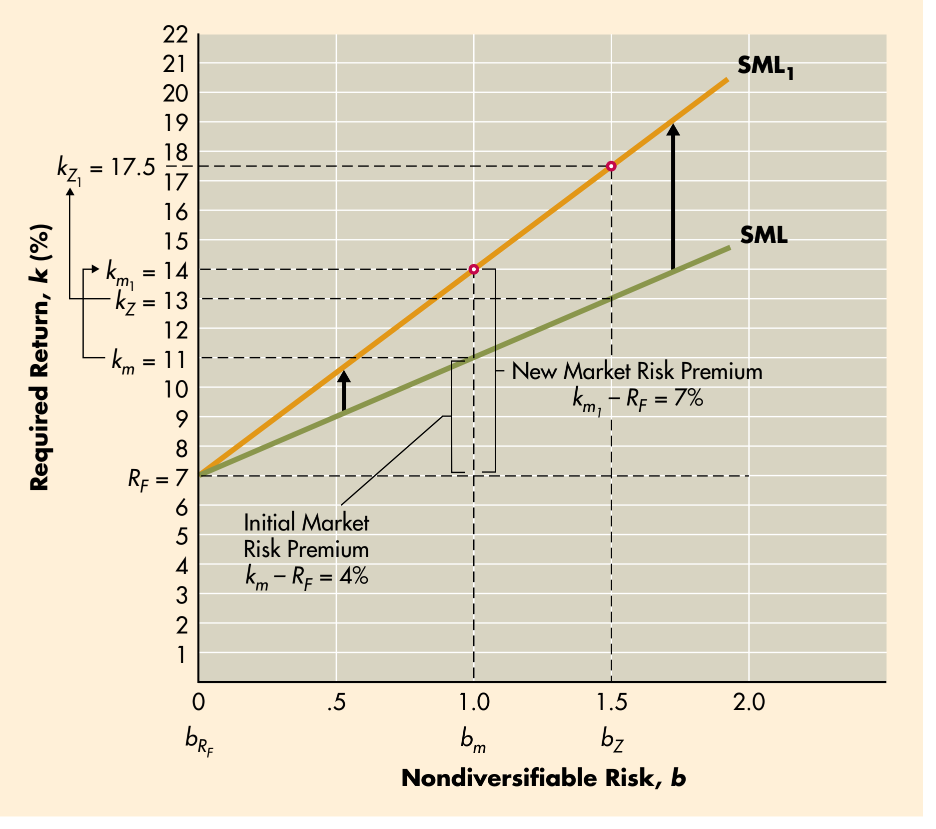
$$k_{Z_1} = 7\% + [1.5 \times (14\% - 7\%)] = 7\% + 10.5\% = \underline{\underline{17.5}}\%$$

This value can be seen on the new security market line (SML_1) in Figure 5.12. Note that although asset Z's risk, as measured by beta, did not change, its required return has increased because of the increased risk aversion reflected in

FIGURE 5.12

Risk Aversion Shifts SML

Impact of increased risk aversion on the SML



In Practice

FOCUS ON PRACTICE What's at Risk? VAR Has the Answer

Financial managers, always on the lookout for new ways to measure and manage risk, have added *value-at -risk* (*VAR*) techniques to their repertoire. VAR is a statistical measure of risk exposure that reflects the potential loss from an unlikely, adverse event in a normal, everyday market environment. It predicts the drop in a company's value that will occur if things go wrong by calculating the financial risk in the future market value of a portfolio of assets, liabilities, and equity.

First used by banks and brokerage firms to measure the risk of market movements, VAR now has proponents among nonfinancial companies such as **Xerox**, **General Motors**, and **GTE**. Unlike other risk tools that measure risk using standard deviation, VAR is stated in currency units: for example, VAR would represent an amount, let's call it *D* dollars, where the chance of losing more than *D* dollars is, say, 1 in 50 over some future time interval, perhaps a week.

VAR shows companies whether they are properly diversified and also whether they have sufficient capital. Among its other benefits, it tells managers whether their actions are too cautious, identifies risk trouble spots that might not be caught, and provides a way to compare business units that measure performance differently for internal reporting.

For example, a bank could take a diverse portfolio of financial assets and calculate price swings by measuring performance on specific days in the past. Plotting the percentage gain or loss for hundreds of days would reveal the value at risk of that portfolio. If it was riskier than previously thought, traders could take corrective action—selling a particular type of security, for example—to reduce risk.

Like any quantitative model, VAR has its limitations. Perhaps its biggest drawback is its reliance on historical patterns that may not hold true in the future.

Sources: Steve Bergsman, "Delivering the Risk Management Goods," *Treasury & Risk Management*, downloaded from *www.treasuryandrisk.com/trmtechguide/article13.cgi;* Peter Coy, "Taking the Angst Out of Taking a Gamble," *Business Week* (July 14, 1997), pp. 52–53; and Paul Hom and Ron Tonuzi, "Value-at-Risk: Safety Net or Abyss?" *Treasury & Risk Management* (November/December 1998), downloaded from *www.cfonet.com;* Barry Schachter, "An Irreverent Guide to Value at Risk," *All About Value-at-Risk* (Web site), downloaded from *www.gloriamundi.com.*

the market risk premium. It should now be clear that *greater risk aversion results in higher required returns for each level of risk. Similarly, a reduction in risk aversion causes the required return for each level of risk to decline.*

Some Comments on CAPM

The capital asset pricing model generally relies on historical data. The betas may or may not actually reflect the *future* variability of returns. Therefore, the required returns specified by the model can be viewed only as rough approximations. Users of betas commonly make subjective adjustments to the historically determined betas to reflect their expectations of the future.

efficient market
A market with the following characteristics: many small investors, all having the same information and expectations with respect to securities; no restrictions on investment, no taxes, and no transaction costs; and rational investors, who view securities similarly and are risk-averse, preferring higher returns and lower risk.

The CAPM was developed to explain the behavior of security prices and provide a mechanism whereby investors could assess the impact of a proposed security investment on their portfolio's overall risk and return. It is based on an assumed **efficient market** with the following characteristics: many small investors, all having the same information and expectations with respect to securities; no restrictions on investment, no taxes, and no transaction costs; and rational investors, who view securities similarly and are risk-averse, preferring higher returns and lower risk.

Although the perfect world of the efficient market appears to be unrealistic, studies have provided support for the existence of the expectational relationship described by CAPM in active markets such as the New York Stock Exchange.[23] In the case of real corporate assets, such as plant and equipment, research thus far has failed to prove the general applicability of CAPM because of indivisibility, relatively large size, limited number of transactions, and absence of an efficient market for such assets.

Despite the limitations of CAPM, it provides a useful conceptual framework for evaluating and linking risk and return. An awareness of this tradeoff and an attempt to consider risk as well as return in financial decision making should help financial managers achieve their goals.

Review Questions

5–11 How are total risk, nondiversifiable risk, and diversifiable risk related? Why is nondiversifiable risk the *only relevant risk?*

5–12 What risk does *beta* measure? How can you find the beta of a portfolio?

5–13 Explain the meaning of each variable in the *capital asset pricing model (CAPM)* equation. What is the *security market line (SML)?*

5–14 What impact would the following changes have on the security market line and therefore on the required return for a given level of risk? (**a**) An *increase* in inflationary expectations. (**b**) Investors become *less* risk-averse.

5–15 Why do financial managers have some difficulty applying CAPM in financial decision making? Generally, what benefit does CAPM provide them?

Summary

FOCUS ON VALUE

A firm's risk and expected return directly affect its share price. As we shall see in Chapter 7, risk and return are the two key determinants of the firm's value. It is therefore the financial manager's responsibility to assess carefully the risk and return of all major decisions in order to make sure that the expected returns justify the level of risk being introduced.

The way the financial manager can expect to achieve **the firm's goal of increasing its share price** (and thereby benefiting its owners) is to take only those actions that earn returns at least commensurate with their risk. Clearly, financial managers need to recognize, measure, and evaluate risk–return tradeoffs in order to ensure that their decisions contribute to the creation of value for owners.

23. A study by Eugene F. Fama and Kenneth R. French, "The Cross-Section of Expected Stock Returns," *Journal of Finance* 47 (June 1992), pp. 427–465, raised serious questions about the validity of CAPM. The study failed to find a significant relationship between the *historical* betas and *historical* returns on over 2,000 stocks during 1963–1990. In other words, it found that the magnitude of a stock's *historical* beta had no relationship to the level of its *historical* return. Although Fama and French's study continues to receive attention, CAPM has not been abandoned because its rejection as a *historical* model fails to discredit its validity as an *expectational* model. Therefore, in spite of this challenge, CAPM continues to be viewed as a logical and useful framework—both conceptually and operationally—for linking *expected* nondiversifiable risk and return.

REVIEW OF LEARNING GOALS

LG1 **Understand the meaning and fundamentals of risk, return, and risk preferences.** Risk is the chance of loss or, more formally, the variability of returns. A number of sources of firm-specific and shareholder-specific risks exists. Return is any cash distributions plus the change in value expressed as a percentage of the initial value. Investment returns vary both over time and between different types of investments. The equation for the rate of return is given in Table 5.13. The three basic risk preference behaviors are risk-averse, risk-indifferent, and risk-seeking. Most financial decision makers are risk-averse. They generally prefer less risky alternatives, and they require higher expected returns as compensation for taking greater risk.

LG2 **Describe procedures for assessing and measuring the risk of a single asset.** The risk of a single asset is measured in much the same way as the risk of a portfolio, or collection, of assets. Sensitivity analysis and probability distributions can be used to assess risk. In addition to the range, the standard deviation and the coefficient of variation are statistics that can be used to measure risk quantitatively. The key equations for the expected value of a return, the standard deviation of a return, and the coefficient of variation are summarized in Table 5.13.

LG3 **Discuss the measurement of return and standard deviation for a portfolio and the various types of correlation that can exist between series of numbers.** The return of a portfolio is calculated as the weighted average of returns on the individual assets from which it is formed. The equation for portfolio return is given in Table 5.13. The portfolio standard deviation is found by using the formula for the standard deviation of a single asset. Correlation—the statistical relationship between any two series of numbers—can be positive (the series move in the same direction), negative (the series move in opposite directions), or uncorrelated (the series exhibit no discernible relationship). At the extremes, the series can be perfectly positively correlated (have a correlation coefficient of +1) or perfectly negatively correlated (have a correlation coefficient of −1).

LG4 **Understand the risk and return characteristics of a portfolio in terms of correlation and diversification, and the impact of international assets on a portfolio.** Diversification involves combining assets with low (less positive and more negative) correlation to reduce the risk of the portfolio. Although the return on a two-asset portfolio will lie between the returns of the two assets held in isolation, the range of risk depends on the correlation between the two assets. If they are perfectly positively correlated, the portfolio's risk will be between the individual asset's risks. If they are uncorrelated, the portfolio's risk will be between the risk of the most risky asset and an amount less than the risk of the least risky asset but greater than zero. If they are negatively correlated, the portfolio's risk will be between the risk of the most risky asset and zero. International diversification can be used to reduce a portfolio's risk further. With foreign assets come the risk of currency fluctuation and political risks.

LG5 **Review the two types of risk and the derivation and role of beta in measuring the relevant risk of both an individual security and a portfolio.** The total risk of a security consists of nondiversifiable and diversifiable risk. Nondiversifiable risk is the only relevant risk; diversifiable risk can be eliminated through diversification. Nondiversifiable risk is measured by the beta coefficient, which is a relative measure of the relationship between an asset's return and the market return. Beta is derived by finding the slope of the "characteristic line" that best explains the historical relationship between the asset's return and the market return. The beta of a portfolio is a weighted average of the betas of the individual assets that it includes. The equations for total risk and the portfolio beta are given in Table 5.13.

LG6 **Explain the capital asset pricing model (CAPM), its relationship to the security market line (SML), and shifts in the SML caused by changes in inflationary expectations and risk aversion.** The capital asset pricing model (CAPM) uses beta to relate an asset's risk relative to the market to the asset's required return. The equation for CAPM is

TABLE 5.13 Summary of Key Definitions and Formulas for Risk and Return

Definitions of variables

b_j = beta coefficient or index of nondiversifiable risk for asset j
b_p = portfolio beta
C_t = cash received from the asset investment in the time period $t-1$ to t
CV = coefficient of variation
$\bar{k}$ = expected value of a return
k_j = return for the jth outcome; return on asset j; required return on asset j
k_m = market return; the return on the market portfolio of assets
k_p = portfolio return
k_t = actual, expected, or required rate of return during period t
n = number of outcomes considered
P_t = price (value) of asset at time t
P_{t-1} = price (value) of asset at time $t-1$
Pr_j = probability of occurrence of the jth outcome
R_F = risk-free rate of return
σ_k = standard deviation of returns
w_j = proportion of total portfolio dollar value represented by asset j

Risk and return formulas

Rate of return during period t:

$$k_t = \frac{C_t + P_t - P_{t-1}}{P_{t-1}} \qquad \text{[Eq. 5.1]}$$

Expected value of a return:
for probabilistic data:

$$\bar{k} = \sum_{j=1}^{n} k_j \times Pr_j \qquad \text{[Eq. 5.2]}$$

general formula:

$$\bar{k} = \frac{\sum_{j=1}^{n} k_j}{n} \qquad \text{[Eq. 5.2a]}$$

Standard deviation of return:
for probabilistic data:

$$\sigma_k = \sqrt{\sum_{j=1}^{n} (k_j - \bar{k})^2 \times Pr_j} \qquad \text{[Eq. 5.3]}$$

general formula:

$$\sigma_k = \sqrt{\frac{\sum_{j=1}^{n} (k_j - \bar{k})^2}{n-1}} \qquad \text{[Eq. 5.3a]}$$

Coefficient of variation:

$$CV = \frac{\sigma_k}{\bar{k}} \qquad \text{[Eq. 5.4]}$$

Portfolio return:

$$k_p = \sum_{j=1}^{n} w_j \times k_j \qquad \text{[Eq. 5.5]}$$

Total security risk = Nondiversifiable risk + Diversifiable risk [Eq. 5.6]

Portfolio beta:

$$b_p = \sum_{j=1}^{n} w_j \times b_j \qquad \text{[Eq. 5.7]}$$

Capital asset pricing model (CAPM):

$$k_j = R_F + [b_j \times (k_m - R_F)] \qquad \text{[Eq. 5.8]}$$

given in Table 5.13. The graphical depiction of CAPM is the security market line (SML), which shifts over time in response to changing inflationary expectations and/or changes in investor risk aversion. Changes in inflationary expectations result in parallel shifts in the SML in direct response to the magnitude and direction of change. Increasing risk aversion results in a steepening in the slope of the SML, and decreasing risk aversion reduces the slope of the SML. Although it has some shortcomings, CAPM provides a useful conceptual framework for evaluating and linking risk and return.

SELF-TEST PROBLEMS (Solutions in Appendix B)

LG3 LG4 **ST 5–1** **Portfolio analysis** You have been asked for your advice in selecting a portfolio of assets and have been given the following data:

	Expected return		
Year	Asset A	Asset B	Asset C
2004	12%	16%	12%
2005	14	14	14
2006	16	12	16

No probabilities have been supplied. You have been told that you can create two portfolios—one consisting of assets A and B and the other consisting of assets A and C—by investing equal proportions (50%) in each of the two component assets.

a. What is the expected return for each asset over the 3-year period?

b. What is the standard deviation for each asset's return?

c. What is the expected return for each of the two portfolios?

d. How would you characterize the correlations of returns of the two assets making up each of the two portfolios identified in part **c**?

e. What is the standard deviation for each portfolio?

f. Which portfolio do you recommend? Why?

LG5 LG6 **ST 5–2** **Beta and CAPM** Currently under consideration is a project with a beta, *b*, of 1.50. At this time, the risk-free rate of return, R_F, is 7%, and the return on the market portfolio of assets, k_m, is 10%. The project is actually *expected* to earn an annual rate of return of 11%.

a. If the return on the market portfolio were to increase by 10%, what would you expect to happen to the project's *required return*? What if the market return were to decline by 10%?

b. Use the capital asset pricing model (CAPM) to find the *required return* on this investment.

c. On the basis of your calculation in part **b**, would you recommend this investment? Why or why not?

d. Assume that as a result of investors becoming less risk-averse, the market return drops by 1% to 9%. What impact would this change have on your responses in parts **b** and **c**?

PROBLEMS

LG1 **5–1 Rate of return** Douglas Keel, a financial analyst for Orange Industries, wishes to estimate the rate of return for two similar-risk investments, X and Y. Keel's research indicates that the immediate past returns will serve as reasonable estimates of future returns. A year earlier, investment X had a market value of \$20,000, investment Y of \$55,000. During the year, investment X generated cash flow of \$1,500 and investment Y generated cash flow of \$6,800. The current market values of investments X and Y are \$21,000 and \$55,000, respectively.

a. Calculate the expected rate of return on investments X and Y using the most recent year's data.

b. Assuming that the two investments are equally risky, which one should Keel recommend? Why?

LG1 **5–2 Return calculations** For each of the investments shown in the following table, calculate the rate of return earned over the unspecified time period.

Investment	Cash flow during period	Beginning-of-period value	End-of-period value
A	−\$ 100	\$ 800	\$ 1,100
B	15,000	120,000	118,000
C	7,000	45,000	48,000
D	80	600	500
E	1,500	12,500	12,400

LG1 **5–3 Risk preferences** Sharon Smith, the financial manager for Barnett Corporation, wishes to evaluate three prospective investments: X, Y, and Z. Currently, the firm earns 12% on its investments, which have a risk index of 6%. The expected return and expected risk of the investments are as follows:

Investment	Expected return	Expected risk index
X	14%	7%
Y	12	8
Z	10	9

a. If Sharon Smith were *risk-indifferent,* which investments would she select? Explain why.

b. If she were *risk-averse,* which investments would she select? Why?

c. If she were *risk-seeking,* which investments would she select? Why?

d. Given the traditional risk preference behavior exhibited by financial managers, which investment would be preferred? Why?

LG2 **5–4 Risk analysis** Solar Designs is considering an investment in an expanded product line. Two possible types of expansion are being considered. After investigating the possible outcomes, the company made the estimates shown in the following table

	Expansion A	Expansion B
Initial investment	$12,000	$12,000
Annual rate of return		
Pessimistic	16%	10%
Most likely	20%	20%
Optimistic	24%	30%

a. Determine the *range* of the rates of return for each of the two projects.
b. Which project is less risky? Why?
c. If you were making the investment decision, which one would you choose? Why? What does this imply about your feelings toward risk?
d. Assume that expansion B's most likely outcome is 21% per year and that all other facts remain the same. Does this change your answer to part **c?** Why?

LG2 5–5 **Risk and probability** Micro-Pub, Inc., is considering the purchase of one of two microfilm cameras, R and S. Both should provide benefits over a 10-year period, and each requires an initial investment of $4,000. Management has constructed the following table of estimates of rates of return and probabilities for pessimistic, most likely, and optimistic results:

	Camera R		Camera S	
	Amount	Probability	Amount	Probability
Initial investment	$4,000	1.00	$4,000	1.00
Annual rate of return				
Pessimistic	20%	.25	15%	.20
Most likely	25%	.50	25%	.55
Optimistic	30%	.25	35%	.25

a. Determine the *range* for the rate of return for each of the two cameras.
b. Determine the *expected value* of return for each camera.
c. Purchase of which camera is riskier? Why?

LG2 5–6 **Bar charts and risk** Swan's Sportswear is considering bringing out a line of designer jeans. Currently, it is negotiating with two different well-known designers. Because of the highly competitive nature of the industry, the two lines of jeans have been given code names. After market research, the firm has established the expectations shown in the following table about the annual rates of return

Market acceptance	Probability	Annual rate of return Line J	Line K
Very poor	.05	.0075	.010
Poor	.15	.0125	.025
Average	.60	.0850	.080
Good	.15	.1475	.135
Excellent	.05	.1625	.150

Use the table to:

a. Construct a bar chart for each line's annual rate of return.

b. Calculate the *expected value* of return for each line.

c. Evaluate the relative riskiness for each jean line's rate of return using the bar charts.

LG2 5–7 **Coefficient of variation** Metal Manufacturing has isolated four alternatives for meeting its need for increased production capacity. The data gathered relative to each of these alternatives is summarized in the following table.

Alternative	Expected return	Standard deviation of return
A	20%	7.0%
B	22	9.5
C	19	6.0
D	16	5.5

a. Calculate the *coefficient of variation* for each alternative.

b. If the firm wishes to minimize risk, which alternative do you recommend? Why?

LG2 5–8 **Standard deviation versus coefficient of variation as measures of risk** Greengage, Inc., a successful nursery, is considering several expansion projects. All of the alternatives promise to produce an acceptable return. The owners are extremely risk-averse; therefore, they will choose the least risky of the alternatives. Data on four possible projects follow.

Project	Expected return	Range	Standard deviation
A	12.0%	.040	.029
B	12.5	.050	.032
C	13.0	.060	.035
D	12.8	.045	.030

a. Which project is least risky, judging on the basis of range?
b. Which project has the lowest standard deviation? Explain why standard deviation is not an appropriate measure of risk for purposes of this comparison.
c. Calculate the coefficient of variation for each project. Which project will Greengage's owners choose? Explain why this may be the best measure of risk for comparing this set of opportunities.

LG2 **5–9** **Assessing return and risk** Swift Manufacturing must choose between two asset purchases. The annual rate of return and the related probabilities given in the following table summarize the firm's analysis to this point.

Project 257		Project 432	
Rate of return	Probability	Rate of return	Probability
−10%	.01	10%	.05
10	.04	15	.10
20	.05	20	.10
30	.10	25	.15
40	.15	30	.20
45	.30	35	.15
50	.15	40	.10
60	.10	45	.10
70	.05	50	.05
80	.04		
100	.01		

a. For each project, compute:
(1) The range of possible rates of return.
(2) The expected value of return.
(3) The standard deviation of the returns.
(4) The coefficient of variation of the returns.
b. Construct a bar chart of each distribution of rates of return.
c. Which project would you consider less risky? Why?

LG2 **5–10** **Integrative—Expected return, standard deviation, and coefficient of variation** Three assets—F, G, and H—are currently being considered by Perth Industries. The probability distributions of expected returns for these assets are shown in the following table.

	Asset F		Asset G		Asset H	
j	Pr_j	Return, k_j	Pr_j	Return, k_j	Pr_j	Return, k_j
1	.10	40%	.40	35%	.10	40%
2	.20	10	.30	10	.20	20
3	.40	0	.30	−20	.40	10
4	.20	−5			.20	0
5	.10	−10			.10	−20

a. Calculate the expected value of return, $\bar{k}$, for each of the three assets. Which provides the largest expected return?

b. Calculate the standard deviation, σ_k, for each of the three assets' returns. Which appears to have the greatest risk?
c. Calculate the coefficient of variation, *CV*, for each of the three assets' returns. Which appears to have the greatest *relative* risk?

LG2 **5–11 Normal probability distribution** Assuming that the rates of return associated with a given asset investment are normally distributed and that the expected return, $\bar{k}$, is 18.9% and the coefficient of variation, *CV*, is .75, answer the following questions.
a. Find the standard deviation of returns, σ_k.
b. Calculate the range of expected return outcomes associated with the following probabilities of occurrence: (1) 68%, (2) 95%, (3) 99%.
c. Draw the probability distribution associated with your findings in parts **a** and **b.**

LG3 **5–12 Portfolio return and standard deviation** Jamie Wong is considering building a portfolio containing two assets, L and M. Asset L will represent 40% of the dollar value of the portfolio, and asset M will account for the other 60%. The expected returns over the next 6 years, 2004–2009, for each of these assets, are shown in the following table.

	Expected return	
Year	Asset L	Asset M
2004	14%	20%
2005	14	18
2006	16	16
2007	17	14
2008	17	12
2009	19	10

a. Calculate the expected portfolio return, k_p, for *each* of the 6 years.
b. Calculate the expected value of portfolio returns, $\bar{k}_p$, over the 6-year period.
c. Calculate the standard deviation of expected portfolio returns, σ_{k_p}, over the 6-year period.
d. How would you characterize the correlation of returns of the two assets L and M?
e. Discuss any benefits of diversification achieved through creation of the portfolio.

LG3 **5–13 Portfolio analysis** You have been given the return data shown in the first table on three assets—F, G, and H—over the period 2004–2007.

	Expected return		
Year	Asset F	Asset G	Asset H
2004	16%	17%	14%
2005	17	16	15
2006	18	15	16
2007	19	14	17

Using these assets, you have isolated the three investment alternatives shown in the following table:

Alternative	Investment
1	100% of asset F
2	50% of asset F and 50% of asset G
3	50% of asset F and 50% of asset H

a. Calculate the expected return over the 4-year period for each of the three alternatives.
b. Calculate the standard deviation of returns over the 4-year period for each of the three alternatives.
c. Use your findings in parts **a** and **b** to calculate the coefficient of variation for each of the three alternatives.
d. On the basis of your findings, which of the three investment alternatives do you recommend? Why?

LG4 **5–14 Correlation, risk, and return** Matt Peters wishes to evaluate the risk and return behaviors associated with various combinations of assets V and W under three assumed degrees of correlation: perfect positive, uncorrelated, and perfect negative. The expected return and risk values calculated for each of the assets are shown in the following table.

Asset	Expected return, $\bar{k}$	Risk (standard deviation), σ_k
V	8%	5%
W	13	10

a. If the returns of assets V and W are *perfectly positively correlated* (correlation coefficient = +1), describe the *range* of (1) expected return and (2) risk associated with all possible portfolio combinations.
b. If the returns of assets V and W are *uncorrelated* (correlation coefficient = 0), describe the *approximate range* of (1) expected return and (2) risk associated with all possible portfolio combinations.
c. If the returns of assets V and W are *perfectly negatively correlated* (correlation coefficient = −1), describe the *range* of (1) expected return and (2) risk associated with all possible portfolio combinations.

LG1 LG4 **5–15 International investment returns** Joe Martinez, a U.S. citizen living in Brownsville, Texas, invested in the common stock of Telmex, a Mexican corporation. He purchased 1,000 shares at 20.50 pesos per share. Twelve months later, he sold them at 24.75 pesos per share. He received no dividends during that time.
a. What was Joe's investment return (in percentage terms) for the year, on the basis of the peso value of the shares?
b. The exchange rate for pesos was 9.21 pesos per $US1.00 at the time of the purchase. At the time of the sale, the exchange rate was 9.85 pesos per $US1.00. Translate the purchase and sale prices into $US.
c. Calculate Joe's investment return on the basis of the $US value of the shares.

d. Explain why the two returns are different. Which one is more important to Joe? Why?

LG5 **5–16** **Total, nondiversifiable, and diversifiable risk** David Talbot randomly selected securities from all those listed on the New York Stock Exchange for his portfolio. He began with a single security and added securities one by one until a total of 20 securities were held in the portfolio. After each security was added, David calculated the portfolio standard deviation, σ_{k_p}. The calculated values are shown in the following table.

Number of securities	Portfolio risk, σ_{k_p}	Number of securities	Portfolio risk, σ_{k_p}
1	14.50%	11	7.00%
2	13.30	12	6.80
3	12.20	13	6.70
4	11.20	14	6.65
5	10.30	15	6.60
6	9.50	16	6.56
7	8.80	17	6.52
8	8.20	18	6.50
9	7.70	19	6.48
10	7.30	20	6.47

a. On a set of "number of securities in portfolio (x axis)–portfolio risk (y axis)" axes, plot the portfolio risk data given in the preceding table.

b. Divide the total portfolio risk in the graph into its *nondiversifiable* and *diversifiable* risk components and label each of these on the graph.

c. Describe which of the two risk components is the *relevant risk,* and explain why it is relevant. How much of this risk exists in David Talbot's portfolio?

LG5 **5–17** **Graphical derivation of beta** A firm wishes to estimate graphically the betas for two assets, A and B. It has gathered the return data shown in the following table for the market portfolio and for both assets over the last ten years, 1994–2003.

	Actual return		
Year	Market portfolio	Asset A	Asset B
1994	6%	11%	16%
1995	2	8	11
1996	−13	−4	−10
1997	−4	3	3
1998	−8	0	−3
1999	16	19	30
2000	10	14	22
2001	15	18	29
2002	8	12	19
2003	13	17	26

a. On a set of "market return (x axis)–asset return (y axis)" axes, use the data given to draw the characteristic line for asset A and for asset B.
b. Use the characteristic lines from part **a** to estimate the betas for assets A and B.
c. Use the betas found in part **b** to comment on the relative risks of assets A and B.

LG5 **5–18 Interpreting beta** A firm wishes to assess the impact of changes in the market return on an asset that has a beta of 1.20.
a. If the market return increased by 15%, what impact would this change be expected to have on the asset's return?
b. If the market return decreased by 8%, what impact would this change be expected to have on the asset's return?
c. If the market return did not change, what impact, if any, would be expected on the asset's return?
d. Would this asset be considered more or less risky than the market? Explain.

LG5 **5–19 Betas** Answer the following questions for assets A to D shown in the following table.

Asset	Beta
A	.50
B	1.60
C	−.20
D	.90

a. What impact would a *10% increase* in the market return be expected to have on each asset's return?
b. What impact would a *10% decrease* in the market return be expected to have on each asset's return?
c. If you were certain that the market return would *increase* in the near future, which asset would you prefer? Why?
d. If you were certain that the market return would *decrease* in the near future, which asset would you prefer? Why?

LG5 **5–20 Betas and risk rankings** Stock A has a beta of .80, stock B has a beta of 1.40, and stock C has a beta of −.30.
a. Rank these stocks from the most risky to the least risky.
b. If the return on the market portfolio increased by 12%, what change would you expect in the return for each of the stocks?
c. If the return on the market portfolio decreased by 5%, what change would you expect in the return for each of the stocks?
d. If you felt that the stock market was just ready to experience a significant decline, which stock would you probably add to your portfolio? Why?
e. If you anticipated a major stock market rally, which stock would you add to your portfolio? Why?

LG5 **5–21 Portfolio betas** Rose Berry is attempting to evaluate two possible portfolios, which consist of the same five assets held in different proportions. She is particularly interested in using beta to compare the risks of the portfolios, so she has gathered the data shown in the following table.

		Portfolio weights	
Asset	Asset beta	Portfolio A	Portfolio B
1	1.30	10%	30%
2	.70	30	10
3	1.25	10	20
4	1.10	10	20
5	.90	40	20
Totals		100%	100%

a. Calculate the betas for portfolios A and B.
b. Compare the risks of these portfolios to the market as well as to each other. Which portfolio is more risky?

LG6 **5–22** **Capital asset pricing model (CAPM)** For each of the cases shown in the following table, use the capital asset pricing model to find the required return.

Case	Risk-free rate, R_F	Market return, k_m	Beta, b
A	5%	8%	1.30
B	8	13	.90
C	9	12	−.20
D	10	15	1.00
E	6	10	.60

LG5 LG6 **5–23** **Beta coefficients and the capital asset pricing model** Katherine Wilson is wondering how much risk she must undertake in order to generate an acceptable return on her portfolio. The risk-free return currently is 5%. The return on the average stock (market return) is 16%. Use the CAPM to calculate the beta coefficient associated with each of the following portfolio returns.
a. 10%
b. 15%
c. 18%
d. 20%
e. Katherine is risk-averse. What is the highest return she can expect if she is unwilling to take more than an average risk?

LG6 **5–24** **Manipulating CAPM** Use the basic equation for the capital asset pricing model (CAPM) to work each of the following problems.
a. Find the *required return* for an asset with a beta of .90 when the risk-free rate and market return are 8% and 12%, respectively.

b. Find the *risk-free rate* for a firm with a required return of 15% and a beta of 1.25 when the market return is 14%.
c. Find the *market return* for an asset with a required return of 16% and a beta of 1.10 when the risk-free rate is 9%.
d. Find the *beta* for an asset with a required return of 15% when the risk-free rate and market return are 10% and 12.5%, respectively.

LG1 LG3 LG5 LG6

5–25 Portfolio return and beta Jamie Peters invested $100,000 to set up the following portfolio one year ago:

Asset	Cost	Beta at purchase	Yearly income	Value today
A	$20,000	.80	$1,600	$20,000
B	35,000	.95	1,400	36,000
C	30,000	1.50	—	34,500
D	15,000	1.25	375	16,500

a. Calculate the portfolio beta on the basis of the original cost figures.
b. Calculate the percentage return of each asset in the portfolio for the year.
c. Calculate the percentage return of the portfolio on the basis of original cost, using income and gains during the year.
d. At the time Jamie made his investments, investors were estimating that the market return for the coming year would be 10%. The estimate of the risk-free rate of return averaged 4% for the coming year. Calculate an expected rate of return for each stock on the basis of its beta and the expectations of market and risk-free returns.
e. On the basis of the actual results, explain how each stock in the portfolio performed relative to those CAPM-generated expectations of performance. What factors could explain these differences?

LG6

5–26 Security market line, SML Assume that the risk-free rate, R_F, is currently 9% and that the market return, k_m, is currently 13%.
a. Draw the security market line (SML) on a set of "nondiversifiable risk (x axis)–required return (y axis)" axes.
b. Calculate and label the *market risk premium* on the axes in part **a.**
c. Given the previous data, calculate the required return on asset A having a beta of .80 and asset B having a beta of 1.30.
d. Draw in the betas and required returns from part **c** for assets A and B on the axes in part **a.** Label the *risk premium* associated with each of these assets, and discuss them.

LG6

5–27 Shifts in the security market line Assume that the risk-free rate, R_F, is currently 8%, the market return, k_m, is 12%, and asset A has a beta, b_A, of 1.10.
a. Draw the security market line (SML) on a set of "nondiversifiable risk (x axis)–required return (y axis)" axes.
b. Use the CAPM to calculate the required return, k_A, on asset A, and depict asset A's beta and required return on the SML drawn in part **a.**
c. Assume that as a result of recent economic events, inflationary expectations have declined by 2%, lowering R_F and k_m to 6% and 10%, respectively.

Draw the new SML on the axes in part **a,** and calculate and show the new required return for asset A.

d. Assume that as a result of recent events, investors have become more risk-averse, causing the market return to rise by 1%, to 13%. Ignoring the shift in part **c,** draw the new SML on the same set of axes that you used before, and calculate and show the new required return for asset A.

e. From the previous changes, what conclusions can be drawn about the impact of (1) decreased inflationary expectations and (2) increased risk aversion on the required returns of risky assets?

LG6 5–28 **Integrative—Risk, return, and CAPM** Wolff Enterprises must consider several investment projects, A through E, using the capital asset pricing model (CAPM) and its graphical representation, the security market line (SML). Relevant information is presented in the following table.

Item	Rate of return	Beta, *b*
Risk-free asset	9%	0
Market portfolio	14	1.00
Project A	—	1.50
Project B	—	.75
Project C	—	2.00
Project D	—	0
Project E	—	−.50

a. Calculate the required rate of return and risk premium for each project, given its level of nondiversifiable risk.

b. Use your findings in part **a** to draw the security market line (required return relative to nondiversifiable risk).

c. Discuss the relative nondiversifiable risk of projects A through E.

d. Assume that recent economic events have caused investors to become less risk-averse, causing the market return to decline by 2%, to 12%. Calculate the new required returns for assets A through E, and draw the new security market line on the same set of axes that you used in part **b.**

e. Compare your findings in parts **a** and **b** with those in part **d.** What conclusion can you draw about the impact of a decline in investor risk aversion on the required returns of risky assets?

CHAPTER 5 CASE Analyzing Risk and Return on Chargers Products' Investments

Junior Sayou, a financial analyst for Chargers Products, a manufacturer of stadium benches, must evaluate the risk and return of two assets, X and Y. The firm is considering adding these assets to its diversified asset portfolio. To assess the return and risk of each asset, Junior gathered data on the annual cash flow and beginning- and end-of-year values of each asset over the immediately preceding 10 years, 1994–2003. These data are summarized in the accompanying table. Junior's investigation suggests that both assets, on average, will tend to

Return Data for Assets X and Y, 1994–2003

	Asset X			Asset Y		
		Value			Value	
Year	Cash flow	Beginning	Ending	Cash flow	Beginning	Ending
1994	$1,000	$20,000	$22,000	$1,500	$20,000	$20,000
1995	1,500	22,000	21,000	1,600	20,000	20,000
1996	1,400	21,000	24,000	1,700	20,000	21,000
1997	1,700	24,000	22,000	1,800	21,000	21,000
1998	1,900	22,000	23,000	1,900	21,000	22,000
1999	1,600	23,000	26,000	2,000	22,000	23,000
2000	1,700	26,000	25,000	2,100	23,000	23,000
2001	2,000	25,000	24,000	2,200	23,000	24,000
2002	2,100	24,000	27,000	2,300	24,000	25,000
2003	2,200	27,000	30,000	2,400	25,000	25,000

perform in the future just as they have during the past 10 years. He therefore believes that the expected annual return can be estimated by finding the average annual return for each asset over the past 10 years.

Junior believes that each asset's risk can be assessed in two ways: in isolation and as part of the firm's diversified portfolio of assets. The risk of the assets in isolation can be found by using the standard deviation and coefficient of variation of returns over the past 10 years. The capital asset pricing model (CAPM) can be used to assess the asset's risk as part of the firm's portfolio of assets. Applying some sophisticated quantitative techniques, Junior estimated betas for assets X and Y of 1.60 and 1.10, respectively. In addition, he found that the risk-free rate is currently 7% and that the market return is 10%.

Required

a. Calculate the annual rate of return for each asset in *each* of the 10 preceding years, and use those values to find the average annual return for each asset over the 10-year period.

b. Use the returns calculated in part **a** to find (1) the standard deviation and (2) the coefficient of variation of the returns for each asset over the 10-year period 1994–2003.

c. Use your findings in parts **a** and **b** to evaluate and discuss the return and risk associated with each asset. Which asset appears to be preferable? Explain.

d. Use the CAPM to find the required return for each asset. Compare this value with the average annual returns calculated in part **a.**

e. Compare and contrast your findings in parts **c** and **d.** What recommendations would you give Junior with regard to investing in either of the two assets? Explain to Junior why he is better off using beta rather than the standard deviation and coefficient of variation to assess the risk of each asset.

f. Rework parts **d** and **e** under each of the following circumstances:
(1) A rise of 1% in inflationary expectations causes the risk-free rate to rise to 8% and the market return to rise to 11%.
(2) As a result of favorable political events, investors suddenly become less risk-averse, causing the market return to drop by 1%, to 9%.

WEB EXERCISE

Go to the RiskGrades Web site, *www.riskgrades.com*. This site, from RiskMetrics Group, provides another way to assess the riskiness of stocks and mutual funds. RiskGrades provide a way to compare investment risk across all asset classes, regions, and currencies. They vary over time to reflect asset-specific information (such as the price of a stock reacting to an earnings release) and general market conditions. RiskGrades operate differently from traditional risk measures, such as standard deviation and beta.

1. First, learn more about RiskGrades by clicking on **RiskGrades Help Center** and reviewing the material. How are RiskGrades calculated? What differences can you identify when you compare them to standard deviation and beta techniques? What are the advantages and disadvantages of this measure, in your opinion?

2. Get RiskGrades for the following stocks using the **Get RiskGrade** pull-down menu at the site's upper right corner. You can enter multiple symbols separated by commas. Select **all dates** to get a historical view.

Company	Symbol
Citigroup	C
Intel	INTC
Microsoft	MSFT
Washington Mutual	WM

What do the results tell you?

3. Select one of the foregoing stocks and find other stocks with similar risk grades. Click on **By RiskGrade** to pull up a list.

4. How much risk can you tolerate? Use a hypothetical portfolio to find out. Click on **Grade Yourself**, take a short quiz, and get your personal RiskGrade measure. Did the results surprise you?

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

CHAPTER

6

INTEREST RATES AND BOND VALUATION

LEARNING GOALS

LG1 Describe interest rate fundamentals, the term structure of interest rates, and risk premiums.

LG2 Review the legal aspects of bond financing and bond cost.

LG3 Discuss the general features, quotations, ratings, popular types, and international issues of corporate bonds.

LG4 Understand the key inputs and basic model used in the valuation process.

LG5 Apply the basic valuation model to bonds and describe the impact of required return and time to maturity on bond values.

LG6 Explain yield to maturity (YTM), its calculation, and the procedure used to value bonds that pay interest semiannually.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand interest rates and the various types of bonds in order to be able to account properly for amortization of bond premiums and discounts and for bond purchases and retirements.

Information systems: You need to understand the data that you will need to track in bond amortization schedules and bond valuation.

Management: You need to understand the behavior of interest rates and how they will affect the types of funds the firm can raise and the timing and cost of bond issues and retirements.

Marketing: You need to understand how the interest rate level and the firm's ability to issue bonds may affect the availability of financing for marketing research projects and new-product development.

Operations: You need to understand how the interest rate level may affect the firm's ability to raise funds to maintain and increase the firm's production capacity.

FORD

FORD CRUISES THE DEBT MARKETS

Ford and **Ford Motor Credit Co**. (FMCC), its finance unit, were frequent visitors to the corporate debt markets in 2001, selling over $22 billion in long-term notes and bonds. Despite the problems in the auto industry, investors nervous about stock market volatility were willing to accept the credit risk to get higher yields. The company's 2001 offerings had something for all types of investors, ranging from 2- to 10-year notes to 30-year bonds. Demand for Ford's debt was so high that in January the company increased the size of its issue from $5 billion to $7.8 billion, and October's plan to issue $3 billion turned into a $9.4 billion offering.

The world's second largest auto manufacturer joined other corporate bond issuers to take advantage of strengthening bond markets. Even though the Federal Reserve began cutting short-term rates, interest rates for the longer maturities remained attractively low for corporations. Unlike some other auto companies who limited the size of their debt offerings, FMCC decided to borrow as much as possible to lock in the very wide spread between its lower borrowing costs and what its auto loans yielded.

All this debt came at a price, however. Both major bond-rating agencies—Moody's Investors Service and Standard & Poor's (S&P)—downgraded Ford's debt quality ratings in October 2001. Moody's lowered Ford's long-term debt rating by one rating class but did not change FMCC's quality rating. Ford spokesman Todd Nissen was pleased that Moody's confirmed the FMCC ratings. "It will help us keep our costs of borrowing down, which benefits Ford Credit and ultimately Ford Motor," he said. S&P's outlook for Ford was more negative; the agency cut ratings on all Ford and FMCC debt one rating class. The lower ratings contributed to the higher yields on Ford's October debt. For example, in April FMCC's 10-year notes yielded 7.1 percent, about 2 points above U.S. Treasury bonds. In October, 10-year FMCC notes yielded 7.3 percent, or 2.7 points above U.S. Treasury bonds.

For corporations like Ford, deciding when to issue debt and selecting the best maturities requires knowledge of interest rate fundamentals, risk premiums, issuance costs, ratings, and similar features of corporate bonds. In this chapter you'll learn about these important topics and also become acquainted with techniques for valuing bonds.

LG1 6.1 Interest Rates and Required Returns

As noted in Chapter 1, financial institutions and markets create the mechanism through which funds flow between savers (funds suppliers) and investors (funds demanders). The level of funds flow between suppliers and demanders can significantly affect economic growth. Growth results from the interaction of a variety of economic factors (such as the money supply, trade balances, and economic policies) that affect the cost of money—the interest rate or required return. The interest rate level acts as a regulating device that controls the flow of funds between suppliers and demanders. The *Board of Governors of the Federal Reserve System* regularly assesses economic conditions and, when necessary, initiates actions to raise or lower interest rates to control inflation and economic growth. Generally, the lower the interest rate, the greater the funds flow and therefore the greater the economic growth; the higher the interest rate, the lower the funds flow and economic growth.

Interest Rate Fundamentals

The interest rate or required return represents the cost of money. It is the compensation that a demander of funds must pay a supplier. When funds are lent, the cost of borrowing the funds is the **interest rate.** When funds are obtained by selling an ownership interest—as in the sale of stock—the cost to the issuer (demander) is commonly called the **required return,** which reflects the funds supplier's level of expected return. In both cases the supplier is compensated for providing funds. Ignoring risk factors, the cost of funds results from the *real rate of interest* adjusted for inflationary expectations and **liquidity preferences**—general preferences of investors for shorter-term securities.

interest rate
The compensation paid by the borrower of funds to the lender; from the borrower's point of view, the cost of borrowing funds.

required return
The cost of funds obtained by selling an ownership interest; it reflects the funds supplier's level of expected return.

liquidity preferences
General preferences of investors for shorter-term securities.

real rate of interest
The rate that creates an equilibrium between the supply of savings and the demand for investment funds in a perfect world, without inflation, where funds suppliers and demanders are indifferent to the term of loans or investments and have no liquidity preference, and where all outcomes are certain.

The Real Rate of Interest

Assume a *perfect world* in which there is no inflation and in which funds suppliers and demanders are indifferent to the term of loans or investments because they have no liquidity preference and all outcomes are certain.[1] At any given point in time in that perfect world, there would be one cost of money—the **real rate of interest.** The real rate of interest creates an equilibrium between the supply of savings and the demand for investment funds. It represents the most basic cost of money. The real rate of interest in the United States is assumed to be stable and equal to around 1 percent.[2] This supply–demand relationship is shown in Figure 6.1 by the supply function (labeled S_0) and the demand function (labeled D). An equilibrium between the supply of funds and the demand for funds ($S_0 = D$) occurs at a rate of interest k_0^*, the real rate of interest.

Clearly, the real rate of interest changes with changing economic conditions, tastes, and preferences. A trade surplus could result in an increased supply of

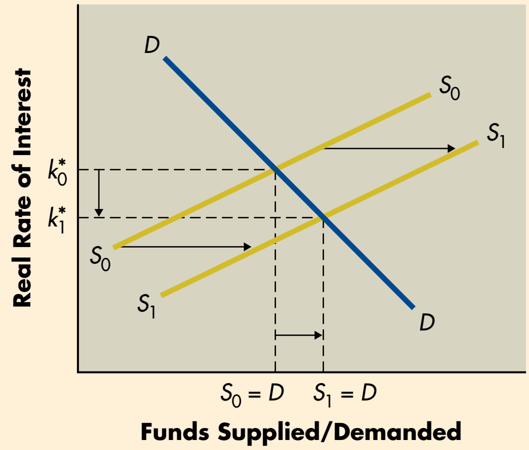
1. These assumptions are made to describe the most basic interest rate, the *real rate of interest.* Subsequent discussions relax these assumptions to develop the broader concept of the interest rate and required return.

2. Data in *Stocks, Bonds, Bills and Inflation, 2001 Yearbook* (Chicago: Ibbotson Associates, Inc., 2001), show that over the period 1926–2000, U.S. Treasury bills provided an average annual real rate of return of about 0.7 percent. Because of certain major economic events that occurred during the 1926–2000 period, many economists believe that the real rate of interest during recent years has been about 1 percent.

FIGURE 6.1

Supply–Demand Relationship

Supply of savings and demand for investment funds



funds, causing the supply function in Figure 6.1 to shift to, say, S_1. This could result in a lower real rate of interest, k_1^*, at equilibrium ($S_1 = D$). Likewise, a change in tax laws or other factors could affect the demand for funds, causing the real rate of interest to rise or fall to a new equilibrium level.

Nominal or Actual Rate of Interest (Return)

nominal rate of interest
The actual rate of interest charged by the supplier of funds and paid by the demander.

The **nominal rate of interest** is the actual rate of interest charged by the supplier of funds and paid by the demander. *Throughout this book, interest rates and required rates of return are nominal rates unless otherwise noted.* The nominal rate of interest differs from the real rate of interest, k^*, as a result of two factors: (1) inflationary expectations reflected in an inflation premium (IP), and (2) issuer and issue characteristics, such as default risk and contractual provisions, reflected in a risk premium (RP). When this notation is adopted, the nominal rate of interest for security 1, k_1, is given in Equation 6.1:

$$k_1 = \underbrace{k^* + IP}_{\substack{\text{risk-free} \\ \text{rate, } R_F}} + \underbrace{RP_1}_{\substack{\text{risk} \\ \text{premium}}} \tag{6.1}$$

As the horizontal braces below the equation indicate, the nominal rate, k_1, can be viewed as having two basic components: a risk-free rate of interest, R_F, and a risk premium, RP_1:

$$k_1 = R_F + RP_1 \tag{6.2}$$

To simplify the discussion, we will assume that the risk premium, RP_1, is equal to zero. By drawing from Equation 6.1,[3] the risk-free rate can (as earlier noted in Equation 5.9) be represented as

$$R_F = k^* + IP \tag{6.3}$$

3. This equation is commonly called the *Fisher equation,* named for the renowned economist Irving Fisher, who first presented this approximate relationship between nominal interest and the rate of inflation. See Irving Fisher, *The Theory of Interest* (New York: Macmillan, 1930).

Thus we concern ourselves only with the *risk-free rate of interest, R_F*, which was defined in Chapter 5 as the required return on a risk-free asset.[4] The risk-free rate (as shown in Equation 6.3) embodies the real rate of interest plus the inflationary expectation. Three-month *U.S. Treasury bills* (*T-bills*), which are (as noted in Chapter 5) short-term IOUs issued by the U.S. Treasury, are commonly considered the risk-free asset. *The real rate of interest can be estimated by subtracting the inflation premium from the nominal rate of interest.* For the risk-free asset in Equation 6.3, the real rate of interest, k^*, would equal $R_F - IP$. A simple example can demonstrate the practical distinction between nominal and real rates of interest.

EXAMPLE

Marilyn Carbo has $10 that she can spend on candy costing $0.25 per piece. She could therefore buy 40 pieces of candy ($10.00/$0.25) today. The nominal rate of interest on a 1-year deposit is currently 7%, and the expected rate of inflation over the coming year is 4%. Instead of buying the 40 pieces of candy today, Marilyn could invest the $10 in a 1-year deposit account now. At the end of 1 year she would have $10.70 because she would have earned 7% interest—an additional $0.70 (0.07 × $10.00)—on her $10 deposit. The 4% inflation rate would over the 1-year period increase the cost of the candy by 4%—an additional $0.01 (0.04 × $0.25)—to $0.26 per piece. As a result, at the end of the 1-year period Marilyn would be able to buy about 41.2 pieces of candy ($10.70/$0.26), or roughly 3% more (41.2/40.0 = 1.03). The increase in the amount of money available to Marilyn at the end of 1 year is merely her nominal rate of return (7%), which must be reduced by the rate of inflation (4%) during the period to determine her real rate of return of 3%. Marilyn's increased buying power therefore equals her 3% real rate of return.

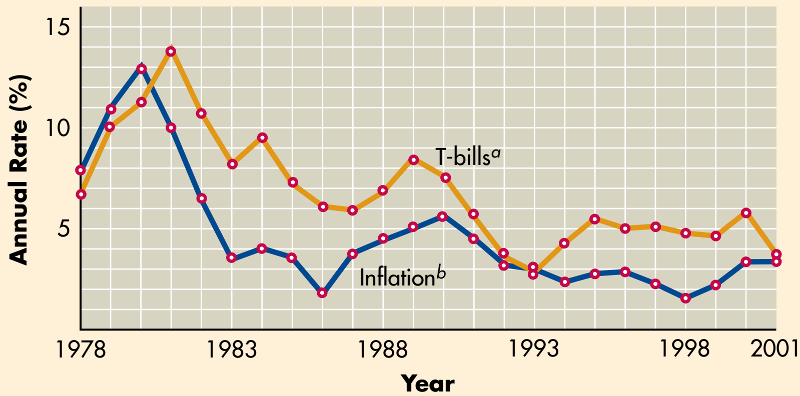
The premium for *inflationary expectations* in Equation 6.3 represents the average rate of *inflation* expected over the life of a loan or investment. It is *not* the rate of inflation experienced over the immediate past; rather, it reflects the forecasted rate. Take, for example, the risk-free asset. During the week ended March 15, 2002, 3-month T-bills earned a 1.81 percent rate of return. Assuming an approximate 1 percent real rate of interest, funds suppliers were forecasting a 0.81 percent (annual) rate of inflation (1.81% − 1.00%) over the next 3 months. This expectation was in striking contrast to the expected rate of inflation 17 years earlier in the week ending May 22, 1981. At that time the 3-month T-bill rate was 16.60 percent, which meant an expected (annual) inflation rate of 15.60 percent (16.60% − 1.00%). The inflationary expectation premium changes over time in response to many factors, including recent rates, government policies, and international events.

Figure 6.2 illustrates the movement of the rate of inflation and the risk-free rate of interest during the period 1978–2001. During this period the two rates tended to move in a similar fashion. Between 1978 and the early 1980s, inflation and interest rates were quite high, peaking at over 13 percent in 1980–1981. Since 1981 these rates have declined to levels generally below those in 1978. The data clearly illustrate the significant impact of inflation on the nominal rate of interest for the risk-free asset.

4. The risk premium and its effect on the nominal rate of interest are discussed and illustrated in a later part of this discussion.

FIGURE 6.2

Impact of Inflation
Relationship between annual rate of inflation and 3-month U.S. Treasury bill average annual returns, 1978–2001



[a] Average annual rate of return on 3-month U.S. Treasury bills.
[b] Annual pecentage change in the consumer price index.

Source: Data from selected *Federal Reserve Bulletins.*

term structure of interest rates
The relationship between the interest rate or rate of return and the time to maturity.

yield to maturity
Annual rate of return earned on a debt security purchased on a given day and held to maturity.

yield curve
A graph of the relationship between the debt's remaining time to maturity (*x* axis) and its yield to maturity (*y* axis); it shows the pattern of annual returns on debts of equal quality and different maturities. Graphically depicts the *term structure of interest rates.*

inverted yield curve
A *downward-sloping* yield curve that indicates generally cheaper long-term borrowing costs than short-term borrowing costs.

normal yield curve
An *upward-sloping* yield curve that indicates generally cheaper short-term borrowing costs than long-term borrowing costs.

flat yield curve
A yield curve that reflects relatively similar borrowing costs for both short- and longer-term loans.

Term Structure of Interest Rates

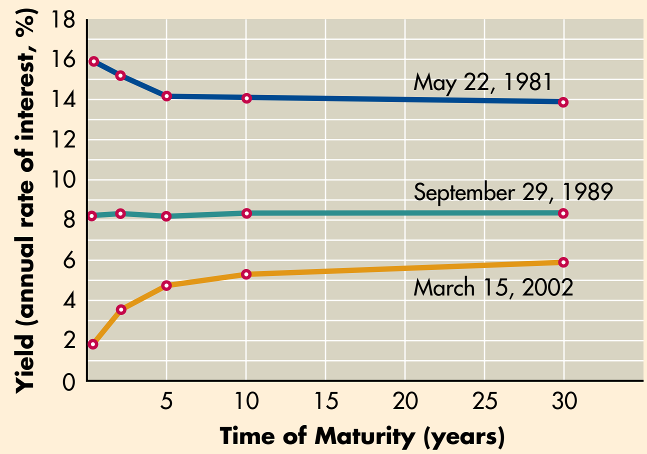
For any class of similar-risk securities, the **term structure of interest rates** relates the interest rate or rate of return to the time to maturity. For convenience we will use Treasury securities as an example, but other classes could include securities that have similar overall quality or risk. The riskless nature of Treasury securities also provides a laboratory in which to develop the term structure.

Yield Curves

A debt security's **yield to maturity** (discussed later in this chapter) represents the annual rate of return earned on a security purchased on a given day and held to maturity. At any point in time, the relationship between the debt's remaining time to maturity and its yield to maturity is represented by the **yield curve.** The yield curve shows the yield to maturity for debts of equal quality and different maturities; it is a graphical depiction of the *term structure of interest rates*. Figure 6.3 shows three yield curves for all U.S. Treasury securities: one at May 22, 1981, a second at September 29, 1989, and a third at March 15, 2002. Note that both the position and the shape of the yield curves change over time. The yield curve of May 22, 1981, indicates that short-term interest rates at that time were above longer-term rates. This curve is described as *downward-sloping*, reflecting long-term borrowing costs generally cheaper than short-term borrowing costs. Historically, the downward-sloping yield curve, which is often called an **inverted yield curve,** has been the exception. More frequently, yield curves similar to that of March 15, 2002, have existed. These *upward-sloping* or **normal yield curves** indicate that short-term borrowing costs are below long-term borrowing costs. Sometimes, a **flat yield curve,** similar to that of September 29, 1989, exists. It reflects relatively similar borrowing costs for both short- and longer-term loans.

FIGURE 6.3

Treasury Yield Curves
Yield curves for U.S. Treasury securities: May 22, 1981; September 29, 1989; and March 15, 2002



Sources: Data from *Federal Reserve Bulletins* (June 1981), p. A25 and (December 1989), p. A24; and *U.S. Financial Data,* Federal Reserve Bank of St. Louis (March 14, 2002), p. 7.

The shape of the yield curve may affect the firm's financing decisions. A financial manager who faces a downward-sloping yield curve is likely to rely more heavily on cheaper, long-term financing; when the yield curve is upward-sloping, the manager is more likely to use cheaper, short-term financing. Although a variety of other factors also influence the choice of loan maturity, the shape of the yield curve provides useful insights into future interest rate expectations.

Theories of Term Structure

Three theories are frequently cited to explain the general shape of the yield curve. They are the expectations theory, liquidity preference theory, and market segmentation theory.

expectations theory
The theory that the yield curve reflects investor expectations about future interest rates; an increasing inflation expectation results in an upward-sloping yield curve, and a decreasing inflation expectation results in a downward-sloping yield curve

Expectations Theory One theory of the term structure of interest rates, the **expectations theory,** suggests that the yield curve reflects investor expectations about future interest rates and inflation. Higher future rates of expected inflation will result in higher long-term interest rates; the opposite occurs with lower future rates. This widely accepted explanation of the term structure can be applied to the securities of any issuer. For example, take the case of U.S. Treasury securities. Thus far, we have concerned ourselves solely with the 3-month Treasury bill. In fact, all Treasury securities are *riskless* in terms of (1) the chance that the Treasury will default on the issue and (2) the ease with which they can be liquidated for cash without losing value. Because it is believed to be easier to forecast inflation over shorter periods of time, the shorter-term 3-month U.S. Treasury bill is considered the risk-free asset. Of course, differing inflation expectations associated with different maturities will cause nominal interest rates to vary. With the addition of a maturity subscript, t, Equation 6.3 can be rewritten as

$$R_{F_t} = k^* + IP_t \tag{6.4}$$

In Practice

FOCUS ON PRACTICE Watch Those Curves!

Why do financial institutions, individual investors, and corporations that need to issue debt pay close attention to the yield curve, looking for any changing patterns? Because the shape of the yield curve—a chart of the gap between short- and long-term interest rates—has been an excellent predictor of future economic growth in the United States. In general, sharp upward-sloping ("normal") yield curves signal a substantial rise in economic activity within a year. Downward-sloping ("inverted") yield curves have preceded every recession since 1955 (although recession did not follow an inverted curve in the mid-1960s).

The yield curve is based on the manner in which rates on different debt maturities are set. The marketplace determines long-term interest rates, which are tied to various economic factors, such as investors' views on the outlook for growth and for inflation. Because the Federal Reserve sets short-term rates, it can direct the pace of economic activity by managing the differences between the two ends of the interest rate spectrum. Most periods of flat or inverted yield curves occur when the Federal Reserve increases short-term rates, tightening monetary policy to control inflation. These higher rates curtail business growth because savers pull money out of long-term investments such as stocks and bonds and put it into lower-risk savings vehicles. When short-term rates are low, people switch money from liquid investments such as money market accounts into long-term investments, fueling economic growth.

This proved true in 2001. An inverted yield curve from July 2000 to early January 2001 triggered the slowdown in economic activity. In January the Federal Reserve cut the federal funds rate (the rate on loan transactions between commercial banks) to stimulate the economy but wasn't able to prevent the recession that began in March 2001. The Fed cut short-term rates 10 more times in 2001—a record for cuts in one year—to bring the "fed funds" rate from 6.5 percent to 1.75 percent, the lowest level since 1961. Long-term U.S. Treasury securities outperformed shorter maturities as institutional and individual investors shifted their portfolios to longer maturities, betting that the curve would return to its more normal upward slope as the Federal Reserve rate cuts took effect. By December 2001 the spread between long-term and short-term Treasury securities was about 2.5 points. As the yield curve turned strongly positive, economists predicted a short recession with a strong recovery in 2002.

Sources: Adapted from Peronet Despeignes, "Fed Cuts Rates by Quarter Point to 1.75%," *FT.com* (December 11, 2001), downloaded from *news.ft.com;* Michael Sivy, "Ahead of the Curve," *Money* (August 2001), p. 51; Michael Wallace, "The Fed Can't Get Ahead of the Curve," *Business Week Online* (November 5, 2001), downloaded from *www.businessweek.com;* Linda Wertheimer, "Analysis: Federal Reserve's Latest Interest Rate Cut," *All Things Considered (NPR)*, November 6, 2001, downloaded from Electric Library, *ask.elibrary.com.*

In other words, for U.S. Treasury securities the nominal, or risk-free, rate for a given maturity varies with the inflation expectation over the term of the security.[5]

EXAMPLE The nominal interest rate, R_F, for four maturities of U.S. Treasury securities on March 15, 2002, is given in column 1 of the following table. Assuming that the real rate of interest is 1%, as noted in column 2, the inflation expectation for each maturity in column 3 is found by solving Equation 6.4 for IP_t. Although a 0.81% rate of inflation was expected over the 3-month period beginning March 15, 2002, a 2.55% average rate of inflation was expected over the 2-year period, and so on. An analysis of the inflation expectations in column 3 for March 15, 2002, suggests that at that time a general expectation of increasing inflation existed. Simply stated, the March 15, 2002, yield curve for U.S. Treasury securities shown

5. Although U.S. Treasury securities have no risk of default or illiquidity, they do suffer from "maturity, or interest rate, risk"—the risk that interest rates will change in the future and thereby affect longer maturities more than shorter maturities. Therefore, the longer the maturity of a Treasury (or any other) security, the greater its interest rate risk. The impact of interest rate changes on bond values is discussed later in this chapter; here we ignore this effect.

in Figure 6.3 was upward-sloping as a result of the expectation that the rate of inflation would increase in the future.[6]

Maturity, t	Nominal interest rate, R_{F_t} (1)	Real interest rate, k^* (2)	Inflation expectation, IP_t [(1) − (2)] (3)
3 months	1.81%	1.00%	0.81%
2 years	3.55	1.00	2.55
5 years	4.74	1.00	3.74
30 years	5.90	1.00	4.90

Generally, under the expectations theory, an increasing inflation expectation results in an upward-sloping yield curve; a decreasing inflation expectation results in a downward-sloping yield curve; and a stable inflation expectation results in a flat yield curve. Although, as we'll see, other theories exist, the observed strong relationship between inflation and interest rates (see Figure 6.2) supports this widely accepted theory.

liquidity preference theory
Theory suggesting that for any given issuer, long-term interest rates tend to be higher than short-term rates because (1) lower liquidity and higher responsiveness to general interest rate movements of longer-term securities exists and (2) borrower willingness to pay a higher rate for long-term financing; causes the yield curve to be upward-sloping.

Liquidity Preference Theory The tendency for yield curves to be upward-sloping can be further explained by **liquidity preference theory.** This theory holds that for a given issuer, such as the U.S. Treasury, long-term rates tend to be higher than short-term rates. This belief is based on two behavioral facts:

1. Investors perceive less risk in short-term securities than in longer-term securities and are therefore willing to accept lower yields on them. The reason is that shorter-term securities are more liquid and less responsive to general interest rate movements.[7]
2. Borrowers are generally willing to pay a higher rate for long-term than for short-term financing. By locking in funds for a longer period of time, they can eliminate the potential adverse consequences of having to roll over short-term debt at unknown costs to obtain long-term financing.

Investors (lenders) tend to require a premium for tying up funds for longer periods, whereas borrowers are generally willing to pay a premium to obtain longer-term financing. These preferences of lenders and borrowers cause the yield curve to tend to be upward-sloping. Simply stated, longer maturities tend to have higher interest rates than shorter maturities.

market segmentation theory
Theory suggesting that the market for loans is segmented on the basis of maturity and that the supply of and demand for loans within each segment determine its prevailing interest rate; the slope of the yield curve is determined by the general relationship between the prevailing rates in each segment.

Market Segmentation Theory The **market segmentation theory** suggests that the market for loans is segmented on the basis of maturity and that the supply of and demand for loans within each segment determine its prevailing interest rate. In other words, the equilibrium between suppliers and demanders of short-term funds, such as seasonal business loans, would determine prevailing short-

6. It is interesting to note (in Figure 6.3) that the expectations reflected by the September 29, 1989, yield curve were not fully borne out by actual events. By March 2002, interest rates had fallen for all maturities, and the yield curve at that time had shifted downward and become upward-sloping, reflecting an expectation of increasing future interest rates and inflation rates.

7. Later in this chapter we demonstrate that debt instruments with longer maturities are more sensitive to changing market interest rates. For a given change in market rates, the price or value of longer-term debts will be more significantly changed (up or down) than the price or value of debts with shorter maturities.

Hint An upward-sloping yield curve will result if the supply outstrips the demand for short-term loans, thereby resulting in relatively low short-term rates at a time when long-term rates are high because the demand for long-term loans is far above their supply.

term interest rates, and the equilibrium between suppliers and demanders of long-term funds, such as real estate loans, would determine prevailing long-term interest rates. The slope of the yield curve would be determined by the general relationship between the prevailing rates in each market segment. Simply stated, low rates in the short-term segment and high rates in the long-term segment cause the yield curve to be upward-sloping. The opposite occurs for high short-term rates and low long-term rates.

All three theories of term structure have merit. From them we can conclude that at any time, the slope of the yield curve is affected by (1) inflationary expectations, (2) liquidity preferences, and (3) the comparative equilibrium of supply and demand in the short- and long-term market segments. Upward-sloping yield curves result from higher future inflation expectations, lender preferences for shorter-maturity loans, and greater supply of short-term loans than of long-term loans relative to demand. The opposite behaviors would result in a downward-sloping yield curve. At any time, the interaction of these three forces determines the prevailing slope of the yield curve.

Risk Premiums: Issuer and Issue Characteristics

So far we have considered only risk-free U.S. Treasury securities. We now reintroduce the risk premium and assess it in view of risky non-Treasury issues. Recall Equation 6.1:

$$k_1 = \underbrace{k^* + IP}_{\substack{\text{risk-free} \\ \text{rate, } R_F}} + \underbrace{RP_1}_{\substack{\text{risk} \\ \text{premium}}}$$

In words, the nominal rate of interest for security 1 (k_1) is equal to the risk-free rate, consisting of the real rate of interest (k^*) plus the inflation expectation premium (IP) plus the risk premium (RP_1). The *risk premium* varies with specific issuer and issue characteristics; it causes similar-maturity securities[8] to have differing nominal rates of interest.

EXAMPLE The nominal interest rates on a number of classes of long-term securities on March 15, 2002, were as follows:[9]

Security	Nominal interest
U.S. Treasury bonds (average)	5.68%
Corporate bonds (by ratings):	
High quality (Aaa–Aa)	6.13
Medium quality (A–Baa)	7.14
Speculative (Ba–C)	8.11
Utility bonds (average rating)	6.99

8. To provide for the same risk-free rate of interest, $k^* + IP$, it is necessary to assume equal maturities. When we do so, the inflationary expectations premium, IP, and therefore R_F, will be held constant, and the issuer and issue characteristics premium, RP, becomes the key factor differentiating the nominal rates of interest on various securities.

9. These yields were obtained from Mr. Mike Steelman at UBS PaineWebber, La Jolla, CA (March 25, 2002). Note that bond ratings are explained later in this chapter, on page 278.

Because the U.S. Treasury bond would represent the risk-free, long-term security, we can calculate the risk premium of the other securities by subtracting the risk-free rate, 5.68%, from each nominal rate (yield):

Security	Risk premium
Corporate bonds (by ratings):	
High quality (Aaa–Aa)	6.13% − 5.68% = 0.45%
Medium quality (A–Baa)	7.14 − 5.68 = 1.46
Speculative (Ba–C)	8.11 − 5.68 = 2.43
Utility bonds (average rating)	6.99 − 5.68 = 1.31

These risk premiums reflect differing issuer and issue risks. The lower-rated corporate issues (speculative) have a higher risk premium than that of the higher-rated corporates (high quality and medium quality), and the utility issue has a risk premium near that of the medium-quality corporates.

The risk premium consists of a number of issuer- and issue-related components, including interest rate risk, liquidity risk, and tax risk, which were defined in Table 5.1 on page 215, and the purely debt-specific risks—default risk, maturity risk, and contractual provision risk, briefly defined in Table 6.1. In general,

TABLE 6.1 Debt-Specific Issuer- and Issue-Related Risk Premium Components

Component	Description
Default risk	The possibility that the issuer of debt will not pay the contractual interest or principal as scheduled. The greater the uncertainty as to the borrower's ability to meet these payments, the greater the risk premium. High bond ratings reflect low default risk, and low bond ratings reflect high default risk.
Maturity risk	The fact that the longer the maturity, the more the value of a security will change in response to a given change in interest rates. If interest rates on otherwise similar-risk securities suddenly rise as a result of a change in the money supply, the prices of long-term bonds will decline by more than the prices of short-term bonds, and vice versa.[a]
Contractual provision risk	Conditions that are often included in a debt agreement or a stock issue. Some of these reduce risk, whereas others may increase risk. For example, a provision allowing a bond issuer to retire its bonds prior to their maturity under favorable terms increases the bond's risk.

[a]A detailed discussion of the effects of interest rates on the price or value of bonds and other fixed-income securities is presented later in this chapter.

the highest risk premiums and therefore the highest returns result from securities issued by firms with a high risk of default and from long-term maturities that have unfavorable contractual provisions.

Review Questions

6–1 What is the *real rate of interest*? Differentiate it from the *nominal rate of interest* for the risk-free asset, a 3-month U.S. Treasury bill.

6–2 What is the *term structure of interest rates,* and how is it related to the *yield curve?*

6–3 For a given class of similar-risk securities, what does each of the following yield curves reflect about interest rates: (**a**) downward-sloping; (**b**) upward-sloping; and (**c**) flat? Which form has been historically dominant?

6–4 Briefly describe the following theories of the general shape of the yield curve: (**a**) expectations theory; (**b**) liquidity preference theory; and (**c**) market segmentation theory.

6–5 List and briefly describe the potential issuer- and issue-related risk components that are embodied in the risk premium. Which are the purely debt-specific risks?

LG2 LG3 6.2 Corporate Bonds

corporate bond
A long-term debt instrument indicating that a corporation has borrowed a certain amount of money and promises to repay it in the future under clearly defined terms.

coupon interest rate
The percentage of a bond's par value that will be paid annually, typically in two equal semiannual payments, as interest.

A **corporate bond** is a long-term debt instrument indicating that a corporation has borrowed a certain amount of money and promises to repay it in the future under clearly defined terms. Most bonds are issued with maturities of 10 to 30 years and with a par value, or face value, of $1,000. The **coupon interest rate** on a bond represents the percentage of the bond's par value that will be paid annually, typically in two equal semiannual payments, as interest. The bondholders, who are the lenders, are promised the semiannual interest payments and, at maturity, repayment of the principal amount.

Legal Aspects of Corporate Bonds

Certain legal arrangements are required to protect purchasers of bonds. Bondholders are protected primarily through the indenture and the trustee.

Bond Indenture

bond indenture
A legal document that specifies both the rights of the bondholders and the duties of the issuing corporation.

A **bond indenture** is a legal document that specifies both the rights of the bondholders and the duties of the issuing corporation. Included in the indenture are descriptions of the amount and timing of all interest and principal payments, various standard and restrictive provisions, and, frequently, sinking-fund requirements and security interest provisions.

standard debt provisions
Provisions in a *bond indenture* specifying certain record-keeping and general business practices that the bond issuer must follow; normally, they do not place a burden on a financially sound business.

Standard Provisions The **standard debt provisions** in the bond indenture specify certain record-keeping and general business practices that the bond issuer must follow. Standard debt provisions do not normally place a burden on a financially sound business.

The borrower commonly must (1) *maintain satisfactory accounting records* in accordance with generally accepted accounting principles (GAAP); (2) periodically *supply audited financial statements;* (3) *pay taxes and other liabilities when due;* and (4) *maintain all facilities in good working order.*

restrictive covenants
Provisions in a *bond indenture* that place operating and financial constraints on the borrower.

Restrictive Provisions Bond indentures also normally include certain **restrictive covenants,** which place operating and financial constraints on the borrower. These provisions help protect the bondholder against increases in borrower risk. Without them, the borrower could increase the firm's risk but not have to pay increased interest to compensate for the increased risk.

The most common restrictive covenants do the following:

1. Require a *minimum level of liquidity,* to ensure against loan default.
2. *Prohibit the sale of accounts receivable* to generate cash. Selling receivables could cause a long-run cash shortage if proceeds were used to meet current obligations.
3. Impose *fixed-asset restrictions.* The borrower must maintain a specified level of fixed assets to guarantee its ability to repay the bonds.
4. *Constrain subsequent borrowing.* Additional long-term debt may be prohibited, or additional borrowing may be *subordinated* to the original loan. **Subordination** means that subsequent creditors agree to wait until all claims of the *senior debt* are satisfied.
5. *Limit the firm's annual cash dividend payments* to a specified percentage or amount.

subordination
In a bond indenture, the stipulation that subsequent creditors agree to wait until all claims of the *senior debt* are satisfied.

Other restrictive covenants are sometimes included in bond indentures.

The violation of any standard or restrictive provision by the borrower gives the bondholders the right to demand immediate repayment of the debt. Generally, bondholders evaluate any violation to determine whether it jeopardizes the loan. They may then decide to demand immediate repayment, continue the loan, or alter the terms of the bond indenture.

sinking-fund requirement
A restrictive provision often included in a bond indenture, providing for the systematic retirement of bonds prior to their maturity.

Sinking-Fund Requirements Another common restrictive provision is a **sinking-fund requirement.** Its objective is to provide for the systematic retirement of bonds prior to their maturity. To carry out this requirement, the corporation makes semiannual or annual payments that are used to retire bonds by purchasing them in the marketplace.

Security Interest The bond indenture identifies any collateral pledged against the bond and specifies how it is to be maintained. The protection of bond collateral is crucial to guarantee the safety of a bond issue.

Trustee

trustee
A paid individual, corporation, or commercial bank trust department that acts as the third party to a bond indenture and can take specified actions on behalf of the bondholders if the terms of the indenture are violated.

A **trustee** is a third party to a bond indenture. The trustee can be an individual, a corporation, or (most often) a commercial bank trust department. The trustee is paid to act as a "watchdog" on behalf of the bondholders and can take specified actions on behalf of the bondholders if the terms of the indenture are violated.

Cost of Bonds to the Issuer

The cost of bond financing is generally greater than the issuer would have to pay for short-term borrowing. The major factors that affect the cost, which is the rate of interest paid by the bond issuer, are the bond's maturity, the size of the offering, the issuer's risk, and the basic cost of money.

Impact of Bond Maturity on Bond Cost

Generally, as we noted earlier, long-term debt pays higher interest rates than short-term debt. In a practical sense, the longer the maturity of a bond, the less accuracy there is in predicting future interest rates, and therefore the greater the bondholders' risk of giving up an opportunity to lend money at a higher rate. In addition, the longer the term, the greater the chance that the issuer might default.

Impact of Offering Size on Bond Cost

The size of the bond offering also affects the interest cost of borrowing, but in an inverse manner: Bond flotation and administration costs per dollar borrowed are likely to decrease with increasing offering size. On the other hand, the risk to the bondholders may increase, because larger offerings result in greater risk of default.

Impact of Issuer's Risk

The greater the issuer's *default risk*, the higher the interest rate. Some of this risk can be reduced through inclusion of appropriate restrictive provisions in the bond indenture. Clearly, bondholders must be compensated with higher returns for taking greater risk. Frequently, bond buyers rely on bond ratings (discussed later) to determine the issuer's overall risk.

Impact of the Cost of Money

The cost of money in the capital market is the basis for determining a bond's coupon interest rate. Generally, the rate on U.S. Treasury securities of equal maturity is used as the lowest-risk cost of money. To that basic rate is added a *risk premium* (as described earlier in this chapter) that reflects the factors mentioned above (maturity, offering size, and issuer's risk).

General Features of a Bond Issue

Three features sometimes included in a corporate bond issue are a conversion feature, a call feature, and stock purchase warrants. These features provide the issuer or the purchaser with certain opportunities for replacing or retiring the bond or supplementing it with some type of equity issue.

conversion feature
A feature of *convertible bonds* that allows bondholders to change each bond into a stated number of shares of common stock.

Convertible bonds offer a **conversion feature** that allows bondholders to change each bond into a stated number of shares of common stock. Bondholders convert their bonds into stock only when the market price of the stock is such that conversion will provide a profit for the bondholder. Inclusion of the conversion feature by the issuer lowers the interest cost and provides for automatic conversion of the bonds to stock if future stock prices appreciate noticeably.

call feature
A feature included in nearly all corporate bond issues that gives the issuer the opportunity to repurchase bonds at a stated *call price* prior to maturity.

call price
The stated price at which a bond may be repurchased, by use of a *call feature,* prior to maturity.

call premium
The amount by which a bond's *call price* exceeds its par value.

The **call feature** is included in nearly all corporate bond issues. It gives the issuer the opportunity to repurchase bonds prior to maturity. The **call price** is the stated price at which bonds may be repurchased prior to maturity. Sometimes the call feature can be exercised only during a certain period. As a rule, the call price exceeds the par value of a bond by an amount equal to 1 year's interest. For example, a $1,000 bond with a 10 percent coupon interest rate would be callable for around $1,100 [$\$1{,}000 + (10\% \times \$1{,}000)$]. The amount by which the call price exceeds the bond's par value is commonly referred to as the **call premium.** This premium compensates bondholders for having the bond called away from them; to the issuer, it is the cost of calling the bonds.

The call feature enables an issuer to call an outstanding bond when interest rates fall and issue a new bond at a lower interest rate. When interest rates rise, the call privilege will not be exercised, except possibly to meet sinking-fund requirements. Of course, to sell a callable bond in the first place, the issuer must pay a higher interest rate than on noncallable bonds of equal risk, to compensate bondholders for the risk of having the bonds called away from them.

stock purchase warrants
Instruments that give their holders the right to purchase a certain number of shares of the issuer's common stock at a specified price over a certain period of time.

Bonds occasionally have stock purchase warrants attached as "sweeteners" to make them more attractive to prospective buyers. **Stock purchase warrants** are instruments that give their holders the right to purchase a certain number of shares of the issuer's common stock at a specified price over a certain period of time. Their inclusion typically enables the issuer to pay a slightly lower coupon interest rate than would otherwise be required.

Interpreting Bond Quotations

quotations
Information on bonds, stocks, and other securities, including current price data and statistics on recent price behavior.

The financial manager needs to stay abreast of the market values of the firm's outstanding securities, whether they are traded on an organized exchange, over the counter, or in international markets. Similarly, existing and prospective investors in the firm's securities need to monitor the prices of the securities they own because these prices represent the current value of their investment. Information on bonds, stocks, and other securities is contained in **quotations,** which include current price data along with statistics on recent price behavior. Security price quotations are readily available for actively traded bonds and stocks. The most up-to-date "quotes" can be obtained electronically, via a personal computer. Price information is available from stockbrokers and is widely published in news media. Popular sources of daily security price quotations include financial newspapers, such as the *Wall Street Journal* and *Investor's Business Daily,* and the business sections of daily general newspapers. Here we focus on bond quotations; stock quotations are reviewed in Chapter 7.

FIGURE 6.4

Bond Quotations

Selected bond quotations for April 22, 2002

BONDS	CUR YLD	VOL	CLOSE	NET CHG
HuntPly 11¾04f	...	22	20.13	−0.88
IBM 7¼02	7.1	15	101.75	−0.38
IBM 5⅜09	5.6	50	96.63	0.25
IBM 8⅜19	...	20	114.25	0.38
IBM 7s25	7.0	10	100.25	−1.75
IPap dc5⅛12	5.9	20	86.50	1.88
IntShip 9s03	9.0	3	100	...
JPMChse 7½03	7.3	10	103	−0.25
JPMChse 6⅛08	6.1	25	100.88	0.63
JPMChse 6½09	6.5	40	100.13	...
JCPL 6⅜03	6.3	4	101	−0.75
KCS En 8⅞06	11.5	30	76.88	...
K&B Hm 7¾04	7.6	36	102	...
K&B Hm 9⅝06	9.2	65	104.38	−0.25
Koppers 8½04	8.6	16	99	...
Leucadia 7¾13	7.6	25	101.25	0.25
LionCT 6⅜03	6.3	15	101	−4.00
LglsLt 9s22	8.6	40	104.50	−0.50
Lucent 7¼06	8.9	585	81.63	−0.50
Lucent 5½08	7.8	240	70.75	−0.88
Lucent 6½28	10.5	89	62	0.25
Lucent 6.45s29	10.4	145	62.13	−0.38
MBNA 8.28s26	8.7	121	95.50	−0.50
MailWell 5s02	cv	30	98.75	0.25
Malan 9½04	cv	41	92.88	0.88
McDnl 6⅝05	6.5	87	102.13	0.38
Motrla zr13	...	10	73.25	−0.50
NRurU 6.55s18	7.0	50	94	−2.63
NYTel 6¼04	6.1	25	102	−0.25
NYTel 7⅝23	7.6	50	100.63	−1.25
NYTel 6.70s23	7.0	5	95	−1.75
NYTel 7s25	7.2	20	97	−0.63
NYTel 7s33	7.1	7	98.38	0.63
OcciP 10⅛09	8.4	5	121	0.13
OffDep zr07	...	30	90	−2.50

IBM

Source: Wall Street Journal, April 23, 2002, p. C14.

Figure 6.4 includes an excerpt from the New York Stock Exchange (NYSE) bond quotations reported in the April 23, 2002, *Wall Street Journal* for transactions through the close of trading on Monday, April 22, 2002. We'll look at the corporate bond quotation for IBM, which is highlighted in Figure 6.4. The numbers following the company name—IBM—represent the bond's *coupon interest rate* and the year it matures: "7s25" means that the bond has a stated coupon interest rate of 7 percent and matures sometime in the year 2025. This information allows investors to differentiate between the various bonds issued by the corporation. Note that on the day of this quote, IBM had four bonds listed. The next column, labeled "Cur Yld.," gives the bond's *current yield,* which is found by dividing its annual coupon (7%, or 7.000%) by its closing price (100.25), which in this case turns out to be 7.0 percent ($7.000 \div 100.25 = 0.0698 = 7.0\%$).

The "Vol" column indicates the actual number of bonds that traded on the given day; 10 IBM bonds traded on Monday, April 22, 2002. The final two columns include price information—the closing price and the net change in closing price from the prior trading day. Although most corporate bonds are issued with a *par,* or *face, value* of $1,000, *all bonds are quoted as a percentage of par.* A $1,000-par-value bond quoted at 110.38 is priced at $1,103.80 (110.38% × $1,000). Corporate bonds are quoted in dollars and cents. Thus IBM's closing price of 100.25 for the day was $1,002.50—that is, 100.25% × $1,000. Because a "Net Chg." of −1.75 is given in the final column, the bond must have closed at 102 or $1,020 (102.00% × $1,000) on the prior day. Its price decreased by 1.75, or $17.50 (1.75% × $1,000), on Tuesday, April 22, 2002. Additional information may be included in a bond quotation, but these are the basic elements.

Bond Ratings

Independent agencies such as Moody's and Standard & Poor's assess the riskiness of publicly traded bond issues. These agencies derive the ratings by using financial ratio and cash flow analyses to assess the likely payment of bond interest and principal. Table 6.2 summarizes these ratings. Normally an inverse relationship exists between the quality of a bond and the rate of return that it must provide bondholders: High-quality (high-rated) bonds provide lower returns than lower-quality (low-rated) bonds. This reflects the lender's risk-return trade-off. When considering bond financing, the financial manager must be concerned with the expected ratings of the bond issue, because these ratings affect salability and cost.

Popular Types of Bonds

Bonds can be classified in a variety of ways. Here we break them into traditional bonds (the basic types that have been around for years) and contemporary bonds (newer, more innovative types). The traditional types of bonds are summarized in terms of their key characteristics and priority of lender's claim in Table 6.3. Note

Hint Note that Moody's has 9 major ratings; Standard & Poor's has 10.

TABLE 6.2 Moody's and Standard & Poor's Bond Ratings[a]

Moody's	Interpretation	Standard & Poor's	Interpretation
Aaa	Prime quality	AAA	Bank investment quality
Aa	High grade	AA	
A	Upper medium grade	A	
Baa	Medium grade	BBB	
Ba	Lower medium grade	BB	Speculative
	or speculative	B	
B	Speculative		
Caa	From very speculative	CCC	
Ca	to near or in default	CC	
C	Lowest grade	C	Income bond
		D	In default

[a]Some ratings may be modified to show relative standing within a major rating category; for example, Moody's uses numerical modifiers (1, 2, 3), whereas Standard & Poor's uses plus (+) and minus (−) signs.

Sources: Moody's Investors Service, Inc. and Standard & Poor's Corporation.

TABLE 6.3 Characteristics and Priority of Lender's Claim of Traditional Types of Bonds

Bond type	Characteristics	Priority of lender's claim
Unsecured Bonds		
Debentures	Unsecured bonds that only creditworthy firms can issue. Convertible bonds are normally debentures.	Claims are the same as those of any general creditor. May have other unsecured bonds subordinated to them.
Subordinated debentures	Claims are not satisfied until those of the creditors holding certain (senior) debts have been fully satisfied.	Claim is that of a general creditor but not as good as a senior debt claim.
Income bonds	Payment of interest is required only when earnings are available. Commonly issued in reorganization of a failing firm.	Claim is that of a general creditor. Are not in default when interest payments are missed, because they are contingent only on earnings being available.
Secured Bonds		
Mortgage bonds	Secured by real estate or buildings.	Claim is on proceeds from sale of mortgaged assets; if not fully satisfied, the lender becomes a general creditor.The *first-mortgage* claim must be fully satisfied before distribution of proceeds to *second-mortgage* holders, and so on. A number of mortgages can be issued against the same collateral.
Collateral trust bonds	Secured by stock and (or) bonds that are owned by the issuer. Collateral value is generally 25% to 35% greater than bond value.	Claim is on proceeds from stock and (or) bond collateral; if not fully satisfied, the lender becomes a general creditor.
Equipment trust certificates	Used to finance "rolling stock"—airplanes, trucks, boats, railroad cars. A trustee buys such an asset with funds raised through the sale of trust certificates and then leases it to the firm, which, after making the final scheduled lease payment, receives title to the asset. A type of leasing.	Claim is on proceeds from the sale of the asset; if proceeds do not satisfy outstanding debt, trust certificate lenders become general creditors.

debentures
subordinated debentures
income bonds
mortgage bonds
collateral trust bonds
equipment trust certificates
See Table 6.3

zero- (or low-) coupon bonds
junk bonds
floating-rate bonds
extendible notes
putable bonds
See Table 6.4

that the first three types—**debentures, subordinated debentures,** and **income bonds**—are unsecured, whereas the last three—**mortgage bonds, collateral trust bonds,** and **equipment trust certificates**—are secured.

Table 6.4 describes the key characteristics of five contemporary types of bonds: **zero-coupon or low-coupon bonds, junk bonds, floating-rate bonds, extendible notes,** and **putable bonds.** These bonds can be either unsecured or secured. Changing capital market conditions and investor preferences have spurred further innovations in bond financing in recent years and will probably continue to do so.

International Bond Issues

Companies and governments borrow internationally by issuing bonds in two principal financial markets: the Eurobond market and the foreign bond market. Both give borrowers the opportunity to obtain large amounts of long-term debt financing quickly, in the currency of their choice and with flexible repayment terms.

TABLE 6.4 Characteristics of Contemporary Types of Bonds

Bond type	Characteristics[a]
Zero- (or low-) coupon bonds	Issued with no (zero) or a very low coupon (stated interest) rate and sold at a large discount from par. A significant portion (or all) of the investor's return comes from gain in value (i.e., par value minus purchase price). Generally callable at par value. Because the issuer can annually deduct the current year's interest accrual without having to pay the interest until the bond matures (or is called), its cash flow each year is increased by the amount of the tax shield provided by the interest deduction.
Junk bonds	Debt rated Ba or lower by Moody's or BB or lower by Standard & Poor's. Commonly used during the 1980s by rapidly growing firms to obtain growth capital, most often as a way to finance mergers and takeovers. High-risk bonds with high yields—often yielding 2% to 3% more than the best-quality corporate debt.
Floating-rate bonds	Stated interest rate is adjusted periodically within stated limits in response to changes in specified money market or capital market rates. Popular when future inflation and interest rates are uncertain. Tend to sell at close to par because of the automatic adjustment to changing market conditions. Some issues provide for annual redemption at par at the option of the bondholder.
Extendible notes	Short maturities, typically 1 to 5 years, that can be renewed for a similar period at the option of holders. Similar to a floating-rate bond. An issue might be a series of 3-year renewable notes over a period of 15 years; every 3 years, the notes could be extended for another 3 years, at a new rate competitive with market interest rates at the time of renewal.
Putable bonds	Bonds that can be redeemed at par (typically, $1,000) at the option of their holder either at specific dates after the date of issue and every 1 to 5 years thereafter or when and if the firm takes specified actions, such as being acquired, acquiring another company, or issuing a large amount of additional debt. In return for its conferring the right to "put the bond" at specified times or when the firm takes certain actions, the bond's yield is lower than that of a nonputable bond.

[a]The claims of lenders (i.e., bondholders) against issuers of each of these types of bonds vary, depending on the bonds' other features. Each of these bonds can be unsecured or secured.

Eurobond
A bond issued by an international borrower and sold to investors in countries with currencies other than the currency in which the bond is denominated.

A **Eurobond** is issued by an international borrower and sold to investors in countries with currencies other than the currency in which the bond is denominated. An example is a dollar-denominated bond issued by a U.S. corporation and sold to Belgian investors. From the founding of the Eurobond market in the 1960s until the mid-1980s, "blue chip" U.S. corporations were the largest single class of Eurobond issuers. Some of these companies were able to borrow in this market at interest rates below those the U.S. government paid on Treasury bonds. As the market matured, issuers became able to choose the currency in which they borrowed, and European and Japanese borrowers rose to prominence. In more recent years, the Eurobond market has become much more balanced in terms of the mix of borrowers, total issue volume, and currency of denomination.

foreign bond
A bond issued in a host country's financial market, in the host country's currency, by a foreign borrower.

In contrast, a **foreign bond** is issued in a host country's financial market, in the host country's currency, by a foreign borrower. A Swiss-franc–denominated bond issued in Switzerland by a U.S. company is an example of a foreign bond. The three largest foreign-bond markets are Japan, Switzerland, and the United States.

Review Questions

6–6 What are typical maturities, denominations, and interest payments of a corporate bond? What mechanisms protect bondholders?

6–7 Differentiate between *standard debt provisions* and *restrictive covenants* included in a bond indenture. What are the consequences of violation of them by the bond issuer?

6–8 How is the cost of bond financing typically related to the cost of short-term borrowing? In addition to a bond's maturity, what other major factors affect its cost to the issuer?

6–9 What is a *conversion feature?* A *call feature? Stock purchase warrants?*

6–10 What information is found in a bond *quotation?* How are bonds rated, and why?

6–11 Compare the basic characteristics of *Eurobonds* and *foreign bonds.*

LG4 6.3 Valuation Fundamentals

valuation
The process that links risk and return to determine the worth of an asset.

Valuation is the process that links risk and return to determine the worth of an asset. It is a relatively simple process that can be applied to *expected* streams of benefits from bonds, stocks, income properties, oil wells, and so on. To determine an asset's worth at a given point in time, a financial manager uses the time-value-of-money techniques presented in Chapter 4 and the concepts of risk and return developed in Chapter 5.

Key Inputs

There are three key inputs to the valuation process: (1) cash flows (returns), (2) timing, and (3) a measure of risk, which determines the required return. Each is described below.

Cash Flows (Returns)

The value of any asset depends on the cash flow(s) it is *expected* to provide over the ownership period. To have value, an asset does not have to provide an annual cash flow; it can provide an intermittent cash flow or even a single cash flow over the period.

EXAMPLE

Celia Sargent, financial analyst for Groton Corporation, a diversified holding company, wishes to estimate the value of three of its assets: common stock in Michaels Enterprises, an interest in an oil well, and an original painting by a well-known artist. Her cash flow estimates for each are as follows:

Stock in Michaels Enterprises *Expect* to receive cash dividends of $300 per year indefinitely.

Oil well *Expect* to receive cash flow of $2,000 at the end of year 1, $4,000 at the end of year 2, and $10,000 at the end of year 4, when the well is to be sold.

Original painting *Expect* to be able to sell the painting in 5 years for $85,000.

With these cash flow estimates, Celia has taken the first step toward placing a value on each of the assets.

Timing

In addition to making cash flow estimates, we must know the timing of the cash flows.[10] For example, Celia expects the cash flows of \$2,000, \$4,000, and \$10,000 for the oil well to occur at the ends of years 1, 2, and 4, respectively. The combination of the cash flow and its timing fully defines the return expected from the asset.

Risk and Required Return

Hint **The required rate of return is the result of investors being risk-averse. In order for the risk-averse investor to purchase a given asset, the investor *must expect* at least enough return to compensate for the asset's perceived risk.**

The level of risk associated with a given cash flow can significantly affect its value. In general, the greater the risk of (or the less certain) a cash flow, the lower its value. Greater risk can be incorporated into a valuation analysis by using a higher required return or discount rate. As in the previous chapter, the higher the risk, the greater the required return, and the lower the risk, the less the required return.

EXAMPLE

Let's return to Celia Sargent's task of placing a value on Groton Corporation's original painting and consider two scenarios.

Scenario 1—Certainty A major art gallery has contracted to buy the painting for \$85,000 at the end of 5 years. Because this is considered a certain situation, Celia views this asset as "money in the bank." She thus would use the prevailing risk-free rate of 9% as the required return when calculating the value of the painting.

Scenario 2—High Risk The values of original paintings by this artist have fluctuated widely over the past 10 years. Although Celia expects to be able to get \$85,000 for the painting, she realizes that its sale price in 5 years could range between \$30,000 and \$140,000. Because of the high uncertainty surrounding the painting's value, Celia believes that a 15% required return is appropriate.

These two estimates of the appropriate required return illustrate how this rate captures risk. The often subjective nature of such estimates is also clear.

The Basic Valuation Model

Simply stated, the value of any asset is *the present value of all future cash flows it is expected to provide over the relevant time period.* The time period can be any length, even infinity. The value of an asset is therefore determined by discounting the expected cash flows back to their present value, using the required return commensurate with the asset's risk as the appropriate discount rate. Utilizing the present value techniques explained in Chapter 4, we can express the value of any asset at time zero, V_0, as

$$V_0 = \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k^2)} + \cdots + \frac{CF_n}{(1+k)^n} \qquad (6.5)$$

10. Although cash flows can occur at any time during a year, for computational convenience as well as custom, we will assume they occur at the *end of the year* unless otherwise noted.

TABLE 6.5 Valuation of Groton Corporation's Assets by Celia Sargent

Asset	Cash flow, CF	Appropriate required return	Valuation[a]
Michaels Enterprises stock[b]	\$300/year indefinitely	12%	$V_0 = \$300 \times (PVIFA_{12\%,\infty})$ $= \$300 \times \frac{1}{0.12} = \underline{\underline{\$2,500}}$
Oil well[c]	Year (t) / CF_t: 1 — \$ 2,000 2 — 4,000 3 — 0 4 — 10,000	20%	$V_0 = [\$2,000 \times (PVIF_{20\%,1})]$ $+ [\$4,000 \times (PVIF_{20\%,2})]$ $+ [\$0 \times (PVIF_{20\%,3})]$ $+ [\$10,000 \times (PVIF_{20\%,4})]$ $= [\$2,000 \times (0.833)]$ $+ [\$4,000 \times (0.694)]$ $+ [\$0 \times (0.579)]$ $+ [\$10,000 \times (0.482)]$ $= \$1,666 + \$2,776$ $+ \$0 + \$4,820$ $= \underline{\underline{\$9,262}}$
Original painting[d]	\$85,000 at end of year 5	15%	$V_0 = \$85,000 \times (PVIF_{15\%,5})$ $= \$85,000 \times (0.497)$ $= \underline{\underline{\$42,245}}$

[a]Based on *PVIF* interest factors from Table A–2. If calculated using a calculator, the values of the oil well and original painting would have been \$9,266.98 and \$42,260.03, respectively.
[b]This is a perpetuity (infinite-lived annuity), and therefore the present value interest factor given in Equation 4.19 is applied.
[c]This is a mixed stream of cash flows and therefore requires a number of *PVIF*s, as noted.
[d]This is a single-amount cash flow and therefore requires a single *PVIF*.

where

V_0 = value of the asset at time zero
CF_t = cash flow *expected* at the end of year t
k = appropriate required return (discount rate)
n = relevant time period

Using present value interest factor notation, $PVIF_{k,n}$ from Chapter 4, Equation 6.5 can be rewritten as

$$V_0 = [CF_1 \times (PVIF_{k,1})] + [CF_2 \times (PVIF_{k,2})] + \cdots + [CF_n \times (PVIF_{k,n})] \quad (6.6)$$

We can use Equation 6.6 to determine the value of any asset.

EXAMPLE Celia Sargent used Equation 6.6 to calculate the value of each asset (using present value interest factors from Table A–2), as shown in Table 6.5. Michaels Enterprises stock has a value of \$2,500, the oil well's value is \$9,262, and the original painting has a value of \$42,245. Note that regardless of the pattern of the expected cash flow from an asset, the basic valuation equation can be used to determine its value.

Review Questions

6–12 Why is it important for financial managers to understand the valuation process?

6–13 What are the three key inputs to the valuation process?
6–14 Does the valuation process apply only to assets that provide an annual cash flow? Explain.
6–15 Define and specify the general equation for the value of any asset, V_0.

LG5 LG6

6.4 Bond Valuation

The basic valuation equation can be customized for use in valuing specific securities: bonds, common stock, and preferred stock. Bond valuation is described in this chapter, and valuation of common stock and preferred stock is discussed in Chapter 7.

Bond Fundamentals

Hint A bondholder receives two cash flows from a bond if it is held to maturity—interest and the bond's face value. For valuation purposes, the interest is an annuity and the face value is a single payment received at a specified future date.

As noted earlier in this chapter, *bonds* are long-term debt instruments used by business and government to raise large sums of money, typically from a diverse group of lenders. Most corporate bonds pay interest *semiannually* (every 6 months) at a stated *coupon interest rate,* have an initial *maturity* of 10 to 30 years, and have a *par value,* or *face value,* of $1,000 that must be repaid at maturity.[11]

EXAMPLE

Mills Company, a large defense contractor, on January 1, 2004, issued a 10% coupon interest rate, 10-year bond with a $1,000 par value that pays interest semiannually. Investors who buy this bond receive the contractual right to two cash flows: (1) $100 annual interest (10% coupon interest rate × $1,000 par value) distributed as $50 (1/2 × $100) at the end of each 6 months, and (2) the $1,000 par value at the end of the tenth year.

We will use data for Mills's bond issue to look at basic bond valuation.

Basic Bond Valuation

The value of a bond is the present value of the payments its issuer is contractually obligated to make, from the current time until it matures. The basic model for the value, B_0, of a bond is given by Equation 6.7:

$$B_0 = I \times \left[\sum_{t=1}^{n} \frac{1}{(1+k_d)^t}\right] + M \times \left[\frac{1}{(1+k_d)^n}\right] \tag{6.7}$$

$$= I \times (PVIFA_{k_d,n}) + M \times (PVIF_{k_d,n}) \tag{6.7a}$$

11. Bonds often have features that allow them to be retired by the issuer prior to maturity; these *conversion* and *call* features were presented earlier in this chapter. For the purpose of the current discussion, these features are ignored.

where

B_0 = value of the bond at time zero
I = *annual* interest paid in dollars[12]
n = number of years to maturity
M = par value in dollars
k_d = required return on a bond

We can calculate bond value using Equation 6.7a and the appropriate financial tables (A–2 and A–4) or by using a financial calculator.

EXAMPLE

Assuming that interest on the Mills Company bond issue is paid annually and that the required return is equal to the bond's coupon interest rate, $I = \$100$, $k_d = 10\%$, $M = \$1{,}000$, and $n = 10$ years.

The computations involved in finding the bond value are depicted graphically on the following time line.

Time line for bond valuation (Mills Company's 10% coupon interest rate, 10-year maturity, $1,000 par, January 1, 2004, issue paying annual interest; required return = 10%)

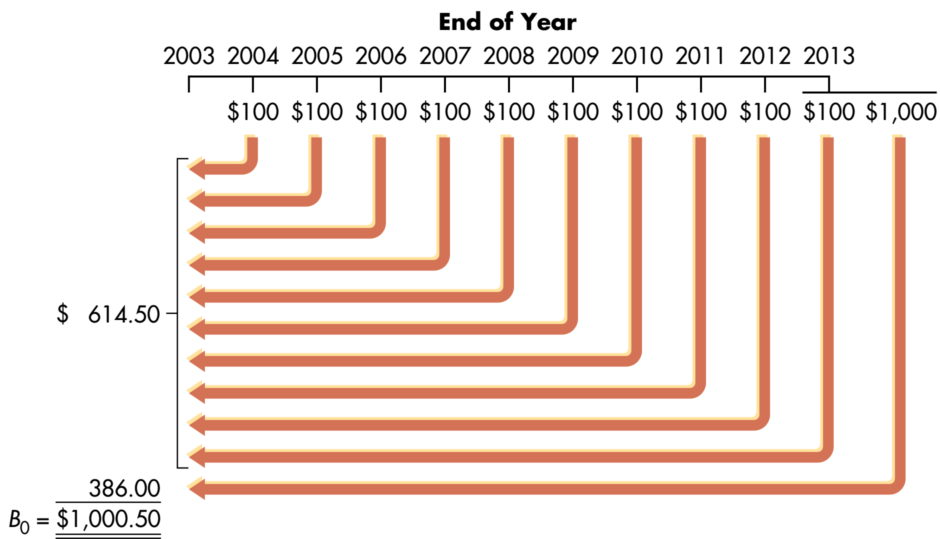


Table Use Substituting the values noted above into Equation 6.7a yields

$$\begin{aligned} B_0 &= \$100 \times (PVIFA_{10\%,10\text{yrs}}) + \$1{,}000 \times (PVIF_{10\%,10\text{yrs}}) \\ &= \$100 \times (6.145) + \$1{,}000 \times (0.386) \\ &= \$614.50 + \$386.00 = \underline{\underline{\$1{,}000.50}} \end{aligned}$$

The bond therefore has a value of approximately $1,000.[13]

12. The payment of annual rather than semiannual bond interest is assumed throughout the following discussion. This assumption simplifies the calculations involved, while maintaining the conceptual accuracy of the valuation procedures presented.

13. Note that a slight rounding error ($0.50) results here from the use of the table factors, which are rounded to the nearest thousandth.

Input	Function
10	N
10	I
100	PMT
1000	FV
	CPT
	PV

Solution
1000

Calculator Use Using the Mills Company's inputs shown at the left, you should find the bond value to be exactly $1,000. Note that *the calculated bond value is equal to its par value; this will always be the case when the required return is equal to the coupon interest rate.*[14]

Bond Value Behavior

In practice, the value of a bond in the marketplace is rarely equal to its par value. In bond quotations (see Figure 6.4), the closing prices of bonds often differ from their par values of 100 (100 percent of par). Some bonds are valued below par (quoted below 100), and others are valued above par (quoted above 100). A variety of forces in the economy, as well as the passage of time, tend to affect value. Although these external forces are in no way controlled by bond issuers or investors, it is useful to understand the impact that required return and time to maturity have on bond value.

Required Returns and Bond Values

Whenever the required return on a bond differs from the bond's coupon interest rate, the bond's value will differ from its par value. The required return is likely to differ from the coupon interest rate because either (1) economic conditions have changed, causing a shift in the basic cost of long-term funds, or (2) the firm's risk has changed. Increases in the basic cost of long-term funds or in risk will raise the required return; decreases in the cost of funds or in risk will lower the required return.

discount
The amount by which a bond sells at a value that is less than its par value.

premium
The amount by which a bond sells at a value that is greater than its par value.

Regardless of the exact cause, what is important is the relationship between the required return and the coupon interest rate: When the required return is greater than the coupon interest rate, the bond value, B_0, will be less than its par value, M. In this case, the bond is said to sell at a **discount,** which will equal $M - B_0$. When the required return falls below the coupon interest rate, the bond value will be greater than par. In this situation, the bond is said to sell at a **premium,** which will equal $B_0 - M$.

EXAMPLE The preceding example showed that when the required return equaled the coupon interest rate, the bond's value equaled its $1,000 par value. If for the same bond the required return were to rise or fall, its value would be found as follows (using Equation 6.7a):

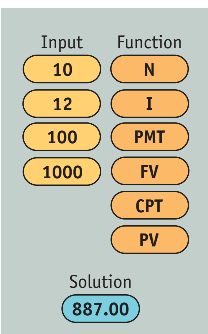
Table Use

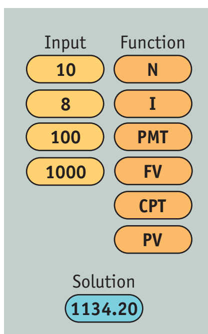
Required Return = 12%	Required Return = 8%
$B_0 = \$100 \times (PVIFA_{12\%,10\text{yrs}}) + \$1{,}000 \times (PVIF_{12\%,10\text{yrs}})$	$B_0 = \$100 \times (PVIFA_{8\%,10\text{yrs}}) + \$1{,}000 \times (PVIF_{8\%,10\text{yrs}})$
$= \underline{\underline{\$887.00}}$	$= \underline{\underline{\$1{,}134.00}}$

14. Note that because bonds pay interest in arrears, the prices at which they are quoted and traded reflect their value *plus* any accrued interest. For example, a $1,000 par value, 10% coupon bond paying interest semiannually and having a calculated value of $900 would pay interest of $50 at the end of each 6-month period. If it is now 3 months since the beginning of the interest period, three-sixths of the $50 interest, or $25 (i.e., 3/6 × $50), would be accrued. The bond would therefore be quoted at $925—its $900 value plus the $25 in accrued interest. For convenience, *throughout this book, bond values will always be assumed to be calculated at the beginning of the interest period,* thereby avoiding the need to consider accrued interest.

TABLE 6.6 Bond Values for Various Required Returns (Mills Company's 10% Coupon Interest Rate, 10-Year Maturity, $1,000 Par, January 1, 2004, Issue Paying Annual Interest)

Required return, k_d	Bond value, B_0	Status
12%	$ 887.00	Discount
10	1,000.00	Par value
8	1,134.00	Premium



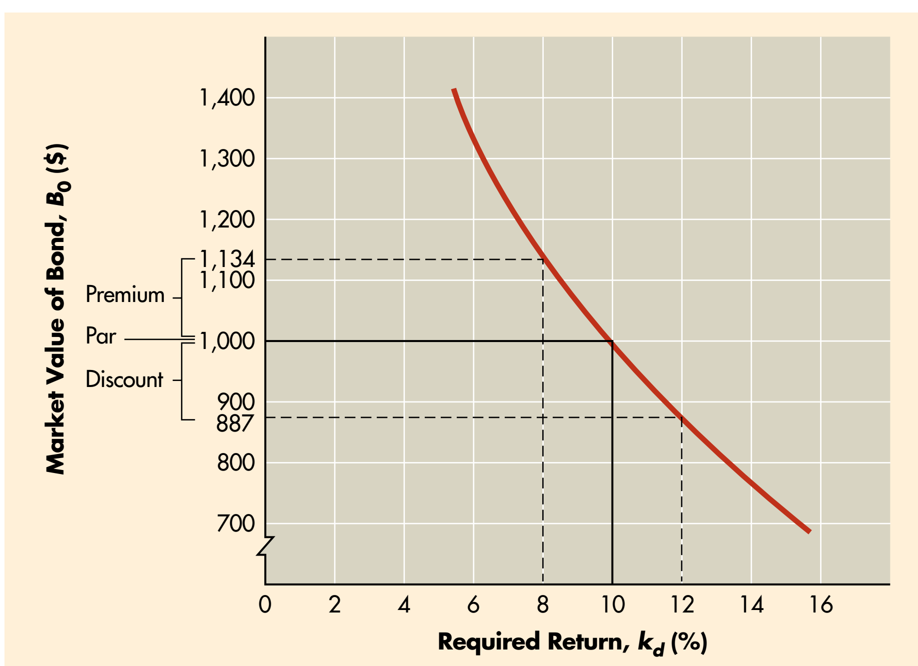


Calculator Use Using the inputs shown at the left for the two different required returns, you will find the value of the bond to be below or above par. At a 12% required return, the bond would sell at a *discount* of $113.00 ($1,000 par value − $887.00 value). At the 8% required return, the bond would sell for a *premium* of about $134.00 ($1,134.00 value − $1,000 par value). The results of this and earlier calculations for Mills Company's bond values are summarized in Table 6.6 and graphically depicted in Figure 6.5. The inverse relationship between bond value and required return is clearly shown in the figure.

FIGURE 6.5

Bond Values and Required Returns

Bond values and required returns (Mills Company's 10% coupon interest rate, 10-year maturity, $1,000 par, January 1, 2004, issue paying annual interest)



Time to Maturity and Bond Values

Whenever the required return is different from the coupon interest rate, the amount of time to maturity affects bond value. An additional factor is whether required returns are constant or changing over the life of the bond.

Constant Required Returns When the required return is different from the coupon interest rate and is assumed to be *constant until maturity*, the value of the bond will approach its par value as the passage of time moves the bond's value closer to maturity. (Of course, when the required return *equals* the coupon interest rate, the bond's value will remain at par until it matures.)

EXAMPLE

Figure 6.6 depicts the behavior of the bond values calculated earlier and presented in Table 6.6 for Mills Company's 10% coupon interest rate bond paying annual interest and having 10 years to maturity. Each of the three required returns—12%, 10%, and 8%—is assumed to remain constant over the 10 years to the bond's maturity. The bond's value at both 12% and 8% approaches and ultimately equals the bond's $1,000 par value at its maturity, as the discount (at 12%) or premium (at 8%) declines with the passage of time.

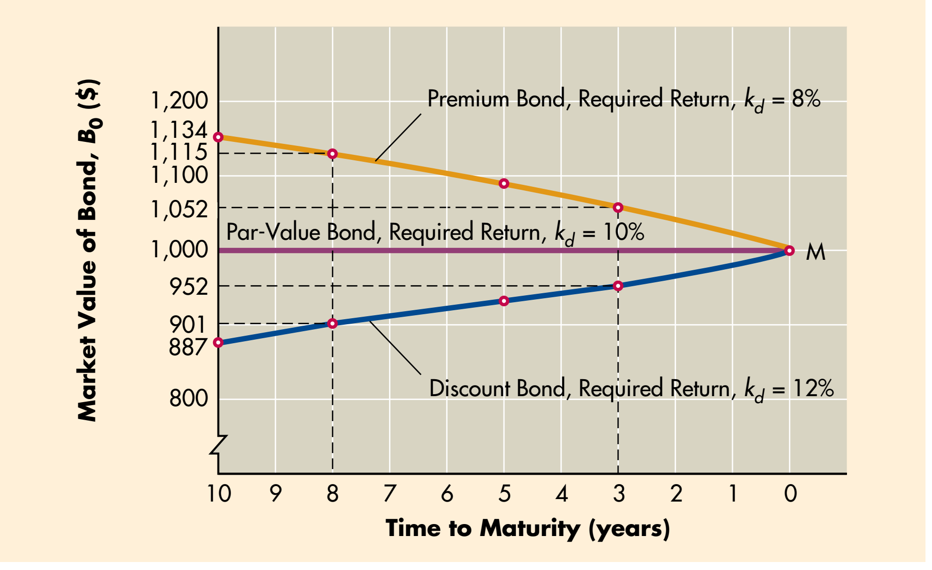
interest rate risk
The chance that interest rates will change and thereby change the required return and bond value. Rising rates, which result in decreasing bond values, are of greatest concern.

Changing Required Returns The chance that interest rates will change and thereby change the required return and bond value is called **interest rate risk.** (This was described as a shareholder-specific risk in Chapter 5, Table 5.1.) Bondholders are typically more concerned with rising interest rates because a rise in interest rates, and therefore in the required return, causes a decrease in bond value. The shorter the amount of time until a bond's maturity, the less responsive

FIGURE 6.6

Time to Maturity and Bond Values

Relationship among time to maturity, required returns, and bond values (Mills Company's 10% coupon interest rate, 10-year maturity, $1,000 par, January 1, 2004, issue paying annual interest)



In Practice

FOCUS ON PRACTICE The Value of a Zero

Many investors buy bonds to get a steady stream of interest payments. So why would anyone buy a zero-coupon bond, which doesn't offer that stream of cash flows? One reason is the cost of "zeros." Because they pay no interest, zeros sell at a deep discount from par value: A $1,000, 30-year government agency zero-coupon bond might cost about $175. At maturity, the investor receives the $1,000 par value. The difference between the price of the bond and its par value is the return to the investor. Stated as an annual yield, the return reflects the compounding of interest, just as though the issuer had paid interest during bond term. In this example, the bond yields 6 percent.

Even though a corporate issuer of a zero-coupon bond makes no cash interest payments, for tax purposes it can take an interest deduction. To calculate the annual implicit interest expense, the issuer must first determine the bond's value at the beginning of each year by using the formula $M/(1 + k_d)^n$, where M = the par value in dollars, k_d = the required return, and n = the number of years to maturity. The difference in the bond's value from year to year is the implicit interest.

Assume that a corporation issues a 5-year zero-coupon bond with a $1,000 par value and a required yield of 6.5 percent. Applying the above formula, we discover that the initial price of this bond is $729.88 [$1,000/(1 + 0.065)^5 = $1,000/1.3700867]. Total implicit interest over the 5 years is $270.12 ($1,000 – $729.88). The following table uses the formula to calculate the bond's value at the end of each year and the implicit interest expense that the corporation can deduct each year.

Sources: Adapted from Hope Hamashige, "More than Zero," *Los Angeles Times* (September 16, 1997), p. D-6; Donald Jay Korn, "Getting Something for Nothing," *Black Enterprise* (April 2000), downloaded from *www.findarticles.com;* "Putting Compound Interest to Work Through Zero Coupon Bonds," The Bond Market Association, PR Newswire (June 24, 1998), downloaded from *www.ask.elibrary.com.*

Year	Beginning value	Ending value	Implicit Interest Expense
1	$729.88	$ 777.32	$ 47.44
2	777.32	827.84	50.52
3	827.84	881.66	53.82
4	881.66	938.97	57.31
5	938.97	1,000.00	61.03
		Total	$270.12

is its market value to a given change in the required return. In other words, short maturities have less interest rate risk than long maturities when all other features (coupon interest rate, par value, and interest payment frequency) are the same. This is because of the mathematics of time value; the present values of short-term cash flows change far less than the present values of longer-term cash flows in response to a given change in the discount rate (required return).

EXAMPLE The effect of changing required returns on bonds of differing maturity can be illustrated by using Mills Company's bond and Figure 6.6. If the required return rises from 10% to 12% (see the dashed line at 8 years), the bond's value decreases from $1,000 to $901—a 9.9% decrease. If the same change in required return had occurred with only 3 years to maturity (see the dashed line at 3 years), the bond's value would have dropped to just $952—only a 4.8% decrease. Similar types of responses can be seen for the change in bond value associated with decreases in required returns. The shorter the time to maturity, the less the impact on bond value caused by a given change in the required return.

Yield to Maturity (YTM)

yield to maturity (YTM)
The rate of return that investors earn if they buy a bond at a specific price and hold it until maturity. (Assumes that the issuer makes all scheduled interest and principal payments as promised.)

When investors evaluate bonds, they commonly consider **yield to maturity (YTM).** This is the rate of return that investors earn if they buy the bond at a specific price and hold it until maturity. (The measure assumes, of course, that the issuer makes all scheduled interest and principal payments as promised.) The yield to maturity on a bond with a current price equal to its par value (that is, $B_0 = M$) will always equal the coupon interest rate. When the bond value differs from par, the yield to maturity will differ from the coupon interest rate.

Assuming that interest is paid annually, the yield to maturity on a bond can be found by solving Equation 6.7 for k_d. In other words, the current value, the annual interest, the par value, and the years to maturity are known, and the required return must be found. The required return is the bond's yield to maturity. The YTM can be found by trial and error or by use of a financial calculator. The calculator provides accurate YTM values with minimum effort.

EXAMPLE

The Mills Company bond, which currently sells for \$1,080, has a 10% coupon interest rate and \$1,000 par value, pays interest annually, and has 10 years to maturity. Because $B_0 = \$1{,}080$, $I = \$100$ $(0.10 \times \$1{,}000)$, $M = \$1{,}000$, and $n = 10$ years, substituting into Equation 6.7a yields

$$\$1{,}080 = \$100 \times (PVIFA_{k_d,10\text{yrs}}) + \$1{,}000 \times (PVIF_{k_d,10\text{yrs}})$$

Our objective is to solve the equation for k_d, the YTM.

Trial and Error Because we know that a required return, k_d, of 10% (which equals the bond's 10% coupon interest rate) would result in a value of \$1,000, the discount rate that would result in \$1,080 must be less than 10%. (Remember that the lower the discount rate, the higher the present value, and the higher the discount rate, the lower the present value.) Trying 9%, we get

$$\begin{aligned} &\$100 \times (PVIFA_{9\%,10\text{yrs}}) + \$1{,}000 \times (PVIF_{9\%,10\text{yrs}}) \\ &= \$100 \times (6.418) + \$1{,}000 \times (0.422) \\ &= \$641.80 + \$422.00 \\ &= \$1{,}063.80 \end{aligned}$$

Because the 9% rate is not quite low enough to bring the value up to \$1,080, we next try 8% and get

$$\begin{aligned} &\$100 \times (PVIFA_{8\%,10\text{yrs}}) + \$1{,}000 \times (PVIF_{8\%,10\text{yrs}}) \\ &= \$100 \times (6.710) + \$1{,}000 \times (0.463) \\ &= \$671.00 + \$463.00 \\ &= \$1{,}134.00 \end{aligned}$$

Because the value at the 8% rate is higher than \$1,080 and the value at the 9% rate is lower than \$1,080, the bond's yield to maturity must be between 8% and

Input	Function
10	N
−1080	PV
100	PMT
1000	FV
	CPT
	I

Solution
8.766

9%. Because the \$1,063.80 is closer to \$1,080, the YTM to the nearest whole percent is 9%. (By using *interpolation,* we could eventually find the more precise YTM value to be 8.77%.)[15]

Calculator Use [*Note:* Most calculators require *either* the present value (B_0 in this case) or the future values (I and M in this case) to be input as negative numbers to calculate yield to maturity. That approach is employed here.] Using the inputs shown at the left, you should find the YTM to be 8.766%.

Semiannual Interest and Bond Values

The procedure used to value bonds paying interest semiannually is similar to that shown in Chapter 4 for compounding interest more frequently than annually, except that here we need to find present value instead of future value. It involves

1. Converting annual interest, I, to semiannual interest by dividing I by 2.
2. Converting the number of years to maturity, n, to the number of 6-month periods to maturity by multiplying n by 2.
3. Converting the required stated (rather than effective)[16] annual return for similar-risk bonds that also pay semiannual interest from an annual rate, k_d, to a semiannual rate by dividing k_d by 2.

Substituting these three changes into Equation 6.7 yields

$$B_0 = \frac{I}{2} \times \left[\sum_{i=1}^{2n} \frac{1}{\left(1+\frac{k_d}{2}\right)^t} \right] + M \times \left[\frac{1}{\left(1+\frac{k_d}{2}\right)^{2n}} \right] \qquad (6.8)^{17}$$

15. For information on how to interpolate to get a more precise answer, see the book's home page at www.aw.com/gitman

16. As we noted in Chapter 4, the effective annual rate of interest, EAR, for stated interest rate i, when interest is paid semiannually ($m = 2$), can be found by using Equation 4.23:

$$\text{EAR} = \left(1 + \frac{i}{2}\right)^2 - 1$$

For example, a bond with a 12% required stated return, k_d, that pays semiannual interest would have an effective annual rate of

$$\text{EAR} = \left(1 + \frac{0.12}{2}\right)^2 - 1 = (1.06)^2 - 1 = 1.1236 - 1 = 0.1236 = \underline{\underline{12.36}}\%$$

Because most bonds pay semiannual interest at semiannual rates equal to 50% of the stated annual rate, their effective annual rates are generally higher than their stated annual rates.

17. Although it may appear inappropriate to use the semiannual discounting procedure on the maturity value, M, this technique is necessary to find the correct bond value. One way to confirm the accuracy of this approach is to calculate the bond value for the case where the required stated annual return and coupon interest rate are equal; for B_0 to equal M, as would be expected in such a case, the maturity value must be discounted on a semiannual basis.

$$= \frac{I}{2} \times (PVIFA_{k_d/2,2n}) + M \times (PVIF_{k_d/2,2n}) \tag{6.8a}$$

EXAMPLE

Assuming that the Mills Company bond pays interest semiannually and that the required stated annual return, k_d, is 12% for similar-risk bonds that also pay semiannual interest, substituting these values into Equation 6.8a yields

$$B_0 = \frac{\$100}{2} \times (PVIFA_{12\%/2,2\times10\text{yrs}}) + \$1{,}000 \times (PVIF_{12\%/2,2\times10\text{yrs}})$$

Table Use

$$B_0 = \$50 \times (PVIFA_{6\%,20\text{periods}}) + \$1{,}000 \times (PVIF_{6\%,20\text{periods}})$$
$$= \$50 \times (11.470) + \$1{,}000 \times (0.312) = \underline{\underline{\$885.50}}$$

Input	Function
20	N
6	I
50	PMT
1000	FV
	CPT
	PV

Solution
885.30

Calculator Use In using a calculator to find bond value when interest is paid semiannually, we must double the number of periods and divide both the required stated annual return and the annual interest by 2. For the Mills Company bond, we would use 20 periods (2 × 10 years), a required return of 6% (12% ÷ 2), and an interest payment of \$50 (\$100 ÷ 2). Using these inputs, you should find the bond value with semiannual interest to be \$885.30, as shown at the left. Note that this value is more precise than the value calculated using the rounded financial-table factors.

Comparing this result with the \$887.00 value found earlier for annual compounding (see Table 6.6), we can see that the bond's value is lower when semiannual interest is paid. *This will always occur when the bond sells at a discount.* For bonds selling at a premium, the opposite will occur: The value with semiannual interest will be greater than with annual interest.

Review Questions

6–16 What basic procedure is used to value a bond that pays annual interest? Semiannual interest?

6–17 What relationship between the required return and the coupon interest rate will cause a bond to sell at a *discount?* At a *premium?* At its *par value?*

6–18 If the required return on a bond differs from its coupon interest rate, describe the behavior of the bond value over time as the bond moves toward maturity.

6–19 As a risk-averse investor, would you prefer bonds with short or long periods until maturity? Why?

6–20 What is a bond's *yield to maturity (YTM)?* Briefly describe both the trial-and-error approach and the use of a financial calculator for finding YTM.

Summary

FOCUS ON VALUE

Interest rates and required returns embody the real cost of money, inflationary expectations, and issuer and issue risk. They reflect the level of return required by market participants as compensation for the risk perceived in a specific security or asset investment. Because these returns are affected by economic expectations, they vary as a function of time, typically rising for longer-term maturities or transactions. The yield curve reflects such market expectations at any point in time.

The value of an asset can be found by calculating the present value of its expected cash flows, using the required return as the discount rate. Bonds are the easiest financial assets to value, because both the amounts and the timing of their cash flows are contractual and therefore known with certainty. The financial manager needs to understand how to apply valuation techniques to bonds, stocks, and tangible assets (as will be demonstrated in the following chapters) in order to make decisions that are consistent with the firm's **share price maximization goal.**

REVIEW OF LEARNING GOALS

LG1 **Describe interest rate fundamentals, the term structure of interest rates, and risk premiums.** The flow of funds between savers (suppliers) and investors (demanders) is regulated by the interest rate or required return. In a perfect, inflation-free, certain world there would be one cost of money—the real rate of interest. The nominal or actual interest rate is the sum of the risk-free rate, which is the sum of the real rate of interest and the inflationary expectation premium, and a risk premium reflecting issuer and issue characteristics. For any class of similar-risk securities, the term structure of interest rates reflects the relationship between the interest rate, or rate of return, and the time to maturity. Yield curves can be downward-sloping (inverted), upward-sloping (normal), or flat. Three theories—expectations theory, liquidity preference theory, and market segmentation theory—are cited to explain the general shape of the yield curve. Risk premiums for non-Treasury debt issues result from interest rate risk, liquidity risk, tax risk, default risk, maturity risk, and contractual provision risk.

LG2 **Review the legal aspects of bond financing and bond cost.** Corporate bonds are long-term debt instruments indicating that a corporation has borrowed an amount that it promises to repay in the future under clearly defined terms. Most bonds are issued with maturities of 10 to 30 years and a par value of $1,000. The bond indenture, enforced by a trustee, states all conditions of the bond issue. It contains both standard debt provisions and restrictive covenants, which may include a sinking-fund requirement and/or a security interest. The cost of bonds to an issuer depends on its maturity, offering size, and issuer risk and on the basic cost of money.

LG3 **Discuss the general features, quotations, ratings, popular types, and international issues of corporate bonds.** A bond issue may include a conversion feature, a call feature, or stock purchase warrants. Bond quotations, published regularly in the financial press, provide information on bonds, including current price data and statistics on recent price behavior. Bond ratings by independent agencies indicate the risk of a bond issue. Various types of traditional and contemporary bonds are available. Eurobonds and foreign bonds enable established creditworthy companies and governments to borrow large amounts internationally.

LG4 **Understand the key inputs and basic model used in the valuation process.** Key inputs to the valuation process include cash flows (returns), timing, and risk and the required return. The value of any asset is equal to the present value of all future cash flows it is *expected* to provide over the relevant time period. The basic valuation formula for any asset is summarized in Table 6.7.

LG5 **Apply the basic valuation model to bonds and describe the impact of required return and time to maturity on bond values.** The value of a bond is the present value of its interest payments plus the present value of its par value. The basic valuation model for a bond is summarized in Table 6.7. The discount rate used to determine bond value is the required return, which may differ from the bond's coupon interest rate. A bond can sell at a discount, at par, or at a premium, depending on whether the required return is greater than, equal to, or less than its coupon interest rate. The amount of time to maturity affects bond values. Even if the required return remains constant, the value of a bond will approach its par value as the bond moves closer to maturity. The chance that interest rates will change and thereby change the required return and bond value is called interest rate risk. The shorter the amount of time until a bond's maturity, the less responsive is its market value to a given change in the required return.

LG6 **Explain yield to maturity (YTM), its calculation, and the procedure used to value bonds that pay interest semiannually.** Yield to maturity (YTM) is the rate of return investors earn if they buy a bond at a specific price and hold it until maturity. YTM can be calculated by trial and error or financial calculator. Bonds that pay interest semiannually are valued by using the same procedure used to value bonds paying annual interest, except that the interest payments are one-half of the annual interest payments, the number of periods is twice the number of years to maturity, and the required return is one-half of the stated annual required return on similar-risk bonds.

SELF-TEST PROBLEMS (Solutions in Appendix B)

LG5 LG6

ST 6–1 Bond valuation Lahey Industries has outstanding a $1,000 par-value bond with an 8% coupon interest rate. The bond has 12 years remaining to its maturity date.

a. If interest is paid *annually,* find the value of the bond when the required return is (1) 7%, (2) 8%, and (3) 10%?

b. Indicate for each case in part **a** whether the bond is selling at a discount, at a premium, or at its par value.

c. Using the 10% required return, find the bond's value when interest is paid *semiannually.*

LG6

ST 6–2 Yield to maturity Elliot Enterprises' bonds currently sell for $1,150, have an 11% coupon interest rate and a $1,000 par value, pay interest *annually,* and have 18 years to maturity.

a. Calculate the bonds' yield to maturity (YTM).

b. Compare the YTM calculated in part **a** to the bonds' coupon interest rate, and use a comparison of the bonds' current price and their par value to explain this difference.

TABLE 6.7 Summary of Key Valuation Definitions and Formulas for Any Asset and for Bonds

Definitions of variables

B_0 = bond value
CF_t = cash flow *expected* at the end of year t
I = annual interest on a bond
k = appropriate required return (discount rate)
k_d = required return on a bond
M = par, or face, value of a bond
n = relevant time period, or number of years to maturity
V_0 = value of the asset at time zero

Valuation formulas

Value of any asset:

$$V_0 = \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \cdots + \frac{CF_n}{(1+k)^n} \qquad \text{[Eq. 6.5]}$$

$$= [CF_1 \times (PVIF_{k,1})] + [CF_2 \times (PVIF_{k,2})] + \cdots + [CF_n \times (PVIF_{k,n})] \qquad \text{[Eq. 6.6]}$$

Bond value:

$$B_0 = I \times \left[\sum_{t=1}^{n} \frac{1}{(1+k_d)^t}\right] + M \times \left[\frac{1}{(1+k_d)^n}\right] \qquad \text{[Eq. 6.7]}$$

$$= I \times (PVIFA_{k_d,n}) + M \times (PVIF_{k_d,n}) \qquad \text{[Eq. 6.7a]}$$

PROBLEMS

LG1 **6–1 Interest rate fundamentals: The real rate of return** Carl Foster, a trainee at an investment banking firm, is trying to get an idea of what real rate of return investors are expecting in today's marketplace. He has looked up the rate paid on 3-month U.S. Treasury bills and found it to be 5.5%. He has decided to use the rate of change in the Consumer Price Index as a proxy for the inflationary expectations of investors. That annualized rate now stands at 3%. On the basis of the information that Carl has collected, what estimate can he make of the real rate of return?

LG1 **6–2 Real rate of interest** To estimate the real rate of interest, the economics division of Mountain Banks—a major bank holding company—has gathered the data summarized in the following table. Because there is a high likelihood that new tax legislation will be passed in the near future, current data as well as data reflecting the probable impact of passage of the legislation on the demand for funds are also included in the table. (*Note:* The proposed legislation will not have any impact on the supply schedule of funds. Assume a perfect world in which inflation is expected to be zero, funds suppliers and demanders have no liquidity preference, and all outcomes are certain.)

Amount of funds supplied/demanded ($ billion)	Currently: Interest rate required by funds suppliers	Currently: Interest rate required by funds demanders	With passage of tax legislation: Interest rate required by funds demanders
$ 1	2%	7%	9%
5	3	6	8
10	4	4	7
20	6	3	6
50	7	2	4
100	9	1	3

a. Draw the supply curve and the demand curve for funds using the current data. (*Note:* Unlike the functions in Figure 6.1, the functions here will not appear as straight lines.)
b. Using your graph, label and note the real rate of interest using current data.
c. Add to the graph drawn in part **a** the new demand curve expected in the event that the proposed tax legislation becomes effective.
d. What is the new real rate of interest? Compare and analyze this finding in light of your analysis in part **b.**

LG1 **6–3 Real and nominal rates interest** Zane Perelli currently has $100 that he can spend today on polo shirts costing $25 each. Instead he could invest the $100 in a risk-free U.S. Treasury security that is expected to earn a 9% nominal rate of interest. The consensus forecast of leading economists is a 5% rate of inflation over the coming year.
a. How many polo shirts can Zane purchase today?
b. How much money will Zane have at the end of 1 year if he forgoes purchasing the polo shirts today?
c. How much would you expect the polo shirts to cost at the end of 1 year in light of the expected inflation?
d. Use your findings in parts **b** and **c** to determine how many polo shirts (fractions are OK) Zane can purchase at the end of 1 year. In percentage terms, how many more or fewer polo shirts can Zane buy at the end of 1 year?
e. What is Zane's real rate of return over the year? How is it related to the percentage change in Zane's buying power found in part **d**? Explain.

LG1 **6–4 Yield curve** A firm wishing to evaluate interest rate behavior has gathered yield data on five U.S. Treasury securities, each having a different maturity and all measured at the same point in time. The summarized data follow.

U.S. Treasury security	Time to maturity	Yield
A	1 year	12.6%
B	10 years	11.2
C	6 months	13.0
D	20 years	11.0
E	5 years	11.4

a. Draw the yield curve associated with these data.
b. Describe the resulting yield curve in part **a**, and explain the general expectations embodied in it.

LG1 **6–5 Nominal interest rates and yield curves** A recent study of inflationary expectations has revealed that the consensus among economic forecasters yields the following average annual rates of inflation expected over the periods noted. (*Note:* Assume that the risk that future interest rate movements will affect longer maturities more than shorter maturities is zero; that is, there is no *maturity risk*.)

Period	Average annual rate of inflation
3 months	5%
2 years	6
5 years	8
10 years	8.5
20 years	9

a. If the real rate of interest is currently 2.5%, find the nominal interest rate on each of the following U.S. Treasury issues: 20-year bond, 3-month bill, 2-year note, and 5-year bond.
b. If the real rate of interest suddenly dropped to 2% without any change in inflationary expectations, what effect, if any, would this have on your answers in part **a**? Explain.
c. Using your findings in part **a**, draw a yield curve for U.S. Treasury securities. Describe the general shape and expectations reflected by the curve.
d. What would a follower of the *liquidity preference theory* say about how the preferences of lenders and borrowers tend to affect the shape of the yield curve drawn in part **c**? Illustrate that effect by placing on your graph a dotted line that approximates the yield curve without the effect of liquidity preference.
e. What would a follower of the *market segmentation theory* say about the supply and demand for long-term loans versus the supply and demand for short-term loans given the yield curve constructed for part **c** of this problem?

LG1 **6–6 Nominal and real rates and yield curves** A firm wishing to evaluate interest rate behavior has gathered data on nominal rate of interest and on inflationary expectation for five U.S. Treasury securities, each having a different maturity and each measured at a different point in time during the year just ended. (*Note:* Assume that the risk that future interest rate movements will affect longer maturities more than shorter maturities is zero; that is, there is no *maturity risk*.) These data are summarized in the following table.

U.S. Treasury security	Point in time	Maturity	Nominal rate of interest	Inflationary expectation
A	Jan. 7	2 years	12.6%	9.5%
B	Mar. 12	10 years	11.2	8.2
C	May 30	6 months	13.0	10.0
D	Aug. 15	20 years	11.0	8.1
E	Dec. 30	5 years	11.4	8.3

a. Using the preceding data, find the real rate of interest at each point in time.
b. Describe the behavior of the real rate of interest over the year. What forces might be responsible for such behavior?
c. Draw the yield curve associated with these data, assuming that the nominal rates were measured at the same point in time.
d. Describe the resulting yield curve in part **c**, and explain the general expectations embodied in it.

LG1 6–7 **Term structure of interest rates** The following yield data for a number of highest quality corporate bonds existed at each of the three points in time noted.

	Yield		
Time to maturity (years)	5 years ago	2 years ago	Today
1	9.1%	14.6%	9.3%
3	9.2	12.8	9.8
5	9.3	12.2	10.9
10	9.5	10.9	12.6
15	9.4	10.7	12.7
20	9.3	10.5	12.9
30	9.4	10.5	13.5

a. On the same set of axes, draw the yield curve at each of the three given times.
b. Label each curve in part **a** with its general shape (downward-sloping, upward-sloping, flat).
c. Describe the general inflationary and interest rate expectation existing at each of the three times.

LG1 6–8 **Risk-free rate and risk premiums** The real rate of interest is currently 3%; the inflation expectation and risk premiums for a number of securities follow.

Security	Inflation expectation premium	Risk premium
A	6%	3%
B	9	2
C	8	2
D	5	4
E	11	1

a. Find the risk-free rate of interest, R_F, that is applicable to each security.
b. Although not noted, what factor must be the cause of the differing risk-free rates found in part **a**?
c. Find the nominal rate of interest for each security.

LG1 6–9 **Risk premiums** Eleanor Burns is attempting to find the nominal rate of interest for each of two securities—A and B—issued by different firms at the same point in time. She has gathered the following data:

Characteristic	Security A	Security B
Time to maturity	3 years	15 years
Inflation expectation premium	9.0%	7.0%
Risk premium for:		
Liquidity risk	1.0%	1.0%
Default risk	1.0%	2.0%
Maturity risk	0.5%	1.5%
Other risk	0.5%	1.5%

a. If the real rate of interest is currently 2%, find the risk-free rate of interest applicable to each security.
b. Find the total risk premium attributable to each security's issuer and issue characteristics.
c. Calculate the nominal rate of interest for each security. Compare and discuss your findings.

LG2 **6–10 Bond interest payments before and after taxes** Charter Corp. has issued 2,500 debentures with a total principal value of $2,500,000. The bonds have a coupon interest rate of 7%.
a. What dollar amount of interest per bond can an investor expect to receive each year from Charter Corp.?
b. What is Charter's total interest expense per year associated with this bond issue?
c. Assuming that Charter is in a 35% corporate tax bracket, what is the company's net after-tax interest cost associated with this bond issue?

LG3 **6–11 Bond quotation** Assume that the following quote for the Financial Management Corporation's $1,000-par-value bond was found in the Wednesday, November 8, issue of the *Wall Street Journal.*

Fin Mgmt 8.75 05 8.7 558 100.25 −0.63

Given this information, answer the following questions.
a. On what day did the trading activity occur?
b. At what price did the bond close at the end of the day on November 7?
c. In what year does the bond mature?
d. How many bonds were traded on the day quoted?
e. What is the bond's coupon interest rate?
f. What is the bond's *current yield?* Explain how this value was calculated.
g. How much of a change, if any, in the bond's closing price took place between the day quoted and the day before? At what price did the bond close on the day before?

LG4 **6–12 Valuation fundamentals** Imagine that you are trying to evaluate the economics of purchasing an automobile. You expect the car to provide annual after-tax cash benefits of $1,200 at the end of each year, and assume that you can sell the car for after-tax proceeds of $5,000 at the end of the planned 5-year ownership period. All funds for purchasing the car will be drawn from your savings, which are currently earning 6% after taxes.

a. Identify the cash flows, their timing, and the required return applicable to valuing the car.

b. What is the maximum price you would be willing to pay to acquire the car? Explain.

LG4 **6–13** **Valuation of assets** Using the information provided in the following table, find the value of each asset.

	Cash flow		
Asset	End of year	Amount	Appropriate required return
A	1	$ 5,000	18%
	2	5,000	
	3	5,000	
B	1 through ∞	$ 300	15%
C	1	$ 0	16%
	2	0	
	3	0	
	4	0	
	5	35,000	
D	1 through 5	$ 1,500	12%
	6	8,500	
E	1	$ 2,000	14%
	2	3,000	
	3	5,000	
	4	7,000	
	5	4,000	
	6	1,000	

LG4 **6–14** **Asset valuation and risk** Laura Drake wishes to estimate the value of an asset expected to provide cash inflows of $3,000 per year at the end of years 1 through 4 and $15,000 at the end of year 5. Her research indicates that she must earn 10% on low-risk assets, 15% on average-risk assets, and 22% on high-risk assets.

a. Determine what is the most Laura should pay for the asset if it is classified as (1) low-risk, (2) average-risk, and (3) high-risk.

b. Say Laura is unable to assess the risk of the asset and wants to be certain she's making a good deal. On the basis of your findings in part **a,** what is the most she should pay? Why?

c. All else being the same, what effect does increasing risk have on the value of an asset? Explain in light of your findings in part **a.**

LG5 **6–15** **Basic bond valuation** Complex Systems has an outstanding issue of $1,000-par-value bonds with a 12% coupon interest rate. The issue pays interest *annually* and has 16 years remaining to its maturity date.

a. If bonds of similar risk are currently earning a 10% rate of return, how much should the Complex Systems bond sell for today?

b. Describe the *two* possible reasons why similar-risk bonds are currently earning a return below the coupon interest rate on the Complex Systems bond.

c. If the required return were at 12% instead of 10%, what would the current value of Complex Systems' bond be? Contrast this finding with your findings in part **a** and discuss.

LG5 **6–16** **Bond valuation—Annual interest** Calculate the value of each of the bonds shown in the following table, all of which pay interest *annually*.

Bond	Par value	Coupon interest rate	Years to maturity	Required return
A	$1,000	14%	20	12%
B	1,000	8	16	8
C	100	10	8	13
D	500	16	13	18
E	1,000	12	10	10

LG5 **6–17** **Bond value and changing required returns** Midland Utilities has outstanding a bond issue that will mature to its $1,000 par value in 12 years. The bond has a coupon interest rate of 11% and pays interest *annually*.

a. Find the value of the bond if the required return is (1) 11%, (2) 15%, and (3) 8%.

b. Plot your findings in part **a** on a set of "required return (x axis)–market value of bond (*y* axis)" axes.

c. Use your findings in parts **a** and **b** to discuss the relationship between the coupon interest rate on a bond and the required return and the market value of the bond relative to its par value.

d. What *two* possible reasons could cause the required return to differ from the coupon interest rate?

LG5 **6–18** **Bond value and time—Constant required returns** Pecos Manufacturing has just issued a 15-year, 12% coupon interest rate, $1,000-par bond that pays interest *annually*. The required return is currently 14%, and the company is certain it will remain at 14% until the bond matures in 15 years.

a. Assuming that the required return does remain at 14% until maturity, find the value of the bond with (1) 15 years, (2) 12 years, (3) 9 years, (4) 6 years, (5) 3 years, and (6) 1 year to maturity.

b. Plot your findings on a set of "time to maturity (*x* axis)–market value of bond (*y* axis)" axes constructed similarly to Figure 6.6.

c. All else remaining the same, when the required return differs from the coupon interest rate and is assumed to be constant to maturity, what happens to the bond value as time moves toward maturity? Explain in light of the graph in part **b**.

LG5 **6–19** **Bond value and time—Changing required returns** Lynn Parsons is considering investing in either of two outstanding bonds. The bonds both have $1,000 par values and 11% coupon interest rates and pay *annual* interest. Bond A has exactly 5 years to maturity, and bond B has 15 years to maturity.

a. Calculate the value of bond A if the required return is (1) 8%, (2) 11%, and (3) 14%.
b. Calculate the value of bond B if the required return is (1) 8%, (2) 11%, and (3) 14%.
c. From your findings in parts **a** and **b,** complete the following table, and discuss the relationship between time to maturity and changing required returns.

Required return	Value of bond A	Value of bond B
8%	?	?
11	?	?
14	?	?

d. If Lynn wanted to minimize *interest rate risk*, which bond should she purchase? Why?

LG6 **6–20 Yield to maturity** The relationship between a bond's yield to maturity and coupon interest rate can be used to predict its pricing level. For each of the bonds listed, state whether the price of the bond will be at a premium to par, at par, or at a discount to par.

Bond	Coupon interest rate	Yield to maturity	Price
A	6%	10%	________
B	8	8	________
C	9	7	________
D	7	9	________
E	12	10	________

LG6 **6–21 Yield to maturity** The Salem Company bond currently sells for $955, has a 12% coupon interest rate and a $1,000 par value, pays interest *annually,* and has 15 years to maturity.
a. Calculate the *yield to maturity* (*YTM*) on this bond.
b. Explain the relationship that exists between the coupon interest rate and yield to maturity and the par value and market value of a bond.

LG6 **6–22 Yield to maturity** Each of the bonds shown in the following table pays interest *annually*.

Bond	Par value	Coupon interest rate	Years to maturity	Current value
A	$1,000	9%	8	$ 820
B	1,000	12	16	1,000
C	500	12	12	560
D	1,000	15	10	1,120
E	1,000	5	3	900

a. Calculate the *yield to maturity* (*YTM*) for each bond.

b. What relationship exists between the coupon interest rate and yield to maturity and the par value and market value of a bond? Explain.

LG2 LG5 LG6 **6–23 Bond valuation and yield to maturity** Mark Goldsmith's broker has shown him two bonds. Each has a maturity of 5 years, a par value of $1,000, and a yield to maturity of 12%. Bond A has a coupon interest rate of 6% paid annually. Bond B has a coupon interest rate of 14% paid annually.

a. Calculate the selling price for each of the bonds.

b. Mark has $20,000 to invest. Judging on the basis of the price of the bonds, how many of either one could Mark purchase if he were to choose it over the other? (Mark cannot really purchase a fraction of a bond, but for purposes of this question, pretend that he can.)

c. Calculate the yearly interest income of each bond on the basis of its coupon rate and the number of bonds that Mark could buy with his $20,000.

d. Assume that Mark will reinvest the interest payments as they are paid (at the end of each year) and that his rate of return on the reinvestment is only 10%. For each bond, calculate the value of the principal payment plus the value of Mark's reinvestment account at the end of the 5 years.

e. Why are the two values calculated in part **d** different? If Mark were worried that he would earn less than the 12% yield to maturity on the reinvested interest payments, which of these two bonds would be a better choice?

LG6 **6–24 Bond valuation—Semiannual interest** Find the value of a bond maturing in 6 years, with a $1,000 par value and a coupon interest rate of 10% (5% paid semiannually) if the required return on similar-risk bonds is 14% annual interest (7% paid semiannually).

LG6 **6–25 Bond valuation—Semiannual interest** Calculate the value of each of the bonds shown in the following table, all of which pay interest *semiannually*.

Bond	Par value	Coupon interest rate	Years to maturity	Required stated annual return
A	$1,000	10%	12	8%
B	1,000	12	20	12
C	500	12	5	14
D	1,000	14	10	10
E	100	6	4	14

LG6 **6–26 Bond valuation—Quarterly interest** Calculate the value of a $5,000-par-value bond paying quarterly interest at an annual coupon interest rate of 10% and having 10 years until maturity if the required return on similar-risk bonds is currently a 12% annual rate paid *quarterly*.

CHAPTER 6 CASE Evaluating Annie Hegg's Proposed Investment in Atilier Industries Bonds

Annie Hegg has been considering investing in the bonds of Atilier Industries. The bonds were issued 5 years ago at their $1,000 par value and have exactly 25 years remaining until they mature. They have an 8% coupon interest rate, are convertible into 50 shares of common stock, and can be called any time at $1,080. The bond is rated Aa by Moody's. Atilier Industries, a manufacturer of sporting goods, recently acquired a small athletic-wear company that was in financial distress. As a result of the acquisition, Moody's and other rating agencies are considering a rating change for Atilier bonds. Recent economic data suggest that inflation, currently at 5% annually, is likely to increase to a 6% annual rate.

Annie remains interested in the Atilier bond but is concerned about inflation, a potential rating change, and maturity risk. In order to get a feel for the potential impact of these factors on the bond value, she decided to apply the valuation techniques she learned in her finance course.

Required

a. If price of the the common stock into which the bond is convertible rises to $30 per share after 5 years and the issuer calls the bonds at $1,080, should Annie let the bond be called away from her or should she convert it into common stock?

b. For each of the following required returns, calculate the bond's value, assuming annual interest. Indicate whether the bond will sell at a discount, at a premium, or at par value.
(1) Required return is 6%.
(2) Required return is 8%.
(3) Required return is 10%.

c. Repeat the calculations in part **b**, assuming that interest is paid *semiannually* and that the semiannual required returns are one-half of those shown. Compare and discuss differences between the bond values for each required return calculated here and in part **b** under the annual versus semiannual payment assumptions.

d. If Annie strongly believes that inflation will rise by 1% during the next 6 months, what is the most she should pay for the bond, assuming annual interest?

e. If the Atilier bonds are downrated by Moody's from Aa to A, and if such a rating change will result in an increase in the required return from 8% to 8.75%, what impact will this have on the bond value, assuming annual interest?

f. If Annie buys the bond today at its $1,000 par value and holds it for exactly 3 years, at which time the required return is 7%, how much of a gain or loss will she experience in the value of the bond (ignoring interest already received and assuming annual interest)?

g. Rework part **f,** assuming that Annie holds the bond for 10 years and sells it when the required return is 7%. Compare your finding to that in part **f,** and comment on the bond's *maturity risk*.

h. Assume that Annie buys the bond at its current closing price of 98.38 and holds it until maturity. What will her *yield to maturity* (*YTM*) be, assuming annual interest?

i. After evaluating all of the issues raised above, what recommendation would you give Annie with regard to her proposed investment in the Atilier Industries bonds?

WEB EXERCISE

Go to the Web site *www.smartmoney.com*. Click on **Economy & Bonds**. Then click on **Bond Calculator**, which is located down the page under the column **Bond Tools**. Read the instructions on how to use the bond calculator. Using the bond calculator:

1. Calculate the *yield to maturity* (*YTM*) for a bond whose coupon rate is 7.5% with maturity date of July 31, 2030, which you bought for 95.
2. What is the YTM of the above bond if you bought it for 105? For 100?
3. Change the yield % box to 8.5. What would be the price of this bond?
4. Change the yield % box to 9.5. What is this bond's price?
5. Change the maturity date to 2006 and reset yield % to 6.5. What is the price of this bond?
6. Why is the price of the bond in Question 5 higher than the price of the bond in Question 4?
7. Explore the other bond-related resources at the site. Using **Bond Market Update**, comment on current interest rate levels and the yield curve.

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

CHAPTER

7

Stock Valuation

LEARNING GOALS

LG1 Differentiate between debt and equity capital.

LG2 Discuss the rights, characteristics, and features of both common and preferred stock.

LG3 Describe the process of issuing common stock, including in your discussion venture capital, going public, the investment banker's role, and stock quotations.

LG4 Understand the concept of market efficiency and basic common stock valuation under each of three cases: zero growth, constant growth, and variable growth.

LG5 Discuss the free cash flow valuation model and the use of book value, liquidation value, and price/earnings (P/E) multiples to estimate common stock values.

LG6 Explain the relationships among financial decisions, return, risk, and the firm's value.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

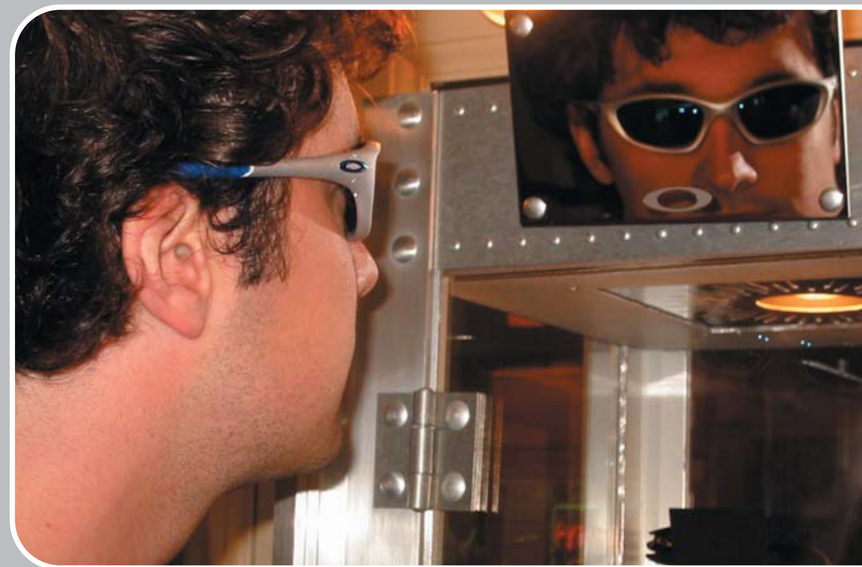
Accounting: You need to understand the difference between debt and equity in terms of tax treatment; the ownership claims of capital providers, including venture capitalists and stockholders; and why book value per share is not a sophisticated basis for common stock valuation.

Information systems: You need to understand the procedures used to issue common stock; the sources and types of information that impact stock value; and how such information can be used in stock valuation models to link proposed actions to share price.

Management: You need to understand the difference between debt and equity capital; the rights and claims of stockholders; the process of raising funds from venture capitalists and through initial public offerings; and how the market will use various stock valuation models to value the firm's common stock.

Marketing: You need to understand that the firm's ideas for products and services will greatly affect the willingness of venture capitalists and stockholders to contribute capital to the firm and also that a perceived increase in risk as a result of new projects may negatively affect the firm's stock value.

Operations: You need to understand that the amount of capital the firm has to invest in plant assets and inventory will depend on the evaluations of venture capitalists and would-be investors; the better the prospects look for growth, the more money the firm will have for operations.



OAKLEY

OAKLEY SEES ITS WAY TO HIGHER VALUE

People who wanted to buy a pair of high-fashion **Oakley** sunglasses in fall 2001 were out of luck if they looked for them at **Sunglass Hut.** In August 2001, Oakley's biggest distributor announced it would no longer carry the brand. The loss of about 25 percent of its sales revenue immediately sent Oakley's share price down 33 percent to about $12 a share, less than half its 52-week high of $26.56.

Interestingly, however, some analysts considered Oakley stock a good buy despite this significant loss of future earnings. They liked Oakley's diversification strategy. Trading on the NYSE under the eyeglass-evoking symbol OO, Oakley is known for its innovative approach to eyewear design. Its products have international appeal to athletes—from skiers and surfers to golfers and motorcyclists—and to nonathletes who just like the brand's trendy looks. To counter the loss of Sunglass Hut, Oakley added Foot Locker and Champs athletic apparel stores to its distribution channels. Expanded product lines include other high-performance athletic gear, such as apparel, footwear, accessories, and prescription eyewear. Company executives are also creative; CEO Jim Jannard conducted the firm's annual meeting wearing an Oakley specialty product—the Medusa, a leather helmet with mirrored goggles and braided strands. Wall Street watchers hoped that Oakley's iconoclastic style would take the company to new heights, even without Sunglass Hut.

Using the *price-earnings* (*P/E*) *multiple approach* to estimate the firm's share value, analysts calculated the share value would be $23.44 (analysts' average estimated 2002 earnings of $0.80 a share times the recreational-products industry P/E of 29.3 on December 14, 2001). Said Eric Beder, an analyst at Ladenburg, Thallmann, "If Oakley can grow at 20 percent a year without Sunglass Hut, then this stock is worth double what it is now [August 2001] because this company is just touching the tip of the iceberg with its product lines."

The new products, retail outlets, and a 20 percent increase in international sales boosted Oakley's third-quarter 2001 sales to record levels. In mid-December 2001, Oakley and Sunglass Hut signed a 3-year agreement to resume their business relationship. With the more optimistic earnings picture, by late March 2002 the stock valuation increased to $31.19 (analysts' average estimated 2003 earnings of $0.97 a share multiplied by a P/E for the recreational products industry on March 27, 2002, of 32.15), which was considerably above the $17.90 level at which the stock had been trading.

Stock valuation requires models that bring together cash flows (returns), timing, and the required return (risk). In this chapter we will examine the differences between debt and equity capital, describe the characteristics of common and preferred stock, and use several different valuation models to determine the value of common stock.

LG1 7.1 Differences Between Debt and Equity Capital

capital
The long-term funds of a firm; all items on the right-hand side of the firm's balance sheet, *excluding current liabilities.*

debt capital
All long-term borrowing incurred by a firm, including bonds.

equity capital
The long-term funds provided by the firm's owners, the stockholders.

The term **capital** denotes the long-term funds of a firm. All items on the right-hand side of the firm's balance sheet, *excluding current liabilities,* are sources of capital. **Debt capital** includes all long-term borrowing incurred by a firm, including bonds, which were discussed in Chapter 6. **Equity capital** consists of long-term funds provided by the firm's owners, the stockholders. A firm can obtain equity capital either *internally,* by retaining earnings rather than paying them out as dividends to its stockholders, or *externally,* by selling common or preferred stock. The key differences between debt and equity capital are summarized in Table 7.1 and discussed below.

Voice in Management

Unlike creditors (lenders), holders of equity capital (common and preferred stockholders) are owners of the firm. Holders of common stock have voting rights that permit them to select the firm's directors and to vote on special issues. In contrast, debtholders and preferred stockholders may receive voting privileges only when the firm has violated its stated contractual obligations to them.

Claims on Income and Assets

Holders of equity have claims on both income and assets that are secondary to the claims of creditors. Their *claims on income* cannot be paid until the claims of all creditors (including both interest and scheduled principal payments) have been satisfied. After satisfying these claims, the firm's board of directors decides whether to distribute dividends to the owners.

The equity holders' *claims on assets* also are secondary to the claims of creditors. If the firm fails, its assets are sold, and the proceeds are distributed in this order: employees and customers, the government, creditors, and (finally) equity holders. Because equity holders are the last to receive any distribution of assets, they expect greater returns from dividends and/or increases in stock price.

TABLE 7.1 Key Differences Between Debt and Equity Capital

	Type of capital	
Characteristic	Debt	Equity
Voice in management[a]	No	Yes
Claims on income and assets	Senior to equity	Subordinate to debt
Maturity	Stated	None
Tax treatment	Interest deduction	No deduction

[a]In the event that the issuer violates its stated contractual obligations to them, debtholders and preferred stockholders *may* receive a voice in management; otherwise, only common stockholders have voting rights.

As is explained in Chapter 11, the costs of equity financing are generally higher than debt costs. One reason is that the suppliers of equity capital take more risk because of their subordinate claims on income and assets. Despite being more costly, equity capital is necessary for a firm to grow. All corporations must initially be financed with some common stock equity.

Maturity

Unlike debt, equity capital is a *permanent form* of financing for the firm. It does not "mature" so repayment is not required. Because equity is liquidated only during bankruptcy proceedings, stockholders must recognize that although a ready market may exist for their shares, the price that can be realized may fluctuate. This fluctuation of the market price of equity makes the overall returns to a firm's stockholders even more risky.

Tax Treatment

Interest payments to debtholders are treated as tax-deductible expenses by the issuing firm, whereas dividend payments to a firm's common and preferred stockholders are not tax-deductible. The tax deductibility of interest lowers the cost of debt financing, further causing it to be lower than the cost of equity financing.

Review Question

7–1 What are the key differences between *debt capital* and *equity capital?*

LG2 LG3 7.2 Common and Preferred Stock

A firm can obtain equity, or ownership, capital by selling either common or preferred stock. All corporations initially issue common stock to raise equity capital. Some of these firms later issue either additional common stock or preferred stock to raise more equity capital. Although both common and preferred stock are forms of equity capital, preferred stock has some similarities to debt capital that significantly differentiate it from common stock. Here we first consider the key features and behaviors of both common and preferred stock and then describe the process of issuing common stock, including the use of venture capital.

Common Stock

The true owners of business firms are the common stockholders. Common stockholders are sometimes referred to as *residual owners* because they receive what is left—the residual—after all other claims on the firm's income and assets have been satisfied. They are assured of only one thing: that they cannot lose any more than they have invested in the firm. As a result of this generally uncertain position, common stockholders expect to be compensated with adequate dividends and, ultimately, capital gains.

Ownership

privately owned (stock)
All common stock of a firm owned by a single individual.

closely owned (stock)
All common stock of a firm owned by a small group of investors (such as a family).

publicly owned (stock)
Common stock of a firm owned by a broad group of unrelated individual or institutional investors.

The common stock of a firm can be **privately owned** by a single individual, **closely owned** by a small group of investors (such as a family), or **publicly owned** by a broad group of unrelated individual or institutional investors. Typically, small corporations are privately or closely owned; if their shares are traded, this occurs infrequently and in small amounts. Large corporations, which are emphasized in the following discussions, are publicly owned, and their shares are generally actively traded on the major securities exchanges described in Chapter 1.

Par Value

par value (stock)
A relatively useless value for a stock established for legal purposes in the firm's corporate charter.

Unlike bonds, which always have a par value, common stock may be sold with or without a par value. The **par value** of a common stock is a relatively useless value established for legal purposes in the firm's corporate charter. It is generally quite low, about $1.

Firms often issue stock with no par value, in which case they may assign the stock a value or record it on the books at the price at which it is sold. A low par value may be advantageous in states where certain corporate taxes are based on the par value of stock; if a stock has no par value, the tax may be based on an arbitrarily determined per-share figure.

Preemptive Rights

preemptive right
Allows common stockholders to maintain their *proportionate* ownership in the corporation when new shares are issued.

dilution of ownership
Occurs when a new stock issue results in each present shareholder having a claim on a *smaller* part of the firm's earnings than previously.

rights
Financial instruments that permit stockholders to purchase additional shares at a price below the market price, in direct proportion to their number of owned shares.

The **preemptive right** allows common stockholders to maintain their *proportionate* ownership in the corporation when new shares are issued. It allows existing shareholders to maintain voting control and protects them against the dilution of their ownership. **Dilution of ownership** usually results in the dilution of earnings, because each present shareholder has a claim on a *smaller* part of the firm's earnings than previously.

In a *rights offering,* the firm grants **rights** to its shareholders. These financial instruments permit stockholders to purchase additional shares at a price below the market price, in direct proportion to their number of owned shares. Rights are used primarily by smaller corporations whose shares are either *closely owned* or *publicly owned* and not actively traded. In these situations, rights are an important financing tool without which shareholders would run the risk of losing their proportionate control of the corporation. From the firm's viewpoint, the use of rights offerings to raise new equity capital may be less costly and may generate more interest than a public offering of stock.

Authorized, Outstanding, and Issued Shares

authorized shares
The number of shares of common stock that a firm's corporate charter allows it to issue.

outstanding shares
The number of shares of common stock held by the public.

treasury stock
The number of shares of outstanding stock that have been repurchased by the firm.

issued shares
The number of shares of common stock that have been put into circulation; the sum of outstanding shares and treasury stock.

A firm's corporate charter indicates how many **authorized shares** it can issue. The firm cannot sell more shares than the charter authorizes without obtaining approval through a shareholder vote. To avoid later having to amend the charter, firms generally attempt to authorize more shares than they initially plan to issue.

Authorized shares become **outstanding shares** when they are held by the public. If the *firm* repurchases any of its outstanding shares, these shares are recorded as **treasury stock** and are no longer considered to be outstanding shares. **Issued shares** are the shares of common stock that have been put into circulation; they represent the sum of outstanding shares and treasury stock.

EXAMPLE Golden Enterprises, a producer of medical pumps, has the following stockholders' equity account on December 31:

Stockholders' Equity	
Common stock—$0.80 par value:	
Authorized 35,000,000 shares; issued 15,000,000 shares	$ 12,000,000
Paid-in capital in excess of par	63,000,000
Retained earnings	31,000,000
	$106,000,000
Less: Cost of treasury stock (1,000,000 shares)	4,000,000
Total stockholders' equity	$102,000,000

How many shares of additional common stock can Golden sell without gaining approval from its shareholders? The firm has 35 million authorized shares, 15 million issued shares, and 1 million shares of treasury stock. Thus 14 million shares are outstanding (15 million issued shares − 1 million shares of treasury stock), and Golden can issue 21 million additional shares (35 million authorized shares − 14 million outstanding shares) without seeking shareholder approval. This total includes the treasury shares currently held, which the firm can reissue to the public without obtaining shareholder approval.

Voting Rights

Generally, each share of common stock entitles its holder to one vote in the election of directors and on special issues. Votes are generally assignable and may be cast at the annual stockholders' meeting.

In recent years, many firms have issued two or more classes of common stock; they differ mainly in having unequal voting rights. A firm can use different classes of stock as a defense against a *hostile takeover* in which an outside group, without management support, tries to gain voting control of the firm by buying its shares in the marketplace. **Supervoting shares** of stock give each owner multiple votes. When supervoting shares are issued to "insiders," an outside group, whose shares have only one vote each typically cannot obtain enough votes to gain control of the firm. At other times, a class of **nonvoting common stock** is issued when the firm wishes to raise capital through the sale of common stock but does not want to give up its voting control.

supervoting shares
Stock that carries with it multiple votes per share rather than the single vote per share typically given on regular shares of common stock.

nonvoting common stock
Common stock that carries no voting rights; issued when the firm wishes to raise capital through the sale of common stock but does not want to give up its voting control.

When different classes of common stock are issued on the basis of unequal voting rights, class A common is typically—but not universally—designated as nonvoting, and class B common has voting rights. Generally, higher classes of shares (class A, for example) are given preference in the distribution of earnings (dividends) and assets; lower-class shares, in exchange, receive voting rights. Treasury stock, which is held within the corporation, generally *does not* have voting rights, *does not* earn dividends, and *does not* have a claim on assets in liquidation.

proxy statement
A statement giving the votes of a stockholder to another party.

Because most small stockholders do not attend the annual meeting to vote, they may sign a **proxy statement** giving their votes to another party. The solicitation of proxies from shareholders is closely controlled by the Securities and Exchange Commission to ensure that proxies are not being solicited on the basis of false or misleading information. Existing management generally receives the stockholders' proxies, because it is able to solicit them at company expense.

proxy battle
The attempt by a nonmanagement group to gain control of the management of a firm by soliciting a sufficient number of proxy votes.

Occasionally, when the firm is widely owned, outsiders may wage a **proxy battle** to unseat the existing management and gain control. To win a corporate election, votes from a majority of the shares voted are required. However, the odds of a nonmanagement group winning a proxy battle are generally slim.

Dividends

The payment of dividends to the firm's shareholders is at the discretion of the corporation's board of directors. Most corporations pay dividends quarterly. Dividends may be paid in cash, stock, or merchandise. Cash dividends are the most common, merchandise dividends the least.

Common stockholders are not promised a dividend, but they come to expect certain payments on the basis of the historical dividend pattern of the firm. Before dividends are paid to common stockholders, the claims of the government, all creditors, and preferred stockholders must be satisfied. Because of the importance of the dividend decision to the growth and valuation of the firm, dividends are discussed in greater detail in Chapter 13.

International Stock Issues

Although the international market for common stock is not so large as the international market for bonds, cross-border issuance and trading of common stock have increased dramatically in the past 20 years.

Some corporations *issue stock in foreign markets*. For example, the stock of General Electric trades in Frankfurt, London, Paris, and Tokyo; the stocks of AOL Time Warner and Microsoft trade in Frankfurt; and the stock of McDonald's trades in Frankfurt and Paris. The London, Frankfurt, and Tokyo markets are the most popular. Issuing stock internationally broadens the ownership base and also helps a company to integrate itself into the local business scene. A listing on a foreign stock exchange both increases local business press coverage and serves as effective corporate advertising. Having locally traded stock can also facilitate corporate acquisitions, because shares can be used as an acceptable method of payment.

Foreign corporations have also discovered the benefits of trading their stock in the United States. The disclosure and reporting requirements mandated by the U.S. Securities and Exchange Commission have historically discouraged all but the largest foreign firms from directly listing their shares on the New York Stock Exchange or the American Stock Exchange. For example, in 1993, Daimler-Benz (now Daimler Chrysler) became the first large German company to be listed on the NYSE.

American depositary receipts (ADRs)
Claims issued by U.S. banks representing ownership of shares of a foreign company's stock held on deposit by the U.S. bank in the foreign market and issued in dollars to U.S. investors.

Alternatively, most foreign companies tap the U.S. market through **American depositary receipts (ADRs)**. These are claims issued by U.S. banks representing ownership of shares of a foreign company's stock held on deposit by the U.S. bank in the foreign market. Because ADRs are issued, in dollars, by a U.S. bank to U.S. investors, they are subject to U.S. securities laws. Yet they still give investors the opportunity to diversify their portfolios internationally.

Preferred Stock

par-value preferred stock
Preferred stock with a stated face value that is used with the specified dividend percentage to determine the annual dollar dividend.

no-par preferred stock
Preferred stock with no stated face value but with a stated annual dollar dividend.

Preferred stock gives its holders certain privileges that make them senior to common stockholders. Preferred stockholders are promised a fixed periodic dividend, which is stated either as a percentage or as a dollar amount. How the dividend is specified depends on whether the preferred stock has a *par value,* which, as in common stock, is a relatively useless stated value established for legal purposes. **Par-value preferred stock** has a stated face value, and its annual dividend is specified as a percentage of this value. **No-par preferred stock** has no stated face value, but its annual dividend is stated in dollars. Preferred stock is most often issued by public utilities, by acquiring firms in merger transactions, and by firms that are experiencing losses and need additional financing.

Basic Rights of Preferred Stockholders

The basic rights of preferred stockholders are somewhat more favorable than the rights of common stockholders. Preferred stock is often considered *quasi-debt* because, much like interest on debt, it specifies a fixed periodic payment (dividend). Of course, as ownership, preferred stock is unlike debt in that it has no maturity date. Because they have a fixed claim on the firm's income that takes precedence over the claim of common stockholders, preferred stockholders are exposed to less risk. They are consequently *not normally given a voting right.*

Preferred stockholders have *preference over common stockholders in the distribution of earnings.* If the stated preferred stock dividend is "passed" (not paid) by the board of directors, the payment of dividends to common stockholders is prohibited. It is this preference in dividend distribution that makes common stockholders the true risk takers.

Preferred stockholders are also usually given *preference over common stockholders in the liquidation of assets* in a legally bankrupt firm, although they must "stand in line" behind creditors. The amount of the claim of preferred stockholders in liquidation is normally equal to the par or stated value of the preferred stock.

Features of Preferred Stock

A number of features are generally included as part of a preferred stock issue. These features, along with the stock's par value, the amount of dividend payments, the dividend payment dates, and any restrictive covenants, are specified in an agreement similar to a *bond indenture.*

Restrictive Covenants The restrictive covenants in a preferred stock issue are aimed at ensuring the firm's continued existence and regular payment of the dividend. These covenants include provisions about passing dividends, the sale of senior securities, mergers, sales of assets, minimum liquidity requirements, and repurchases of common stock. The violation of preferred stock covenants usually permits preferred stockholders either to obtain representation on the firm's board of directors or to force the retirement of their stock at or above its par or stated value.

cumulative preferred stock
Preferred stock for which all passed (unpaid) dividends in arrears, along with the current dividend, must be paid before dividends can be paid to common stockholders.

Cumulation Most preferred stock is **cumulative** with respect to any dividends passed. That is, all dividends in arrears, along with the current dividend, must be paid before dividends can be paid to common stockholders. If preferred stock is **noncumulative,** passed (unpaid) dividends do not accumulate. In this case, only the current dividend must be paid before dividends can be paid to common stockholders. Because the common stockholders can receive dividends only after the dividend claims of preferred stockholders have been satisfied, it is in the firm's best interest to pay preferred dividends when they are due.[1]

noncumulative preferred stock
Preferred stock for which passed (unpaid) dividends do not accumulate.

Other Features Preferred stock is generally *callable*—the issuer can retire outstanding stock within a certain period of time at a specified price. The call option generally cannot be exercised until a specified date. The call price is normally set above the initial issuance price, but it may decrease as time passes. Making preferred stock callable provides the issuer with a way to bring the fixed-payment commitment of the preferred issue to an end if conditions in the financial markets make it desirable to do so.

Preferred stock quite often contains a **conversion feature** that allows *holders of convertible preferred stock* to change each share into a stated number of shares of common stock. Sometimes the number of shares of common stock that the preferred stock can be exchanged for changes according to a prespecified formula.

conversion feature (preferred stock)
A feature of *convertible preferred stock* that allows holders to change each share into a stated number of shares of common stock.

Issuing Common Stock

Because of the high risk associated with a business startup, a firm's initial financing typically comes from its founders in the form of a common stock investment. Until the founders have made an equity investment, it is highly unlikely that others will contribute either equity or debt capital. Early-stage investors in the firm's equity, as well as lenders who provide debt capital, want to be assured that they are taking no more risk than the founding owner(s). In addition, they want confirmation that the founders are confident enough in their vision for the firm that they are willing to risk their own money.

The initial nonfounder financing for business startups with attractive growth prospects comes from private equity investors. Then, as the firm establishes the viability of its product or service offering and begins to generate revenues, cash flow, and profits, it will often "go public" by issuing shares of common stock to a much broader group of investors.

Before we consider the initial *public* sales of equity, let's review some of the key aspects of early-stage equity financing in firms that have attractive growth prospects.

Venture Capital

The initial external equity financing privately raised by firms, typically early-stage firms with attractive growth prospects, is called **venture capital.** Those who provide venture capital are known as **venture capitalists** (VCs)**.** They typically are

venture capital
Privately raised external equity capital used to fund early-stage firms with attractive growth prospects.

venture capitalists (VCs)
Providers of venture capital; typically, formal businesses that maintain strong oversight over the firms they invest in and that have clearly defined exit strategies.

1. Most preferred stock is cumulative, because it is difficult to sell noncumulative stock. Common stockholders obviously prefer issuance of noncumulative preferred stock, because it does not place them in quite so risky a position. But it is often in the best interest of the firm to sell cumulative preferred stock because of its lower cost.

Most preferred stock has a fixed dividend, but some firms issue *adjustable-rate (floating-rate) preferred stock (ARPS)* whose dividend rate is tied to interest rates on specific government securities. Rate adjustments are commonly made quarterly. ARPS offers investors protection against sharp rises in interest rates, which means that the issue can be sold at an initially lower dividend rate.

formal business entities that maintain strong oversight over the firms they invest in and that have clearly defined exit strategies. Less visible early-stage investors called **angel capitalists** (or **angels**) tend to be investors who do not actually operate as a business; they are often wealthy individual investors who are willing to invest in promising early-stage companies in exchange for a portion of the firm's equity. Although angels play a major role in early-stage equity financing, we will focus on VCs because of their more formal structure and greater public visibility.

angel capitalists (angels)
Wealthy individual investors who do not operate as a business but invest in promising early-stage companies in exchange for a portion of the firm's equity.

Organization and Investment Stages Institutional venture capital investors tend to be organized in one of four basic ways, as described in Table 7.2. The *VC limited partnership* is by far the dominant structure. These funds have as their sole objective to earn high returns, rather than to obtain access to the companies in order to sell or buy other products or services.

VCs can invest in early-stage companies, later-stage companies, or buyouts and acquisitions. Generally, about 40 to 50 percent of VC investments are devoted to early-stage companies (for startup funding and expansion) and a similar percentage to later-stage companies (for marketing, production expansion, and preparation for public offering); the remaining 5 to 10 percent are devoted to the buyout or acquisition of other companies. Generally, VCs look for compound rates of return ranging from 20 to 50 percent or more, depending on both the development stage and the attributes of each company. Earlier-stage investments tend to demand higher returns than later-stage financing because of the higher risk associated with the earlier stages of a firm's growth.

Deal Structure and Pricing Regardless of the development stage, venture capital investments are made under a legal contract that clearly allocates responsibilities and ownership interests between existing owners (founders) and the VC fund or limited partnership. The terms of the agreement will depend on numerous

TABLE 7.2 Organization of Institutional Venture Capital Investors

Organization	Description
Small business investment companies (SBICs)	Corporations chartered by the federal government that can borrow at attractive rates from the U.S. Treasury and use the funds to make venture capital investments in private companies.
Financial VC funds	Subsidiaries of financial institutions, particularly banks, set up to help young firms grow and, it is hoped, become major customers of the institution.
Corporate VC funds	Firms, sometimes subsidiaries, established by nonfinancial firms, typically to gain access to new technologies that the corporation can access to further its own growth.
VC limited partnerships	Limited partnerships organized by professional VC firms, who serve as the general partner and organize, invest, and manage the partnership using the limited partners' funds; the professional VCs ultimately liquidate the partnership and distribute the proceeds to all partners.

factors related to the founders; the business structure, stage of development, and outlook; and other market and timing issues. The specific financial terms will, of course, depend on the value of the enterprise, the amount of funding, and the perceived risk. To control the VC's risk, various covenants are included in the agreement, and the actual funding may be pegged to the achievement of measurable milestones. The VC will negotiate numerous other provisions into the contract, both to ensure the firm's success and to control its risk exposure. The contract will have an explicit exit strategy for the VC that may be tied both to measurable milestones and to time.

The amount of equity to which the VC is entitled will, of course, depend on the value of the firm, the terms of the contract, the exit terms, and the minimum compound rate of return required by the VC on its investment. Although each VC investment is unique and no standard contract exists, the transaction will be structured to provide the VC with a high rate of return that is consistent with the typically high risk of such transactions. The exit strategy of most VC investments is to take the firm public through an initial public offering.

Going Public

When a firm wishes to sell its stock in the primary market, it has three alternatives. It can make (1) a *public offering,* in which it offers its shares for sale to the general public; (2) a *rights offering,* in which new shares are sold to existing stockholders; or (3) a *private placement,* in which the firm sells new securities directly to an investor or group of investors. Here we focus on public offerings, particularly the **initial public offering (IPO),** which is the first public sale of a firm's stock. IPOs are typically made by small, rapidly growing companies that either require additional capital to continue expanding or have met a milestone for going public that was established in a contract signed earlier in order to obtain VC funding.

initial public offering (IPO)
The first public sale of a firm's stock.

To go public, the firm must first obtain the approval of its current shareholders, the investors who own its privately issued stock. Next, the company's auditors and lawyers must certify that all documents for the company are legitimate. The company then finds an investment bank willing to *underwrite* the offering. This underwriter is responsible for promoting the stock and facilitating the sale of the company's IPO shares. The underwriter often brings in other investment banking firms as participants. We'll discuss the role of the investment banker in more detail in the next section.

The company files a registration statement with the SEC. One portion of the registration statement is called the **prospectus.** It describes the key aspects of the issue, the issuer, and its management and financial position. During the waiting period between the statement's filing and its approval, prospective investors can receive a preliminary prospectus. This preliminary version is called a **red herring,** because a notice printed in red on the front cover indicates the tentative nature of the offer. The cover of the preliminary prospectus describing the 2002 stock issue of Ribapharm, Inc. is shown in Figure 7.1. Note the red herring printed vertically on its left edge.

prospectus
A portion of a security registration statement that describes the key aspects of the issue, the issuer, and its management and financial position.

red herring
A preliminary prospectus made available to prospective investors during the waiting period between the registration statement's filing with the SEC and its approval.

After the SEC approves the registration statement, the investment community can begin analyzing the company's prospects. However, from the time it files until at least one month after the IPO is complete, the company must observe a *quiet period,* during which there are restrictions on what company officials may say

FIGURE 7.1 **Cover of a Preliminary Prospectus for a Stock Issue**

Some of the key factors related to the 2002 common stock issue by Ribapharm, Inc. are summarized on the cover of the prospectus. The type printed vertically on the left edge is normally red, which explains its name "red herring." (*Source:* Ribapharm, Inc., March 21, 2002, p. 1.)

The information in this preliminary prospectus is not complete and may be changed. We may not sell these securities until the registration statement filed with the Securities and Exchange Commission is effective. This preliminary prospectus is not an offer to sell these securities and it is not soliciting an offer to buy these securities in any state where the offer or sale is not permitted.

PRELIMINARY PROSPECTUS Subject to completion March 21, 2002

26,000,000 Shares

Ribapharm

Common Stock

This is an initial public offering of shares of our common stock. ICN Pharmaceuticals, Inc. is selling all of these shares of our common stock and will receive all of the proceeds of this offering. We expect the public offering price to be between $13.00 and $15.00 per share.

Upon completion of this offering, ICN will own approximately 82.67% of our outstanding shares of common stock, assuming no exercise of the over-allotment option referred to below. If the over-allotment option referred to below is exercised, ICN will own approximately 80.07% of our outstanding shares of common stock.

Our common stock is approved for listing on the New York Stock Exchange under the symbol "RNA," subject to official notice of issuance.

Before buying any shares you should read the discussion of material risks of investing in our common stock in "Risk factors" beginning on page 11.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or passed upon the adequacy or accuracy of this prospectus. Any representation to the contrary is a criminal offense.

	Per share	Total
Public offering price	$	$
Underwriting discounts and commissions	$	$
Proceeds, before expenses, to ICN	$	$

The underwriters may also purchase up to an additional 3,900,000 shares of our common stock from ICN at the public offering price, less the underwriting discounts and commissions, within 30 days from the date of this prospectus. The underwriters may exercise this option only to cover over-allotments, if any. If the underwriters exercise the option in full, the total underwriting discounts and commissions will be $ and the total proceeds to ICN, before expenses, will be $.

The underwriters are offering the common stock as set forth under "Underwriting." Delivery of the shares will be made on or about , 2002.

UBS Warburg **CIBC World Markets** **SG Cowen**

about the company. The purpose of the quiet period is to make sure that all potential investors have access to the same information about the company—the information presented in the preliminary prospectus—and not to any unpublished data that might give them an unfair advantage.

The investment bankers and company executives promote the company's stock offering through a *road show,* a series of presentations to potential

In Practice

FOCUS ON PRACTICE Investors Eat Up Weight Watchers Shares

After a sluggish year for initial public offerings (IPOs) of common stock, companies rushed to tap the equity markets again during the last few months of 2001. Many investors feasted on 17.4 million shares of **Weight Watchers International,** which went public on November 14, just before the holiday eating season began. Investor appetite raised the offering price to $24 per share, up from the original range of $21 to $23 set by lead underwriters Credit Suisse First Boston and Goldman, Sachs & Co. Net proceeds from the IPO, after underwriting costs, were $417 million. The share price fattened throughout the day, closing up 19 percent at $28.50 on the first day. A month later, the shares were trading at the $32 level.

"The company's timing for doing this offering now is good," said John LaRosa, research director of Marketdata Enterprises Inc., a research firm that focuses on health care industries. "Their name is well known and their earnings have been strong." Other reasons for the popularity of the Weight Watchers' IPO included its global presence and strong retail sales. Its long history of profitability, its easily understood business plan, and its familiar product made it stand out from the crowd of Internet and other technology IPOs.

Was Weight Watchers a good investment at $32 a share? Only time will tell. Some analysts thought the stock was overpriced. Although the company's $1.5 billion in retail sales is attractive, franchisees and licensees such as Heinz retain most of the profits on food sales. The company also gained over $481 million in debt when Artal Luxembourg S.A., a private European investment company, bought Weight Watchers from H. J. Heinz in 1999. The debt burden that Weight Watchers carries exceeds its assets, resulting in a negative net worth of almost $200 million. Unlike most IPOs in which the company retains the proceeds, Artal—the selling shareholders—kept the proceeds rather than reducing the Weight Watchers debt. The company was also trading at a high price/earnings multiple, about 40 times.

Sources: Adapted from Robert Barker, "Weight Watchers: A Little Debt Heavy?" *Business Week* (December 10, 2001), p. 100; Alan Clendenning, "Weight Watchers Shares Surge," *AP Online* (November 15, 2001), downloaded from *www.findarticles.com;* Elena Molinari, "IPO Market Ends Sluggish Year with a Boom," *Reuters Business Report* (December 9, 2001), downloaded from eLibrary, *ask.elibrary.com;* and Tania Padgett, "Weight Watchers New Plan Offers IPO," *Newsday* (November 13, 2001), p. A71, downloaded from eLibrary, *ask.elibrary.com.*

investment banker
Financial intermediary that specializes in selling new security issues and advising firms with regard to major financial transactions.

underwriting
The role of the *investment banker* in bearing the risk of reselling, at a profit, the securities purchased from an issuing corporation at an agreed-on price.

underwriting syndicate
A group formed by an investment banker to share the financial risk associated with *underwriting* new securities.

selling group
A large number of brokerage firms that join the originating investment banker(s); each accepts responsibility for selling a certain portion of a new security issue on a commission basis.

investors around the country and sometimes overseas. In addition to providing investors with information about the new issue, road show sessions help the investment bankers gauge the demand for the offering and set an expected pricing range. After the underwriter sets terms and prices the issue, the SEC must approve the offering.

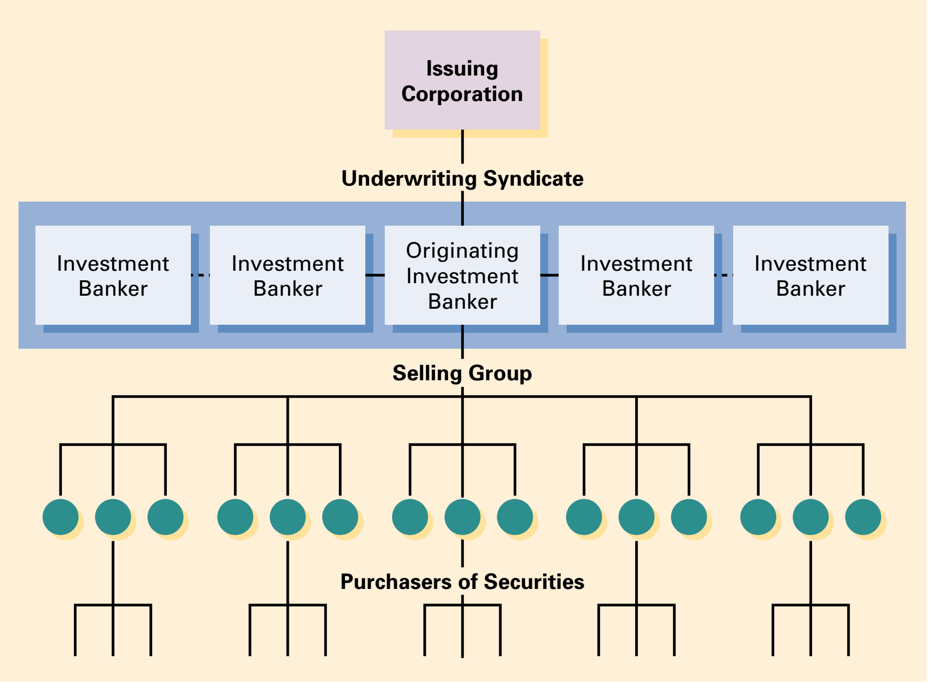
The Investment Banker's Role

Most public offerings are made with the assistance of an **investment banker.** The investment banker is a financial intermediary (such as Salomon Brothers or Goldman, Sachs) that specializes in selling new security issues and advising firms with regard to major financial transactions. The main activity of the investment banker is **underwriting.** This process involves purchasing the security issue from the issuing corporation at an agreed-on price and bearing the risk of reselling it to the public at a profit. The investment banker also provides the issuer with advice about pricing and other important aspects of the issue.

In the case of very large security issues, the investment banker brings in other bankers as partners to form an **underwriting syndicate.** The syndicate shares the financial risk associated with buying the entire issue from the issuer and reselling the new securities to the public. The originating investment banker and the syndicate members put together a **selling group,** normally made up of themselves and a

FIGURE 7.2

The Selling Process for a Large Security Issue
The investment banker hired by the issuing corporation may form an underwriting syndicate. The underwriting syndicate buys the entire security issue from the issuing corporation at an agreed-on price. The underwriter then has the opportunity (and bears the risk) of reselling the issue to the public at a profit. Both the originating investment banker and the other syndicate members put together a selling group to sell the issue on a commission basis to investors.



large number of brokerage firms. Each member of the selling group accepts the responsibility for selling a certain portion of the issue and is paid a commission on the securities it sells. The selling process for a large security issue is depicted in Figure 7.2.

Compensation for underwriting and selling services typically comes in the form of a discount on the sale price of the securities. For example, an investment banker may pay the issuing firm $24 per share for stock that will be sold for $26 per share. The investment banker may then sell the shares to members of the selling group for $25.25 per share. In this case, the original investment banker earns $1.25 per share ($25.25 sale price − $24 purchase price). The members of the selling group earn 75 cents for each share they sell ($26 sale price − $25.25 purchase price). Although some primary security offerings are directly placed by the issuer, the majority of new issues are sold through public offering via the mechanism just described.

Interpreting Stock Quotations

The financial manager needs to stay abreast of the market values of the firm's outstanding stock, whether it is traded on an organized exchange, over the counter, or in international markets. Similarly, existing and prospective stockholders need to monitor the prices of the securities they own because these prices represent the current value of their investments. Price *quotations,* which include current price data along with statistics on recent price behavior, are readily available for actively traded stocks. The most up-to-date "quotes" can be obtained electronically, via a personal computer. Price information is available from stockbrokers and is widely published in news media. Popular sources of daily security price quotations include financial newspapers, such as the *Wall Street Journal* and *Investor's Business Daily,* and the business sections of daily general newspapers.

Figure 7.3 includes an excerpt from the NYSE quotations, reported in the *Wall Street Journal* of March 18, 2002, for transactions through the close of trading on Friday, March 15, 2002. We'll look at the quotations for common stock for McDonalds, highlighted in the figure. The quotations show that stock prices are quoted in dollars and cents.

Hint Preferred stock quotations are listed separately and include only four data items: dividend, dividend yield, closing price, and change in closing price from the previous day.

The first column gives the percent change in the stock's closing price for the calendar year to date. You can see that McDonalds' price has increased 8.5 percent (+8.5) since the start of 2002. The next two columns, labeled "HI" and "LO," show the highest and lowest prices at which the stock sold during the preceding 52 weeks. McDonalds common stock, for example, traded between \$24.75 and \$31.00 during the 52-week period that ended March 15, 2002. Listed to the right of the company's name is its *stock symbol;* McDonalds goes by "MCD." The figure listed right after the stock symbol under "DIV" is the annual cash dividend paid on each share of stock. The dividend for McDonalds was \$0.23 per share. The next item, labeled "YLD%," is the *dividend yield,* which is found by dividing the stated dividend by the last share price. The dividend yield for McDonalds is 0.8 percent ($0.23 \div 28.72 = 0.0080 = 0.8\%$).

FIGURE 7.3

Stock Quotations

Selected stock quotations for March 15, 2002

YTD % CHG	52 WEEKS HI	52 WEEKS LO	STOCK (SYM)	DIV	YLD %	PE	VOL 100S	LAST	NET CHG
− 5.6	15.70	9.40	Masisa ADS **MYS**	.41e	3.4	...	361	12.20	− 0.05
▲+ 23.8	15	4.95	MasoniteIntl **MHM**		...	18	37	15.12	+ 0.31
− 20.6	28.95	12.25	MasseyEngy **MEE**	.16	1.0	dd	3883	16.45	+ 0.70
− 12.7	**19.45**	**3.98**	**MasTec MTZ**		**...**	**dd**	**590**	**6.07**	**− 0.44**
+ 4.9	19.04	10.85	Matav **MTA**	.17e	1.0	...	34	17.83	− 0.01
+ 2.2	10.96	6.64	MaterlSci **MSC**		...	dd	166	10.34	− 0.19
+ 7.4	19.47	11.14	MatsuElec **MC**	.08e	.6	...	2312	13.53	− 0.03
▲+ 16.5	**19.92**	**14.25**	**Mattel MAT**	**.05**	**.2**	**28**	**51657**	**20.04**	**+ 1.21**
+ 10.4	27.20	8.47	♣MavrckTube **MVK**		...	17	2724	14.30	+ 0.15
+ 4.7	8.38	3.30	Maxtor **MXO**		...	dd	11416	6.64	− 0.18
+ 1.7	39.65	27	MayDeptStrs **MAY**	.95f	2.5	17	13201	37.60	+ 0.58
+ 44.4	45.58	22.25	Maytag **MYG**	.72	1.6	65	8034	44.80	+ 0.05
+ 21.1	59.40	36.50	McClatchy A **MNI**	.40	.7	45	394	56.93	+ 0.77
+ 15.3	49.57	36.50	McCrmkCo **MKC**	.84	1.7	...	3337	48.41	+ 1.14
+ 14.0	49	40.80	McCrmkCo Vtg **MKCV** n	.21	.4	...	10	48.60	+ 0.75
+ 18.3	15.17	7.31	McDermInt **MDR**	.15j	...	dd	3621	14.51	+ 0.26
+ 8.5	31	24.75	McDonalds **MCD**	.23f	.8	23	59195	28.72	+ 0.57
+ 11.5	70.87	48.70	McGrawH **MHP**	1.02f	1.5	35	10305	67.99	+ 0.48
− 0.5	41.50	23.40	McKesson **MCK**	.24	.6	98	24513	37.22	+ 0.95
− 21.4	15	3.20	McMoRanExpl **MMR**		...	dd	762	4.55	+ 0.16
+ 48.2	4.10	1.66	♣MdwbrkInsGp **MIG**	.12	4.1	dd	43	2.95	+ 0.05
+ 14.1	36.50	23.71	MeadWstVaco **MWV**		...	dd	14191	35.25	− 0.51
+ 20.2	4.85	1.88	MediaArts **MDA**		...	dd	277	3.16	+ 0.03
+ 15.4	59.10	38.45	MediaGen A **MEG**	.72f	1.3	73	973	57.51	+ 0.51
− 20.4	35.75	18.50	MedOne PIES II	3.04	14.1	...	16	21.60	+ 0.13
− 12.5	64.60	31	MedicisPhrm **MRX**		...	36	2123	56.50	+ 0.60
− 10.0	51.68	36.64	Medtronic **MDT**	.23	.5	54	56604	46.08	+ 0.98
+ 6.6	47.25	27.75	MellonFnl **MEL**	.48	1.2	15	22026	40.09	+ 0.72
+ 21.5	30	17	MensWearhs **MW**		...	24	1572	25.10	+ 0.79
+ 1.6	**80.85**	**56.71**	**Merck MRK**	**1.40**	**2.3**	**19**	**266814**	**59.75**	**− 3.69**
− 0.4	44.50	32	♣MercuryGen **MCY**	1.20f	2.8	22	675	43.48	− 0.12
+ 17.8	42.27	26.50	Meredith **MDP**	.36	.9	45	1648	41.98	+ 0.03
+ 9.4	14.78	5.75	MeridnGld **MDG**		...	22	3804	11.30	− 0.25
+ 2.8	7.98	2.65	MeridnRes **TMR**		...	11	2376	4.10	− 0.09

McDonalds

Source: Wall Street Journal, March 18, 2002, p. C4.

The price/earnings (P/E) ratio, labeled "PE," is next. It is calculated by dividing the closing market price by the firm's most recent annual earnings per share (EPS). The price/earnings (P/E) ratio, as noted in Chapter 2, measures the amount investors are willing to pay for each dollar of the firm's earnings. McDonalds' P/E ratio was 23—the stock was trading at 23 times it earnings. The P/E ratio is believed to reflect investor expectations concerning the firm's future prospects: Higher P/E ratios reflect investor optimism and confidence; lower P/E ratios reflect investor pessimism and concern.

The daily volume, labeled "VOL 100s," follows the P/E ratio. Here the day's sales are quoted in lots of 100 shares. The value 59195 for McDonalds indicates that 5,919,500 shares of its common stock were traded on March 15, 2002. The next column, labeled "LAST," contains the last price at which the stock sold on the given day. The value for McDonalds was $28.72. The final column, "NET CHG," indicates the change in the closing price from that on the prior trading day. McDonalds closed up $0.57 from March 14, 2002, which means the closing price on that day was $28.15.

Similar quotations systems are used for stocks that trade on other exchanges such as the American Stock Exchange (AMEX) and for the over-the-counter (OTC) exchange's Nasdaq National Market Issues. Also note that when a stock (or bond) issue is not traded on a given day, it generally is not quoted in the financial and business press.

Review Questions

7–2 What risks do common stockholders take that other suppliers of long-term capital do not?

7–3 How does a rights offering protect a firm's stockholders against the *dilution of ownership?*

7–4 Explain the relationships among authorized shares, outstanding shares, treasury stock, and issued shares.

7–5 What are the advantages to both U.S.-based and foreign corporations of issuing stock outside their home markets? What are *American depositary receipts (ADRs)*?

7–6 What claims do preferred stockholders have with respect to distribution of earnings (dividends) and assets?

7–7 Explain the *cumulative feature* of preferred stock. What is the purpose of a *call feature* in a preferred stock issue?

7–8 What is the difference between a *venture capitalist* (*VC*) and an *angel capitalist* (*angel*)?

7–9 Into what bodies are institutional VCs most commonly organized? How are their deals structured and priced?

7–10 What general procedures must a private firm go through in order to go public via an *initial public offering* (*IPO*)?

7–11 What role does an *investment banker* play in a public offering? Explain the sequence of events in the issuing of stock.

7–12 Describe the key items of information included in a stock *quotation.* What information does the stock's price/earnings (P/E) ratio provide?

LG4 LG5

7.3 Common Stock Valuation

Common stockholders expect to be rewarded through periodic cash dividends and an increasing—or at least nondeclining—share value. Like current owners, prospective owners and security analysts frequently estimate the firm's value. Investors purchase the stock when they believe that it is *undervalued*—when its true value is greater than its market price. They sell the stock when they feel that it is *overvalued*—when its market price is greater than its true value.

In this section, we will describe specific stock valuation techniques. First, though, we will look at the concept of an efficient market, which questions whether the prices of actively traded stocks can differ from their true values.

Market Efficiency[2]

Economically rational buyers and sellers use their assessment of an asset's risk and return to determine its value. To a buyer, the asset's value represents the maximum price that he or she would pay to acquire it; a seller views the asset's value as a minimum sale price. In competitive markets with many active participants, such as the New York Stock Exchange, the interactions of many buyers and sellers result in an equilibrium price—the *market value*—for each security. This price reflects the collective actions that buyers and sellers take on the basis of all available information. Buyers and sellers are assumed to digest new information immediately as it becomes available and, through their purchase and sale activities, to create a new market equilibrium price quickly.

Hint Be sure to clarify in your own mind the difference between the required return and the expected return. *Required return* is what an investor *has to have* to invest in a specific asset, and *expected return* is the return an investor *thinks she will get* if the asset is purchased.

Market Adjustment to New Information

The process of market adjustment to new information can be viewed in terms of rates of return. From Chapter 5, we know that for a given level of risk, investors require a specified periodic return—the *required return, k*—which can be estimated by using beta and CAPM. At each point in time, investors estimate the **expected return, $\hat{k}$**—the return that is expected to be earned on a given asset each period over an infinite time horizon. The expected return can be estimated by using a simplified form of Equation 5.1:

expected return, $\hat{k}$
The return that is expected to be earned on a given asset each period over an infinite time horizon.

$$\hat{k} = \frac{\text{Expected benefit during each period}}{\text{Current price of asset}} \tag{7.1}$$

Hint This relationship between the expected return and the required return can be seen in Equation 7.1, where a decrease in asset price will result in an increase in the expected return.

Whenever investors find that the expected return is not equal to the required return ($\hat{k} \neq k$), a market price adjustment occurs. If the expected return is less than the required return ($\hat{k} < k$), investors sell the asset, because they do not expect it to earn a return commensurate with its risk. Such action drives the asset's price down, which (assuming no change in expected benefits) causes its expected return to rise to the level of its required return. If the expected return were above the

2. A great deal of theoretical and empirical research has been performed in the area of market efficiency. For purposes of this discussion, generally accepted beliefs about market efficiency are described, rather than the technical aspects of the various forms of market efficiency and their theoretical implications. For a good discussion of the theory and evidence relative to market efficiency, see William L. Megginson, *Corporate Finance Theory* (Boston, MA: Addison Wesley, 1997), Chapter 3.

required return ($\hat{k} > k$), investors would buy the asset, driving its price up and its expected return down to the point where it equals the required return.

EXAMPLE

The common stock of Alton Industries (AI) is currently selling for \$50 per share, and market participants expect it to generate benefits of \$6.50 per share during each coming period. In addition, the risk-free rate, R_F, is currently 7%; the market return, k_m, is 12%; and the stock's beta, b_{AI}, is 1.20. When these values are substituted into Equation 7.1, the firm's current expected return, $\hat{k}_0$, is

$$\hat{k}_0 = \frac{\$6.50}{\$50.00} = \underline{\underline{13}}\%$$

When the appropriate values are substituted into the CAPM (Equation 5.8), the current required return, k_0, is

$$k_0 = 7\% + [1.20 \times (12\% - 7\%)] = 7\% + 6\% = \underline{\underline{13}}\%$$

Because $\hat{k}_0 = k_0$, the market is currently in equilibrium, and the stock is fairly priced at \$50 per share.

Assume that a press release announces that a major product liability suit has been filed against Alton Industries. As a result, investors immediately adjust their risk assessment upward, raising the firm's beta from 1.20 to 1.40. The new required return, k_1, becomes

$$k_1 = 7\% + [1.40 \times (12\% - 7\%)] = 7\% + 7\% = \underline{\underline{14}}\%$$

Because the expected return of 13% is now below the required return of 14%, many investors sell the stock—driving its price down to about \$46.43—the price that will result in a 14% expected return, $\hat{k}_1$.

$$\hat{k}_1 = \frac{\$6.50}{\$46.43} = \underline{\underline{14}}\%$$

The new price of \$46.43 brings the market back into equilibrium, because the expected return now equals the required return.

The Efficient-Market Hypothesis

efficient-market hypothesis
Theory describing the behavior of an assumed "perfect" market in which (1) securities are typically in equilibrium, (2) security prices fully reflect all public information available and react swiftly to new information, and, (3) because stocks are fairly priced, investors need not waste time looking for mispriced securities.

As noted in Chapter 1, active markets such as the New York Stock Exchange are *efficient*—they are made up of many rational investors who react quickly and objectively to new information. The **efficient-market hypothesis,** which is the basic theory describing the behavior of such a "perfect" market, specifically states that

1. Securities are typically in equilibrium, which means that they are fairly priced and that their expected returns equal their required returns.
2. At any point in time, security prices fully reflect all public information available about the firm and its securities,[3] and these prices react swiftly to new information.

3. Those market participants who have nonpublic—*inside*—information may have an unfair advantage that enables them to earn an excess return. Since the mid-1980s disclosure of the insider-trading activities of a number of well-known financiers and investors, major national attention has been focused on the "problem" of insider trading and its resolution. Clearly, those who trade securities on the basis of inside information have an unfair and illegal advantage. Empirical research has confirmed that those with inside information do indeed have an opportunity to earn an excess return. Here we ignore this possibility, given its illegality and that given enhanced surveillance and enforcement by the securities industry and the government have in recent years (it appears) significantly reduced insider trading. We, in effect, assume that all relevant information is public and that therefore the market is efficient.

3. Because stocks are fully and fairly priced, investors need not waste their time trying to find and capitalize on mispriced (undervalued or overvalued) securities.

Not all market participants are believers in the efficient-market hypothesis. Some feel that it is worthwhile to search for undervalued or overvalued securities and to trade them to profit from market inefficiencies. Others argue that it is mere luck that would allow market participants to anticipate new information correctly and as a result earn *excess returns*—that is, actual returns greater than required returns. They believe it is unlikely that market participants can *over the long run* earn excess returns. Contrary to this belief, some well-known investors such as Warren Buffett and Peter Lynch *have* over the long run consistently earned excess returns on their portfolios. It is unclear whether their success is the result of their superior ability to anticipate new information or of some form of market inefficiency.

Throughout this text we ignore the disbelievers and continue to assume market efficiency. This means that *the terms "expected return" and "required return" are used interchangeably,* because they should be equal in an efficient market. This also means that stock prices accurately reflect true value based on risk and return. In other words, we will operate under the assumption that the market price at any point in time is the best estimate of value. We're now ready to look closely at the mechanics of stock valuation.

The Basic Stock Valuation Equation

Like the value of a bond, which we discussed in Chapter 6, *the value of a share of common stock is equal to the present value of all future cash flows (dividends) that it is expected to provide over an infinite time horizon.*[4] Although a stockholder can earn capital gains by selling stock at a price above that originally paid, what is really sold is the right to all future dividends. What about stocks that are not expected to pay dividends in the foreseeable future? Such stocks have a value attributable to a distant dividend expected to result from sale of the company or liquidation of its assets. Therefore, *from a valuation viewpoint, only dividends are relevant.*

By redefining terms, the basic valuation model in Equation 6.5 can be specified for common stock, as given in Equation 7.2:

$$P_0 = \frac{D_1}{(1+k_s)^1} + \frac{D_2}{(1+k_s)^2} + \cdots + \frac{D_\infty}{(1+k_s)^\infty} \qquad (7.2)$$

where

P_0 = value of common stock
D_t = per-share dividend *expected* at the end of year t
k_s = required return on common stock

4. The need to consider an infinite time horizon is not critical, because a sufficiently long period—say, 50 years—will result in about the same present value as an infinite period for moderate-sized required returns. For example, at 15%, a dollar to be received 50 years from now, $PVIF_{15\%,50\text{yrs}}$, is worth only about \$0.001 today.

The equation can be simplified somewhat by redefining each year's dividend, D_t, in terms of anticipated growth. We will consider three models here: zero-growth, constant-growth, and variable-growth.

Zero-Growth Model

zero-growth model
An approach to dividend valuation that assumes a constant, nongrowing dividend stream.

The simplest approach to dividend valuation, the **zero-growth model,** assumes a constant, nongrowing dividend stream. In terms of the notation already introduced,

$$D_1 = D_2 = \cdots = D_\infty$$

When we let D_1 represent the amount of the annual dividend, Equation 7.2 under zero growth reduces to

$$P_0 = D_1 \times \sum_{t=1}^{\infty} \frac{1}{(1+k_s)^t} = D_1 \times (PVIFA_{k_s,\infty}) = D_1 \times \frac{1}{k_s} = \frac{D_1}{k_s} \tag{7.3}$$

The equation shows that with zero growth, the value of a share of stock would equal the present value of a perpetuity of D_1 dollars discounted at a rate k_s. (Perpetuities were introduced in Chapter 4; see Equation 4.19 and the related discussion.)

EXAMPLE

The dividend of Denham Company, an established textile producer, is expected to remain constant at \$3 per share indefinitely. If the required return on its stock is 15%, the stock's value is \$20 (\$3 ÷ 0.15) per share.

Preferred Stock Valuation Because preferred stock typically provides its holders with a fixed annual dividend over its assumed infinite life, *Equation 7.3 can be used to find the value of preferred stock*. The value of preferred stock can be estimated by substituting the stated dividend on the preferred stock for D_1 and the required return for k_s in Equation 7.3. For example, a preferred stock paying a \$5 stated annual dividend and having a required return of 13 percent would have a value of \$38.46 (\$5 ÷ 0.13) per share.

Constant-Growth Model

constant-growth model
A widely cited dividend valuation approach that assumes that dividends will grow at a constant rate, but a rate that is less than the required return.

The most widely cited dividend valuation approach, the **constant-growth model,** assumes that dividends will grow at a constant rate, but a rate that is less than the required return. (The assumption that the constant rate of growth, g, is less than the required return, k_s, is a necessary mathematical condition for deriving this model.[5]) By letting D_0 represent the most recent dividend, we can rewrite Equation 7.2 as follows:

$$P_0 = \frac{D_0 \times (1+g)^1}{(1+k_s)^1} + \frac{D_0 \times (1+g)^2}{(1+k_s)^2} + \cdots + \frac{D_0 \times (1+g)^\infty}{(1+k_s)^\infty} \tag{7.4}$$

5. Another assumption of the constant-growth model as presented is that earnings and dividends grow at the same rate. This assumption is true only in cases in which a firm pays out a fixed percentage of its earnings each year (has a fixed payout ratio). In the case of a declining industry, a negative growth rate ($g < 0\%$) might exist. In such a case, the constant-growth model, as well as the variable-growth model presented in the next section, remains fully applicable to the valuation process.

If we simplify Equation 7.4, it can be rewritten as[6]

Gordon model
A common name for the *constant-growth model* that is widely cited in dividend valuation.

$$P_0 = \frac{D_1}{k_s - g} \tag{7.5}$$

The constant-growth model in Equation 7.5 is commonly called the **Gordon model.** An example will show how it works.

EXAMPLE

Lamar Company, a small cosmetics company, from 1998 through 2003 paid the following per-share dividends:

Year	Dividend per share
2003	$1.40
2002	1.29
2001	1.20
2000	1.12
1999	1.05
1998	1.00

We assume that the historical compound annual growth rate of dividends is an accurate estimate of the future constant annual rate of dividend growth, g. Using Appendix Table A–2 or a financial calculator, we find that the historical compound annual growth rate of Lamar Company dividends equals 7%.[7] The com-

6. For the interested reader, the calculations necessary to derive Equation 7.5 from Equation 7.4 follow. The first step is to multiply each side of Equation 7.4 by $(1 + k_s)/(1 + g)$ and subtract Equation 7.4 from the resulting expression. This yields

$$\frac{P_0 \times (1 + k_s)}{1 + g} - P_0 = D_0 - \frac{D_0 \times (1 + g)^{\infty}}{(1 + k_s)^{\infty}} \tag{1}$$

Because k_s is assumed to be greater than g, the second term on the right side of Equation 1 should be zero. Thus

$$P_0 \times \left(\frac{1 + k_s}{1 + g} - 1\right) = D_0 \tag{2}$$

Equation 2 is simplified as follows:

$$P_0 \times \left[\frac{(1 + k_s) - (1 + g)}{1 + g}\right] = D_0 \tag{3}$$

$$P_0 + (k_s - g) = D_0 \times (1 + g) \tag{4}$$

$$P_0 = \frac{D_1}{k_s - g} \tag{5}$$

Equation 5 equals Equation 7.5.

7. The technique involves solving the following equation for g:

$$D_{2003} = D_{1998} \times (1 + g)^5$$

$$\frac{D_{1998}}{D_{2003}} = \frac{1}{(1 + g)^5} = PVIF_{g,5}$$

To do so, we can use financial tables or a financial calculator.

Two basic steps can be followed using the present value table. First, dividing the earliest dividend ($D_{1998} = \$1.00$) by the most recent dividend ($D_{2003} = \$1.40$) yields a factor for the present value of one dollar, *PVIF*, of 0.714 ($1.00 ÷ $1.40). Although six dividends are shown, *they reflect only 5 years of growth*. (The number of years of growth can also be found by subtracting the earliest year from the most recent year—that is, 2003 − 1998 = *5 years of growth*.) By looking across the Appendix Table A–2 at the *PVIF* for 5 years, we find that the factor closest to 0.714 occurs at 7% (0.713). Therefore, the growth rate of the dividends, rounded to the nearest whole percent, is 7%.

Alternatively, a financial calculator can be used. (*Note:* Most calculators require *either* the *PV* or *FV* value to be input as a negative number to calculate an unknown interest or growth rate. That approach is used here.) Using the inputs shown at the left, you should find the growth rate to be 6.96%, which we round to 7%.

Input	Function
1.00	PV
−1.40	FV
5	N
	CPT
	I
Solution	
6.96	

pany estimates that its dividend in 2004, D_1, will equal \$1.50. The required return, k_s, is assumed to be 15%. By substituting these values into Equation 7.5, we find the value of the stock to be

$$P_0 = \frac{\$1.50}{0.15 - 0.07} = \frac{\$1.50}{0.08} = \underline{\underline{\$18.75}} \text{ per share}$$

Assuming that the values of D_1, k_s, and g are accurately estimated, Lamar Company's stock value is \$18.75 per share.

Variable-Growth Model

variable-growth model
A dividend valuation approach that allows for a change in the dividend growth rate.

The zero- and constant-growth common stock models do not allow for any shift in expected growth rates. Because future growth rates might shift up or down because of changing expectations, it is useful to consider a **variable-growth model** that allows for a change in the dividend growth rate.[8] We will assume that a single shift in growth rates occurs at the end of year N, and we will use g_1 to represent the initial growth rate and g_2 for the growth rate after the shift. To determine the value of a share of stock in the case of variable growth, we use a four-step procedure.

Step 1 Find the value of the cash dividends at the end of *each year*, D_t, during the initial growth period, years 1 through N. This step may require adjusting the most recent dividend, D_0, using the initial growth rate, g_1, to calculate the dividend amount for each year. Therefore, for the first N years,

$$D_t = D_0 \times (1 + g_1)^t = D_0 \times FVIF_{g_1,t}$$

Step 2 Find the present value of the dividends expected during the initial growth period. Using the notation presented earlier, we can give this value as

$$\sum_{t=1}^{N} \frac{D_0 \times (1+g_1)^t}{(1+k_s)^t} = \sum_{t=1}^{N} \frac{D_t}{(1+k_s)^t} = \sum_{t=1}^{N} (D_t \times PVIF_{k_s,t})$$

Step 3 Find the value of the stock *at the end of the initial growth period*, $P_N = (D_{N+1})/(k_s - g_2)$, which is the present value of all dividends expected from year $N+1$ to infinity, assuming a constant dividend growth rate, g_2. This value is found by applying the constant-growth model (Equation 7.5) to the dividends expected from year $N+1$ to infinity. The present value of P_N would represent the value *today* of all dividends that are expected to be received from year $N+1$ to infinity. This value can be represented by

$$\frac{1}{(1+k_s)^N} \times \frac{D_{N+1}}{k_s - g_2} = PVIF_{k_s,N} \times P_N$$

8. More than one change in the growth rate can be incorporated into the model, but to simplify the discussion we will consider only a single growth-rate change. The number of variable-growth valuation models is technically unlimited, but concern over all possible shifts in growth is unlikely to yield much more accuracy than a simpler model.

Step 4 Add the present value components found in Steps 2 and 3 to find the value of the stock, P_0, given in Equation 7.6:

$$P_0 = \underbrace{\sum_{t=1}^{N} \frac{D_0 \times (1+g_1)^t}{(1+k_s)^t}}_{\substack{\text{Present value of}\\ \text{dividends}\\ \text{during initial}\\ \text{growth period}}} + \underbrace{\left[\frac{1}{(1+k_s)^N} \times \frac{D_{N+1}}{k_s - g_2}\right]}_{\substack{\text{Present value of}\\ \text{price of stock}\\ \text{at end of initial}\\ \text{growth period}}} \tag{7.6}$$

The following example illustrates the application of these steps to a variable-growth situation with only one change in growth rate.

EXAMPLE The most recent (2003) annual dividend payment of Warren Industries, a rapidly growing boat manufacturer, was \$1.50 per share. The firm's financial manager expects that these dividends will increase at a 10% annual rate, g_1, over the next 3 years (2004, 2005, and 2006) because the introduction of a hot new boat. At the end of the 3 years (the end of 2006), the firm's mature product line is expected to result in a slowing of the dividend growth rate to 5% per year, g_2, for the foreseeable future. The firm's required return, k_s, is 15%. To estimate the current (end-of-2003) value of Warren's common stock, $P_0 = P_{2003}$, the four-step procedure must be applied to these data.

Step 1 The value of the cash dividends in each of the next 3 years is calculated in columns 1, 2, and 3 of Table 7.3. The 2004, 2005, and 2006 dividends are \$1.65, \$1.82, and \$2.00, respectively.

Step 2 The present value of the three dividends expected during the 2004–2006 initial growth period is calculated in columns 3, 4, and 5 of Table 7.3. The sum of the present values of the three dividends is \$4.14.

Step 3 The value of the stock at the end of the initial growth period (N = 2006) can be found by first calculating $D_{N+1} = D_{2007}$:

$$D_{2007} = D_{2006} \times (1 + 0.05) = \$2.00 \times (1.05) = \$2.10$$

TABLE 7.3 Calculation of Present Value of Warren Industries Dividends (2004–2006)

t	End of year	$D_0 = D_{2003}$ (1)	$FVIF_{10\%,t}$ (2)	D_t [(1) × (2)] (3)	$PVIF_{15\%,t}$ (4)	Present value of dividends [(3) × (4)] (5)
1	2004	\$1.50	1.100	\$1.65	0.870	\$1.44
2	2005	1.50	1.210	1.82	0.756	1.38
3	2006	1.50	1.331	2.00	0.658	1.32

Sum of present value of dividends $= \sum_{t=1}^{3} \frac{D_0 \times (1+g_1)^t}{(1+k_s)^t} = \$4.14$

By using $D_{2007} = \$2.10$, a 15% required return, and a 5% dividend growth rate, we can calculate the value of the stock at the end of 2006 as follows:

$$P_{2006} = \frac{D_{2007}}{k_s - g_2} = \frac{\$2.10}{0.15 - 0.05} = \frac{\$2.10}{0.10} = \$21.00$$

Finally, in Step 3, the share value of \$21 at the end of 2006 must be converted into a present (end-of-2003) value. Using the 15% required return, we get

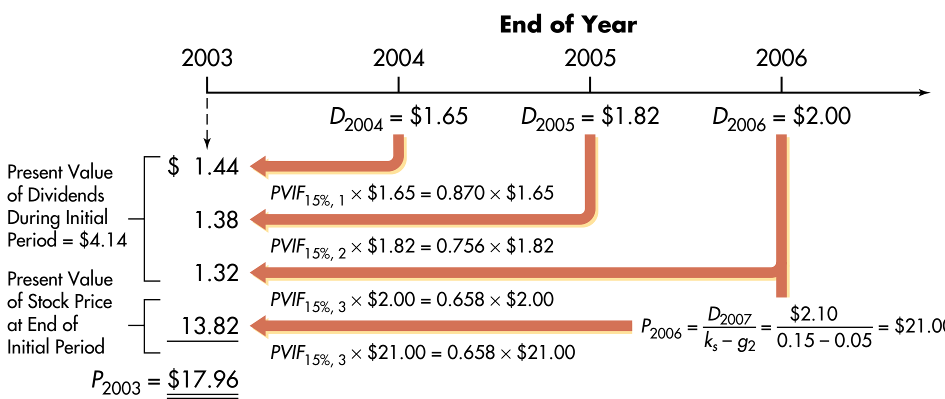
$$PVIF_{k_s,N} \times P_N = PVIF_{15\%,3} \times P_{2006} = 0.658 \times \$21.00 = \$13.82$$

Step 4 Adding the present value of the initial dividend stream (found in Step 2) to the present value of the stock at the end of the initial growth period (found in Step 3) as specified in Equation 7.6, we get the current (end-of-2003) value of Warren Industries stock:

$$P_{2003} = \$4.14 + \$13.82 = \underline{\underline{\$17.96}} \text{ per share}$$

The stock is currently worth \$17.96 per share. The calculation of this value is depicted graphically on the following time line.

Time line for finding Warren Industries current (end-of-2003) value with variable growth



The zero-, constant-, and variable-growth valuation models provide useful frameworks for estimating stock value. Clearly, the estimates produced cannot be very precise, given that the forecasts of future growth and discount rates are themselves necessarily approximate. Furthermore, a great deal of measurement error can be introduced into the stock price estimate as a result of the imprecise and rounded growth and discount rate estimates used as inputs. When applying valuation models, it is therefore advisable to estimate these rates carefully and round them conservatively, probably to the nearest tenth of a percent.

Free Cash Flow Valuation Model

As an alternative to the dividend valuation models presented above, a firm's value can be estimated by using its projected *free cash flows* (*FCFs*). This approach is appealing when one is valuing firms that have no dividend history or are startups or when one is valuing an operating unit or division of a larger public company.

In Practice

FOCUS ON e-FINANCE What's the Value of the American Dream?

For many people, owning their own business represents the dream of a lifetime. But how much should this dream cost? To get an idea of how to value a small business, check out the "Business for Sale" column in *Inc.,* a magazine that focuses on smaller emerging businesses. Each month the column describes the operations, financial situation, industry outlook, price rationale, and pros and cons of a small business offered for sale. For example, columns featured in 2000 and 2001 included such diverse companies as a distributor of semi-precious stones, a software developer, a Christmas tree grower, a small chain of used-book stores, and a baseball camp, with prices ranging from $200,000 to $9 million. Most valuations are based on a multiple of cash flow or annual sales, with accepted guidelines for different industries. That number is just a starting point, however, and must be adjusted for other factors.

For example, food distributors typically sell for about 30 percent of annual sales. A Southeastern seafood distributor was recently offered for $2.25 million, a discount from the $3.9 million price you'd get strictly on the basis of annual sales. The reason? The new owner would have to buy or lease a warehouse facility, freezers, and other equipment.

Because valuing a small business is difficult, many owners make use of reasonably priced valuation software such as BallPark Business Valuation and VALUware. These programs offer buyers and sellers a quick way to estimate the business's value and to answer such questions as:

- How much cash will my business generate or consume?
- What will my balance sheet, income statement, and cash flow statement look like in 5 years?
- Should I seek debt or equity to finance growth?
- What impact will capital purchases have on my venture?
- How much ownership in my business should I give up for a $2 million equity contribution?

Once the negotiators decide to move forward, however, they usually should hire an experienced valuation professional to develop a formal valuation.

Sources: "About Ballpark Business Valuation," *Bullet Proof Business Plans,* downloaded from *www.bulletproofbizplans.com/BallPark/About_/about_.html;* Jill Andresky Fraser, "Business for Sale: Southeastern Seafood Distributor," *Inc.* (October 1, 2000), downloaded from *www.inc.com; VALUware, www.bizbooksoftware.com/VALUWARE.HTM.*

Although dividend valuation models are widely used and accepted, in these situations it is preferable to use a more general free cash flow valuation model.

free cash flow valuation model
A model that determines the value of an entire company as the present value of its expected free cash flows discounted at the firm's *weighted average cost of capital,* which is its expected average future cost of funds over the long run.

The **free cash flow valuation model** is based on the same basic premise as dividend valuation models: The value of a share of common stock is the present value of all future cash flows it is expected to provide over an infinite time horizon. However, in the free cash flow valuation model, instead of valuing the firm's expected dividends, we value the firm's expected *free cash flows,* defined in Equation 3.3 (page 106). They represent the amount of cash flow available to investors—the providers of debt (creditors) and equity (owners)—after all other obligations have been met.

The free cash flow valuation model estimates the value of the entire company by finding the present value of its expected free cash flows discounted at its *weighted average cost of capital,* which is its expected average future cost of funds over the long run (see Chapter 11), as specified in Equation 7.7.

$$V_C = \frac{FCF_1}{(1+k_a)^1} + \frac{FCF_2}{(1+k_a)^2} + \cdots + \frac{FCF_\infty}{(1+k_a)^\infty} \tag{7.7}$$

where

V_C = value of the entire company
FCF_t = free cash flow *expected* at the end of year t
k_a = the firm's weighted average cost of capital

Note the similarity between Equations 7.7 and 7.2, the general stock valuation equation.

Because the value of the entire company, V_C, is the market value of the entire enterprise (that is, of all assets), to find common stock value, V_S, we must subtract the market value of all of the firm's debt, V_D, and the market value of preferred stock, V_P, from V_C.

$$V_S = V_C - V_D - V_P \tag{7.8}$$

Because it is difficult to forecast a firm's free cash flow, specific annual cash flows are typically forecast for only about 5 years, beyond which a constant growth rate is assumed. Here we assume that the first 5 years of free cash flows are explicitly forecast and that a constant rate of free cash flow growth occurs beyond the end of year 5 to infinity.[9] This model is methodologically similar to the variable-growth model presented earlier. Its application is best demonstrated with an example.

EXAMPLE

Dewhurst Inc. wishes to determine the value of its stock by using the free cash flow valuation model. In order to apply the model, the firm's CFO developed the data given in Table 7.4. Application of the model can be performed in four steps.

Step 1 Calculate the present value of the free cash flow occurring from the end of 2009 to infinity, measured at the beginning of 2009 (that is, at the end of 2008). Because a constant rate of growth in FCF is forecast beyond 2008, we can use the constant-growth dividend valuation model (Equation 7.5) to calculate the value of the free cash flows from the end of 2009 to infinity.

$$\text{Value of } FCF_{2009\rightarrow\infty} = \frac{FCF_{2009}}{k_a - g_{FCF}}$$
$$= \frac{\$600{,}000 \times (1 + 0.03)}{0.09 - 0.03}$$
$$= \frac{\$618{,}000}{0.06} = \underline{\underline{\$10{,}300{,}000}}$$

TABLE 7.4 Dewhurst Inc.'s Data for Free Cash Flow Valuation Model

Year (t)	Free cash flow (FCF_t)[a]	Other data
2004	$400,000	Growth rate of FCF, beyond 2008 to infinity, $g_{FCF} = 3\%$
2005	450,000	Weighted average cost of capital, $k_a = 9\%$
2006	520,000	Market value of all debt, $V_D = \$3{,}100{,}000$
2007	560,000	Market value of preferred stock, $V_P = \$800{,}000$
2008	600,000	Number of shares of common stock outstanding = 300,000

[a]Developed using Equations 3.2 and 3.3 (page 106).

9. The approach demonstrated here is consistent with that found in Alfred Rappaport, *Creating Shareholder Value* (New York: The Free Press, 1998). A somewhat similar approach to value can be found in G. Bennett Stewart III, *The Quest for Value* (New York: HarperCollins, 1999).

Note that to calculate the FCF in 2009, we had to increase the 2008 FCF value of $600,000 by the 3% FCF growth rate, g_{FCF}.

Step 2 Add the present value of the FCF from 2009 to infinity, which is measured at the end of 2008, to the 2008 FCF value to get the total FCF in 2008.

$$\text{Total } FCF_{2008} = \$600{,}000 + \$10{,}300{,}000 = \$10{,}900{,}000$$

Step 3 Find the sum of the present values of the FCFs for 2004 through 2008 to determine the value of the entire company, V_C. This calculation is shown in Table 7.5, using present value interest factors, *PVIF*s, from Appendix Table A–2.

Step 4 Calculate the value of the common stock using Equation 7.8. Substituting the value of the entire company, V_C, calculated in Step 3, and the market values of debt, V_D, and preferred stock, V_P, given in Table 7.4, yields the value of the common stock, V_S:

$$V_S = \$8{,}628{,}620 - \$3{,}100{,}000 - \$800{,}000 = \underline{\underline{\$4{,}728{,}620}}$$

The value of Dewhurst's common stock is therefore estimated to be $4,728,620. By dividing this total by the 300,000 shares of common stock that the firm has outstanding, we get a common stock value of *$15.76 per share* ($4,728,620 ÷ 300,000).

It should now be clear that the free cash flow valuation model is consistent with the dividend valuation models presented earlier. The appeal of this approach is its focus on the free cash flow estimates rather than on forecast dividends, which are far more difficult to estimate, given that they are paid at the discretion of the firm's board. The more general nature of the free cash flow model is responsible for its growing popularity, particularly with CFOs and other financial managers.

TABLE 7.5 Calculation of the Value of the Entire Company for Dewhurst Inc.

Year (t)	FCF_t (1)	$PVIF_{9\%,t}$ (2)	Present value of FCF_t [(1) × (2)] (3)
2004	$ 400,000	0.917	$ 366,800
2005	450,000	0.842	378,900
2006	520,000	0.772	401,440
2007	560,000	0.708	396,480
2008	10,900,000[a]	0.650	7,085,000
		Value of entire company, V_C =	$8,628,620

[a]This amount is the sum of the FCF_{2008} of $600,000 from Table 7.4 and the $10,300,000 value of the $FCF_{2009\rightarrow\infty}$ calculated in Step 1.

Other Approaches to Common Stock Valuation

Many other approaches to common stock valuation exist. The more popular approaches include book value, liquidation value, and some type of price/earnings multiple.

Book Value

book value per share
The amount per share of common stock that would be received if all of the firm's assets were *sold for their exact book (accounting) value* and the proceeds remaining after paying all liabilities (including preferred stock) were divided among the common stockholders.

Book value per share is simply the amount per share of common stock that would be received if all of the firm's assets were *sold for their exact book (accounting) value* and the proceeds remaining after paying all liabilities (including preferred stock) were divided among the common stockholders. This method lacks sophistication and can be criticized on the basis of its reliance on historical balance sheet data. It ignores the firm's expected earnings potential and generally lacks any true relationship to the firm's value in the marketplace. Let us look at an example.

EXAMPLE

At year-end 2003, Lamar Company's balance sheet shows total assets of $6 million, total liabilities (including preferred stock) of $4.5 million, and 100,000 shares of common stock outstanding. Its book value per share therefore would be

$$\frac{\$6{,}000{,}000 - \$4{,}500{,}000}{100{,}000 \text{ shares}} = \underline{\underline{\$15}} \text{ per share}$$

Because this value assumes that assets could be sold for their book value, it may not represent the minimum price at which shares are valued in the marketplace. As a matter of fact, although most stocks sell above book value, it is not unusual to find stocks selling below book value when investors believe either that assets are overvalued or that the firm's liabilities are understated.

Liquidation Value

liquidation value per share
The *actual amount* per share of common stock that would be received if all of the firm's assets were *sold for their market value,* liabilities (including preferred stock) were paid, and any remaining money were divided among the common stockholders.

Liquidation value per share is the *actual amount* per share of common stock that would be received if all of the firm's assets were *sold for their market value,* liabilities (including preferred stock) were paid, and any remaining money were divided among the common stockholders.[10] This measure is more realistic than book value—because it is based on the current market value of the firm's assets—but it still fails to consider the earning power of those assets. An example will illustrate.

EXAMPLE

Lamar Company found upon investigation that it could obtain only $5.25 million if it sold its assets today. The firm's liquidation value per share therefore would be

$$\frac{\$5{,}250{,}000 - \$4{,}500{,}000}{100{,}000 \text{ shares}} = \underline{\underline{\$7.50}} \text{ per share}$$

Ignoring liquidation expenses, this amount would be the firm's minimum value.

10. In the event of liquidation, creditors' claims must be satisfied first, then those of the preferred stockholders. Anything left goes to common stockholders. A more detailed discussion of liquidation procedures is presented in Chapter 17.

Price/Earnings (P/E) Multiples

The *price/earnings (P/E) ratio,* introduced in Chapter 2, reflects the amount investors are willing to pay for each dollar of earnings. The average P/E ratio in a particular industry can be used as the guide to a firm's value—if it is assumed that investors value the earnings of that firm in the same way they do the "average" firm in the industry. The **price/earnings multiple approach** is a popular technique used to estimate the firm's share value; it is calculated by multiplying the firm's expected earnings per share (EPS) by the average price/earnings (P/E) ratio for the industry. The average P/E ratio for the industry can be obtained from a source such as *Standard & Poor's Industrial Ratios.*

price/earnings multiple approach
A popular technique used to estimate the firm's share value; calculated by multiplying the firm's expected earnings per share (EPS) by the average price/earnings (P/E) ratio for the industry.

The use of P/E multiples is especially helpful in valuing firms that are not publicly traded, whereas market price quotations can be used to value publicly traded firms.[11] In any case, the price/earnings multiple approach is considered superior to the use of book or liquidation values because it considers *expected* earnings.[12] An example will demonstrate the use of price/earnings multiples.

EXAMPLE

Lamar Company is expected to earn $2.60 per share next year (2004). This expectation is based on an analysis of the firm's historical earnings trend and of expected economic and industry conditions. The average price/earnings (P/E) ratio for firms in the same industry is 7. Multiplying Lamar's expected earnings per share (EPS) of $2.60 by this ratio gives us a value for the firm's shares of $18.20, assuming that investors will continue to measure the value of the average firm at 7 times its earnings.

So how much is Lamar Company's stock really worth? That's a trick question, because there's no one right answer. It is important to recognize that the answer depends on the assumptions made and the techniques used. Professional securities analysts typically use a variety of models and techniques to value stocks. For example, an analyst might use the constant-growth model, liquidation value, and price/earnings (P/E) multiples to estimate the worth of a given stock. If the analyst feels comfortable with his or her estimates, the stock would be valued at no more than the largest estimate. Of course, should the firm's estimated liquidation value per share exceed its "going concern" value per share, estimated by using one of the valuation models (zero-, constant-, or variable-growth or free cash flow) or the P/E multiple approach, the firm would be viewed as being "worth more dead than alive." In such an event, the firm would lack sufficient earning power to justify its existence and should probably be liquidated.

Hint From an investor's perspective, the stock in this situation would be an attractive investment only if it could be purchased at a price below its liquidation value—which in an efficient market could never occur.

11. Generally, when the P/E ratio is used to value *privately owned* or *closely owned* corporations, a premium is added to adjust for the issue of control. This adjustment is necessary because the P/E ratio implicitly reflects minority interests of noncontrolling investors in *publicly owned* companies—a condition that does not exist in privately or closely owned corporations.

12. The price/earnings multiple approach to valuation does have a theoretical explanation. If we view 1 divided by the price/earnings ratio, or the *earnings/price ratio,* as the rate at which investors discount the firm's earnings, and if we assume that the projected earnings per share will be earned indefinitely (i.e., no growth in earnings per share), the price/earnings multiple approach can be looked on as a method of finding the present value of a perpetuity of projected earnings per share at a rate equal to the earnings/price ratio. This method is in effect a form of the zero-growth model presented in Equation 7.3 on page 325.

Review Questions

7–13 Describe the events that occur in an *efficient market* in response to new information that causes the expected return to exceed the required return. What happens to the market value?

7–14 What does the *efficient-market hypothesis* say about (**a**) securities prices, (**b**) their reaction to new information, and (**c**) investor opportunities to profit?

7–15 Describe, compare, and contrast the following common stock dividend valuation models: (**a**) zero-growth, (**b**) constant-growth, and (**c**) variable-growth.

7–16 Describe the *free cash flow valuation model* and explain how it differs from the dividend valuation models. What is the appeal of this model?

7–17 Explain each of the three other approaches to common stock valuation: (**a**) book value, (**b**) liquidation value, and (**c**) price/earnings (P/E) multiples. Which of these is considered the best?

LG6 7.4 Decision Making and Common Stock Value

Valuation equations measure the stock value at a point in time based on expected return and risk. Any decisions of the financial manager that affect these variables can cause the value of the firm to change. Figure 7.4 depicts the relationship among financial decisions, return, risk, and stock value.

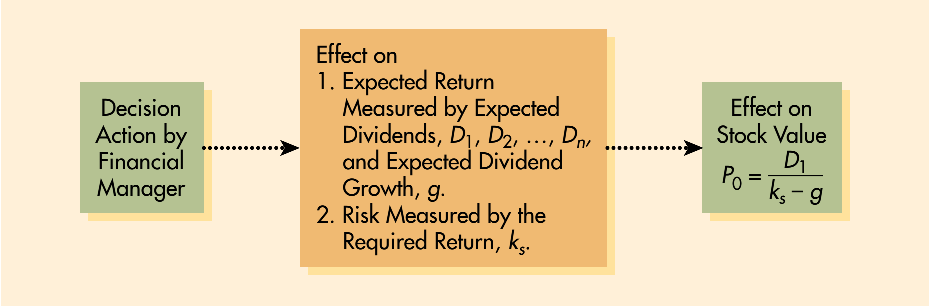
Changes in Expected Return

Assuming that economic conditions remain stable, any management action that would cause current and prospective stockholders to raise their dividend expectations should increase the firm's value. In Equation 7.5,[13] we can see that P_0 will

FIGURE 7.4

Decision Making and Stock Value

Financial decisions, return, risk, and stock value



13. To convey the interrelationship among financial decisions, return, risk, and stock value, the constant-growth model is used. Other models—zero-growth, variable-growth, or free cash flow—could be used, but the simplicity of exposition using the constant-growth model justifies its use here.

increase for any increase in D_1 or g. Any action of the financial manager that will increase the level of expected returns without changing risk (the required return) should be undertaken, because it will positively affect owners' wealth.

EXAMPLE Using the constant-growth model, we found Lamar Company to have a share value of \$18.75. On the following day, the firm announced a major technological breakthrough that would revolutionize its industry. Current and prospective stockholders would not be expected to adjust their required return of 15%, but they would expect that future dividends will increase. Specifically, they expect that although the dividend next year, D_1, will remain at \$1.50, the expected rate of growth thereafter will increase from 7% to 9%. If we substitute $D_1 = \$1.50$, $k_s = 0.15$, and $g = 0.09$ into Equation 7.5, the resulting value is \$25 [$\$1.50 \div (0.15 - 0.09)$]. The increased value therefore resulted from the higher expected future dividends reflected in the increase in the growth rate.

Changes in Risk

Although k_s is defined as the required return, we know from Chapter 5 that it is directly related to the nondiversifiable risk, which can be measured by beta. The *capital asset pricing model (CAPM)* given in Equation 5.8 is restated here as Equation 7.9:

$$k_s = R_F + [b \times (k_m - R_F)] \tag{7.9}$$

With the risk-free rate, R_F, and the market return, k_m, held constant, the required return, k_s, depends directly on beta. Any action taken by the financial manager that increases risk (beta) will also increase the required return. In Equation 7.5, we can see that with everything else constant, an increase in the required return, k_s, will reduce share value, P_0. Likewise, a decrease in the required return will increase share value. Thus any action of the financial manager that increases risk contributes to a reduction in value, and any action that decreases risk contributes to an increase in value.

EXAMPLE Assume that Lamar Company's 15% required return resulted from a risk-free rate of 9%, a market return of 13%, and a beta of 1.50. Substituting into the capital asset pricing model, Equation 7.9, we get a required return, k_s, of 15%:

$$k_s = 9\% + [1.50 \times (13\% - 9\%)] = \underline{\underline{15}}\%$$

With this return, the value of the firm was calculated in the example above to be \$18.75.

Now imagine that the financial manager makes a decision that, without changing expected dividends, causes the firm's beta to increase to 1.75. Assuming that R_F and k_m remain at 9% and 13%, respectively, the required return will increase to 16% ($9\% + [1.75 \times (13\% - 9\%)]$) to compensate stockholders for the increased risk. Substituting $D_1 = \$1.50$, $k_s = 0.16$, and $g = 0.07$ into the valuation equation, Equation 7.5, results in a share value of \$16.67 [$\$1.50 \div (0.16 - 0.07)$]. As expected, raising the required return, without any corresponding increase in expected return, causes the firm's stock value to decline. Clearly, the financial manager's action was not in the owners' best interest.

Combined Effect

A financial decision rarely affects return and risk independently; most decisions affect both factors. In terms of the measures presented, with an increase in risk (b), one would expect an increase in return (D_1 or g, or both), assuming that R_F and k_m remain unchanged. The net effect on value depends on the size of the changes in these variables.

EXAMPLE If we assume that the two changes illustrated for Lamar Company in the preceding examples occur simultaneously, key variable values would be $D_1 = \$1.50$, $k_s = 0.16$, and $g = 0.09$. Substituting into the valuation model, we obtain a share price of \$21.43 [$\$1.50 \div (0.16 - 0.09)$]. The net result of the decision, which increased return (g, from 7% to 9%) as well as risk (b, from 1.50 to 1.75 and therefore k_s from 15% to 16%), is positive: The share price increased from \$18.75 to \$21.43. The decision appears to be in the best interest of the firm's owners, because it increases their wealth.

Review Questions

7–18 Explain the linkages among financial decisions, return, risk, and stock value.

7–19 Assuming that all other variables remain unchanged, what impact would *each* of the following have on stock price? (**a**) The firm's beta increases. (**b**) The firm's required return decreases. (**c**) The dividend expected next year decreases. (**d**) The rate of growth in dividends is expected to increase.

Summary

FOCUS ON VALUE

The price of each share of a firm's common stock is the value of each ownership interest. Although common stockholders typically have voting rights, which indirectly give them a say in management, their only significant right is their claim on the residual cash flows of the firm. This claim is subordinate to those of vendors, employees, customers, lenders, the government (for taxes), and preferred stockholders. The value of the common stockholders' claim is embodied in the cash flows they are entitled to receive from now to infinity. The present value of those expected cash flows is the firm's share value.

To determine this present value, cash flows are discounted at a rate that reflects the riskiness of the forecast cash flows. Riskier cash flows are discounted at higher rates, resulting in lower present values than less risky expected cash flows, which are discounted at lower rates. The value of the firm's common stock is therefore driven by its expected cash flows (returns) and risk (certainty of the expected cash flows).

In pursuing the firm's goal of **maximizing the stock price,** the financial manager must carefully consider the balance of return and risk associated with each proposal and must undertake only those that create value for owners—that is, increase share price. By focusing on value creation and by managing and monitoring the firm's cash flows and risk, the financial manager should be able to achieve the firm's goal of share price maximization.

REVIEW OF LEARNING GOALS

LG1 **Differentiate between debt and equity capital.** Holders of equity capital (common and preferred stock) are owners of the firm. Typically, only common stockholders have a voice in management through their voting rights. Equity holders have claims on income and assets that are secondary to the claims of creditors, there is no maturity date, and the firm does not benefit from tax deductibility of dividends paid to stockholders, as is the case for interest paid to debtholders.

LG2 **Discuss the rights, characteristics, and features of both common and preferred stock.** The common stock of a firm can be privately owned, closely owned, or publicly owned. It can be sold with or without a par value. Preemptive rights allow common stockholders to avoid dilution of ownership when new shares are issued. Not all shares authorized in the corporate charter are outstanding. If a firm has treasury stock, it will have issued more shares than are outstanding. Some firms have two or more classes of common stock that differ mainly in having unequal voting rights. Proxies transfer voting rights from one party to another. Dividend distributions to common stockholders are made at the discretion of the firm's board of directors. Firms can issue stock in foreign markets. The stock of many foreign corporations is traded in the form of American depositary receipts (ADRs) in U.S. markets.

Preferred stockholders have preference over common stockholders with respect to the distribution of earnings and assets and so are normally not given voting privileges. Preferred stock issues may have certain restrictive covenants, cumulative dividends, a call feature, and a conversion feature.

LG3 **Describe the process of issuing common stock, including in your discussion venture capital, going public, the investment banker's role, and stock quotations.** The initial nonfounder financing for business startups with attractive growth prospects typically comes from private equity investors. These investors can be either angel capitalists or venture capitalists (VCs), which are more formal business entities. Institutional VCs can be organized in a number of ways, but the VC limited partnership is the most common. VCs usually invest in both early-stage and later-stage companies that they hope to take public in order to cash out their investments.

The first public issue of a firm's stock is called an initial public offering (IPO). The company selects an investment banker to advise it and to sell the securities. The lead investment banker may form a selling syndicate with other investment bankers to sell the issue. The IPO process includes filing a registration statement with the Securities and Exchange Commission (SEC), getting SEC approval, promoting the offering to investors, pricing the issue, and selling the shares.

Stock quotations, published regularly in the financial media, provide information on stocks, including calendar year change in price, 52-week high and low, dividend, dividend yield, P/E ratio, volume, latest price, and net price change from the prior trading day.

LG4 **Understand the concept of market efficiency and basic common stock valuation under each of three cases: zero growth, constant growth, and variable growth.** Market efficiency, which is assumed throughout the text, suggests that there are many rational investors whose quick reactions to new information cause the market value of common stock to adjust upward or downward depending upon whether the expected return is above or below, respectively, the required return for the period. The efficient-market hypothesis suggests that securities are fairly priced, that they reflect fully all publicly available information, and that investors should therefore not waste time trying to find and capitalize on mispriced securities. The value of a share of common stock is the present value of all future dividends it is expected to provide over an infinite time horizon. Three dividend growth models—zero-growth, constant-growth, and variable-growth—can be considered in common stock valuation. The basic stock valuation equation and these models are summarized in Table 7.6. The most widely cited model is the constant-growth model.

LG5 **Discuss the free cash flow valuation model and the use of book value, liquidation value, and price/earnings (P/E) multiples to estimate common stock values.** The free cash flow valuation model is appealing when one is valuing firms that have no dividend history, startups, or operating units or divisions of a larger public company. The model finds the value of the entire company by discounting the firm's expected free cash flow at its weighted average cost of capital. The common stock value is found by subtracting the market values of the firm's debt and preferred stock from the value of the entire company. The two equations involved in this model are summarized in Table 7.6.

Book value per share is the amount per share of common stock that would be received if all of the firm's assets were *sold for their book (accounting) value* and the proceeds remaining after paying all liabilities (including preferred stock) were divided among the common stockholders. Liquidation value per share is the *actual amount* per share of common stock that would be received if all of the firm's assets were *sold for their market value,* liabilities (including preferred stock) were paid, and the remaining money were divided among the common stockholders. The price/earnings (P/E) multiples approach estimates stock value by multiplying the firm's expected earnings per share (EPS) by the average price/earnings (P/E) ratio for the industry.

LG6 **Explain the relationships among financial decisions, return, risk, and the firm's value.** In a stable economy, any action of the financial manager that increases the level of expected return without changing risk should increase share value, and any action that reduces the level of expected return without changing risk should reduce share value. Similarly, any action that increases risk (required return) will reduce share value, and any action that reduces risk will increase share value. Because most financial decisions affect both return and risk, an assessment of their combined effect on stock value must be part of the financial decision-making process.

SELF-TEST PROBLEMS (Solutions in Appendix B)

LG4 **ST 7–1** **Common stock valuation** Perry Motors' common stock currently pays an annual dividend of $1.80 per share. The required return on the common stock is 12%. Estimate the value of the common stock under each of the following assumptions about the dividend.

a. Dividends are expected to grow at an annual rate of 0% to infinity.
b. Dividends are expected to grow at a constant annual rate of 5% to infinity.
c. Dividends are expected to grow at an annual rate of 5% for each of the next 3 years, followed by a constant annual growth rate of 4% in years 4 to infinity.

LG5 **ST 7–2** **Free cash flow valuation** Erwin Footwear wishes to assess the value of its Active Shoe Division. This division has debt with a market value of $12,500,000 and no preferred stock. Its weighted average cost of capital is 10%. The Active

TABLE 7.6 **Summary of Key Valuation Definitions and Formulas for Common Stock**

Definitions of variables

D_t = per-share dividend *expected* at the end of year t

FCF_t = free cash flow *expected* at the end of year t

g = constant rate of growth in dividends

g_1 = initial dividend growth rate (in variable-growth model)

g_2 = subsequent dividend growth rate (in variable-growth model)

k_a = weighted average cost of capital

k_s = required return on common stock

N = last year of initial growth period (in variable-growth model)

P_0 = value of common stock

V_C = value of the entire company

V_D = market value of all the firm's debt

V_P = market value of preferred stock

V_S = value of common stock

Valuation formulas

Basic stock value:

$$P_0 = \frac{D_1}{(1+k_s)^1} + \frac{D_2}{(1+k_s)^2} + \cdots + \frac{D_\infty}{(1+k_s)^\infty} \qquad \text{[Eq. 7.2]}$$

Common stock value:

Zero-growth:

$$P_0 = \frac{D_1}{k_s} \text{ (also used to value preferred stock)} \qquad \text{[Eq. 7.3]}$$

Constant-growth:

$$P_0 = \frac{D_1}{k_s - g} \qquad \text{[Eq. 7.5]}$$

Variable-growth:

$$P_0 = \sum_{t=1}^{N} \frac{D_0 \times (1+g_1)^t}{(1+k_s)^t} + \left[\frac{1}{(1+k_s)^N} \times \frac{D_{N+1}}{k_s - g_2}\right] \qquad \text{[Eq. 7.6]}$$

FCF value of entire company:

$$V_C = \frac{FCF_1}{(1+k_a)^1} + \frac{FCF_2}{(1+k_a)^2} + \cdots + \frac{FCF_\infty}{(1+k_a)^\infty} \qquad \text{[Eq. 7.7]}$$

FCF common stock value:

$$V_S = V_C - V_D - V_P \qquad \text{[Eq. 7.8]}$$

Shoe Division's estimated free cash flow each year from 2004 through 2007 is given in the accompanying table. Beyond 2007 to infinity, the firm expects its free cash flow to grow at 4% annually.

Year (t)	Free cash flow (FCF_t)
2004	$ 800,000
2005	1,200,000
2006	1,400,000
2007	1,500,000

a. Use the *free cash flow valuation model* to estimate the value of Erwin's Active Shoe Division.
b. Use your finding in part **a** along with the data provided above to find this division's common stock value.
c. If the Active Shoe Division as a public company will have 500,000 shares outstanding, use your finding in part **b** to calculate its value per share.

PROBLEMS

LG2 **7–1 Authorized and available shares** Aspin Corporation's charter authorizes issuance of 2,000,000 shares of common stock. Currently, 1,400,000 shares are outstanding and 100,000 shares are being held as treasury stock. The firm wishes to raise $48,000,000 for a plant expansion. Discussions with its investment bankers indicate that the sale of new common stock will net the firm $60 per share.
a. What is the maximum number of new shares of common stock that the firm can sell without receiving further authorization from shareholders?
b. Judging on the basis of the data given and your finding in part **a,** will the firm be able to raise the needed funds without receiving further authorization?
c. What must the firm do to obtain authorization to issue more than the number of shares found in part **a?**

LG2 **7–2 Preferred dividends** Slater Lamp Manufacturing has an outstanding issue of preferred stock with an $80 par value and an 11% annual dividend.
a. What is the annual dollar dividend? If it is paid quarterly, how much will be paid each quarter?
b. If the preferred stock is *noncumulative* and the board of directors has passed the preferred dividend for the last 3 quarters, how much must be paid to preferred stockholders before dividends are paid to common stockholders?
c. If the preferred stock is *cumulative* and the board of directors has passed the preferred dividend for the last 3 quarters, how much must be paid to preferred stockholders before dividends are paid to common stockholders?

LG2 **7–3 Preferred dividends** In each case in the following table, how many dollars of preferred dividends per share must be paid to preferred stockholders before common stock dividends are paid?

Case	Type	Par value	Dividend per share per period	Periods of dividends passed
A	Cumulative	$ 80	$ 5	2
B	Noncumulative	110	8%	3
C	Noncumulative	100	$11	1
D	Cumulative	60	8.5%	4
E	Cumulative	90	9%	0

LG2 **7–4 Convertible preferred stock** Valerian Corp. convertible preferred stock has a fixed conversion ratio of 5 common shares per 1 share of preferred stock. The preferred stock pays a dividend of $10.00 per share per year. The common stock currently sells for $20.00 per share and pays a dividend of $1.00 per share per year.

a. Judging on the basis of the conversion ratio and the price of the common shares, what is the current conversion value of each preferred share?

b. If the preferred shares are selling at $96.00 each, should an investor convert the preferred shares to common shares?

c. What factors might cause an investor not to convert from preferred to common?

LG2 **7–5 Stock quotation** Assume that the following quote for the Advanced Business Machines stock (traded on the NYSE) was found in the Thursday, December 14, issue of the *Wall Street Journal.*

+3.2 84.13 51.25 AdvBusMach ABM 1.32 1.6 23 12432 81.75 +1.63

Given this information, answer the following questions:

a. On what day did the trading activity occur?

b. At what price did the stock sell at the end of the day on Wednesday, December 13?

c. What percentage change has occurred in the stock's last price since the beginning of the calendar year?

d. What is the firm's price/earnings ratio? What does it indicate?

e. What is the last price at which the stock traded on the day quoted?

f. How large a dividend is expected in the current year?

g. What are the highest and the lowest price at which the stock traded during the latest 52-week period?

h. How many shares of stock were traded on the day quoted?

i. How much, if any, of a change in stock price took place between the day quoted and the day before? At what price did the stock close on the day before?

LG4 **7–6 Common stock valuation—Zero growth** Scotto Manufacturing is a mature firm in the machine tool component industry. The firm's most recent common stock dividend was $2.40 per share. Because of its maturity as well as its stable sales and earnings, the firm's management feels that dividends will remain at the current level for the foreseeable future.

a. If the required return is 12%, what will be the value of Scotto's common stock?

b. If the firm's risk as perceived by market participants suddenly increases, causing the required return to rise to 20%, what will be the common stock value?

c. Judging on the basis of your findings in parts **a** and **b,** what impact does risk have on value? Explain.

LG4 7–7 **Common stock value—Zero growth** Kelsey Drums, Inc., is a well-established supplier of fine percussion instruments to orchestras all over the United States. The company's class A common stock has paid a dividend of $5.00 per share per year for the last 15 years. Management expects to continue to pay at that rate for the foreseeable future. Sally Talbot purchased 100 shares of Kelsey class A common 10 years ago at a time when the required rate of return for the stock was 16%. She wants to sell her shares today. The current required rate of return for the stock is 12%. How much capital gain or loss will she have on her shares?

LG4 7–8 **Preferred stock valuation** Jones Design wishes to estimate the value of its outstanding preferred stock. The preferred issue has an $80 par value and pays an annual dividend of $6.40 per share. Similar-risk preferred stocks are currently earning a 9.3% annual rate of return.

a. What is the market value of the outstanding preferred stock?

b. If an investor purchases the preferred stock at the value calculated in part **a,** how much does she gain or lose per share if she sells the stock when the required return on similar-risk preferreds has risen to 10.5%? Explain.

LG4 7–9 **Common stock value—Constant growth** Use the constant-growth model (Gordon model) to find the value of each firm shown in the following table.

Firm	Dividend expected next year	Dividend growth rate	Required return
A	$1.20	8%	13%
B	4.00	5	15
C	0.65	10	14
D	6.00	8	9
E	2.25	8	20

LG4 7–10 **Common stock value—Constant growth** McCracken Roofing, Inc., common stock paid a dividend of $1.20 per share last year. The company expects earnings and dividends to grow at a rate of 5% per year for the foreseeable future.

a. What required rate of return for this stock would result in a price per share of $28?

b. If McCracken had both earnings growth and dividend growth at a rate of 10%, what required rate of return would result in a price per share of $28?

LG4 7–11 **Common stock value—Constant growth** Elk County Telephone has paid the dividends shown in the following table over the past 6 years.

Year	Dividend per share
2003	$2.87
2002	2.76
2001	2.60
2000	2.46
1999	2.37
1998	2.25

The firm's dividend per share next year is expected to be \$3.02.

a. If you can earn 13% on similar-risk investments, what is the most you would be willing to pay per share?

b. If you can earn only 10% on similar-risk investments, what is the most you would be willing to pay per share?

c. Compare and contrast your findings in parts **a** and **b,** and discuss the impact of changing risk on share value.

LG4 **7–12 Common stock value—Variable growth** Newman Manufacturing is considering a cash purchase of the stock of Grips Tool. During the year just completed, Grips earned \$4.25 per share and paid cash dividends of \$2.55 per share ($D_0 =$ \$2.55). Grips' earnings and dividends are expected to grow at 25% per year for the next 3 years, after which they are expected to grow at 10% per year to infinity. What is the maximum price per share that Newman should pay for Grips if it has a required return of 15% on investments with risk characteristics similar to those of Grips?

LG4 **7–13 Common stock value—Variable growth** Home Place Hotels, Inc., is entering into a 3-year remodeling and expansion project. The construction will have a limiting effect on earnings during that time, but when it is complete, it should allow the company to enjoy much improved growth in earnings and dividends. Last year, the company paid a dividend of \$3.40. It expects zero growth in the next year. In years 2 and 3, 5% growth is expected, and in year 4, 15% growth. In year 5 and thereafter, growth should be a constant 10% per year. What is the maximum price per share that an investor who requires a return of 14% should pay for Home Place Hotels common stock?

LG4 **7–14 Common stock value—Variable growth** Lawrence Industries' most recent annual dividend was \$1.80 per share ($D_0 =$ \$1.80), and the firm's required return is 11%. Find the market value of Lawrence's shares when:

a. Dividends are expected to grow at 8% annually for 3 years, followed by a 5% constant annual growth rate in years 4 to infinity.

b. Dividends are expected to grow at 8% annually for 3 years, followed by a 0% constant annual growth rate in years 4 to infinity.

c. Dividends are expected to grow at 8% annually for 3 years, followed by a 10% constant annual growth rate in years 4 to infinity.

LG4 **7–15 Common stock value—All growth models** You are evaluating the potential purchase of a small business currently generating \$42,500 of after-tax cash flow ($D_0 =$ \$42,500). On the basis of a review of similar-risk investment opportunities, you must earn an 18% rate of return on the proposed purchase. Because you are relatively uncertain about future cash flows, you decide to estimate the firm's value using several possible assumptions about the growth rate of cash flows.

a. What is the firm's value if cash flows are expected to grow at an annual rate of 0% from now to infinity?

b. What is the firm's value if cash flows are expected to grow at a constant annual rate of 7% from now to infinity?

c. What is the firm's value if cash flows are expected to grow at an annual rate of 12% for the first 2 years, followed by a constant annual rate of 7% from year 3 to infinity?

LG5 **7–16 Free cash flow valuation** Nabor Industries is considering going public but is unsure of a fair offering price for the company. Before hiring an investment banker to assist in making the public offering, managers at Nabor have decided to make their own estimate of the firm's common stock value. The firm's CFO has gathered data for performing the valuation using the free cash flow valuation model.

The firm's weighted average cost of capital is 11%, and it has $1,500,000 of debt at market value and $400,000 of preferred stock at its assumed market value. The estimated free cash flows over the next 5 years, 2004 through 2008, are given below. Beyond 2008 to infinity, the firm expects its free cash flow to grow by 3% annually.

Year (t)	Free cash flow (FCF_t)
2004	$200,000
2005	250,000
2006	310,000
2007	350,000
2008	390,000

a. Estimate the value of Nabor Industries' entire company by using the *free cash flow valuation model.*

b. Use your finding in part **a,** along with the data provided above, to find Nabor Industries' common stock value.

c. If the firm plans to issue 200,000 shares of common sock, what is its estimated value per share?

LG5 **7–17 Using the free cash flow valuation model to price an IPO** Assume that you have an opportunity to buy the stock of CoolTech, Inc., an IPO being offered for $12.50 per share. Although you are very much interested in owning the company, you are concerned about whether it is fairly priced. In order to determine the value of the shares, you have decided to apply the free cash flow valuation model to the firm's financial data that you've developed from a variety of data sources. The key values you have compiled are summarized in the following table.

Free cash flow		
Year (t)	FCF_t	Other data
2004	$ 700,000	Growth rate of FCF, beyond 2007 to infinity = 2%
2005	800,000	Weighted average cost of capital = 8%
2006	950,000	Market value of all debt = $2,700,000
2007	1,100,000	Market value of preferred stock = $1,000,000
		Number of shares of common stock outstanding = 1,100,000

a. Use the *free cash flow valuation model* to estimate CoolTech's common stock value per share.

b. Judging on the basis of your finding in part **a** and the stock's offering price, should you buy the stock?

c. Upon further analysis, you find that the growth rate in FCF beyond 2007 will be 3% rather than 2%. What effect would this finding have on your responses in parts **a** and **b**?

LG5 **7–18** **Book and liquidation value** The balance sheet for Gallinas Industries is as follows.

Gallinas Industries
Balance Sheet
December 31

Assets		Liabilities and Stockholders' Equity	
Cash	$ 40,000	Accounts payable	$100,000
Marketable securities	60,000	Notes payable	30,000
Accounts receivable	120,000	Accrued wages	30,000
Inventories	160,000	Total current liabilities	$160,000
Total current assets	$380,000	Long-term debt	$180,000
Land and buildings (net)	$150,000	Preferred stock	$ 80,000
Machinery and equipment	250,000	Common stock (10,000 shares)	360,000
Total fixed assets (net)	$400,000	Total liabilities and stockholders' equity	$780,000
Total assets	$780,000		

Additional information with respect to the firm is available:
(1) Preferred stock can be liquidated at book value.
(2) Accounts receivable and inventories can be liquidated at 90% of book value.
(3) The firm has 10,000 shares of common stock outstanding.
(4) All interest and dividends are currently paid up.
(5) Land and buildings can be liquidated at 130% of book value.
(6) Machinery and equipment can be liquidated at 70% of book value.
(7) Cash and marketable securities can be liquidated at book value.

Given this information, answer the following:
a. What is Gallinas Industries' book value per share?
b. What is its liquidation value per share?
c. Compare, contrast, and discuss the values found in parts **a** and **b.**

LG5 **7–19** **Valuation with price/earnings multiples** For each of the firms shown in the following table, use the data given to estimate their common stock value employing price/earnings (P/E) multiples.

Firm	Expected EPS	Price/earnings multiple
A	$3.00	6.2
B	4.50	10.0
C	1.80	12.6
D	2.40	8.9
E	5.10	15.0

LG6 **7–20 Management action and stock value** REH Corporation's most recent dividend was $3 per share, its expected annual rate of dividend growth is 5%, and the required return is now 15%. A variety of proposals are being considered by management to redirect the firm's activities. Determine the impact on share price for each of the following proposed actions, and indicate the best alternative.

a. Do nothing, which will leave the key financial variables unchanged.
b. Invest in a new machine that will increase the dividend growth rate to 6% and lower the required return to 14%.
c. Eliminate an unprofitable product line, which will increase the dividend growth rate to 7% and raise the required return to 17%.
d. Merge with another firm, which will reduce the growth rate to 4% and raise the required return to 16%.
e. Acquire a subsidiary operation from another manufacturer. The acquisition should increase the dividend growth rate to 8% and increase the required return to 17%.

LG4 LG6 **7–21 Integrative—Valuation and CAPM formulas** Given the following information for the stock of Foster Company, calculate its beta.

Current price per share of common	$50.00
Expected dividend per share next year	$ 3.00
Constant annual dividend growth rate	9%
Risk-free rate of return	7%
Return on market portfolio	10%

LG4 LG6 **7–22 Integrative—Risk and valuation** Giant Enterprises has a beta of 1.20, the risk-free rate of return is currently 10%, and the market return is 14%. The company, which plans to pay a dividend of $2.60 per share in the coming year, anticipates that its future dividends will increase at an annual rate consistent with that experienced over the 1997–2003 period, when the following dividends were paid:

Year	Dividend per share
2003	$2.45
2002	2.28
2001	2.10
2000	1.95
1999	1.82
1998	1.80
1997	1.73

a. Use the capital asset pricing model (CAPM) to determine the required return on Giant's stock.
b. Using the constant-growth model and your finding in part **a,** estimate the value of Giant's stock.
c. Explain what effect, if any, a decrease in beta would have on the value of Giant's stock.

LG4 LG6 **7–23** **Integrative—Valuation and CAPM** Hamlin Steel Company wishes to determine the value of Craft Foundry, a firm that it is considering acquiring for cash. Hamlin wishes to use the capital asset pricing model (CAPM) to determine the applicable discount rate to use as an input to the constant-growth valuation model. Craft's stock is not publicly traded. After studying the betas of firms similar to Craft that are publicly traded, Hamlin believes that an appropriate beta for Craft's stock would be 1.25. The risk-free rate is currently 9%, and the market return is 13%. Craft's dividend per share for each of the past 6 years is shown in the following table.

Year	Dividend per share
2003	$3.44
2002	3.28
2001	3.15
2000	2.90
1999	2.75
1998	2.45

a. Given that Craft is expected to pay a dividend of $3.68 next year, determine the maximum cash price that Hamlin should pay for each share of Craft.

b. Discuss the use of the CAPM for estimating the value of common stock, and describe the effect on the resulting value of Craft of:

(1) A decrease in its dividend growth rate of 2% from that exhibited over the 1998–2003 period.

(2) A decrease in its beta to 1.

CHAPTER 7 CASE Assessing the Impact of Suarez Manufacturing's Proposed Risky Investment on Its Stock Value

Early in 2004, Inez Marcus, the chief financial officer for Suarez Manufacturing, was given the task of assessing the impact of a proposed risky investment on the firm's stock value. To perform the necessary analysis, Inez gathered the following information on the firm's stock.

During the immediate past 5 years (1999–2003), the annual dividends paid on the firm's common stock were as follows:

Year	Dividend per share
2003	$1.90
2002	1.70
2001	1.55
2000	1.40
1999	1.30

The firm expects that without the proposed investment, the dividend in 2004 will be $2.09 per share and the historical annual rate of growth (rounded to the nearest whole percent) will continue in the future. Currently, the required return on the common stock is 14%. Inez's research indicates that if the proposed investment is undertaken, the 2004 dividend will rise to $2.15 per share and the annual rate of dividend growth will increase to 13%. She feels that in the *best case*, the dividend would continue to grow at this rate each year into the future and that in the *worst case*, the 13% annual rate of growth in dividends would continue only through 2006, and then, at the beginning of 2007, would return to the rate that was experienced between 1999 and 2003. As a result of the increased risk associated with the proposed risky investment, the required return on the common stock is expected to increase by 2% to an annual rate of 16%, regardless of which dividend growth outcome occurs.

Armed with the preceding information, Inez must now assess the impact of the proposed risky investment on the market value of Suarez's stock. To simplify her calculations, she plans to round the historical growth rate in common stock dividends to the nearest whole percent.

Required

a. Find the *current* value per share of Suarez Manufacturing's common stock.
b. Find the value of Suarez's common stock in the event that it *undertakes the proposed risky investment* and assuming that the dividend growth rate stays at 13% forever. Compare this value to that found in part **a.** What effect would the proposed investment have on the firm's stockholders? Explain.
c. On the basis of your findings in part **b,** do the stockholders win or lose as a result of undertaking the proposed risky investment? Should the firm do it? Why?
d. Rework parts **b** and **c** assuming that at the beginning of 2007 the annual dividend growth rate returns to the rate experienced between 1999 and 2003.

WEB EXERCISE

To use the price/earnings multiples approach to valuation, you need to find a firm's projected earnings and the P/E multiple. One of the most popular sites to obtain these estimates is Zacks Investment Research, *www.zacks.com*.

1. At the top of the page, locate the area where you can enter a company's ticker symbol and select the desired information.
2. Enter OO for Oakley Inc. and select **estimates** from the pull-down menu.
   a. What is the current mean/consensus estimate for the next fiscal year's earnings?
   b. Using the indicated price/earnings ratio further down on that page, calculate the stock price.
3. Repeat steps **2a** and **b** for the following stocks:
   a. Southwest Airlines: LUV
   b. Microsoft: MSFT
   c. Weight Watchers: WTW

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

INTEGRATIVE CASE 2

Encore International

In the world of trendsetting fashion, instinct and marketing savvy are prerequisites to success. Jordan Ellis had both. During 2003, his international casual-wear company, Encore, rocketed to $300 million in sales after 10 years in business. His fashion line covered the young woman from head to toe with hats, sweaters, dresses, blouses, skirts, pants, sweatshirts, socks, and shoes. In Manhattan, there was an Encore shop every five or six blocks, each featuring a different color. Some shops showed the entire line in mauve, and others featured it in canary yellow.

Encore had made it. The company's historical growth was so spectacular that no one could have predicted it. However, securities analysts speculated that Encore could not keep up the pace. They warned that competition is fierce in the fashion industry and that the firm might encounter little or no growth in the future. They estimated that stockholders also should expect no growth in future dividends.

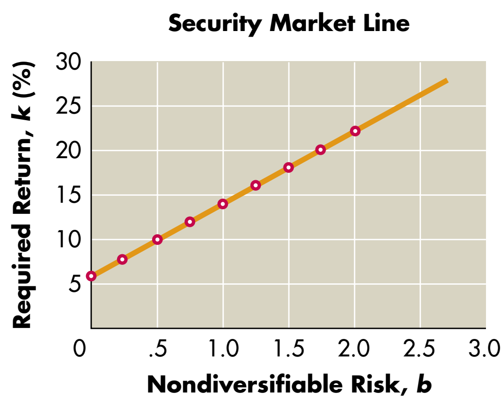
Contrary to the conservative securities analysts, Jordan Ellis felt that the company could maintain a constant annual growth rate in dividends per share of 6% in the future, or possibly 8% for the next 2 years and 6% thereafter. Ellis based his estimates on an established long-term expansion plan into European and Latin American markets. Venturing into these markets was expected to cause the risk of the firm, as measured by beta, to increase immediately from 1.10 to 1.25.

In preparing the long-term financial plan, Encore's chief financial officer has assigned a junior financial analyst, Marc Scott, to evaluate the firm's current stock price. He has asked Marc to consider the conservative predictions of the securities analysts and the aggressive predictions of the company founder, Jordan Ellis.

Marc has compiled these 2003 financial data to aid his analysis:

Data item	2003 value
Earnings per share (EPS)	$6.25
Price per share of common stock	$40.00
Book value of common stock equity	$60,000,000
Total common shares outstanding	2,500,000
Common stock dividend per share	$4.00

Figure 1



Data Points

b	k
0.00	6.00%
0.25	8.00
0.50	10.00
0.75	12.00
1.00	14.00
1.25	16.00
1.50	18.00
1.75	20.00
2.00	22.00

Required

a. What is the firm's current book value per share?

b. What is the firm's current P/E ratio?

c. (1) What are the required return and risk premium for Encore stock using the capital asset pricing model, assuming a beta of 1.10? (*Hint:* Use the security market line—with data points noted—given in Figure 1 to find the market return.)

(2) What are the required return and risk premium for Encore stock using the capital asset pricing model, assuming a beta of 1.25?

(3) What will be the effect on the required return if the beta rises as expected?

d. If the securities analysts are correct and there is no growth in future dividends, what will be the value per share of the Encore stock? (*Note:* Beta = 1.25.)

e. (1) If Jordan Ellis's predictions are correct, what will be the value per share of Encore stock if the firm maintains a constant annual 6% growth rate in future dividends? (*Note:* Beta = 1.25.)

(2) If Jordan Ellis's predictions are correct, what will be the value per share of Encore stock if the firm maintains a constant annual 8% growth rate in dividends per share over the next 2 years and 6% thereafter? (*Note:* Beta = 1.25.)

f. Compare the current (2003) price of the stock and the stock values found in parts **a, d,** and **e.** Discuss why these values may differ. Which valuation method do you believe most clearly represents the true value of the Encore stock?

CHAPTER

8

Capital Budgeting Cash Flows

LEARNING GOALS

LG1 Understand the key motives for capital expenditure and the steps in the capital budgeting process.

LG2 Define basic capital budgeting terminology.

LG3 Discuss the major components of relevant cash flows, expansion versus replacement cash flows, sunk costs and opportunity costs, and international capital budgeting and long-term investments.

LG4 Calculate the initial investment associated with a proposed capital expenditure.

LG5 Determine relevant operating cash inflows using the income statement format.

LG6 Find the terminal cash flow.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand capital budgeting cash flows in order to provide revenue, cost, depreciation, and tax data for use both in monitoring existing projects and in developing cash flows for proposed projects.

Information systems: You need to understand capital budgeting cash flows in order to maintain and facilitate the retrieval of cash flow data for both completed and existing projects.

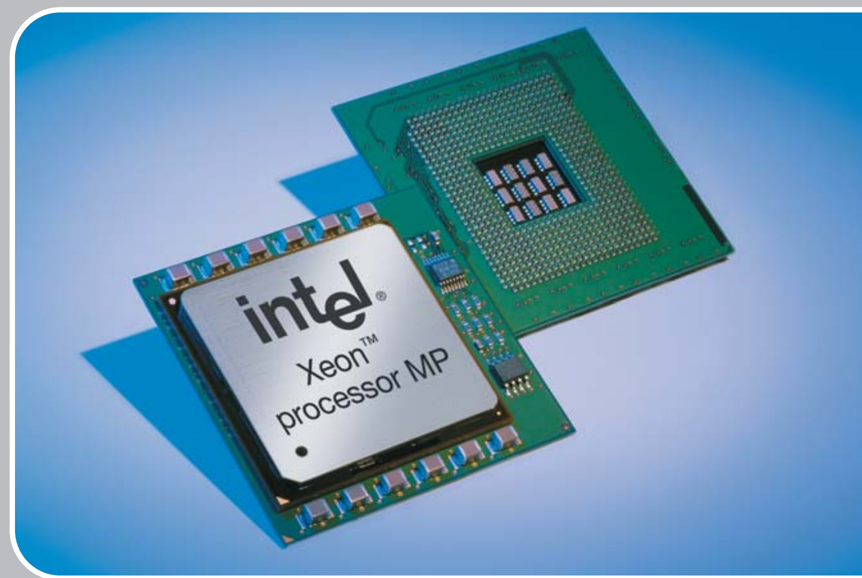
Management: You need to understand capital budgeting cash flows so that you will understand what cash flows are relevant in making decisions about proposals for acquiring additional production facilities, for new products, and for the expansion of existing product lines.

Marketing: You need to understand capital budgeting cash flows so that you can make revenue estimates for proposals for new marketing programs, for new products, and for the expansion of existing product lines.

Operations: You need to understand capital budgeting cash flows so that you can make cost estimates for proposals for the acquisition of new equipment and production facilities.

INTEL

CHIPPING AWAY AT E-BUSINESS INVESTMENT ANALYSIS



It should come as no surprise that **Intel,** the world's largest chip maker and technology pioneer, is also a leader in e-business. Chairman Andy Grove decided in 1998 that Intel would transform itself into a "100 percent e-corporation." Since then, each of the company's new business applications has been based on the Internet or on e-commerce. Leading the Internet initiative was CFO Andy Bryant, whose responsibilities were expanded to include enterprise services.

Bryant was an unlikely choice to lead the company's transformation, because he was skeptical about the value of e-commerce. He quickly changed his tune when he learned that Intel receives over one-quarter of its orders after hours. The flexibility of online ordering added value for customers. Intel has launched more than 300 e-business projects since 1998. In 2001, the company generated 90 percent of its revenue—$31.4 billion—from e-commerce transactions.

Ironically, Bryant's skepticism about e-commerce turned out to be a good thing. He developed methods to analyze e-business proposals to make sure they added value to the company, applying rigorous financial discipline and monitoring returns on investment. "Every project has an ROI," Bryant says. "It isn't always positive, but you still have to measure what you put in and what you get back."

The difficulty comes in deciding what to measure—and how. Like most companies, Intel already had expertise in evaluating new manufacturing facilities and other capital projects. But technology projects also have intangible benefits that aren't easily quantified. One of Bryant's challenges was formalizing financial accountability for e-business applications.

The company's track record has been quite good so far. E-business projects have reduced costs in many areas. For example, an electronic accounts payable (A/P) system was devised to take over many routine transactions so that employees could focus on analysis. Bryant estimates that the present value of this project's cash inflows, less the initial investment, is $8 million. And the company no longer misses opportunities to take advantage of discounts for prompt payments.

Like Intel, every firm must evaluate the costs and returns of projects for expansion, asset replacement or renewal, research and development, advertising, and other areas that require long-term commitments of funds in expectation of future returns. Chapter 8 introduces this process, which is called *capital budgeting,* and explains how to identify the relevant cash outflows and inflows that must be considered in making capital budgeting decisions.

LG1 LG2 8.1 The Capital Budgeting Decision Process

Long-term investments represent sizable outlays of funds that commit a firm to some course of action. Consequently, the firm needs procedures to analyze and properly select its long-term investments. It must be able to measure cash flows and apply appropriate decision techniques. As time passes, fixed assets may become obsolete or may require an overhaul; at these points, too, financial decisions may be required. **Capital budgeting** is the process of evaluating and selecting long-term investments that are consistent with the firm's goal of maximizing owner wealth. Firms typically make a variety of long-term investments, but the most common for the manufacturing firm is in *fixed assets,* which include property (land), plant, and equipment. These assets, often referred to as *earning assets,* generally provide the basis for the firm's earning power and value.

capital budgeting
The process of evaluating and selecting long-term investments that are consistent with the firm's goal of maximizing owner wealth.

Because firms treat capital budgeting (investment) and financing decisions *separately,* Chapters 8 through 10 concentrate on fixed-asset acquisition without regard to the specific method of financing used. We begin by discussing the motives for capital expenditure.

Motives for Capital Expenditure

A **capital expenditure** is an outlay of funds by the firm that is expected to produce benefits over a period of time *greater than* 1 year. An **operating expenditure** is an outlay resulting in benefits received *within* 1 year. Fixed-asset outlays are capital expenditures, but not all capital expenditures are classified as fixed assets. A $60,000 outlay for a new machine with a usable life of 15 years is a capital expenditure that would appear as a fixed asset on the firm's balance sheet. A $60,000 outlay for advertising that produces benefits over a long period is also a capital expenditure, but would rarely be shown as a fixed asset.[1]

capital expenditure
An outlay of funds by the firm that is expected to produce benefits over a period of time *greater than* 1 year.

operating expenditure
An outlay of funds by the firm resulting in benefits received *within* 1 year.

Capital expenditures are made for many reasons. The basic motives for capital expenditures are to expand, replace, or renew fixed assets or to obtain some other, less tangible benefit over a long period. Table 8.1 briefly describes the key motives for making capital expenditures.

Steps in the Process

The **capital budgeting process** consists of five distinct but interrelated steps.

capital budgeting process
Five distinct but interrelated steps: *proposal generation, review and analysis, decision making, implementation,* and *follow-up.*

1. *Proposal generation.* Proposals are made at all levels within a business organization and are reviewed by finance personnel. Proposals that require large outlays are more carefully scrutinized than less costly ones.
2. *Review and analysis.* Formal review and analysis is performed to assess the appropriateness of proposals and evaluate their economic viability. Once the analysis is complete, a summary report is submitted to decision makers.

1. Some firms do, in effect, capitalize advertising outlays if there is reason to believe that the benefit of the outlay will be received at some future date. The capitalized advertising may appear as a deferred charge such as "deferred advertising expense," which is then amortized over the future. Expenses of this type are often deferred for reporting purposes to increase reported earnings, whereas for tax purposes, the entire amount is expensed to reduce tax liability.

TABLE 8.1 Key Motives for Making Capital Expenditures

Motive	Description
Expansion	The most common motive for a capital expenditure is to expand the level of operations—usually through acquisition of fixed assets. A growing firm often needs to acquire new fixed assets rapidly, as in the purchase of property and plant facilities.
Replacement	As a firm's growth slows and it reaches maturity, most capital expenditures will be made to replace or renew obsolete or worn-out assets. Each time a machine requires a major repair, the outlay for the repair should be compared to the outlay to replace the machine and the benefits of replacement.
Renewal	Renewal, an alternative to replacement, may involve rebuilding, overhauling, or retrofitting an existing fixed asset. For example, an existing drill press could be renewed by replacing its motor and adding a numeric control system, or a physical facility could be renewed by rewiring and adding air conditioning. To improve efficiency, both replacement and renewal of existing machinery may be suitable solutions.
Other purposes	Some capital expenditures do not result in the acquisition or transformation of tangible fixed assets. Instead, they involve a long-term commitment of funds in expectation of a future return. These expenditures include outlays for advertising, research and development, management consulting, and new products. Other capital expenditure proposals—such as the installation of pollution-control and safety devices mandated by the government—are difficult to evaluate because they provide intangible returns rather than clearly measurable cash flows.

3. *Decision making*. Firms typically delegate capital expenditure decision making on the basis of dollar limits. Generally, the board of directors must authorize expenditures beyond a certain amount. Often plant managers are given authority to make decisions necessary to keep the production line moving.
4. *Implementation*. Following approval, expenditures are made and projects implemented. Expenditures for a large project often occur in phases.
5. *Follow-up*. Results are monitored, and actual costs and benefits are compared with those that were expected. Action may be required if actual outcomes differ from projected ones.

Each step in the process is important. Review and analysis and decision making (Steps 2 and 3) consume the majority of time and effort, however. Follow-up (Step 5) is an important but often ignored step aimed at allowing the firm to improve the accuracy of its cash flow estimates continuously. Because of their fundamental importance, this and the following chapters give primary consideration to review and analysis and to decision making.

Basic Terminology

Before we develop the concepts, techniques, and practices related to the capital budgeting process, we need to explain some basic terminology. In addition, we will present some key assumptions that are used to simplify the discussion in the remainder of this chapter and in Chapters 9 and 10.

In Practice

FOCUS ON e-FINANCE Information Technology's Big Byte

Information technology (IT) is one of a company's largest capital expense categories. In the rapidly changing IT environment, managers clamor for the latest hardware and software upgrades to keep IT systems current and improve operational efficiencies. The right IT applications, they claim, can save millions in operating costs. Financial managers, on the other hand, struggle to control capital spending while at the same time approving projects that boost the company's competitive position. Although some of these projects involve the latest hardware and software, many more now focus on leveraging the firm's investment in existing technology by centralizing technology services, integrating the different parts of a company's information systems, and making similar improvements. E-business projects are also on the rise and now account for an average of 15.5 percent of the total IT budget.

With so much at stake in terms of dollars spent and potential benefits, managers must create a business case that justifies the project and shows how it adds value—no easy task. In addition to measuring dollar benefits that appear on the firm's income statement, they must attempt to quantify indirect and qualitative benefits. This may be straightforward for transactional systems, where order volume is a critical measure. But how does the company assign a dollar value to, for example, the increased customer satisfaction generated by a new, easier-to-use interface for its customer information system?

During 2001, declining sales and an uncertain economic future meant companies had to choose IT projects that yielded the greatest return on investment or gave the biggest strategic advantage. Gary Clark, director of corporate IT services at **La-Z-Boy Inc.**, the leading U.S. manufacturer of upholstered furniture, said, "Previously, we would look primarily at high-level issues. Now, we're not only examining the details of a project but also the underlying assumptions and the business case. It's all about cost and results." La-Z-Boy decided to postpone projects related to information security and general business systems but moved ahead with strategic technology projects. For example, analysis of a new payroll and human resources system showed that it should lower costs for the entire organization.

Sources: Shari Caudron, "The Tao of E-Business," *Business Finance* (September 2001), downloaded from *www.businessfinance.com;* Sam Greengard, "IT: Luxury or Necessity?" *Industry Week* (December 1, 2001), downloaded from *www. industryweek.com;* and Ivy McLemore, "High Stakes Game," *Business Finance* (May 1999), downloaded from *www.businessfinance.com.*

Independent versus Mutually Exclusive Projects

independent projects
Projects whose cash flows are unrelated or independent of one another; the acceptance of one *does not eliminate* the others from further consideration.

mutually exclusive projects
Projects that compete with one another, so that the acceptance of one *eliminates* from further consideration all other projects that serve a similar function.

The two most common types of projects are (1) independent projects and (2) mutually exclusive projects. **Independent projects** are those whose cash flows are unrelated or independent of one another; the acceptance of one *does not eliminate* the others from further consideration. **Mutually exclusive projects** are those that have the same function and therefore compete with one another. The acceptance of one *eliminates* from further consideration all other projects that serve a similar function. For example, a firm in need of increased production capacity could obtain it by (1) expanding its plant, (2) acquiring another company, or (3) contracting with another company for production. Clearly, accepting any one option eliminates the need for either of the others.

Unlimited Funds versus Capital Rationing

unlimited funds
The financial situation in which a firm is able to accept all independent projects that provide an acceptable return.

The availability of funds for capital expenditures affects the firm's decisions. If a firm has **unlimited funds** for investment, making capital budgeting decisions is quite simple: All independent projects that will provide an acceptable return can

capital rationing
The financial situation in which a firm has only a fixed number of dollars available for capital expenditures, and numerous projects compete for these dollars.

be accepted. Typically, though, firms operate under **capital rationing** instead. This means that they have only a fixed number of dollars available for capital expenditures and that numerous projects will compete for these dollars. Procedures for dealing with capital rationing are presented in Chapter 10. The discussions that follow here and in the following chapter assume unlimited funds.

Accept–Reject versus Ranking Approaches

accept–reject approach
The evaluation of capital expenditure proposals to determine whether they meet the firm's minimum acceptance criterion.

ranking approach
The ranking of capital expenditure projects on the basis of some predetermined measure, such as the rate of return.

Two basic approaches to capital budgeting decisions are available. The **accept–reject approach** involves evaluating capital expenditure proposals to determine whether they meet the firm's minimum acceptance criterion. This approach can be used when the firm has unlimited funds, as a preliminary step when evaluating mutually exclusive projects, or in a situation in which capital must be rationed. In these cases, only acceptable projects should be considered.

The second method, the **ranking approach,** involves ranking projects on the basis of some predetermined measure, such as the rate of return. The project with the highest return is ranked first, and the project with the lowest return is ranked last. Only acceptable projects should be ranked. Ranking is useful in selecting the "best" of a group of mutually exclusive projects and in evaluating projects with a view to capital rationing.

Conventional versus Nonconventional Cash Flow Patterns

conventional cash flow pattern
An initial outflow followed only by a series of inflows.

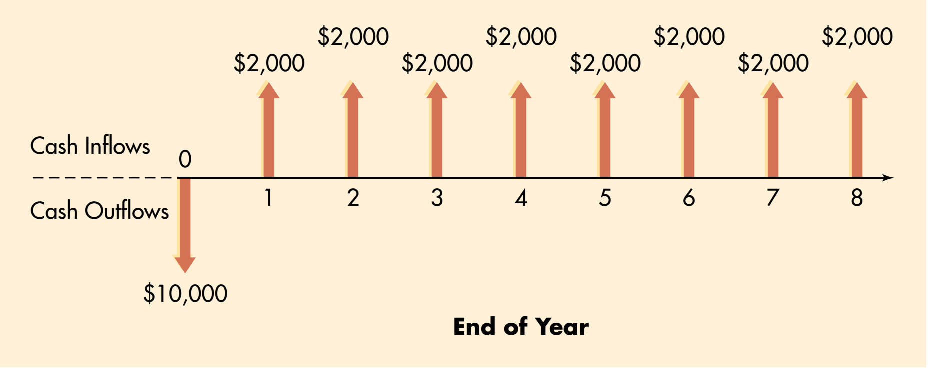
nonconventional cash flow pattern
An initial outflow followed by a series of inflows *and* outflows.

Cash flow patterns associated with capital investment projects can be classified as *conventional* or *nonconventional.* A **conventional cash flow pattern** consists of an initial outflow followed only by a series of inflows. For example, a firm may spend $10,000 today and as a result expect to receive equal annual cash inflows (an annuity) of $2,000 each year for the next 8 years, as depicted on the time line in Figure 8.1.[2] A conventional cash flow pattern that provides unequal annual cash inflows is depicted in Figure 8.3 on page 361.

A **nonconventional cash flow pattern** is one in which an initial outflow is followed by a series of inflows *and* outflows. For example, the purchase of a machine

FIGURE 8.1

Conventional Cash Flow
Time line for a conventional cash flow pattern

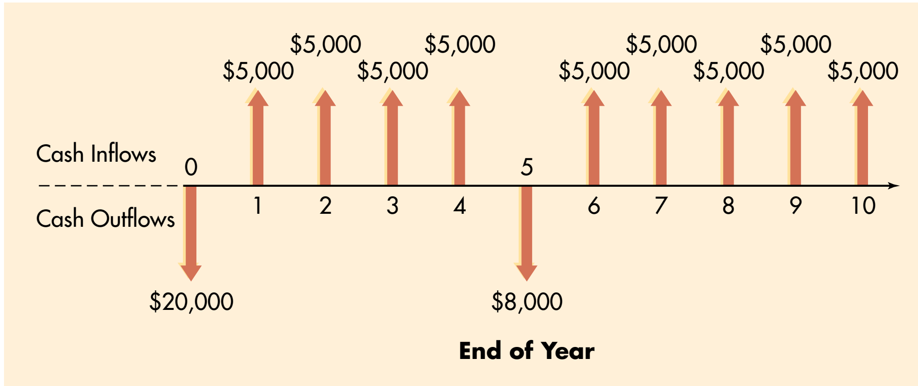


2. Arrows rather than plus or minus signs are frequently used on time lines to distinguish between cash inflows and cash outflows. Upward-pointing arrows represent cash inflows (positive cash flows), and downward-pointing arrows represent cash outflows (negative cash flows).

FIGURE 8.2

Nonconventional Cash Flow

Time line for a nonconventional cash flow pattern



may require an initial cash outflow of $20,000 and may generate cash inflows of $5,000 each year for 4 years. In the fifth year after purchase, an outflow of $8,000 may be required to overhaul the machine, after which it generates inflows of $5,000 each year for 5 more years. This nonconventional pattern is illustrated on the time line in Figure 8.2.

Difficulties often arise in evaluating projects with nonconventional patterns of cash flow. *The discussions in the remainder of this chapter and in Chapters 9 and 10 are therefore limited to the evaluation of conventional cash flow patterns.*

Review Questions

8–1 What is *capital budgeting?* Do all capital expenditures involve fixed assets? Explain.

8–2 What are the key motives for making capital expenditures? Discuss, compare, and contrast them.

8–3 What are the five steps involved in the capital budgeting process?

8–4 Differentiate between the members of each of the following pairs of capital budgeting terms: (**a**) independent versus mutually exclusive projects; (**b**) unlimited funds versus capital rationing; (**c**) accept–reject versus ranking approaches; and (**d**) conventional versus nonconventional cash flow patterns.

LG3 8.2 The Relevant Cash Flows

relevant cash flows
The *incremental cash outflow (investment) and resulting subsequent inflows* associated with a proposed capital expenditure.

incremental cash flows
The *additional* cash flows—outflows or inflows—expected to result from a proposed capital expenditure.

To evaluate capital expenditure alternatives, the firm must determine the **relevant cash flows.** These are the *incremental cash outflow (investment) and resulting subsequent inflows.* The **incremental cash flows** represent the *additional* cash flows—outflows or inflows—expected to result from a proposed capital expenditure. As noted in Chapter 3, cash flows rather than accounting figures are used, because cash flows directly affect the firm's ability to pay bills and purchase assets. The remainder of this chapter is devoted to the procedures for measuring the relevant cash flows associated with proposed capital expenditures.

Major Cash Flow Components

initial investment
The relevant cash outflow for a proposed project at time zero.

operating cash inflows
The incremental after-tax cash inflows resulting from implementation of a project during its life.

terminal cash flow
The after-tax nonoperating cash flow occurring in the final year of a project. It is usually attributable to liquidation of the project.

The cash flows of any project having the *conventional pattern* can include three basic components: (1) an initial investment, (2) operating cash inflows, and (3) terminal cash flow. All projects—whether for expansion, replacement, renewal, or some other purpose—have the first two components. Some, however, lack the final component, terminal cash flow.

Figure 8.3 depicts on a time line the cash flows for a project. The **initial investment** for the proposed project is $50,000. This is the relevant cash outflow at time zero. The **operating cash inflows,** which are the incremental after-tax cash inflows resulting from implementation of the project during its life, gradually increase from $4,000 in its first year to $10,000 in its tenth and final year. The **terminal cash flow** is the after-tax nonoperating cash flow occurring in the final year of the project. It is usually attributable to liquidation of the project. In this case it is $25,000, received at the end of the project's 10-year life. Note that the terminal cash flow does *not* include the $10,000 operating cash inflow for year 10.

Expansion versus Replacement Cash Flows

Developing relevant cash flow estimates is most straightforward in the case of *expansion decisions*. In this case, the initial investment, operating cash inflows, and terminal cash flow are merely the after-tax cash outflow and inflows associated with the proposed capital expenditure.

Identifying relevant cash flows for *replacement decisions* is more complicated, because the firm must identify the *incremental* cash outflow and inflows that would result from the proposed replacement. The initial investment in the case of replacement is the difference between the initial investment needed to acquire the new asset and any after-tax cash inflows expected from liquidation of

FIGURE 8.3

Cash Flow Components
Time line for major cash flow components

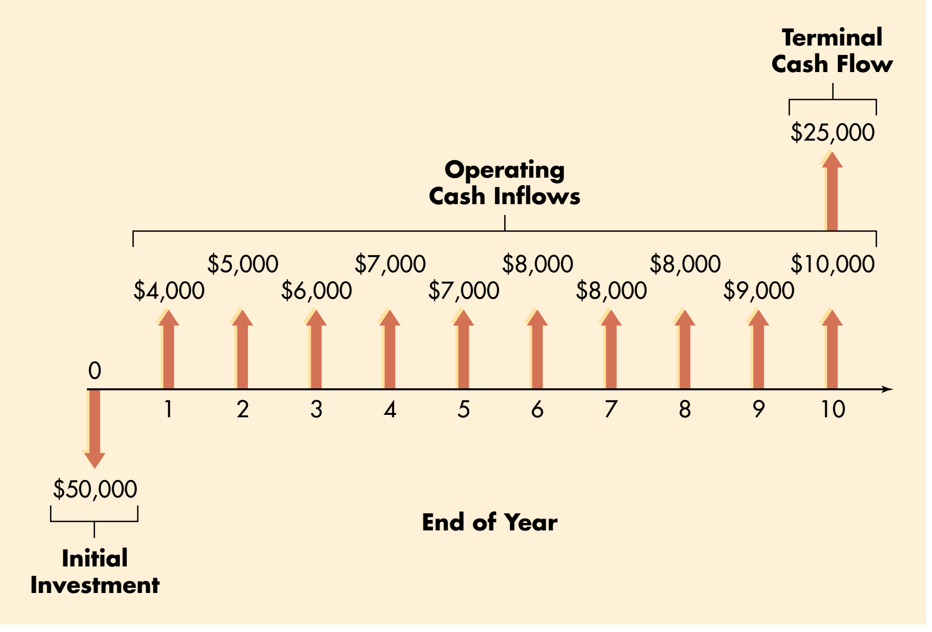
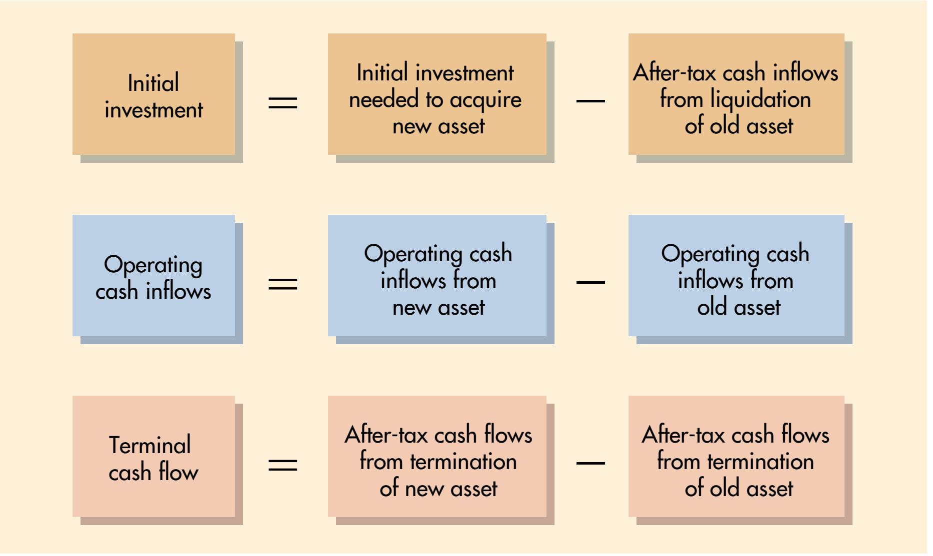


FIGURE 8.4

Relevant Cash Flows for Replacement Decisions
Calculation of the three components of relevant cash flow for a replacement decision



the old asset. The operating cash inflows are the difference between the operating cash inflows from the new asset and those from the old asset. The terminal cash flow is the difference between the after-tax cash flows expected upon termination of the new and the old assets. These relationships are shown in Figure 8.4.

Actually, all capital budgeting decisions can be viewed as replacement decisions. Expansion decisions are merely replacement decisions in which all cash flows from the old asset are zero. In light of this fact, this chapter focuses primarily on replacement decisions.

Sunk Costs and Opportunity Costs

When estimating the relevant cash flows associated with a proposed capital expenditure, the firm must recognize any *sunk costs* and *opportunity costs*. These costs are easy to mishandle or ignore, particularly when determining a project's incremental cash flows. **Sunk costs** are cash outlays that have already been made (past outlays) and therefore have no effect on the cash flows relevant to the current decision. As a result, *sunk costs should not be included in a project's incremental cash flows*.

sunk costs
Cash outlays that have already been made (past outlays) and therefore have no effect on the cash flows relevant to a current decision.

Opportunity costs are cash flows that could be realized from the best alternative use of an owned asset. They therefore represent cash flows that will *not be realized* as a result of employing that asset in the proposed project. Because of this, any *opportunity costs should be included as cash outflows when one is determining a project's incremental cash flows*.

opportunity costs
Cash flows that could be realized from the best alternative use of an owned asset.

EXAMPLE

Jankow Equipment is considering renewing its drill press X12, which it purchased 3 years earlier for $237,000, by retrofitting it with the computerized control system from an obsolete piece of equipment it owns. The obsolete equipment could be sold today for a high bid of $42,000, but without its computerized control system, it would be worth nothing. Jankow is in the process of estimating the labor

In Practice

FOCUS ON PRACTICE Coors Brews Better Financial Performance

As **Coors Brewing Company** grew from a local brewer to the number-3 national brand, it went on a capital spending spree to add capacity. The firm needed better financial planning, however: Managers did not prepare project cost reports, the company bought top-of-the-line equipment, top management approved projects in spite of unattractive projected returns. By the early 1990s, Coors' financial performance was suffering.

This changed in 1995 when seasoned financial executive Tim Wolf joined Coors as CFO. Wolf quickly identified the need for greater financial discipline in planning and capital budgeting. He implemented more stringent guidelines for capital spending and required business unit managers to develop a sound business case to justify proposed capital expenditures. He also created a partnership between finance and operating departments, which now recognized the key role that finance plays.

The first project to use Wolf's new capital budgeting procedures was a facility to wash and sanitize returnable bottles. Before replacing outdated equipment, managers analyzed the financial implications of six operating scenarios to determine the best alternative: moving the facility to Virginia. Every department that would be affected had input into the facility's design and into estimates of its operating costs. The project team presented the complete business case to Wolf, who spent 6 months asking questions that resulted in cutting over 25 percent from the initial cost estimates. "I think the extra time was well spent," says Wolf. "If you can reduce your capital costs, leverage the benefits, and get them faster, that's the way to run your capital process."

In Wolf's first 3 years at Coors, capital spending dropped significantly, return on invested capital rose from 5.9 percent in 1995 to 8.8 percent in late 1997, and cash flow went from a negative $26 million to a positive $138 million. The company continued to apply its disciplined capital budgeting approach to expansion projects required to meet a large increase in demand. By 2000, return on invested capital was almost 12 percent, and return on equity was almost 13 percent. The result was improved shareholder value as the stock price climbed from $19 in early 1997 to peak at $82 in December 2000; it was trading at about $65 a share in March 2002.

Sources: Stephen Barr, "Coors's New Brew," *CFO* (March 1998), downloaded from *www.cfonet.com; Coors Annual Report, 2000, www.coors.com;* "Coors Reports 13 Percent Rise," *AP Online* (October 25, 2001), downloaded from *Electric Library, ask.elibrary.com;* and John Rebchook, "Coors Building Expanded Distribution Facility off I-70," *Denver Rocky Mountain News* (December 19, 2001), p. 4B.

Hint Sunk costs and opportunity costs are concepts you must fully understand. Funds already spent are irrelevant to future decisions, but funds given to one project that eliminates the investment returns of another project *are* considered a relevant cost.

and materials costs of retrofitting the system to drill press X12 and the benefits expected from the retrofit. The $237,000 cost of drill press X12 is a *sunk cost* because it represents an earlier cash outlay. It *would not be included* as a cash outflow when determining the cash flows relevant to the retrofit decision. Although Jankow owns the obsolete piece of equipment, the proposed use of its computerized control system represents an *opportunity cost* of $42,000—the highest price at which it could be sold today. This opportunity cost *would be included* as a cash outflow associated with using the computerized control system.

International Capital Budgeting and Long-Term Investments

Although the same basic capital budgeting principles are used for domestic and international projects, several additional factors must be addressed in evaluating foreign investment opportunities. International capital budgeting differs from the domestic version because (1) cash outflows and inflows occur in a foreign currency, and (2) foreign investments entail potentially significant political risk. Both of these risks can be minimized through careful planning.

Companies face both long-term and short-term *currency risks* related to both the invested capital and the cash flows resulting from it. Long-term currency risk can be minimized by financing the foreign investment at least partly in the local capital markets rather than with dollar-denominated capital from the parent company. This step ensures that the project's revenues, operating costs, and financing costs will be in the local currency. Likewise, the dollar value of short-term, local-currency cash flows can be protected by using special securities and strategies such as futures, forwards, and options market instruments.

Political risks can be minimized by using both operating and financial strategies. For example, by structuring the investment as a joint venture and selecting a well-connected local partner, the U.S. company can minimize the risk of its operations being seized or harassed. Companies also can protect themselves from having their investment returns blocked by local governments by structuring the financing of such investments as debt rather than as equity. Debt-service payments are legally enforceable claims, whereas equity returns (such as dividends) are not. Even if local courts do not support the claims of the U.S. company, the company can threaten to pursue its case in U.S. courts.

foreign direct investment
The transfer of capital, managerial, and technical assets to a foreign country.

In spite of the preceding difficulties, **foreign direct investment,** which involves the transfer of capital, managerial, and technical assets to a foreign country, has surged in recent years. This is evident in the growing market values of foreign assets owned by U.S.-based companies and of foreign direct investment in the United States, particularly by British, Canadian, Dutch, German, and Japanese companies. Furthermore, foreign direct investment by U.S. companies seems to be accelerating.

Review Questions

8–5 Why is it important to evaluate capital budgeting projects on the basis of *incremental cash flows?*

8–6 What three components of cash flow may exist for a given project? How can expansion decisions be treated as replacement decisions? Explain.

8–7 What effect do *sunk costs* and *opportunity costs* have on a project's incremental cash flows?

8–8 How can *currency risk* and *political risk* be minimized when one is making *foreign direct investment?*

LG4 8.3 Finding the Initial Investment

The term *initial investment* as used here refers to the relevant cash outflows to be considered when evaluating a prospective capital expenditure. Because our discussion of capital budgeting is concerned only with investments that exhibit conventional cash flows, the initial investment occurs at *time zero*—the time at which the expenditure is made. The initial investment is calculated by subtracting all cash inflows occurring at time zero from all cash outflows occurring at time zero.

The basic format for determining the initial investment is given in Table 8.2. The cash flows that must be considered when determining the initial investment

TABLE 8.2 The Basic Format for Determining Initial Investment

	Installed cost of new asset =
	Cost of new asset
	+ Installation costs
−	**After-tax proceeds from sale of old asset =**
	Proceeds from sale of old asset
	∓ Tax on sale of old asset
±	**Change in net working capital**
	Initial investment

associated with a capital expenditure are the installed cost of the new asset, the after-tax proceeds (if any) from the sale of an old asset, and the change (if any) in net working capital. Note that if there are no installation costs and the firm is not replacing an existing asset, then the purchase price of the asset, adjusted for any change in net working capital, is equal to the initial investment.

cost of new asset
The net outflow necessary to acquire a new asset.

installation costs
Any added costs that are necessary to place an asset into operation.

installed cost of new asset
The cost of the asset plus its installation costs; equals the asset's depreciable value.

after-tax proceeds from sale of old asset
The difference between the old asset's sale proceeds and any applicable taxes or tax refunds related to its sale.

proceeds from sale of old asset
The cash inflows, net of any *removal* or *cleanup costs,* resulting from the sale of an existing asset.

tax on sale of old asset
Tax that depends on the relationship among the old asset's sale price, initial purchase price, and *book value,* and on existing government tax rules.

Installed Cost of New Asset

As shown in Table 8.2, the installed cost of the new asset is found by adding the cost of the new asset to its installation costs. The **cost of new asset** is the net outflow that its acquisition requires. Usually, we are concerned with the acquisition of a fixed asset for which a definite purchase price is paid. **Installation costs** are any added costs that are necessary to place an asset into operation. The Internal Revenue Service (IRS) requires the firm to add installation costs to the purchase price of an asset to determine its depreciable value, which is expensed over a period of years. The **installed cost of new asset,** calculated by adding the cost of the asset to its installation costs, equals its depreciable value.

After-Tax Proceeds from Sale of Old Asset

Table 8.2 shows that the **after-tax proceeds from sale of old asset** decrease the firm's initial investment in the new asset. These proceeds are the difference between the old asset's sale proceeds and any applicable taxes or tax refunds related to its sale. The **proceeds from sale of old asset** are the net cash inflows it provides. This amount is net of any costs incurred in the process of removing the asset. Included in these *removal costs* are *cleanup costs,* such as those related to removal and disposal of chemical and nuclear wastes. These costs may not be trivial.

The proceeds from the sale of an old asset are normally subject to some type of tax.[3] This **tax on sale of old asset** depends on the relationship among its sale price, initial purchase price, and *book value,* and on existing government tax rules.

3. A brief discussion of the tax treatment of ordinary and capital gains income was presented in Chapter 1.

book value
The strict accounting value of an asset, calculated by subtracting its accumulated depreciation from its installed cost.

Book Value

The **book value** of an asset is its strict accounting value. It can be calculated by using the following equation:

$$\text{Book value} = \text{Installed cost of asset} - \text{Accumulated depreciation} \qquad (8.1)$$

EXAMPLE

Hudson Industries, a small electronics company, 2 years ago acquired a machine tool with an installed cost of \$100,000. The asset was being depreciated under MACRS using a 5-year recovery period.[4] Table 3.2 (page 100) shows that under MACRS for a 5-year recovery period, 20% and 32% of the installed cost would be depreciated in years 1 and 2, respectively. In other words, 52% (20% + 32%) of the \$100,000 cost, or \$52,000 (0.52 × \$100,000), would represent the accumulated depreciation at the end of year 2. Substituting into Equation 8.1, we get

$$\text{Book value} = \$100{,}000 - \$52{,}000 = \underline{\underline{\$48{,}000}}$$

The book value of Hudson's asset at the end of year 2 is therefore \$48,000.

Basic Tax Rules

Four potential tax situations can occur when an asset is sold. These situations depend on the relationship between the asset's sale price, its initial purchase price, and its book value. The three key forms of taxable income and their associated tax treatments are defined and summarized in Table 8.3. The assumed tax rates used throughout this text are noted in the final column. There are four possible tax situations, which result in one or more forms of taxable income: The

TABLE 8.3 Tax Treatment on Sales of Assets

Form of taxable income	Definition	Tax treatment	Assumed tax rate
Capital gain	Portion of the sale price that is in excess of the initial purchase price.	Regardless of how long the asset has been held, the total capital gain is taxed as ordinary income.	40%
Recaptured depreciation	Portion of the sale price that is in excess of book value and represents a recovery of previously taken depreciation.	All recaptured depreciation is taxed as ordinary income.	40%
Loss on sale of asset	Amount by which sale price is *less than* book value.	If the asset is depreciable and used in business, loss is deducted from ordinary income.	40% of loss is a tax savings
		If the asset is *not* depreciable or is *not* used in business, loss is deductible only against capital gains.	40% of loss is a tax savings

4. For a review of MACRS, see Chapter 3. Under current tax law, most manufacturing equipment has a 7-year recovery period, as noted in Table 3.1. Using this recovery period results in 8 years of depreciation, which unnecessarily complicates examples and problems. To simplify, *manufacturing equipment is treated as a 5-year asset in this and the following chapters.*

asset may be sold (1) for more than its initial purchase price, (2) for more than its book value but less than its initial purchase price, (3) for its book value, or (4) for less than its book value. An example will illustrate.

EXAMPLE

The old asset purchased 2 years ago for $100,000 by Hudson Industries has a current book value of $48,000. What will happen if the firm now decides to sell the asset and replace it? The tax consequences depend on the sale price. Figure 8.5 on page 368 depicts the taxable income resulting from four possible sale prices in light of the asset's initial purchase price of $100,000 and its current book value of $48,000. The taxable consequences of each of these sale prices is described below.

recaptured depreciation
The portion of an asset's sale price that is above its book value and below its initial purchase price.

The sale of the asset for more than its initial purchase price If Hudson sells the old asset for $110,000, it realizes a capital gain of $10,000, which is taxed as ordinary income.[5] The firm also experiences ordinary income in the form of **recaptured depreciation,** which is the portion of the sale price that is above book value and below the initial purchase price. In this case there is recaptured depreciation of $52,000 ($100,000 − $48,000). Both the $10,000 capital gain and the $52,000 recaptured depreciation are shown under the $110,000 sale price in Figure 8.5. The taxes on the total gain of $62,000 are calculated as follows:

	Amount (1)	Rate (2)	Tax [(1) × (2)] (3)
Capital gain	$10,000	0.40	$ 4,000
Recaptured depreciation	52,000	0.40	20,800
Totals	$62,000		$24,800

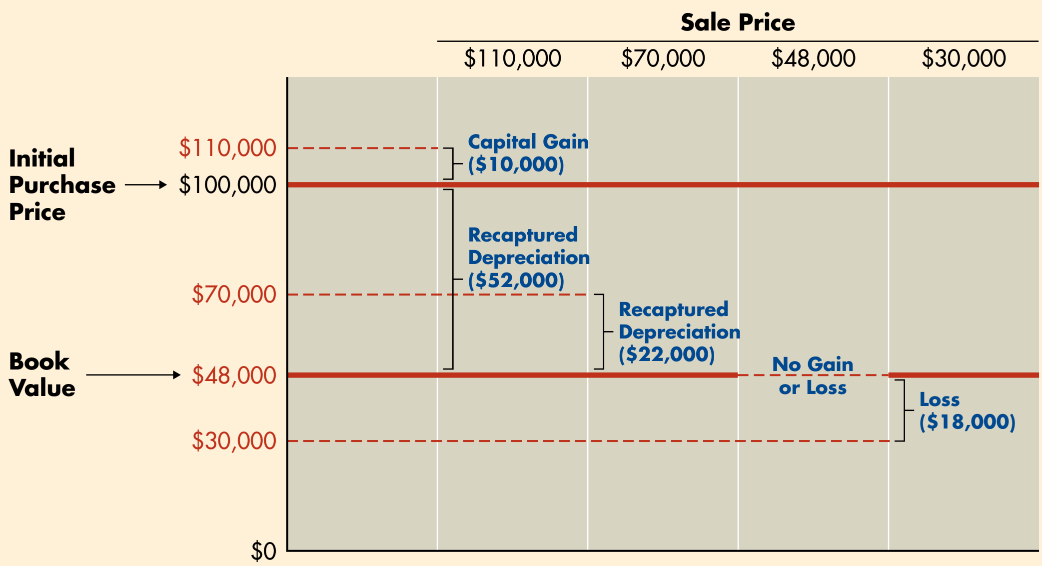
These taxes should be used in calculating the initial investment in the new asset, using the format in Table 8.2. In effect, the taxes raise the amount of the firm's initial investment in the new asset by reducing the proceeds from the sale of the old asset.

The sale of the asset for more than its book value but less than its initial purchase price If Hudson sells the old asset for $70,000, there is no capital gain. However, the firm still experiences a gain in the form of recaptured depreciation of $22,000 ($70,000 − $48,000), as shown under the $70,000 sale price in Figure 8.5. This recaptured depreciation is taxed as ordinary income. Because the firm is assumed to be in the 40% tax bracket, the taxes on the $22,000 gain are $8,800. This amount in taxes should be used in calculating the initial investment in the new asset.

The sale of the asset for its book value If the asset is sold for $48,000, its book value, the firm breaks even. There is no gain or loss, as shown under the $48,000

5. Although the current tax law requires corporate capital gains to be treated as ordinary income, the structure for corporate capital gains is retained under the law to facilitate a rate differential in the likely event of future tax revisions. Therefore, this distinction is made throughout the text discussions.

FIGURE 8.5 **Taxable Income from Sale of Asset**
Taxable income from sale of asset at various sale prices for Hudson Industries



sale price in Figure 8.5. Because *no tax results from selling an asset for its book value,* there is no tax effect on the initial investment in the new asset.

The sale of the asset for less than its book value If Hudson sells the asset for $30,000, it experiences a loss of $18,000 ($48,000 − $30,000), as shown under the $30,000 sale price in Figure 8.5. If this is a depreciable asset used in the business, the loss may be used to offset ordinary operating income. If the asset is *not* depreciable or is *not* used in the business, the loss can be used only to offset capital gains. In either case, the loss will save the firm $7,200 ($18,000 × 0.40) in taxes. And, if current operating earnings or capital gains are not sufficient to offset the loss, the firm may be able to apply these losses to prior or future years' taxes.[6]

Change in Net Working Capital[7]

net working capital
The amount by which a firm's current assets exceed its current liabilities.

Net working capital is the amount by which a firm's current assets exceed its current liabilities. This topic is treated in depth in Chapter 14, but at this point it is important to note that changes in net working capital often accompany capital expenditure decisions. If a firm acquires new machinery to expand its level of operations, it will experience an increase in levels of cash, accounts receivable, inventories, accounts payable, and accruals. These increases result from the need

6. As noted in Chapter 1, the tax law provides detailed procedures for using *tax loss carrybacks/carryforwards.* Application of such procedures to capital budgeting is beyond the scope of this text, and they are therefore ignored in subsequent discussions.

7. Occasionally, this cash outflow is intentionally ignored to enhance the attractiveness of a proposed investment and thereby improve its likelihood of acceptance. Similar intentional omissions and/or overly optimistic estimates are sometimes made to enhance project acceptance. The presence of formal review and analysis procedures should help the firm to ensure that capital budgeting cash flow estimates are realistic and unbiased and that the "best" projects—those that make the maximum contribution to owner wealth—are accepted.

TABLE 8.4 Calculation of Change in Net Working Capital for Danson Company

Current account	Change in balance	
Cash	+$ 4,000	
Accounts receivable	+ 10,000	
Inventories	+ 8,000	
(1) Current assets		+$22,000
Accounts payable	+$ 7,000	
Accruals	+ 2,000	
(2) Current liabilities		+ 9,000
Change in net working capital [(1) − (2)]		+$13,000

for more cash to support expanded operations, more accounts receivable and inventories to support increased sales, and more accounts payable and accruals to support increased outlays made to meet expanded product demand. As noted in Chapter 3, increases in cash, accounts receivable, and inventories are *outflows of cash,* whereas increases in accounts payable and accruals are *inflows of cash.*

change in net working capital
The difference between a change in current assets and a change in current liabilities.

The difference between the change in current assets and the change in current liabilities is the **change in net working capital.** Generally, current assets increase by more than current liabilities, resulting in an increased investment in net working capital. This increased investment is treated as an initial outflow.[8] If the change in net working capital were negative, it would be shown as an initial inflow. The change in net working capital—regardless of whether it is an increase or a decrease—*is not taxable* because it merely involves a net buildup or net reduction of current accounts.

EXAMPLE Danson Company, a metal products manufacturer, is contemplating expanding its operations. Financial analysts expect that the changes in current accounts summarized in Table 8.4 will occur and will be maintained over the life of the expansion. Current assets are expected to increase by $22,000, and current liabilities are expected to increase by $9,000, resulting in a $13,000 increase in net working capital. In this case, the increase will represent an increased net working capital investment and will be treated as a cash outflow in calculating the initial investment.

Calculating the Initial Investment

A variety of tax and other considerations enter into the initial investment calculation. The following example illustrates calculation of the initial investment according to the format in Table 8.2.[9]

8. When changes in net working capital apply to the initial investment associated with a proposed capital expenditure, they are for convenience assumed to be instantaneous and thereby occurring at time zero. In practice, the change in net working capital will frequently occur over a period of months as the capital expenditure is implemented.

9. Throughout the discussions of capital budgeting, all assets evaluated as candidates for replacement are assumed to be depreciable assets that are directly used in the business, so any losses on the sale of these assets can be applied against ordinary operating income. The decisions are also structured to ensure that the usable life remaining on the old asset is just equal to the life of the new asset; this assumption enables us to avoid the problem of unequal lives, which is discussed in Chapter 10.

EXAMPLE Powell Corporation, a large, diversified manufacturer of aircraft components, is trying to determine the initial investment required to replace an old machine with a new, more sophisticated model. The machine's purchase price is $380,000, and an additional $20,000 will be necessary to install it. It will be depreciated under MACRS using a 5-year recovery period. The present (old) machine was purchased 3 years ago at a cost of $240,000 and was being depreciated under MACRS using a 5-year recovery period. The firm has found a buyer willing to pay $280,000 for the present machine and to remove it at the buyer's expense. The firm expects that a $35,000 increase in current assets and an $18,000 increase in current liabilities will accompany the replacement; these changes will result in a $17,000 ($35,000 − $18,000) *increase* in net working capital. Both ordinary income and capital gains are taxed at a rate of 40%.

The only component of the initial investment calculation that is difficult to obtain is taxes. Because the firm is planning to sell the present machine for $40,000 more than its initial purchase price, a *capital gain* of $40,000 will be realized. The book value of the present machine can be found by using the depreciation percentages from Table 3.2 (page 100) of 20%, 32%, and 19% for years 1, 2, and 3, respectively. The resulting *book value is $69,600* ($240,000 − [(0.20 + 0.32 + 0.19) × $240,000]). An *ordinary gain* of $170,400 ($240,000 − $69,600) in recaptured depreciation is also realized on the sale. The total taxes on the gain are $84,160 [($40,000 + $170,400) × 0.40]. Substituting these amounts into the format in Table 8.2 results in an initial investment of $221,160, which represents the net cash outflow required at time zero.

Installed cost of proposed machine		
Cost of proposed machine	$380,000	
+ Installation costs	20,000	
Total installed cost—proposed (depreciable value)		$400,000
− After-tax proceeds from sale of present machine		
Proceeds from sale of present machine	$280,000	
− Tax on sale of present machine	84,160	
Total after-tax proceeds—present		195,840
+ Change in net working capital		17,000
Initial investment		$221,160

Review Questions

8–9 Explain how each of the following inputs is used to calculate the *initial investment:* (**a**) cost of new asset, (**b**) installation costs, (**c**) proceeds from sale of old asset, (**d**) tax on sale of old asset, and (**e**) change in net working capital.

8–10 How is the *book value* of an asset calculated? What are the three key forms of taxable income?

8–11 What four tax situations may result from the sale of an asset that is being replaced?

8–12 Referring to the basic format for calculating initial investment, explain how a firm would determine the *depreciable value* of the new asset.

LG5

8.4 Finding the Operating Cash Inflows

The benefits expected from a capital expenditure or "project" are embodied in its *operating cash inflows,* which are *incremental after-tax cash inflows.* In this section we use the income statement format to develop clear definitions of the terms *after-tax, cash inflows,* and *incremental.*

Interpreting the Term *After-Tax*

Benefits expected to result from proposed capital expenditures must be measured on an *after-tax basis,* because the firm will not have the use of any benefits until it has satisfied the government's tax claims. These claims depend on the firm's taxable income, so deducting taxes *before* making comparisons between proposed investments is necessary for consistency when evaluating capital expenditure alternatives.

Interpreting the Term *Cash Inflows*

All benefits expected from a proposed project must be measured on a *cash flow basis.* Cash inflows represent dollars that can be spent, not merely "accounting profits." A simple accounting technique for converting after-tax net profits into operating cash inflows was given in Equation 3.1 on page 102. The basic calculation requires adding depreciation and any other *noncash charges* (amortization and depletion) deducted as expenses on the firm's income statement back to net profits after taxes. Because depreciation is commonly found on income statements, it is the only noncash charge we consider.

EXAMPLE

Powell Corporation's estimates of its revenue and expenses (excluding depreciation), with and without the proposed new machine described in the preceding example, are given in Table 8.5. Note that both the expected usable life of the proposed machine and the remaining usable life of the present machine are 5 years. The amount to be depreciated with the proposed machine is calculated by

TABLE 8.5 Powell Corporation's Revenue and Expenses (Excluding Depreciation) for Proposed and Present Machines

With proposed machine			With present machine		
Year	Revenue (1)	Expenses (excl. depr.) (2)	Year	Revenue (1)	Expenses (excl. depr.) (2)
1	$2,520,000	$2,300,000	1	$2,200,000	$1,990,000
2	2,520,000	2,300,000	2	2,300,000	2,110,000
3	2,520,000	2,300,000	3	2,400,000	2,230,000
4	2,520,000	2,300,000	4	2,400,000	2,250,000
5	2,520,000	2,300,000	5	2,250,000	2,120,000

TABLE 8.6 Depreciation Expense for Proposed and Present Machines for Powell Corporation

Year	Cost (1)	Applicable MACRS depreciation percentages (from Table 3.2) (2)	Depreciation [(1) × (2)] (3)
With proposed machine			
1	$400,000	20%	$ 80,000
2	400,000	32	128,000
3	400,000	19	76,000
4	400,000	12	48,000
5	400,000	12	48,000
6	400,000	5	20,000
Totals		100%	$400,000
With present machine			
1	$240,000	12% (year-4 depreciation)	$28,800
2	240,000	12 (year-5 depreciation)	28,800
3	240,000	5 (year-6 depreciation)	12,000
4	Because the present machine is at the end of the third year of its cost recovery at the time the analysis is performed, it has only the final 3 years of depreciation (as noted above) still applicable.		0
5			0
6			0
Total			$69,600[a]

[a]The total $69,600 represents the book value of the present machine at the end of the third year, as calculated in the preceding example.

summing the purchase price of $380,000 and the installation costs of $20,000. The proposed machine is to be depreciated under MACRS using a 5-year recovery period.[10] The resulting depreciation on this machine for each of the 6 years, as well as the remaining 3 years of depreciation (years 4, 5, and 6) on the present machine, are calculated in Table 8.6.[11]

The operating cash inflows in each year can be calculated by using the income statement format shown in Table 8.7. Substituting the data from Tables 8.5 and 8.6 into this format and assuming a 40% tax rate, we get Table 8.8. It demonstrates the calculation of operating cash inflows for each year for both the proposed and the present machine. Because the proposed machine is depreciated over 6 years, the analysis must be performed over the 6-year period to capture fully the tax effect of its year-6 depreciation. The resulting operating cash inflows are shown in the final row of Table 8.8 for each machine. The $8,000 year-6 cash inflow for the proposed machine results solely from the tax benefit of its year-6 depreciation deduction.

10. As noted in Chapter 3, it takes $n + 1$ years to depreciate an n-year class asset under current tax law. Therefore, MACRS percentages are given for each of 6 years for use in depreciating an asset with a 5-year recovery period.

11. It is important to recognize that although both machines will provide 5 years of use, the proposed new machine will be depreciated over the 6-year period, whereas the present machine, as noted in the preceding example, has been depreciated over 3 years and therefore has remaining only its final 3 years (years 4, 5, and 6) of depreciation (12%, 12%, and 5%, respectively, under MACRS).

TABLE 8.7 Calculation of Operating Cash Inflows Using the Income Statement Format

Revenue
− Expenses (excluding depreciation)
Profits before depreciation and taxes
− Depreciation
Net profits before taxes
− Taxes
Net profits after taxes
+ Depreciation
Operating cash inflows

TABLE 8.8 Calculation of Operating Cash Inflows for Powell Corporation's Proposed and Present Machines

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
With proposed machine						
Revenue[a]	$2,520,000	$2,520,000	$2,520,000	$2,520,000	$2,520,000	$ 0
− Expenses (excl. depr.)[b]	2,300,000	2,300,000	2,300,000	2,300,000	2,300,000	0
Profits before depr. and taxes	$ 220,000	$ 220,000	$ 220,000	$ 220,000	$ 220,000	$ 0
− Depreciation[c]	80,000	128,000	76,000	48,000	48,000	20,000
Net profits before taxes	$ 140,000	$ 92,000	$ 144,000	$ 172,000	$ 172,000	−$20,000
− Taxes (rate = 40%)	56,000	36,800	57,600	68,800	68,800	− 8,000
Net profits after taxes	$ 84,000	$ 55,200	$ 86,400	$ 103,200	$ 103,200	−$12,000
+ Depreciation[c]	80,000	128,000	76,000	48,000	48,000	20,000
Operating cash inflows	$ 164,000	$ 183,200	$ 162,400	$ 151,200	$ 151,200	$ 8,000
With present machine						
Revenue[a]	$2,200,000	$2,300,000	$2,400,000	$2,400,000	$2,250,000	$ 0
− Expenses (excl. depr.)[b]	1,990,000	2,110,000	2,230,000	2,250,000	2,120,000	0
Profits before depr. and taxes	$ 210,000	$ 190,000	$ 170,000	$ 150,000	$ 130,000	$ 0
− Depreciation[c]	28,800	28,800	12,000	0	0	0
Net profits before taxes	$ 181,200	$ 161,200	$ 158,000	$ 150,000	$ 130,000	$ 0
− Taxes (rate = 40%)	72,480	64,480	63,200	60,000	52,000	0
Net profits after taxes	$ 108,720	$ 96,720	$ 94,800	$ 90,000	$ 78,000	$ 0
+ Depreciation[c]	28,800	28,800	12,000	0	0	0
Operating cash inflows	$ 137,520	$ 125,520	$ 106,800	$ 90,000	$ 78,000	$ 0

[a]From column 1 of Table 8.5.
[b]From column 2 of Table 8.5.
[c]From column 3 of Table 8.6.

Interpreting the Term *Incremental*

The final step in estimating the operating cash inflows for a proposed project is to calculate the *incremental (relevant)* cash inflows. Incremental operating cash inflows are needed, because our concern is *only* with the change in operating cash inflows that result from the proposed project.

EXAMPLE Table 8.9 demonstrates the calculation of Powell Corporation's incremental (relevant) operating cash inflows for each year. The estimates of operating cash inflows developed in Table 8.8 are given in columns 1 and 2. Column 2 values represent the amount of operating cash inflows that Powell Corporation will receive if it does not replace the present machine. If the proposed machine replaces the present machine, the firm's operating cash inflows for each year will be those shown in column 1. Subtracting the present machine's operating cash inflows from the proposed machine's operating cash inflows, we get the incremental operating cash inflows for each year, shown in column 3. These cash flows represent the amounts by which each respective year's cash inflows will increase as a result of the replacement. For example, in year 1, Powell Corporation's cash inflows would increase by \$26,480 if the proposed project were undertaken. Clearly, these are the relevant inflows to be considered when evaluating the benefits of making a capital expenditure for the proposed machine.[12]

TABLE 8.9 Incremental (Relevant) Operating Cash Inflows for Powell Corporation

	Operating cash inflows		
Year	Proposed machine[a] (1)	Present machine[a] (2)	Incremental (relevant) [(1) − (2)] (3)
1	\$164,000	\$137,520	\$26,480
2	183,200	125,520	57,680
3	162,400	106,800	55,600
4	151,200	90,000	61,200
5	151,200	78,000	73,200
6	8,000	0	8,000

[a]From final row for respective machine in Table 8.8.

12. The following equation can be used to calculate more directly the incremental cash inflow in year t, ICI_t.

$$ICI_t = [\Delta PBDT_t \times (1 - T)] + (\Delta D_t \times T)$$

where

$\Delta PBDT_t$ = change in profits before depreciation and taxes [revenues − expenses (excl. depr.)] in year t
ΔD_t = change in depreciation expense in year t
T = firm's marginal tax rate

Applying this formula to the Powell Corporation data given in Tables 8.5 and 8.6 for year 3, we get the following values of variables:

$$\Delta PBDT_3 = (\$2{,}520{,}000 - \$2{,}300{,}000) - (\$2{,}400{,}000 - \$2{,}230{,}000)$$
$$= \$220{,}000 - \$170{,}000 = \$50{,}000$$

Review Questions

8–13 How does depreciation enter into the calculation of operating cash inflows?

8–14 How are the incremental (relevant) *operating cash inflows* that are associated with a replacement decision calculated?

LG6

8.5 Finding the Terminal Cash Flow

Terminal cash flow is the cash flow resulting from termination and liquidation of a project at the end of its economic life. It represents the after-tax cash flow, exclusive of operating cash inflows, that occurs in the final year of the project. When it applies, this flow can significantly affect the capital expenditure decision. Terminal cash flow can be calculated for replacement projects by using the basic format presented in Table 8.10.

Proceeds from Sale of Assets

The proceeds from sale of the new and the old asset, often called "salvage value," represent the amount *net of any removal or cleanup costs* expected upon termination of the project. For replacement projects, proceeds from both the new asset and the old asset must be considered. For expansion and renewal types of capital expenditures, the proceeds from the old asset are zero. Of course, it is not unusual for the value of an asset to be zero at the termination of a project.

TABLE 8.10 The Basic Format for Determining Terminal Cash Flow

	After-tax proceeds from sale of new asset =
	Proceeds from sale of new asset
	∓ Tax on sale of new asset
−	**After-tax proceeds from sale of old asset =**
	Proceeds from sale of old asset
	∓ Tax on sale of old asset
±	**Change in net working capital**
	Terminal cash flow

$$\Delta D_3 = \$76{,}000 - \$12{,}000 = \$64{,}000$$
$$T = 0.40$$

Substituting into the equation yields

$$ICI_3 = [\$50{,}000 \times (1 - 0.40)] + (\$64{,}000 \times 0.40)$$
$$= \$30{,}000 + \$25{,}600 = \underline{\underline{\$55{,}600}}$$

The $55,600 of incremental cash inflow for year 3 is the same value as that calculated for year 3 in column 3 of Table 8.9.

Taxes on Sale of Assets

Earlier we calculated the tax on sale of old asset (as part of finding the initial investment). Similarly, taxes must be considered on the terminal sale of both the new and the old asset for replacement projects and on only the new asset in other cases. The tax calculations apply whenever an asset is sold for a value different from its book value. If the net proceeds from the sale are expected to exceed book value, a tax payment shown as an *outflow* (deduction from sale proceeds) will occur. When the net proceeds from the sale are less than book value, a tax rebate shown as a cash *inflow* (addition to sale proceeds) will result. For assets sold to net exactly book value, no taxes will be due.

Change in Net Working Capital

When we calculated the initial investment, we took into account any change in net working capital that is attributable to the new asset. Now, when we calculate the terminal cash flow, the change in net working capital represents the reversion of any initial net working capital investment. Most often, this will show up as a cash inflow due to the reduction in net working capital; with termination of the project, the need for the increased net working capital investment is assumed to end.[13] Because the net working capital investment is in no way consumed, the amount recovered at termination will equal the amount shown in the calculation of the initial investment.[14] Tax considerations are not involved.

Calculating the terminal cash flow involves the same procedures as those used to find the initial investment. In the following example, the terminal cash flow is calculated for a replacement decision.

EXAMPLE

Continuing with the Powell Corporation example, assume that the firm expects to be able to liquidate the new machine at the end of its 5-year usable life to net \$50,000 after paying removal and cleanup costs. The old machine can be liquidated at the end of the 5 years to net \$0 because it will then be completely obsolete. The firm expects to recover its \$17,000 net working capital investment upon termination of the project. Both ordinary income and capital gains are taxed at a rate of 40%.

From the analysis of the operating cash inflows presented earlier, we can see that the proposed (new) machine will have a book value of \$20,000 (equal to the year-6 depreciation) at the end of 5 years. The present (old) machine will be fully depreciated and therefore have a book value of zero at the end of the 5 years. Because the sale price of \$50,000 for the proposed (new) machine is below its initial installed cost of \$400,000 but greater than its book value of \$20,000, taxes will have to be paid only on the recaptured depreciation of \$30,000 (\$50,000 sale proceeds − \$20,000 book value). Applying the ordinary tax rate of 40% to this \$30,000 results in a tax of \$12,000 (0.40 × \$30,000) on the sale of the proposed machine. Its after-tax sale proceeds would therefore equal \$38,000 (\$50,000 sale

13. As noted earlier, the change in net working capital is for convenience assumed to occur instantaneously—in this case, on termination of the project. In actuality, it may take a number of months for the original increase in net working capital to be worked down to zero.

14. In practice, the full net working capital investment may not be recovered. This occurs because some accounts receivable may not be collectible and some inventory will probably be obsolete, and so their book values cannot be fully realized.

proceeds − $12,000 taxes). Because the present machine would net $0 at termination and its book value would be $0, no tax would be due on its sale. Its after-tax sale proceeds would therefore equal $0. Substituting the appropriate values into the format in Table 8.10 results in the terminal cash inflow of $55,000.

After-tax proceeds from sale of proposed machine		
Proceeds from sale of proposed machine	$50,000	
− Tax on sale of proposed machine	12,000	
Total after-tax proceeds—proposed		$38,000
− **After-tax proceeds from sale of present machine**		
Proceeds from sale of present machine	$ 0	
∓ Tax on sale of present machine	0	
Total after-tax proceeds—present		0
+ **Change in net working capital**		17,000
Terminal cash flow		$55,000

Review Question

8–15 Explain how the *terminal cash flow* is calculated for replacement projects.

LG4 LG5 LG6 8.6 Summarizing the Relevant Cash Flows

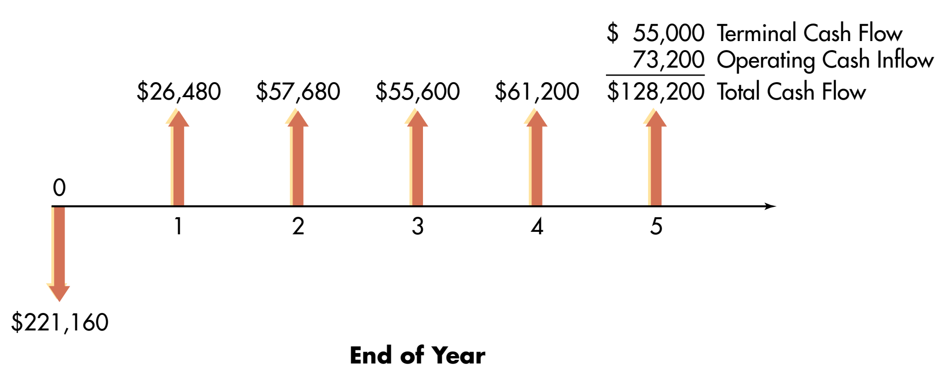
Hint Capital expenditures are critical to a firm's success, and these funds are usually limited. Because of this, the process of determining cash flows should be finely tuned so that it is both objective and realistic.

The initial investment, operating cash inflows, and terminal cash flow together represent a project's *relevant cash flows*. These cash flows can be viewed as the incremental after-tax cash flows attributable to the proposed project. They represent, in a cash flow sense, how much better or worse off the firm will be if it chooses to implement the proposal.

EXAMPLE

The relevant cash flows for Powell Corporation's proposed replacement expenditure can now be shown graphically, on a time line. Note that because the new asset is assumed to be sold at the end of its 5-year usable life, the year-6 incremental operating cash inflow calculated in Table 8.9 has no relevance; the terminal cash flow effectively replaces this value in the analysis. As the following time line shows, the relevant cash flows follow a *conventional cash flow pattern*.

Time line for Powell Corporation's relevant cash flows with the proposed machine



Techniques for analyzing conventional cash flow patterns to determine whether to undertake a proposed capital investment are discussed in Chapter 9.

Review Question

8–16 Diagram and describe the three components of the *relevant cash flows* for a capital budgeting project.

SUMMARY

FOCUS ON VALUE

A key responsibility of financial managers is to review and analyze proposed investment decisions in order to make sure that only those that contribute positively to the value of the firm are undertaken. Utilizing a variety of tools and techniques, financial managers estimate the cash flows that a proposed investment will generate and then apply appropriate decision techniques to assess the investment's impact on the firm's value. The most difficult and important aspect of this capital budgeting process is developing good estimates of the relevant cash flows.

The relevant cash flows are the incremental after-tax cash flows resulting from a proposed investment. These estimates represent the cash flow benefits that are likely to accrue to the firm as a result of implementing the investment. By applying to the cash flows decision techniques that capture time value of money and risk factors, the financial manager can estimate the impact the investment will have on the firm's share price. Clearly, only those investments that can be expected to increase the stock price should be undertaken. Consistent application of capital budgeting procedures to proposed long-term investments should therefore allow the firm to **maximize its stock price.**

REVIEW OF LEARNING GOALS

LG1 **Understand the key motives for capital expenditure and the steps in the capital budgeting process.** Capital budgeting is the process used to evaluate and select capital expenditures consistent with the firm's goal of maximizing owner wealth. Capital expenditures are long-term investments made to expand, replace, or renew fixed assets or to obtain some less tangible benefit. The capital budgeting process includes five distinct but interrelated steps: proposal generation, review and analysis, decision making, implementation, and follow-up.

LG2 **Define basic capital budgeting terminology.** Capital expenditure proposals may be independent or mutually exclusive. Typically, firms have only limited funds for capital investments and must ration them among carefully selected projects. Two basic approaches to capital budgeting decisions are the accept–reject approach and the ranking approach. Conventional cash flow patterns consist of an initial outflow followed by a series of inflows; any other pattern is nonconventional.

LG3 **Discuss the major components of relevant cash flows, expansion versus replacement cash flows, sunk costs and opportunity costs, and international capital budgeting and long-term investments.** The relevant cash flows for capital budgeting decisions are the initial investment, the operating cash inflows, and the terminal cash flow. For replacement decisions, these flows are found by determining the difference between the cash flows of the new asset and the old asset. Expansion decisions are viewed as replacement decisions in which all cash flows from the old asset are zero. When estimating relevant cash flows, one should ignore sunk costs, and opportunity costs should be included as cash outflows. In international capital budgeting, currency risks and political risks can be minimized through careful planning.

LG4 **Calculate the initial investment associated with a proposed capital expenditure.** The initial investment is the initial outflow required, taking into account the installed cost of the new asset, the after-tax proceeds from the sale of the old asset, and any change in net working capital. Finding the after-tax proceeds from sale of the old asset, which reduces the initial investment, involves cost, depreciation, and tax data. The book value of an asset is its accounting value, which is used to determine what taxes are owed as a result of its sale. Any of three forms of taxable income—capital gain, recaptured depreciation, or a loss—can result from sale of an asset. The form of taxable income that applies depends on whether the asset is sold for (1) more than its initial purchase price, (2) more than book value but less than what was initially paid, (3) book value, or (4) less than book value. The change in net working capital is the difference between the change in current assets and the change in current liabilities expected to accompany a given capital expenditure.

LG5 **Determine relevant operating cash inflows using the income statement format.** The operating cash inflows are the incremental after-tax cash inflows expected to result from a project. The income statement format involves adding depreciation back to net profits after taxes and gives the operating cash inflows associated with the proposed and present projects. The relevant (incremental) cash inflows are the difference between the operating cash inflows of the proposed project and those of the present project.

LG6 **Find the terminal cash flow.** The terminal cash flow represents the after-tax cash flow, exclusive of operating cash inflows, that is expected from liquidation of a project. It is calculated by finding the difference between the after-tax proceeds from sale of the new and the old asset at project termination and then adjusting this difference for any change in net working capital. Sale price and depreciation data are used to find the taxes and the after-tax sale proceeds on the new and old assets. The change in net working capital typically represents the reversion of any initial net working capital investment.

SELF-TEST PROBLEMS (Solutions in Appendix B)

LG4 ST 8–1 **Book value, taxes, and initial investment** Irvin Enterprises is considering the purchase of a new piece of equipment to replace the current equipment. The new equipment costs $75,000 and requires $5,000 in installation costs. It will be depreciated under MACRS using a 5-year recovery period. The old piece of equipment was purchased 4 years ago for an installed cost of $50,000; it was being depreciated under MACRS using a 5-year recovery period. The old equipment can be sold today for $55,000 net of any removal or cleanup costs. As a result of the proposed replacement, the firm's investment in net working capital is expected to increase by $15,000. The firm pays taxes at a rate of 40% on both ordinary income and capital gains. (Table 3.2 on page 100 contains the applicable MACRS depreciation percentages.)

a. Calculate the book value of the old piece of equipment.
b. Determine the taxes, if any, attributable to the sale of the old equipment.
c. Find the initial investment associated with the proposed equipment replacement.

LG4 LG5 LG6

ST 8–2 Determining relevant cash flows A machine currently in use was originally purchased 2 years ago for $40,000. The machine is being depreciated under MACRS using a 5-year recovery period; it has 3 years of usable life remaining. The current machine can be sold today to net $42,000 after removal and cleanup costs. A new machine, using a 3-year MACRS recovery period, can be purchased at a price of $140,000. It requires $10,000 to install and has a 3-year usable life. If the new machine is acquired, the investment in accounts receivable will be expected to rise by $10,000, the inventory investment will increase by $25,000, and accounts payable will increase by $15,000. *Profits before depreciation and taxes* are expected to be $70,000 for each of the next 3 years with the old machine and to be $120,000 in the first year and $130,000 in the second and third years with the new machine. At the end of 3 years, the market value of the old machine will equal zero, but the new machine could be sold to net $35,000 before taxes. Both ordinary corporate income and capital gains are subject to a 40% tax. (Table 3.2 on page 100 contains the applicable MACRS depreciation percentages.)

a. Determine the initial investment associated with the proposed replacement decision.
b. Calculate the incremental operating cash inflows for years 1 to 4 associated with the proposed replacement. (*Note:* Only depreciation cash flows must be considered in year 4.)
c. Calculate the terminal cash flow associated with the proposed replacement decision. (*Note:* This is at the end of year 3.)
d. Depict on a time line the relevant cash flows found in parts **a, b,** and **c** that are associated with the proposed replacement decision, assuming that it is terminated at the end of year 3.

PROBLEMS

LG1

8–1 Classification of expenditures Given the following list of outlays, indicate whether each is normally considered a *capital* or an *operating* expenditure. Explain your answers.

a. An initial lease payment of $5,000 for electronic point-of-sale cash register systems.
b. An outlay of $20,000 to purchase patent rights from an inventor.
c. An outlay of $80,000 for a major research and development program.
d. An $80,000 investment in a portfolio of marketable securities.
e. A $300 outlay for an office machine.
f. An outlay of $2,000 for a new machine tool.
g. An outlay of $240,000 for a new building.
h. An outlay of $1,000 for a marketing research report.

LG2 **8–2 Basic terminology** A firm is considering the following three separate situations.

Situation A Build either a small office building or a convenience store on a parcel of land located in a high-traffic area. Adequate funding is available, and both projects are known to be acceptable. The office building requires an initial investment of $620,000 and is expected to provide operating cash inflows of $40,000 per year for 20 years. The convenience store is expected to cost $500,000 and to provide a growing stream of operating cash inflows over its 20-year life. The initial operating cash inflow is $20,000, and it will increase by 5% each year.

Situation B Replace a machine with a new one that requires a $60,000 initial investment and will provide operating cash inflows of $10,000 per year for the first 5 years. At the end of year 5, a machine overhaul costing $20,000 will be required. After it is completed, expected operating cash inflows will be $10,000 in year 6; $7,000 in year 7; $4,000 in year 8; and $1,000 in year 9, at the end of which the machine will be scrapped.

Situation C Invest in any or all of the four machines whose relevant cash flows are given in the following table. The firm has $500,000 budgeted to fund these machines, all of which are known to be acceptable. Initial investment for each machine is $250,000.

	Operating cash inflows			
Year	Machine 1	Machine 2	Machine 3	Machine 4
1	$ 50,000	$70,000	$65,000	$90,000
2	70,000	70,000	65,000	80,000
3	90,000	70,000	80,000	70,000
4	− 30,000	70,000	80,000	60,000
5	100,000	70,000	− 20,000	50,000

For each situation, indicate:

a. Whether the projects involved are independent or mutually exclusive.
b. Whether the availability of funds is unlimited or capital rationing exists.
c. Whether accept–reject or ranking decisions are required.
d. Whether each project's cash flows are conventional or nonconventional.

LG3 **8–3 Relevant cash flow pattern fundamentals** For each of the following projects, determine the *relevant cash flows,* classify the cash flow pattern, and depict the cash flows on a time line.

a. A project that requires an initial investment of $120,000 and will generate annual operating cash inflows of $25,000 for the next 18 years. In each of the 18 years, maintenance of the project will require a $5,000 cash outflow.
b. A new machine with an installed cost of $85,000. Sale of the old machine will yield $30,000 after taxes. Operating cash inflows generated by the replacement will exceed the operating cash inflows of the old machine by $20,000 in each year of a 6-year period. At the end of year 6, liquidation of the new machine will yield $20,000 after taxes, which is $10,000 greater

than the after-tax proceeds expected from the old machine had it been retained and liquidated at the end of year 6.

c. An asset that requires an initial investment of $2 million and will yield annual operating cash inflows of $300,000 for each of the next 10 years. Operating cash outlays will be $20,000 for each year except year 6, when an overhaul requiring an additional cash outlay of $500,000 will be required. The asset's liquidation value at the end of year 10 is expected to be $0.

LG3 **8–4 Expansion versus replacement cash flows** Edison Systems has estimated the cash flows over the 5-year lives for two projects, A and B. These cash flows are summarized in the following table.

	Project A	Project B
Initial investment	**$40,000**	**$12,000[a]**
Year	**Operating cash inflows**	
1	$10,000	$ 6,000
2	12,000	6,000
3	14,000	6,000
4	16,000	6,000
5	10,000	6,000

[a]After-tax cash inflow expected from liquidation.

a. If project A were actually a *replacement* for project B and if the $12,000 initial investment shown for project B were the after-tax cash inflow expected from liquidating it, what would be the relevant cash flows for this replacement decision?

b. How can an *expansion decision* such as project A be viewed as a special form of a replacement decision? Explain.

LG3 **8–5 Sunk costs and opportunity costs** Masters Golf Products, Inc., spent 3 years and $1,000,000 to develop its new line of club heads to replace a line that is becoming obsolete. In order to begin manufacturing them, the company will have to invest $1,800,000 in new equipment. The new clubs are expected to generate an increase in operating cash inflows of $750,000 per year for the next 10 years. The company has determined that the existing line could be sold to a competitor for $250,000.

a. How should the $1,000,000 in development costs be classified?

b. How should the $250,000 sale price for the existing line be classified?

c. Depict all of the known relevant cash flows on a time line.

LG3 **8–6 Sunk costs and opportunity costs** Covol Industries is developing the relevant cash flows associated with the proposed replacement of an existing machine tool with a new, technologically advanced one. Given the following costs related to the proposed project, explain whether each would be treated as a *sunk cost* or an *opportunity cost* in developing the relevant cash flows associated with the proposed replacement decision.

a. Covol would be able to use the same tooling, which had a book value of $40,000, on the new machine tool as it had used on the old one.
b. Covol would be able to use its existing computer system to develop programs for operating the new machine tool. The old machine tool did not require these programs. Although the firm's computer has excess capacity available, the capacity could be leased to another firm for an annual fee of $17,000.
c. Covol would have to obtain additional floor space to accommodate the larger new machine tool. The space that would be used is currently being leased to another company for $10,000 per year.
d. Covol would use a small storage facility to store the increased output of the new machine tool. The storage facility was built by Covol 3 years earlier at a cost of $120,000. Because of its unique configuration and location, it is currently of no use to either Covol or any other firm.
e. Covol would retain an existing overhead crane, which it had planned to sell for its $180,000 market value. Although the crane was not needed with the old machine tool, it would be used to position raw materials on the new machine tool.

LG4 8–7 **Book value** Find the book value for each of the assets shown in the following table, assuming that MACRS depreciation is being used. *(Note:* See Table 3.2 on page 100 for the applicable depreciation percentages.)

Asset	Installed cost	Recovery period (years)	Elapsed time since purchase (years)
A	$ 950,000	5	3
B	40,000	3	1
C	96,000	5	4
D	350,000	5	1
E	1,500,000	7	5

LG4 8–8 **Book value and taxes on sale of assets** Troy Industries purchased a new machine 3 years ago for $80,000. It is being depreciated under MACRS with a 5-year recovery period using the percentages given in Table 3.2 on page 100. Assume 40% ordinary and capital gains tax rates.
a. What is the book value of the machine?
b. Calculate the firm's tax liability if it sold the machine for each of the following amounts: $100,000; $56,000; $23,200; and $15,000.

LG4 8–9 **Tax calculations** For each of the following cases, describe the various taxable components of the funds received through sale of the asset, and determine the total taxes resulting from the transaction. Assume 40% ordinary and capital gains tax rates. The asset was purchased 2 years ago for $200,000 and is being depreciated under MACRS using a 5-year recovery period. (See Table 3.2 on page 100 for the applicable depreciation percentages.)
a. The asset is sold for $220,000.
b. The asset is sold for $150,000.
c. The asset is sold for $96,000.
d. The asset is sold for $80,000.

LG4 **8–10 Change in net working capital calculation** Samuels Manufacturing is considering the purchase of a new machine to replace one they feel is obsolete. The firm has total current assets of $920,000 and total current liabilities of $640,000. As a result of the proposed replacement, the following *changes* are anticipated in the levels of the current asset and current liability accounts noted.

Account	Change
Accruals	+ $ 40,000
Marketable securities	0
Inventories	− 10,000
Accounts payable	+ 90,000
Notes payable	0
Accounts receivable	+ 150,000
Cash	+ 15,000

a. Using the information given, calculate the change, if any, in net working capital that is expected to result from the proposed replacement action.
b. Explain why a change in these current accounts would be relevant in determining the initial investment for the proposed capital expenditure.
c. Would the change in net working capital enter into any of the other cash flow components that make up the relevant cash flows? Explain.

LG4 **8–11 Calculating initial investment** Vastine Medical, Inc., is considering replacing its existing computer system, which was purchased 2 years ago at a cost of $325,000. The system can be sold today for $200,000. It is being depreciated using MACRS and a 5-year recovery period (see Table 3.2, page 100). A new computer system will cost $500,000 to purchase and install. Replacement of the computer system would not involve any change in net working capital. Assume a 40% tax rate on ordinary income and capital gains.
a. Calculate the book value of the existing computer system.
b. Calculate the after-tax proceeds of its sale for $200,000.
c. Calculate the initial investment associated with the replacement project.

LG4 **8–12 Initial investment—Basic calculation** Cushing Corporation is considering the purchase of a new grading machine to replace the existing one. The existing machine was purchased 3 years ago at an installed cost of $20,000; it was being depreciated under MACRS using a 5-year recovery period. (See Table 3.2 on page 100 for the applicable depreciation percentages.) The existing machine is expected to have a usable life of at least 5 more years. The new machine costs $35,000 and requires $5,000 in installation costs; it will be depreciated using a 5-year recovery period under MACRS. The existing machine can currently be sold for $25,000 without incurring any removal or cleanup costs. The firm pays 40% taxes on both ordinary income and capital gains. Calculate the *initial investment* associated with the proposed purchase of a new grading machine.

LG4 **8–13 Initial investment at various sale prices** Edwards Manufacturing Company is considering replacing one machine with another. The old machine was purchased 3 years ago for an installed cost of $10,000. The firm is depreciating the machine under MACRS, using a 5-year recovery period. (See Table 3.2 on page 100 for the applicable depreciation percentages.) The new machine costs $24,000 and requires $2,000 in installation costs. The firm is subject to a 40% tax rate on both ordinary income and capital gains. In each of the following cases, calculate the initial investment for the replacement.

a. Edwards Manufacturing Company (EMC) sells the old machine for $11,000.
b. EMC sells the old machine for $7,000.
c. EMC sells the old machine for $2,900.
d. EMC sells the old machine for $1,500.

LG4 **8–14** **Calculating initial investment** DuPree Coffee Roasters, Inc., wishes to expand and modernize its facilities. The installed cost of a proposed computer-controlled automatic-feed roaster will be $130,000. The firm has a chance to sell its 4-year-old roaster for $35,000. The existing roaster originally cost $60,000 and was being depreciated using MACRS and a 7-year recovery period (see Table 3.2 on page 100). DuPree pays taxes at a rate of 40% on ordinary income and capital gains.

a. What is the book value of the existing roaster?
b. Calculate the after-tax proceeds of the sale of the existing roaster.
c. Calculate the change in net working capital using the following figures:

Anticipated Changes in Current Assets and Current Liabilities	
Accruals	−$20,000
Inventory	+ 50,000
Accounts payable	+ 40,000
Accounts receivable	+ 70,000
Cash	0
Notes payable	+ 15,000

d. Calculate the initial investment associated with the proposed new roaster.

LG5 **8–15** **Depreciation** A firm is evaluating the acquisition of an asset that costs $64,000 and requires $4,000 in installation costs. If the firm depreciates the asset under MACRS, using a 5-year recovery period (see Table 3.2 on page 100 for the applicable depreciation percentages), determine the depreciation charge for each year.

LG5 **8–16** **Incremental operating cash inflows** A firm is considering renewing its equipment to meet increased demand for its product. The cost of equipment modifications is $1.9 million plus $100,000 in installation costs. The firm will depreciate the equipment modifications under MACRS, using a 5-year recovery period. (See Table 3.2 on page 100 for the applicable depreciation percentages.) Additional sales revenue from the renewal should amount to $1.2 million per year, and additional operating expenses and other costs (excluding depreciation) will amount to 40% of the additional sales. The firm has an ordinary tax rate of 40%. (*Note:* Answer the following questions for each of the next 6 *years*.)

a. What incremental earnings before depreciation and taxes will result from the renewal?

b. What incremental earnings after taxes will result from the renewal?

c. What incremental operating cash inflows will result from the renewal?

LG5 **8–17 Incremental operating cash inflows—Expense reduction** Miller Corporation is considering replacing a machine. The replacement will reduce operating expenses (that is, increase revenues) by $16,000 per year for each of the 5 years the new machine is expected to last. Although the old machine has zero book value, it can be used for 5 more years. The depreciable value of the new machine is $48,000. The firm will depreciate the machine under MACRS using a 5-year recovery period (see Table 3.2 on page 100 for the applicable depreciation percentages) and is subject to a 40% tax rate on ordinary income. Estimate the incremental operating cash inflows generated by the replacement. (*Note:* Be sure to consider the depreciation in year 6.)

LG5 **8–18 Incremental operating cash inflows** Strong Tool Company has been considering purchasing a new lathe to replace a fully depreciated lathe that will last 5 more years. The new lathe is expected to have a 5-year life and depreciation charges of $2,000 in year 1; $3,200 in year 2; $1,900 in year 3; $1,200 in both year 4 and year 5; and $500 in year 6. The firm estimates the revenues and expenses (excluding depreciation) for the new and the old lathes to be as shown in the following table. The firm is subject to a 40% tax rate on ordinary income.

	New lathe		Old lathe	
Year	Revenue	Expenses (excl. depr.)	Revenue	Expenses (excl. depr.)
1	$40,000	$30,000	$35,000	$25,000
2	41,000	30,000	35,000	25,000
3	42,000	30,000	35,000	25,000
4	43,000	30,000	35,000	25,000
5	44,000	30,000	35,000	25,000

a. Calculate the operating cash inflows associated with each lathe. (*Note:* Be sure to consider the depreciation in year 6.)

b. Calculate the incremental (relevant) operating cash inflows resulting from the proposed lathe replacement.

c. Depict on a time line the incremental operating cash inflows calculated in part **b.**

LG5 **8–19 Determining operating cash inflows** Scenic Tours, Inc., is a provider of bus tours throughout the New England area. The corporation is considering the replacement of 10 of its older buses. The existing buses were purchased 4 years ago at a total cost of $2,700,000 and are being depreciated using MACRS and a 5-year recovery period (see Table 3.2, page 100). The new buses would have larger passenger capacity and better fuel efficiency as well as lower maintenance costs. The total cost for 10 new buses is $3,000,000. Like the older buses, the new ones would be depreciated using MACRS and a 5-year recovery period. Scenic is taxed at a rate of 40% on ordinary income and capital gains. The following table presents revenues and cash expenses for the proposed purchase as well as the present fleet. Use all of the information given to calculate operating cash inflows for the proposed and present buses.

	Year					
	1	2	3	4	5	6
With the proposed new buses						
Revenue	$1,850,000	$1,850,000	$1,830,000	$1,825,000	$1,815,000	$1,800,000
− Expenses (excl. depreciation)	460,000	460,000	468,000	472,000	485,000	500,000
With the present buses						
Revenue	$1,800,000	$1,800,000	$1,790,000	$1,785,000	$1,775,000	$1,750,000
− Expenses (excl. depreciation)	500,000	510,000	520,000	520,000	530,000	535,000

LG6 **8–20 Terminal cash flow—Various lives and sale prices** Looner Industries is currently analyzing the purchase of a new machine that costs $160,000 and requires $20,000 in installation costs. Purchase of this machine is expected to result in an increase in net working capital of $30,000 to support the expanded level of operations. The firm plans to depreciate the machine under MACRS using a 5-year recovery period (see Table 3.2 on page 100 for the applicable depreciation percentages) and expects to sell the machine to net $10,000 before taxes at the end of its usable life. The firm is subject to a 40% tax rate on both ordinary and capital gains income.

a. Calculate the terminal cash flow for a usable life of (1) 3 years, (2) 5 years, and (3) 7 years.

b. Discuss the effect of usable life on terminal cash flows using your findings in part **a.**

c. Assuming a 5-year usable life, calculate the terminal cash flow if the machine were sold to net (1) $9,000 or (2) $170,000 (before taxes) at the end of 5 years.

d. Discuss the effect of sale price on terminal cash flow using your findings in part **c.**

LG6 **8–21 Terminal cash flow—Replacement decision** Russell Industries is considering replacing a fully depreciated machine that has a remaining useful life of 10 years with a newer, more sophisticated machine. The new machine will cost $200,000 and will require $30,000 in installation costs. It will be depreciated under MACRS using a 5-year recovery period (see Table 3.2 on page 100 for the applicable depreciation percentages). A $25,000 increase in net working capital will be required to support the new machine. The firm's managers plans to evaluate the potential replacement over a 4-year period. They estimate that the old machine could be sold at the end of 4 years to net $15,000 before taxes; the new machine at the end of 4 years will be worth $75,000 before taxes. Calculate the terminal cash flow at the end of year 4 that is relevant to the proposed purchase of the new machine. The firm is subject to a 40% tax rate on both ordinary and capital gains income.

LG4 LG5 LG6

8–22 Relevant cash flows for a marketing campaign Marcus Tube, a manufacturer of high-quality aluminum tubing, has maintained stable sales and profits over the past 10 years. Although the market for aluminum tubing has been expanding by 3% per year, Marcus has been unsuccessful in sharing this growth. To increase its sales, the firm is considering an aggressive marketing campaign that centers on regularly running ads in all relevant trade journals and exhibiting products at all major regional and national trade shows. The campaign is expected to require an *annual* tax-deductible expenditure of $150,000 over the next 5 years. Sales revenue, as shown in the income statement for 2003 (below), totaled $20,000,000. If the proposed marketing campaign is not initiated, sales are expected to remain at this level in each of the next 5 years, 2004–2008. With the marketing campaign, sales are expected to rise to the levels shown in the accompanying table for each of the next 5 years; cost of goods sold is expected to remain at 80% of sales; general and administrative expense (exclusive of any marketing campaign outlays) is expected to remain at 10% of sales; and annual depreciation expense is expected to remain at $500,000. Assuming a 40% tax rate, find the relevant cash flows over the next 5 years associated with the proposed marketing campaign.

Marcus Tube
Income Statement
for the Year Ended December 31, 2003

Sales revenue		$20,000,000
Less: Cost of goods sold (80%)		16,000,000
Gross profits		$ 4,000,000
Less: Operating expenses		
General and administrative expense (10%)	$2,000,000	
Depreciation expense	500,000	
Total operating expense		2,500,000
Net profits before taxes		$ 1,500,000
Less: Taxes (rate = 40%)		600,000
Net profits after taxes		$ 900,000

Marcus Tube
Sales Forecast

Year	Sales revenue
2004	$20,500,000
2005	21,000,000
2006	21,500,000
2007	22,500,000
2008	23,500,000

LG4 LG5

8–23 Relevant cash flows—No terminal value Central Laundry and Cleaners is considering replacing an existing piece of machinery with a more sophisticated machine. The old machine was purchased 3 years ago at a cost of $50,000, and this amount was being depreciated under MACRS using a 5-year recovery period. The machine has 5 years of usable life remaining. The new machine that is being considered costs $76,000 and requires $4,000 in installation costs. The new machine would be depreciated under MACRS using a 5-year recovery period. The firm can currently sell the old machine for $55,000 without incurring any removal or cleanup costs. The firm pays a tax rate of 40% on both ordinary income and capital gains. The revenues and expenses (excluding depreciation) associated with the new and the old machine for the next 5 years are given in the table below. (Table 3.2 on page 100 contains the applicable MACRS depreciation percentages.)

	New machine		Old machine	
Year	Revenue	Expenses (excl. depr.)	Revenue	Expenses (excl. depr.)
1	$750,000	$720,000	$674,000	$660,000
2	750,000	720,000	676,000	660,000
3	750,000	720,000	680,000	660,000
4	750,000	720,000	678,000	660,000
5	750,000	720,000	674,000	660,000

a. Calculate the initial investment associated with replacement of the old machine by the new one.

b. Determine the incremental operating cash inflows associated with the proposed replacement. (*Note:* Be sure to consider the depreciation in year 6.)

c. Depict on a time line the relevant cash flows found in parts **a** and **b** associated with the proposed replacement decision.

LG4 LG5 LG6 8–24 **Integrative—Determining relevant cash flows** Lombard Company is contemplating the purchase of a new high-speed widget grinder to replace the existing grinder. The existing grinder was purchased 2 years ago at an installed cost of $60,000; it was being depreciated under MACRS using a 5-year recovery period. The existing grinder is expected to have a usable life of 5 more years. The new grinder costs $105,000 and requires $5,000 in installation costs; it has a 5-year usable life and would be depreciated under MACRS using a 5-year recovery period. Lombard can currently sell the existing grinder for $70,000 without incurring any removal or cleanup costs. To support the increased business resulting from purchase of the new grinder, accounts receivable would increase by $40,000, inventories by $30,000, and accounts payable by $58,000. At the end of 5 years, the existing grinder is expected to have a market value of zero; the new grinder would be sold to net $29,000 after removal and cleanup costs and before taxes. The firm pays taxes at a rate of 40% on both ordinary income and capital gains. The estimated *profits before depreciation and taxes* over the 5 years for both the new and the existing grinder are shown in the following table. (Table 3.2 on page 100 contains the applicable MACRS depreciation percentages.)

	Profits before depreciation and taxes	
Year	New grinder	Existing grinder
1	$43,000	$26,000
2	43,000	24,000
3	43,000	22,000
4	43,000	20,000
5	43,000	18,000

a. Calculate the initial investment associated with the replacement of the existing grinder by the new one.
b. Determine the incremental operating cash inflows associated with the proposed grinder replacement. (*Note:* Be sure to consider the depreciation in year 6.)
c. Determine the terminal cash flow expected at the end of year 5 from the proposed grinder replacement.
d. Depict on a time line the relevant cash flows associated with the proposed grinder replacement decision.

LG4 LG5 LG6 8–25 **Integrative—Determining relevant cash flows** Atlantic Drydock is considering replacing an existing hoist with one of two newer, more efficient pieces of equipment. The existing hoist is 3 years old, cost $32,000, and is being depreciated under MACRS using a 5-year recovery period. Although the existing hoist has only 3 years (years 4, 5, and 6) of depreciation remaining under MACRS, it has a remaining usable life of 5 years. Hoist A, one of the two possible replacement hoists, costs $40,000 to purchase and $8,000 to install. It has a 5-year usable life and will be depreciated under MACRS using a 5-year recovery period. The other hoist, B, costs $54,000 to purchase and $6,000 to install. It also has a 5-year usable life and will be depreciated under MACRS using a 5-year recovery period.

Increased investments in net working capital will accompany the decision to acquire hoist A or hoist B. Purchase of hoist A would result in a $4,000 increase in net working capital; hoist B would result in a $6,000 increase in net working capital. The projected *profits before depreciation and taxes* with each alternative hoist and the existing hoist are given in the following table.

	Profits before depreciation and taxes		
Year	With hoist A	With hoist B	With existing hoist
1	$21,000	$22,000	$14,000
2	21,000	24,000	14,000
3	21,000	26,000	14,000
4	21,000	26,000	14,000
5	21,000	26,000	14,000

The existing hoist can currently be sold for $18,000 and will not incur any removal or cleanup costs. At the end of 5 years, the existing hoist can be sold to net $1,000 before taxes. Hoists A and B can be sold to net $12,000 and $20,000 before taxes, respectively, at the end of the 5-year period. The firm is subject to a 40% tax rate on both ordinary income and capital gains. (Table 3.2 on page 100 contains the applicable MACRS depreciation percentages.)
a. Calculate the initial investment associated with each alternative.
b. Calculate the incremental operating cash inflows associated with each alternative. *(Note:* Be sure to consider the depreciation in year 6.)
c. Calculate the terminal cash flow at the end of year 5 associated with each alternative.
d. Depict on a time line the relevant cash flows associated with each alternative.

CHAPTER 8 CASE

Developing Relevant Cash Flows for Clark Upholstery Company's Machine Renewal or Replacement Decision

Bo Humphries, chief financial officer of Clark Upholstery Company, expects the firm's *net profits after taxes* for the next 5 years to be as shown in the following table.

Year	Net profits after taxes
1	$100,000
2	150,000
3	200,000
4	250,000
5	320,000

Bo is beginning to develop the relevant cash flows needed to analyze whether to renew or replace Clark's *only* depreciable asset, a machine that originally cost $30,000, has a current book value of zero, and can now be sold for $20,000. *(Note:* Because the firm's only depreciable asset is fully depreciated—its book value is zero—its expected net profits after taxes equal its operating cash inflows.) He estimates that at the end of 5 years, the existing machine can be sold to net $2,000 before taxes. Bo plans to use the following information to develop the relevant cash flows for each of the alternatives.

Alternative 1 Renew the existing machine at a total depreciable cost of $90,000. The renewed machine would have a 5-year usable life and would be depreciated under MACRS using a 5-year recovery period. Renewing the machine would result in the following projected revenues and expenses (excluding depreciation):

Year	Revenue	Expenses (excl. depreciation)
1	$1,000,000	$801,500
2	1,175,000	884,200
3	1,300,000	918,100
4	1,425,000	943,100
5	1,550,000	968,100

The renewed machine would result in an increased investment in net working capital of $15,000. At the end of 5 years, the machine could be sold to net $8,000 before taxes.

Alternative 2 Replace the existing machine with a new machine that costs $100,000 and requires installation costs of $10,000. The new machine would have a 5-year usable life and would be depreciated under MACRS using a 5-

year recovery period. The firm's projected revenues and expenses (excluding depreciation), if it acquires the machine, would be as follows:

Year	Revenue	Expenses (excl. depreciation)
1	$1,000,000	$764,500
2	1,175,000	839,800
3	1,300,000	914,900
4	1,425,000	989,900
5	1,550,000	998,900

The new machine would result in an increased investment in net working capital of $22,000. At the end of 5 years, the new machine could be sold to net $25,000 before taxes.

The firm is subject to a 40% tax on both ordinary income and capital gains. As noted, the company uses MACRS depreciation. (See Table 3.2 on page 100 for the applicable depreciation percentages.)

Required

a. Calculate the initial investment associated with each of Clark Upholstery's alternatives.
b. Calculate the incremental operating cash inflows associated with each of Clark's alternatives. (*Note:* Be sure to consider the depreciation in year 6.)
c. Calculate the terminal cash flow at the end of year 5 associated with each of Clark's alternatives.
d. Use your findings in parts **a, b,** and **c** to depict on a time line the relevant cash flows associated with each of Clark Upholstery's alternatives.
e. Solely on the basis of your comparison of their relevant cash flows, which alternative appears to be better? Why?

WEB EXERCISE

Go to the Web site *www.reportgallery.com*. Click on **Reports**, at the top of the page, navigate to the listing for Intel Corp., and click on **Annual Report**. This takes you to an investor relations page; select the most recent annual report. Answer the following questions using information in various report sections, such as **Intel Facts and Figures, Financial Summary, Consolidated Balance Sheets**, and **Consolidated Statements of Cash Flow**. (These may change from year to year and may be listed in the left navigation bar.)

1. How much did Intel spend on capital expenditures for each of the past 5 years?
2. Did capital expenditures increase or decrease?
3. Is Intel's capital spending consistent or erratic?

4. What were the major uses of capital spending for the most recent 2 years?
5. What were the account balances for property, plant, and equipment (PP&E) for the most recent 2 years (found on the *Consolidated Balance Sheets*)?
6. What percent of PP&E does Intel replace every year? (*Hint:* For a rough estimate, divide capital expenditures for a year by that year's PP&E balance.)
7. Select *one* of the following companies, and use the *Reportgallery* site to access its annual report. Research its capital spending patterns and compare them to Intel's.
   a. Abbot Laboratories
   b. Southwest Airlines
   c. Ford Motor Company

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

CHAPTER

9

Capital Budgeting Techniques

LEARNING GOALS

LG1 Understand the role of capital budgeting techniques in the capital budgeting process.

LG2 Calculate, interpret, and evaluate the payback period.

LG3 Calculate, interpret, and evaluate the net present value (NPV).

LG4 Calculate, interpret, and evaluate the internal rate of return (IRR).

LG5 Use net present value profiles to compare NPV and IRR techniques.

LG6 Discuss NPV and IRR in terms of conflicting rankings and the theoretical and practical strengths of each approach.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand capital budgeting techniques in order to help determine the after-tax cash flows associated with proposed capital expenditures.

Information systems: You need to understand capital budgeting techniques in order to design decision modules that help reduce the amount of work required to analyze proposed capital projects.

Management: You need to understand capital budgeting techniques in order to understand the decision criteria used to accept or reject proposed projects.

Marketing: You need to understand capital budgeting techniques in order to understand how proposals for new marketing programs for new products, and for the expansion of existing product lines will be evaluated by the firm's decision makers.

Operations: You need to understand capital budgeting techniques in order to understand how proposals for the acquisition of new equipment and plants will be evaluated by the firm's decision makers.

Delta

Delta Cuts the Wires

Have you ever been stuck at an airport because your flight was late and you missed your connection? You were frustrated by the long lines at customer service counters and pay phones, and when you called on your cell phone, you were placed on hold for what seemed like forever. Wouldn't it be nice to use your Internet-capable cell phone or personal digital assistant (PDA) to pull up flight information and timetables and reschedule your flight? Since 2000, **Delta Airlines** passengers have been able to do just that.

The airline was one of the first to recognize that it could increase customer loyalty by giving business travelers better flight information more quickly. Before Delta's e-business unit added this feature, however, the project had to be justified the project on the basis of its economic value. Unlike making capital budgeting decisions about whether to buy new aircraft or build maintenance facilities, decisions that managers had been making for years, this project was moving them into uncharted skies—literally.

Delta's capital budgeting methodology for this Internet project used traditional net present value (NPV) analysis to develop relevant cash flows, discount them at the company's cost of capital, and subtract the project's initial investment. Anticipated cost savings were a major factor in developing projected cash flows. Wireless Web access enables customers to obtain information and conduct transactions without calling Delta's customer service representatives, so the airline doesn't have to add employees to handle a larger customer base. Another potential savings: lower paper costs, because more tickets will be issued electronically, even when last-minute changes are involved. The system is more cost-effective, thereby resulting in better resource utilization and a higher ROI.

Improved productivity is another benefit to be derived from this wireless project. Delta hopes to add self-service features so that passengers can choose seats, check in, and handle other routine transactions online. This will free reservations agents to handle more calls placed to purchase tickets, thus generating more revenue. Building on its initial success, Delta is ready to expand its wireless applications. A joint project with American Airlines, United Airlines, and Boeing Corporation will equip planes with broadband Internet connections so that the airlines can sell in-flight wireless services. Delta's innovative technology initiatives have made it one of five finalists for Computerworld's 21st Century Achievement Award.

Delta based its decision to accept the wireless-communication project on the project's positive NPV, which indicated that the project would earn a return above its cost of capital. This chapter focuses on the capital budgeting techniques, including NPV, that companies use to accept or reject and to rank proposed projects.

LG1 9.1 Overview of Capital Budgeting Techniques

When firms have developed relevant cash flows, as demonstrated in Chapter 8, they analyze them to assess whether a project is acceptable or to rank projects. A number of techniques are available for performing such analyses. The preferred approaches integrate time value procedures, risk and return considerations, and valuation concepts to select capital expenditures that are consistent with the firm's goal of maximizing owners' wealth. This chapter focuses on the use of these techniques in an environment of certainty. Chapter 10 covers risk and other refinements in capital budgeting.

We will use one basic problem to illustrate all the techniques described in this chapter. The problem concerns Bennett Company, a medium-sized metal fabricator that is currently contemplating two projects: Project A requires an initial investment of \$42,000, project B an initial investment of \$45,000. The projected relevant operating cash inflows for the two projects are presented in Table 9.1 and depicted on the time lines in Figure 9.1.[1] The projects exhibit *conventional cash flow patterns,* which are assumed throughout the text. In addition, we initially assume that all projects' cash flows have the same level of risk, that projects being compared have equal usable lives, and that the firm has unlimited funds. (The risk assumption will be relaxed in Chapter 10.) We begin with a look at the three most popular capital budgeting techniques: payback period, net present value, and internal rate of return.[2]

Hint Remember that the initial investment is an *outflow* occurring at time zero.

TABLE 9.1 Capital Expenditure Data for Bennett Company

	Project A	Project B
Initial investment	\$42,000	\$45,000
Year	Operating cash inflows	
1	\$14,000	\$28,000
2	14,000	12,000
3	14,000	10,000
4	14,000	10,000
5	14,000	10,000

1. For simplification, these 5-year-lived projects with 5 years of cash inflows are used throughout this chapter. Projects with usable lives equal to the number of years of cash inflows are also included in the end-of-chapter problems. Recall from Chapter 8 that under current tax law, MACRS depreciation results in $n + 1$ years of depreciation for an n-year class asset. This means that projects will commonly have at least 1 year of cash flow beyond their recovery period. In actual practice, the usable lives of projects (and the associated cash inflows) may differ significantly from their depreciable lives. Generally, under MACRS, usable lives are longer than depreciable lives.

2. Two other, closely related techniques that are sometimes used to evaluate capital budgeting projects are the *average (or accounting) rate of return (ARR)* and the *profitability index (PI)*. The ARR is an unsophisticated technique that is calculated by dividing a project's average profits after taxes by its average investment. Because it fails to con-

FIGURE 9.1

Bennett Company's projects A and B

Time lines depicting the conventional cash flows of projects A and B

Review Question

9–1 Once the firm has determined its projects' relevant cash flows, what must it do next? What is its goal in selecting projects?

LG2 9.2 Payback Period

payback period
The amount of time required for a firm to recover its initial investment in a project, as calculated from *cash inflows.*

Payback periods are commonly used to evaluate proposed investments. The **payback period** is the amount of time required for the firm to recover its initial investment in a project, as calculated from *cash inflows*. In the case of an *annuity*, the payback period can be found by dividing the initial investment by the annual

sider cash flows and the time value of money, it is ignored here. The PI, sometimes called the *benefit–cost ratio*, is calculated by dividing the present value of cash inflows by the initial investment. This technique, which does consider the time value of money, is sometimes used as a starting point in the selection of projects under capital rationing; the more popular NPV and IRR methods are discussed here.

cash inflow. For a *mixed stream* of cash inflows, the yearly cash inflows must be accumulated until the initial investment is recovered. Although popular, the payback period is generally viewed as an *unsophisticated capital budgeting technique,* because it does not *explicitly* consider the time value of money.

The Decision Criteria

When the payback period is used to make accept–reject decisions, the decision criteria are as follows:

- If the payback period is *less than* the maximum acceptable payback period, *accept* the project.
- If the payback period is *greater than* the maximum acceptable payback period, *reject* the project.

The length of the maximum acceptable payback period is determined by management. This value is set *subjectively* on the basis of a number of factors, including the type of project (expansion, replacement, renewal), the perceived risk of the project, and the perceived relationship between the payback period and the share value. It is simply a value that management feels, on average, will result in value-creating investment decisions.

EXAMPLE

We can calculate the payback period for Bennett Company's projects A and B using the data in Table 9.1. For project A, which is an annuity, the payback period is 3.0 years ($42,000 initial investment ÷ $14,000 annual cash inflow). Because project B generates a mixed stream of cash inflows, the calculation of its payback period is not as clear-cut. In year 1, the firm will recover $28,000 of its $45,000 initial investment. By the end of year 2, $40,000 ($28,000 from year 1 + $12,000 from year 2) will have been recovered. At the end of year 3, $50,000 will have been recovered. Only 50% of the year 3 cash inflow of $10,000 is needed to complete the payback of the initial $45,000. The payback period for project B is therefore 2.5 years (2 years + 50% of year 3).

If Bennett's maximum acceptable payback period were 2.75 years, project A would be rejected and project B would be accepted. If the maximum payback were 2.25 years, both projects would be rejected. If the projects were being ranked, B would be preferred over A, because it has a shorter payback period.

Hint In *all three* of the decision methods presented in this text, the relevant data are *after-tax cash flows.* Accounting profit is used only to help determine the after-tax cash flow.

Hint The payback period indicates to firms taking on projects of high risk how quickly they can recover their investment. In addition, it tells firms with limited sources of capital how quickly the funds invested in a given project will become available for future projects.

Pros and Cons of Payback Periods

The payback period is widely used by large firms to evaluate small projects and by small firms to evaluate most projects. Its popularity results from its computational simplicity and intuitive appeal. It is also appealing in that it considers cash flows rather than accounting profits. By measuring how quickly the firm recovers its initial investment, the payback period also gives *implicit* consideration to the timing of cash flows and therefore to the time value of money. Because it can be viewed as a measure of *risk exposure,* many firms use the payback period as a decision criterion or as a supplement to other decision techniques. The longer the firm must wait to recover its invested funds, the greater the possibility of a calamity. Therefore, the shorter the payback period, the lower the firm's exposure to such risk.

The major weakness of the payback period is that the appropriate payback period is merely a subjectively determined number. It cannot be specified in light of the wealth maximization goal because it is not based on discounting cash flows to determine whether they add to the firm's value. Instead, the appropriate payback period is simply the maximum acceptable period of time over which management decides that a project's cash flows must break even (that is, just equal the initial investment). A second weakness is that this approach fails to take *fully* into account the time factor in the value of money.[3] This weakness can be illustrated by an example.

EXAMPLE DeYarman Enterprises, a small medical appliance manufacturer, is considering two mutually exclusive projects, which it has named projects Gold and Silver. The firm uses only the payback period to choose projects. The relevant cash flows and payback period for each project are given in Table 9.2. Both projects have 3-year payback periods, which would suggest that they are equally desirable. But comparison of the pattern of cash inflows over the first 3 years shows that more of the $50,000 initial investment in project Silver is recovered sooner than is recovered for project Gold. For example, in year 1, $40,000 of the $50,000 invested in project Silver is recovered, whereas only $5,000 of the $50,000 investment in project Gold is recovered. Given the time value of money, project Silver would clearly be preferred over project Gold, in spite of the fact that they both have identical 3-year payback periods. The payback approach does not fully account for the time value of money, which, if recognized, would cause project Silver to be preferred over project Gold.

A third weakness of payback is its failure to recognize cash flows that occur *after* the payback period.

TABLE 9.2 Relevant Cash Flows and Payback Periods for DeYarman Enterprises' Projects

	Project Gold	Project Silver
Initial investment	**$50,000**	**$50,000**
Year	**Operating cash inflows**	
1	$ 5,000	$40,000
2	5,000	2,000
3	40,000	8,000
4	10,000	10,000
5	10,000	10,000
Payback period	3 years	3 years

3. To consider differences in timing *explicitly* in applying the payback method, the *present value payback period* is sometimes used. It is found by first calculating the present value of the cash inflows at the appropriate discount rate and then finding the payback period by using the present value of the cash inflows.

In Practice

FOCUS ON PRACTICE Limits of Payback Analysis

The high labor component of U.S. textile manufacturers creates a cost disadvantage that makes it hard for them to compete in global markets. They lag behind other U.S. industries and foreign textile producers in terms of plant automation. One key hurdle is payback period. The industry standard for capital expenditure projects for machinery is 3 years. Because few major automation projects have such a short payback period, the pace of automation has been very slow. For example, the payback period for materials transport automation—moving material from one point to another with minimum labor—averages 5 to 6 years.

This situation underscores a major limitation of payback period analysis. Companies that rely only on the payback period may not give fair consideration to technology that can greatly improve their long-term manufacturing effectiveness. Whereas Japanese managers will invest $1 million to replace one job, U.S. managers invest about $250,000. At prevailing wage rates, the Japanese accept a 5- to 6-year payback, compared to a period of 3 to 4 years in the United States. These differences underscore the linkages that exist between a firm's operations and finance.

EXAMPLE Rashid Company, a software developer, has two investment opportunities, X and Y. Data for X and Y are given in Table 9.3. The payback period for project X is 2 years; for project Y it is 3 years. Strict adherence to the payback approach suggests that project X is preferable to project Y. However, if we look beyond the payback period, we see that project X returns only an additional $1,200 ($1,000 in year 3 + $100 in year 4 + $100 in year 5), whereas project Y returns an additional $7,000 ($4,000 in year 4 + $3,000 in year 5). On the basis of this information, project Y appears preferable to X. The payback approach ignored the cash inflows occurring after the end of the payback period.[4]

TABLE 9.3 Calculation of the Payback Period for Rashid Company's Two Alternative Investment Projects

	Project X	Project Y
Initial investment	$10,000	$10,000
Year	Operating cash inflows	
1	$5,000	$3,000
2	5,000	4,000
3	1,000	3,000
4	100	4,000
5	100	3,000
Payback period	2 years	3 years

4. To get around this weakness, some analysts add a desired dollar return to the initial investment and then calculate the payback period for the increased amount. For example, if the analyst wished to pay back the initial investment plus 20% for projects X and Y in Table 9.3, the amount to be recovered would be $12,000 [$10,000 + (0.20 × $10,000)]. For project X, the payback period would be infinite because the $12,000 would never be recovered; for project Y, the payback period would be 3.50 years [3 years + ($2,000 ÷ $4,000) years]. Clearly, project Y would be preferred.

Review Questions

9–2 What is the *payback period?* How is it calculated?

9–3 What weaknesses are commonly associated with the use of the payback period to evaluate a proposed investment?

LG3

9.3 Net Present Value (NPV)

Because *net present value (NPV)* gives explicit consideration to the time value of money, it is considered a *sophisticated capital budgeting technique*. All such techniques in one way or another discount the firm's cash flows at a specified rate. This rate—often called the *discount rate, required return, cost of capital,* or *opportunity cost*—is the minimum return that must be earned on a project to leave the firm's market value unchanged. In this chapter, we take this rate as a "given." In Chapter 11 we will explore how it is calculated.

net present value (NPV)
A sophisticated capital budgeting technique; found by subtracting a project's initial investment from the present value of its cash inflows discounted at a rate equal to the firm's cost of capital.

The **net present value (NPV)** is found by subtracting a project's initial investment (CF_0) from the present value of its cash inflows (CF_t) discounted at a rate equal to the firm's cost of capital (k).

$$\text{NPV} = \text{Present value of cash inflows} - \text{Initial investment}$$

$$\text{NPV} = \sum_{t=1}^{n} \frac{CF_t}{(1+k)^t} - CF_0 \qquad (9.1)$$

$$= \sum_{t=1}^{n} (CF_t \times PVIF_{k,t}) - CF_0 \qquad (9.1a)$$

When NPV is used, both inflows and outflows are measured in terms of present dollars. Because we are dealing only with investments that have *conventional cash flow patterns,* the initial investment is automatically stated in terms of today's dollars. If it were not, the present value of a project would be found by subtracting the present value of outflows from the present value of inflows.

The Decision Criteria

When NPV is used to make accept–reject decisions, the decision criteria are as follows:

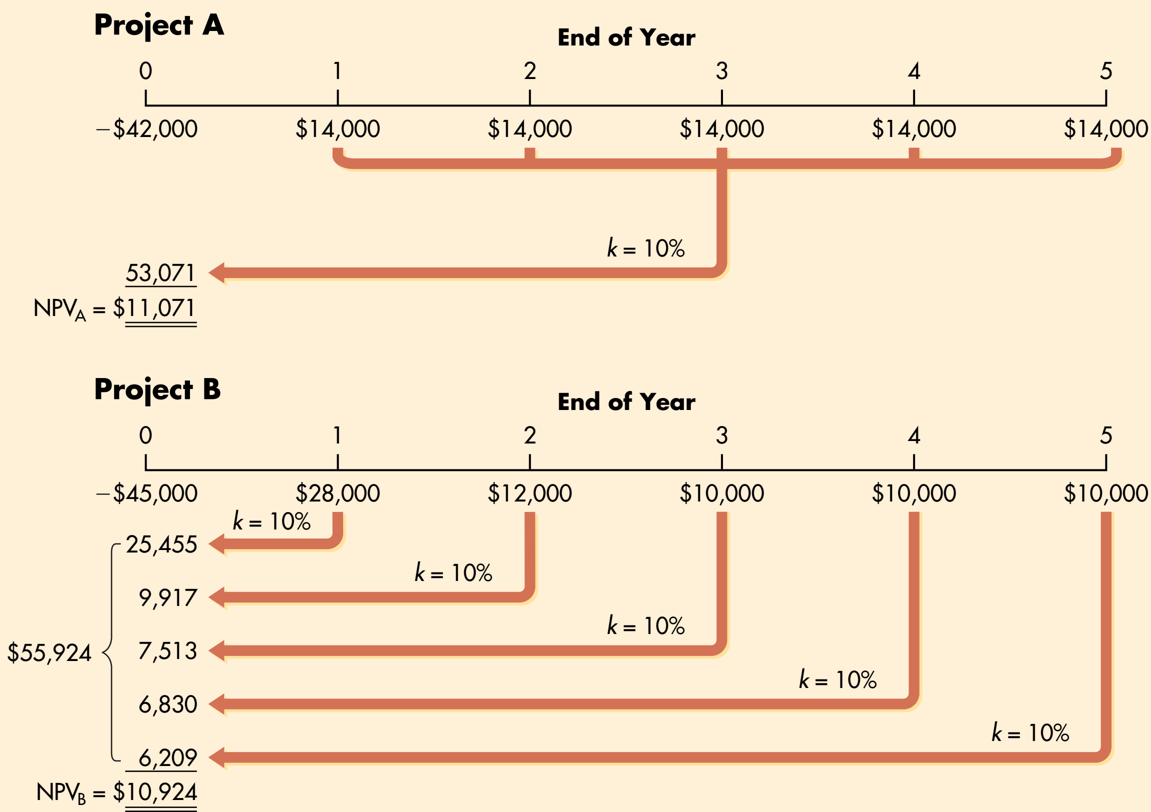
- If the NPV is *greater than* \$0, *accept* the project.
- If the NPV is *less than* \$0, *reject* the project.

If the NPV is greater than \$0, the firm will earn a return greater than its cost of capital. Such action should enhance the market value of the firm and therefore the wealth of its owners.

EXAMPLE

We can illustrate the net present value (NPV) approach by using Bennett Company data presented in Table 9.1. If the firm has a 10% cost of capital, the net present values for projects A (an annuity) and B (a mixed stream) can be calculated as shown on the time lines in Figure 9.2. These calculations result in net present

FIGURE 9.2 **Calculation of NPVs for Bennett Company's Capital Expenditure Alternatives**
Time lines depicting the cash flows and NPV calculations for projects A and B



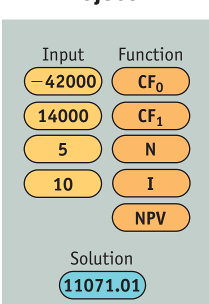
values for projects A and B of $11,071 and $10,924, respectively. Both projects are acceptable, because the net present value of each is greater than $0. If the projects were being ranked, however, project A would be considered superior to B, because it has a higher net present value than that of B ($11,071 versus $10,924).

Calculator Use The preprogrammed NPV function in a financial calculator can be used to simplify the NPV calculation. The keystrokes for project A—the annuity—typically are as shown at left. Note that because project A is an annuity, only its first cash inflow, $CF_1 = 14000$, is input, followed by its frequency, $N = 5$.

The keystrokes for project B—the mixed stream—are as shown on page 403. Because the last three cash inflows for project B are the same ($CF_3 = CF_4 = CF_5 = 10000$), after inputting the first of these cash inflows, CF_3, we merely input its frequency, $N = 3$.

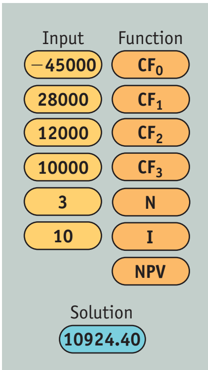
The calculated NPVs for projects A and B of $11,071 and $10,924, respectively, agree with the NPVs cited above.

Project A



Spreadsheet Use The NPVs can be calculated as shown on the following Excel spreadsheet.

Project B



	A	B		C	
1	DETERMINING THE NET PRESENT VALUE				
2	Firm's cost of capital			10%	
3		Year-End Cash Flow			
4	Year	Project A		Project B	
5	0	$	(42,000)	$	(45,000)
6	1	$	14,000	$	28,000
7	2	$	14,000	$	12,000
8	3	$	14,000	$	10,000
9	4	$	14,000	$	10,000
10	5	$	14,000	$	10,000
11	NPV	$	11,071	$	10,924
12	Choice of project			Project A	

Entry in Cell B11 is
=NPV(C2,B6:B10)+B5
Copy the entry in Cell B11 to Cell C11.
Entry in Cell C12 is IF(B11>C11,B4,C4).

Review Questions

9–4 How is the *net present value (NPV)* calculated for a project with a *conventional cash flow pattern?*

9–5 What are the acceptance criteria for NPV? How are they related to the firm's market value?

LG4 9.4 Internal Rate of Return (IRR)

internal rate of return (IRR)
A sophisticated capital budgeting technique; the discount rate that equates the NPV of an investment opportunity with $0 (because the present value of cash inflows equals the initial investment); it is the compound annual rate of return that the firm will earn if it invests in the project and receives the given cash inflows.

The *internal rate of return (IRR)* is probably the most widely used *sophisticated capital budgeting technique*. However, it is considerably more difficult than NPV to calculate by hand. The **internal rate of return (IRR)** is the discount rate that equates the NPV of an investment opportunity with $0 (because the present value of cash inflows equals the initial investment). It is the compound annual rate of return that the firm will earn if it invests in the project and receives the given cash inflows. Mathematically, the IRR is the value of k in Equation 9.1 that causes NPV to equal $0.

$$\$0 = \sum_{t=1}^{n} \frac{CF_t}{(1+IRR)^t} - CF_0 \tag{9.2}$$

$$\sum_{t=1}^{n} \frac{CF_t}{(1+IRR)^t} = CF_0 \tag{9.2a}$$

The Decision Criteria

When IRR is used to make accept–reject decisions, the decision criteria are as follows:

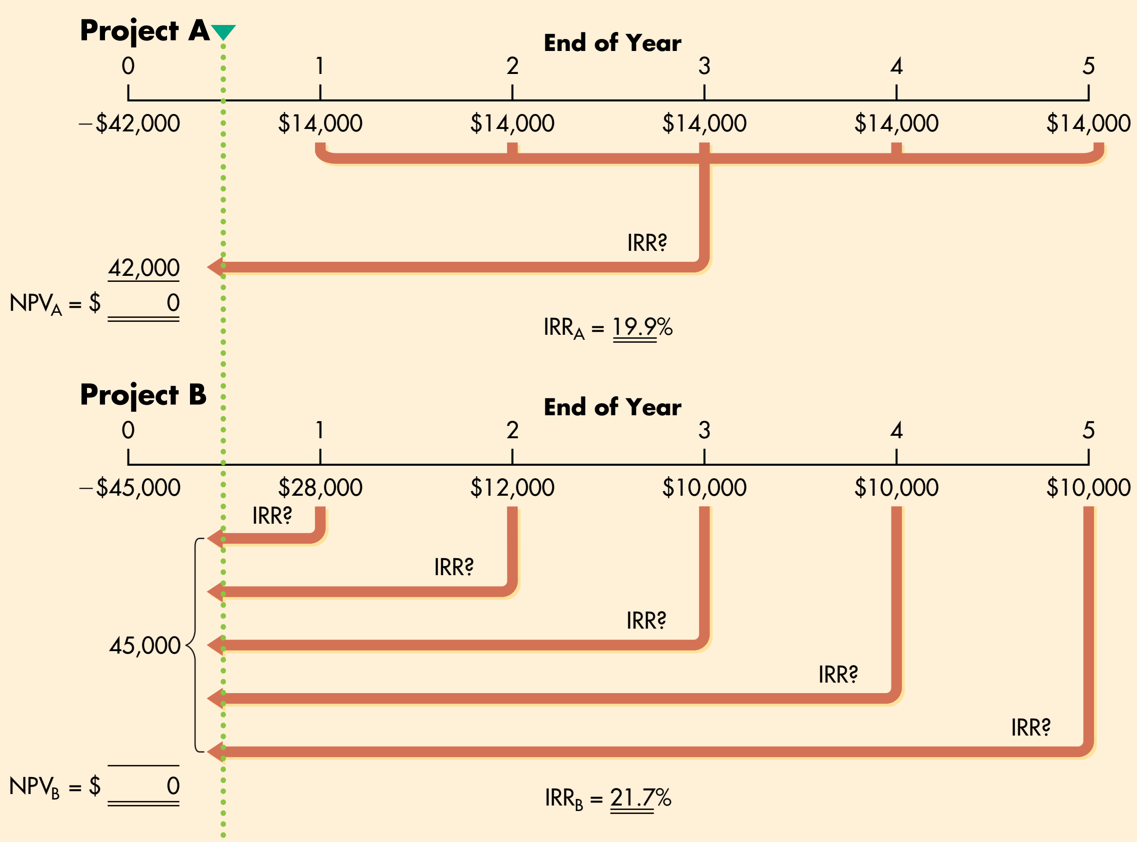
- If the IRR is *greater than* the cost of capital, *accept* the project.
- If the IRR is *less than* the cost of capital, *reject* the project.

These criteria guarantee that the firm earns at least its required return. Such an outcome should enhance the market value of the firm and therefore the wealth of its owners.

Calculating the IRR

The actual calculation by hand of the IRR from Equation 9.2a is no easy chore. It involves a complex trial-and-error technique that is described and demonstrated on this text's Web site: *www.aw.com/gitman*. Fortunately, many financial calculators have a preprogrammed IRR function that can be used to simplify the IRR calculation. With these calculators, you merely punch in all cash flows just as if to calculate NPV and then depress IRR to find the internal rate of return. Computer software, including spreadsheets, is also available for simplifying these calculations. All NPV and IRR values presented in this and subsequent chapters are obtained by using these functions on a popular financial calculator.

FIGURE 9.3 **Calculation of IRRs for Bennett Company's Capital Expenditure Alternatives**
Time lines depicting the cash flows and IRR calculations for projects A and B



EXAMPLE

We can demonstrate the internal rate of return (IRR) approach using Bennett Company data presented in Table 9.1. Figure 9.3 (page 404) uses time lines to depict the framework for finding the IRRs for Bennett's projects A and B, both of which have conventional cash flow patterns. It can be seen in the figure that the IRR is the unknown discount rate that causes the NPV just to equal \$0.

Calculator Use To find the IRR using the preprogrammed function in a financial calculator, the keystrokes for each project are the same as those shown on page 403 for the NPV calculation, except that the last two NPV keystrokes (punching **I** and then **NPV**) are replaced by a single **IRR** keystroke.

Comparing the IRRs of projects A and B given in Figure 9.3 to Bennett Company's 10% cost of capital, we can see that both projects are acceptable because

$$IRR_A = 19.9\% > 10.0\% \text{ cost of capital}$$
$$IRR_B = 21.7\% > 10.0\% \text{ cost of capital}$$

Comparing the two projects' IRRs, we would prefer project B over project A because $IRR_B = 21.7\% > IRR_A = 19.9\%$. If these projects are mutually exclusive, the IRR decision technique would recommend project B.

Spreadsheet Use The internal rate of return also can be calculated as shown on the Excel spreadsheet on page 405.

	A	B	C
1	**DETERMINING THE INTERNAL RATE OF RETURN**		
2		Year-End Cash Flow	
3	Year	Project A	Project B
4	0	\$ (42,000)	\$ (45,000)
5	1	\$ 14,000	\$ 28,000
6	2	\$ 14,000	\$ 12,000
7	3	\$ 14,000	\$ 10,000
8	4	\$ 14,000	\$ 10,000
9	5	\$ 14,000	\$ 10,000
10	IRR	19.9%	21.7%
11	**Choice of Project**		**Project B**

Entry in Cell B10 is =IRR(B4:B9).
Copy the entry in Cell B10 to Cell C10.
Entry in Cell C11 is =IF(B10>C10,B3,C3).

It is interesting to note in the preceding example that the IRR suggests that project B, which has an IRR of 21.7%, is preferable to project A, which has an IRR of 19.9%. This conflicts with the NPV rankings obtained in an earlier example. Such conflicts are not unusual. *There is no guarantee that NPV and IRR will rank projects in the same order. However, both methods should reach the same conclusion about the acceptability or nonacceptability of projects.*

In Practice

FOCUS ON PRACTICE EVAlue Creation

Answering the question "Does the company use investors' money wisely?" is one of the financial manager's chief responsibilities and greatest challenges. At many firms—from Fortune 500 companies and investment firms to community hospitals—economic value added (EVA®) is the measurement tool of choice for making investment decisions, measuring overall financial performance, and motivating management.

Developed in 1983 by financial consultants Stern Stewart and protected by trademark, EVA® is the difference between an investment's net operating profits after taxes and the cost of funds used to finance the investment (the amount of capital times the company's cost of capital). An investment with a positive EVA® exceeds the firm's cost of capital and therefore creates wealth. The EVA® calculation is similar to calculating internal rate of return (IRR), except that the result is stated *in dollars* rather than percentages. It can be applied to the company as a whole as well as to specific long-term investments such as new facilities or equipment and acquisitions.

According to its proponents, EVA® represents "real" profits and provides a more accurate measure than accounting profits. Over time, it also has better correlation with stock prices than does earnings per share (EPS). Income calculations include only the cost of debt (interest expense), whereas EVA® uses the total cost of capital—both debt and equity (an expensive form of capital). In addition, EVA® treats research and development (R&D) outlays as investments in future products or processes and capitalizes rather than expenses them. A growing EVA® can signal future increases in stock prices.

Companies that use EVA® believe doing so leads to better overall performance. Managers who apply it focus on allocating and managing assets, not just accounting profits. They will accelerate the development of a hot new product even if it reduces earnings in the near term. Likewise, EVA®-driven companies will expense rather than capitalize the cost of a new venture. Although earnings will drop for a few quarters, so will taxes—and cash flow actually increases.

EVA® is not a panacea, however. Its critics say it's just another accounting measure and may not be the right one for many companies. They claim that because it favors big projects in big companies, it doesn't do a good job on capital allocation.

Each year *Fortune* and Stern Stewart publish a "wealth creators" list that answers a critical question: Is the company creating or destroying wealth for its shareholders? This list uses both EVA® and market value added (MVA®)—the difference between what investors can now take out of a company and what they put in—to rank companies. In 2001 the list also included another measure, *future growth value*, an estimate of the value of the companies' future growth today, based on current net operating profits after taxes. **General Electric** again topped the 2001 list, followed by **Microsoft**, **Wal-Mart**, **IBM**, and **Pfizer**.

EVA® is gaining acceptance worldwide as well. At the French corporation **Danone**, chief executive Franck Riboud uses an EVA® formula to measure performance. "It's a question of tools and language," says Riboud. "If I talk EVA®, I will be understood all over the world."

Sources: Geoffrey Colvin, "Earnings Aren't Everything," *Fortune* (September 17, 2001), p. 58; Janet Guyon, "Companies Around the World Are Going the America Way," *Fortune* (November 26, 2001), pp. 114–120; Randy Myers, "Measure for Measure," *CFO* (November 1997), downloaded from *www.cfonet.com;* Stern Stewart Web site, *www.sternstewart.com;* and David Stires," America's Best and Worst Wealth Creators," *Fortune* (December 10, 2001), pp. 137–142.

Review Questions

9–6 What is the *internal rate of return (IRR)* on an investment? How is it determined?

9–7 What are the acceptance criteria for IRR? How are they related to the firm's market value?

9–8 Do the net present value (NPV) and internal rate of return (IRR) always agree with respect to accept–reject decisions? With respect to ranking decisions? Explain.

LG5 LG6 9.5 Comparing NPV and IRR Techniques

To understand the differences between the NPV and IRR techniques and decision makers' preferences in their use, we need to look at net present value profiles, conflicting rankings, and the question of which approach is better.

Net Present Value Profiles

net present value profile
Graph that depicts a project's NPVs for various discount rates.

Projects can be compared graphically by constructing **net present value profiles** that depict the projects' NPVs for various discount rates. These profiles are useful in evaluating and comparing projects, especially when conflicting rankings exist. They are best demonstrated via an example.

EXAMPLE

To prepare net present value profiles for Bennett Company's two projects, A and B, the first step is to develop a number of "discount rate–net present value" coordinates. Three coordinates can be easily obtained for each project; they are at discount rates of 0%, 10% (the cost of capital, k), and the IRR. The net present value at a 0% discount rate is found by merely adding all the cash inflows and subtracting the initial investment. Using the data in Table 9.1 and Figure 9.1, we get

For project A:

$$(\$14{,}000 + \$14{,}000 + \$14{,}000 + \$14{,}000 + \$14{,}000) - \$42{,}000 = \$28{,}000$$

For project B:

$$(\$28{,}000 + \$12{,}000 + \$10{,}000 + \$10{,}000 + \$10{,}000) - \$45{,}000 = \$25{,}000$$

The net present values for projects A and B at the 10% cost of capital are \$11,071 and \$10,924, respectively (from Figure 9.2). Because the IRR is the discount rate for which net present value equals zero, the IRRs (from Figure 9.3) of 19.9% for project A and 21.7% for project B result in \$0 NPVs. The three sets of coordinates for each of the projects are summarized in Table 9.4.

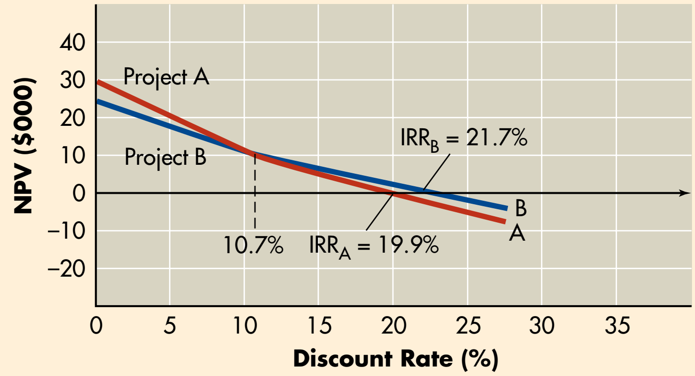
Plotting the data from Table 9.4 results in the net present value profiles for projects A and B shown in Figure 9.4. The figure indicates that for any discount

TABLE 9.4 Discount-Rate–NPV Coordinates for Projects A and B

	Net present value	
Discount rate	Project A	Project B
0 %	\$28,000	\$25,000
10	11,071	10,924
19.9	0	—
21.7	—	0

FIGURE 9.4

NPV Profiles
Net present value profiles for Bennett Company's projects A and B



rate less than approximately 10.7%, the NPV for project A is greater than the NPV for project B. Beyond this point, the NPV for project B is greater. Because the net present value profiles for projects A and B cross at a positive NPV, the IRRs for the projects cause conflicting rankings whenever they are compared to NPVs calculated at discount rates below 10.7%.

Conflicting Rankings

conflicting rankings
Conflicts in the ranking given a project by NPV and IRR, resulting from *differences in the magnitude and timing of cash flows.*

intermediate cash inflows
Cash inflows received prior to the termination of a project.

Ranking is an important consideration when projects are mutually exclusive or when capital rationing is necessary. When projects are mutually exclusive, ranking enables the firm to determine which project is best from a financial standpoint. When capital rationing is necessary, ranking projects will provide a logical starting point for determining what group of projects to accept. As we'll see, **conflicting rankings** using NPV and IRR result from *differences in the magnitude and timing of cash flows.*

The underlying cause of conflicting rankings is different implicit assumptions about the *reinvestment* of **intermediate cash inflows**—cash inflows received prior to the termination of a project. NPV assumes that intermediate cash inflows are reinvested at the cost of capital, whereas IRR assumes that intermediate cash inflows are invested at a rate equal to the project's IRR.[5] These differing assumptions can be demonstrated with an example.

5. To eliminate the reinvestment rate assumption of the IRR, some practitioners calculate the *modified internal rate of return* (*MIRR*). The MIRR is found by converting each operating cash inflow to its future value measured at the end of the project's life and then summing the future values of all inflows to get the project's *terminal value.* Each future value is found by using the cost of capital, thereby eliminating the reinvestment rate criticism of the traditional IRR. The MIRR represents the discount rate that causes the terminal value just to equal the initial investment. Because it uses the cost of capital as the reinvestment rate, the MIRR is generally viewed as a better measure of a project's true profitability than the IRR. Although this technique is frequently used in commercial real estate valuation and is a preprogrammed function on some sophisticated financial calculators, its failure to resolve the issue of conflicting rankings and its theoretical inferiority to NPV have resulted in the MIRR receiving only limited attention and acceptance in the financial literature. For a thorough analysis of the arguments surrounding IRR and MIRR, see D. Anthony Plath and William F. Kennedy, "Teaching Return-Based Measures of Project Evaluation," *Financial Practice and Education* (Spring/Summer 1994), pp. 77–86.

TABLE 9.5 Reinvestment Rate Comparisons for a Project[a]

			Reinvestment rate			
			10%		15%	
Year (1)	Cash inflows (2)	Number of years earning interest (t) [3 − (1)] (3)	$FVIF_{10\%,t}$ (4)	Future value [(2) × (4)] (5)	$FVIF_{15\%,t}$ (6)	Future value [(2) × (6)] (7)
1	$ 52,000	2	1.210	$ 62,920	1.323	$ 68,796
2	78,000	1	1.100	85,800	1.150	89,700
3	100,000	0	1.000	100,000	1.000	100,000
		Future value end of year 3		$248,720		$258,496

NPV @ 10% = $16,867

IRR = 15%

[a]Initial investment in this project is $170,000.

EXAMPLE

A project requiring a $170,000 initial investment is expected to provide operating cash inflows of $52,000, $78,000, and $100,000 at the end of each of the next 3 years. The NPV of the project (at the firm's 10% cost of capital) is $16,867 and its IRR is 15%. Clearly, the project is acceptable (NPV = $16,867 > $0 and IRR = 15% > 10% cost of capital). Table 9.5 demonstrates calculation of the project's future value at the end of its 3-year life, assuming both a 10% (its cost of capital) and a 15% (its IRR) rate of return. A future value of $248,720 results from reinvestment at the 10% cost of capital (total in column 5), and a future value of $258,496 results from reinvestment at the 15% IRR (total in column 7).

If the future value in each case in Table 9.5 were viewed as the return received 3 years from today from the $170,000 initial investment, the cash flows would be those given in Table 9.6. The NPVs and IRRs in each case are shown below the cash flows in Table 9.6. You can see that at the 10% reinvestment rate, the NPV remains at $16,867; reinvestment at the 15% IRR produces an NPV of $24,213.

From this result, it should be clear that the NPV technique assumes reinvestment at the cost of capital (10% in this example). (Note that with reinvestment at 10%, the IRR would be 13.5%.) On the other hand, the IRR technique assumes an ability to reinvest intermediate cash inflows at the IRR. If reinvestment does not occur at this rate, the IRR will differ from 15%. Reinvestment at a rate below the IRR would result in an IRR below that calculated (at 13.5%, for example, if the reinvestment rate were only 10%). Reinvestment at a rate above the IRR would result in an IRR above that calculated.

In general, projects with similar-size investments and lower cash inflows in the early years tend to be preferred at lower discount rates.[6] Projects that have

6. Because differences in the relative sizes of initial investments can also affect conflicts in rankings, the initial investments are assumed to be similar. This permits isolation of the effect of differences in the magnitude and timing of cash inflows on project rankings.

TABLE 9.6 Project Cash Flows After Reinvestment

	Reinvestment Rate	
	10%	15%
Initial investment	$170,000	
Year	Operating cash inflows	
1	$ 0	$ 0
2	0	0
3	248,720	258,496
NPV @ 10%	$ 16,867	$ 24,213
IRR	13.5%	15.0%

higher cash inflows in the early years tend to be preferred at higher discount rates. Why? Because at high discount rates, later-year cash inflows tend to be severely penalized in present value terms. For example, at a high discount rate, say 20 percent, the present value of $1 received at the end of 5 years is about 40 cents, whereas for $1 received at the end of 15 years it is less than 7 cents. Clearly, at high discount rates a project's early-year cash inflows count most in terms of its NPV. Table 9.7 summarizes the preferences associated with extreme discount rates and dissimilar cash inflow patterns.

EXAMPLE Bennett Company's projects A and B were found to have conflicting rankings at the firm's 10% cost of capital (as depicted in Figure 9.4). If we review each project's cash inflow pattern as presented in Table 9.1 and Figure 9.1, we see that although the projects require similar initial investments, they have dissimilar cash inflow patterns. Table 9.7 indicates that project B, which has higher early-year cash inflows than project A, would be preferred over project A at higher discount rates. Figure 9.4 shows that this is in fact the case. At any discount rate in excess

TABLE 9.7 Preferences Associated with Extreme Discount Rates and Dissimilar Cash Inflow Patterns

	Cash inflow pattern	
Discount rate	Lower early-year cash inflows	Higher early-year cash inflows
Low	Preferred	Not preferred
High	Not preferred	Preferred

of 10.7%, project B's NPV is above that of project A. Clearly, the magnitude and timing of the projects' cash inflows do affect their rankings.

Although the classification of cash inflow patterns in Table 9.7 is useful in explaining conflicting rankings, differences in the magnitude and timing of cash inflows do not guarantee conflicts in ranking. In general, the greater the difference between the magnitude and timing of cash inflows, the greater the likelihood of conflicting rankings. Conflicts based on NPV and IRR can be reconciled computationally; to do so, one creates and analyzes an incremental project reflecting the difference in cash flows between the two mutually exclusive projects. Because a detailed description of this procedure is beyond the scope of an introductory text, suffice it to say that IRR techniques can be used to generate consistently the same project rankings as those obtained by using NPV.

Which Approach Is Better?

It is difficult to choose one approach over the other, because the theoretical and practical strengths of the approaches differ. It is therefore wise to view both NPV and IRR techniques in each of those dimensions.

Theoretical View

On a purely theoretical basis, NPV is the better approach to capital budgeting as a result of several factors. Most important is that the use of NPV implicitly assumes that any intermediate cash inflows generated by an investment are *reinvested at the firm's cost of capital.* The use of IRR assumes *reinvestment at the often high rate specified by the IRR.* Because the cost of capital tends to be a reasonable estimate of the rate at which the firm could *actually reinvest* intermediate cash inflows, the use of NPV, with its more conservative and realistic reinvestment rate, is in theory preferable.

In addition, certain mathematical properties may cause a project with a nonconventional cash flow pattern to have zero or more than one *real* IRR; this problem does not occur with the NPV approach.

Practical View

Evidence suggests that in spite of the theoretical superiority of NPV, *financial managers prefer to use IRR.*[7] The preference for IRR is due to the general disposition of businesspeople toward *rates of return* rather than actual *dollar returns.* Because interest rates, profitability, and so on are most often expressed as annual rates of return, the use of IRR makes sense to financial decision makers. They tend to find NPV less intuitive because it does not measure benefits *relative to the*

7. For example, see Harold Bierman, Jr., "Capital Budgeting in 1992: A Survey," *Financial Management* (Autumn 1993), p. 24, and Lawrence J. Gitman and Charles E. Maxwell, "A Longitudinal Comparison of Capital Budgeting Techniques Used by Major U.S. Firms: 1986 versus 1976," *Journal of Applied Business Research* (Fall 1987), pp. 41–50, for discussions of evidence with respect to capital budgeting decision-making practices in major U.S. firms.

amount invested. Because a variety of techniques are available for avoiding the pitfalls of the IRR, its widespread use does not imply a lack of sophistication on the part of financial decision makers.

Review Questions

9–9 How is a *net present value profile* used to compare projects? What causes conflicts in the ranking of projects via net present value and internal rate of return?

9–10 Does the assumption concerning the reinvestment of intermediate cash inflow tend to favor NPV or IRR? In practice, which technique is preferred and why?

Summary

FOCUS ON VALUE

After estimating the relevant cash flows, the financial manager must apply appropriate decision techniques to assess whether the project creates value for shareholders. Net present value (NPV) and internal rate of return (IRR) are the generally preferred capital budgeting techniques. Both use the cost of capital as the required return needed to compensate shareholders for undertaking projects with the same risk as that of the firm. The appeal of NPV and IRR stems from the fact that both indicate whether a proposed investment creates or destroys shareholder value.

NPV clearly indicates the expected dollar amount of wealth creation from a proposed project, whereas IRR provides the same accept-or-reject decision as NPV. As a consequence of some fundamental differences, NPV and IRR do not necessarily rank projects the same. Although the potential conflicting rankings can be reconciled, NPV is the theoretically preferred approach. In practice, however, IRR is preferred because of its intuitive appeal. Regardless, the application of NPV and IRR to good estimates of relevant cash flows should enable the financial manager to recommend projects that are consistent with the firm's goals of **maximizing stock price.**

REVIEW OF LEARNING GOALS

LG1 **Understand the role of capital budgeting techniques in the capital budgeting process.** Capital budgeting techniques are used to analyze and assess project acceptability and ranking. They are applied to each project's relevant cash flows to select capital expenditures that are consistent with the firm's goal of maximizing owners' wealth.

LG2 **Calculate, interpret, and evaluate the payback period.** The payback period is the amount of time required for the firm to recover its initial investment, as calculated from cash inflows. The formula and decision criteria for the payback period are summarized in Table 9.8. Shorter payback periods are preferred. The payback period's strengths include ease of calculation, simple intuitive appeal, its consideration of cash flows, its implicit consideration of timing, and its ability to measure risk exposure. Its weaknesses include its lack of linkage to the wealth maximization goal, its failure to consider time value explicitly, and the fact that it ignores cash flows that occur after the payback period.

LG3 **Calculate, interpret, and evaluate the net present value (NPV).** Because it gives explicit consideration to the time value of money, NPV is considered a sophisticated capital budgeting technique. The key formula and decision criteria for NPV are summarized in Table 9.8. In calculating NPV, the rate at which cash flows are discounted is often called the discount rate, required return, cost of capital, or opportunity cost. By whatever name, this rate represents the minimum return that must be earned on a project to leave the firm's market value unchanged.

LG4 **Calculate, interpret, and evaluate the internal rate of return (IRR).** Like NPV, IRR is a sophisticated capital budgeting technique because it explicitly considers the time value of money. The key formula and decision criteria for IRR are summarized in Table 9.8. IRR can be viewed as the compound annual rate of return that the firm will earn if it invests in a project and receives the given cash inflows. By accepting only those projects with IRRs in excess of the firm's cost of capital, the firm should enhance its market value and the wealth of its owners. Both NPV and IRR yield the same accept–reject decisions, but they often provide conflicting ranks.

LG5 **Use net present value profiles to compare NPV and IRR techniques.** A net present value profile is a graph that depicts the projects' NPVs for various discount rates. It is useful in comparing projects, especially when NPV and IRR yield conflicting rankings. The NPV profile is prepared by developing a number of "discount rate–net present value" coordinates, often using discount rates of 0 percent, the cost of capital, and the IRR for each project, and then plotting them on the same set of discount-rate–NPV axes.

LG6 **Discuss NPV and IRR in terms of conflicting rankings and the theoretical and practical strengths of each approach.** Conflicting rankings of projects frequently emerge from NPV and IRR, as a result of differences in the magnitude and timing of each project's cash flows. The underlying cause is the differing implicit assumptions of NPV and IRR

TABLE 9.8 Summary of Key Formulas/Definitions and Decision Criteria for Capital Budgeting Techniques

Technique	Formula/definition	Decision criteria
Payback period[a]	*For annuity:* $\frac{\text{Initial investment}}{\text{Annual cash inflow}}$ *For mixed stream:* Calculate cumulative cash inflows on year-to-year basis until the initial investment is recovered.	*Accept* if < maximum acceptable payback period. *Reject* if > maximum acceptable payback period.
Net present value (NPV)[b]	Present value of cash inflows − Initial investment.	*Accept* if > \$0. *Reject* if < \$0.
Internal rate of return (IRR)[b]	The discount rate that causes NPV = \$0 (present value of cash inflows equals the initial investment).	*Accept* if > the cost of capital. *Reject* if < the cost of capital.

[a]Unsophisticated technique, because it does not give explicit consideration to the time value of money.

[b]Sophisticated technique, because it gives explicit consideration to the time value of money.

with regard to the reinvestment of intermediate cash inflows—cash inflows received prior to termination of a project. NPV assumes reinvestment of intermediate cash inflows at the more conservative cost of capital, whereas IRR assumes reinvestment at the project's IRR. On a purely theoretical basis, NPV is preferred over IRR, because NPV assumes the more conservative reinvestment rate and does not exhibit the mathematical problems that often occur when IRRs are calculated for nonconventional cash flows. In practice, however, the IRR is more commonly used because it is consistent with the general preference for rates of return.

SELF-TEST PROBLEM (Solution in Appendix B)

LG2 LG3 LG4 LG5 LG6

ST 9–1 **All techniques with NPV profile—Mutually exclusive projects** Fitch Industries is in the process of choosing the better of two equal-risk, mutually exclusive capital expenditure projects—M and N. The relevant cash flows for each project are shown in the following table. The firm's cost of capital is 14%.

	Project M	Project N
Initial investment (CF_0)	$28,500	$27,000
Year (t)	**Cash inflows (CF_t)**	
1	$10,000	$11,000
2	10,000	10,000
3	10,000	9,000
4	10,000	8,000

a. Calculate each project's payback period.
b. Calculate the net present value (NPV) for each project.
c. Calculate the internal rate of return (IRR) for each project.
d. Summarize the preferences dictated by each measure you calculated, and indicate which project you would recommend. Explain why.
e. Draw the net present value profiles for these projects on the same set of axes, and explain the circumstances under which a conflict in rankings might exist.

PROBLEMS

LG2

9–1 **Payback period** Jordan Enterprises is considering a capital expenditure that requires an initial investment of $42,000 and returns after-tax cash inflows of $7,000 per year for 10 years. The firm has a maximum acceptable payback period of 8 years.
a. Determine the payback period for this project.
b. Should the company accept the project? Why or why not?

LG2

9–2 **Payback comparisons** Nova Products has a 5-year maximum acceptable payback period. The firm is considering the purchase of a new machine and must choose between two alternative ones. The first machine requires an initial investment of $14,000 and generates annual after-tax cash inflows of $3,000 for each of the next 7 years. The second machine requires an initial investment of $21,000 and provides an annual cash inflow after taxes of $4,000 for 20 years.

a. Determine the payback period for each machine.
b. Comment on the acceptability of the machines, assuming that they are independent projects.
c. Which machine should the firm accept? Why?
d. Do the machines in this problem illustrate any of the weaknesses of using payback? Discuss.

LG2 LG3 9–3 **Choosing between two projects with acceptable payback periods** Shell Camping Gear, Inc., is considering two mutually exclusive projects. Each requires an initial investment of $100,000. John Shell, president of the company, has set a maximum payback period of 4 years. The after-tax cash inflows associated with each project are as follows:

	Cash inflows (CF_t)	
Year	Project A	Project B
1	$10,000	$40,000
2	20,000	30,000
3	30,000	20,000
4	40,000	10,000
5	20,000	20,000

a. Determine the payback period of each project.
b. Because they are mutually exclusive, Shell must choose one. Which should the company invest in?
c. Explain why one of the projects is a better choice than the other.

LG3 9–4 **NPV** Calculate the net present value (NPV) for the following 20-year projects. Comment on the acceptability of each. Assume that the firm has an opportunity cost of 14%.

a. Initial investment is $10,000; cash inflows are $2,000 per year.
b. Initial investment is $25,000; cash inflows are $3,000 per year.
c. Initial investment is $30,000; cash inflows are $5,000 per year.

LG3 9–5 **NPV for varying costs of capital** Dane Cosmetics is evaluating a new fragrance-mixing machine. The machine requires an initial investment of $24,000 and will generate after-tax cash inflows of $5,000 per year for 8 years. For each of the costs of capital listed, (1) calculate the net present value (NPV), (2) indicate whether to accept or reject the machine, and (3) explain your decision.

a. The cost of capital is 10%.
b. The cost of capital is 12%.
c. The cost of capital is 14%.

LG3 **9–6 Net present value—Independent projects** Using a 14% cost of capital, calculate the net present value for each of the independent projects shown in the following table, and indicate whether each is acceptable.

	Project A	Project B	Project C	Project D	Project E
Initial investment (CF_0)	$26,000	$500,000	$170,000	$950,000	$80,000
Year (t)	Cash inflows (CF_t)				
1	$4,000	$100,000	$20,000	$230,000	$ 0
2	4,000	120,000	19,000	230,000	0
3	4,000	140,000	18,000	230,000	0
4	4,000	160,000	17,000	230,000	20,000
5	4,000	180,000	16,000	230,000	30,000
6	4,000	200,000	15,000	230,000	0
7	4,000		14,000	230,000	50,000
8	4,000		13,000	230,000	60,000
9	4,000		12,000		70,000
10	4,000		11,000		

LG3 **9–7 NPV** Simes Innovations, Inc., is negotiating to purchase exclusive rights to manufacture and market a solar-powered toy car. The car's inventor has offered Simes the choice of either a one-time payment of $1,500,000 today or a series of 5 year-end payments of $385,000.

a. If Simes has a cost of capital of 9%, which form of payment should the company choose?

b. What yearly payment would make the two offers identical in value at a cost of capital of 9%?

c. Would your answer to part **a** of this problem be different if the yearly payments were made at the beginning of each year? Show what difference, if any, that change in timing would make to the present value calculation.

d. The after-tax cash inflows associated with this purchase are projected to amount to $250,000 per year for 15 years. Will this factor change the firm's decision about how to fund the initial investment?

LG3 **9–8 NPV and maximum return** A firm can purchase a fixed asset for a $13,000 initial investment. The asset generates an annual after-tax cash inflow of $4,000 for 4 years.

a. Determine the net present value (NPV) of the asset, assuming that the firm has a 10% cost of capital. Is the project acceptable?

b. Determine the maximum required rate of return (closest whole-percentage rate) that the firm can have and still accept the asset. Discuss this finding in light of your response in part **a.**

LG3 **9–9 NPV—Mutually exclusive projects** Hook Industries is considering the replacement of one of its old drill presses. Three alternative replacement presses are under consideration. The relevant cash flows associated with each are shown in the following table. The firm's cost of capital is 15%.

	Press A	Press B	Press C
Initial investment (CF_0)	\$85,000	\$60,000	\$130,000
Year (t)	**Cash inflows (CF_t)**		
1	\$18,000	\$12,000	\$50,000
2	18,000	14,000	30,000
3	18,000	16,000	20,000
4	18,000	18,000	20,000
5	18,000	20,000	20,000
6	18,000	25,000	30,000
7	18,000	—	40,000
8	18,000	—	50,000

a. Calculate the net present value (NPV) of each press.
b. Using NPV, evaluate the acceptability of each press.
c. Rank the presses from best to worst using NPV.

LG2 LG3 **9–10 Payback and NPV** Neil Corporation has three projects under consideration. The cash flows for each of them are shown in the following table. The firm has a 16% cost of capital.

	Project A	Project B	Project C
Initial investment (CF_0)	\$40,000	\$40,000	\$40,000
Year (t)	**Cash inflows (CF_t)**		
1	\$13,000	\$ 7,000	\$19,000
2	13,000	10,000	16,000
3	13,000	13,000	13,000
4	13,000	16,000	10,000
5	13,000	19,000	7,000

a. Calculate each project's payback period. Which project is preferred according to this method?
b. Calculate each project's net present value (NPV). Which project is preferred according to this method?
c. Comment on your findings in parts **a** and **b,** and recommend the best project. Explain your recommendation.

LG4 **9–11 Internal rate of return** For each of the projects shown in the following table, calculate the internal rate of return (IRR). Then indicate, for each project, the maximum cost of capital that the firm could have and still find the IRR acceptable.

	Project A	Project B	Project C	Project D
Initial investment (CF_0)	$90,000	$490,000	$20,000	$240,000
Year (t)	Cash inflows (CF_t)			
1	$20,000	$150,000	$7,500	$120,000
2	25,000	150,000	7,500	100,000
3	30,000	150,000	7,500	80,000
4	35,000	150,000	7,500	60,000
5	40,000	—	7,500	—

LG4

9–12 IRR—Mutually exclusive projects Bell Manufacturing is attempting to choose the better of two mutually exclusive projects for expanding the firm's warehouse capacity. The relevant cash flows for the projects are shown in the following table. The firm's cost of capital is 15%.

	Project X	Project Y
Initial investment (CF_0)	$500,000	$325,000
Year (t)	Cash inflows (CF_t)	
1	$100,000	$140,000
2	120,000	120,000
3	150,000	95,000
4	190,000	70,000
5	250,000	50,000

a. Calculate the IRR to the nearest whole percent for each of the projects.
b. Assess the acceptability of each project on the basis of the IRRs found in part **a.**
c. Which project, on this basis, is preferred?

LG4

9–13 IRR, investment life, and cash inflows Oak Enterprises accepts projects earning more than the firm's 15% cost of capital. Oak is currently considering a 10-year project that provides annual cash inflows of $10,000 and requires an initial investment of $61,450. (*Note:* All amounts are after taxes.)
a. Determine the IRR of this project. Is it acceptable?
b. Assuming that the cash inflows continue to be $10,000 per year, how many *additional years* would the flows have to continue to make the project acceptable (that is, to make it have an IRR of 15%)?
c. With the given life, initial investment, and cost of capital, what is the minimum annual cash inflow that the firm should accept?

LG3 LG4

9–14 NPV and IRR Benson Designs has prepared the following estimates for a long-term project it is considering. The initial investment is $18,250, and the project is expected to yield after-tax cash inflows of $4,000 per year for 7 years. The firm has a 10% cost of capital.
a. Determine the net present value (NPV) for the project.
b. Determine the internal rate of return (IRR) for the project.

c. Would you recommend that the firm accept or reject the project? Explain your answer.

LG3 **9–15 NPV, with rankings** Botany Bay, Inc., a maker of casual clothing, is considering four projects. Because of past financial difficulties, the company has a high cost of capital at 15%. Which of these projects would be acceptable under those cost circumstances?

	Project A	Project B	Project C	Project D
Initial investment (CF_0)	$50,000	$100,000	$80,000	$180,000
Year (t)	Cash inflows (CF_t)			
1	$20,000	$35,000	$20,000	$100,000
2	20,000	50,000	40,000	80,000
3	20,000	50,000	60,000	60,000

a. Calculate the NPV of each project, using a cost of capital of 15%.
b. Rank acceptable projects by NPV.
c. At what approximate cost of capital would all of the projects be acceptable?

LG2 LG3 LG4 **9–16 All techniques, conflicting rankings** Nicholson Roofing Materials, Inc., is considering two mutually exclusive projects, each with an initial investment of $150,000. The company's board of directors has set a 4-year payback requirement and has set its cost of capital at 9%. The cash inflows associated with the two projects are as follows:

	Cash inflows (CF_t)	
Year	Project A	Project B
1	$45,000	$75,000
2	45,000	60,000
3	45,000	30,000
4	45,000	30,000
5	45,000	30,000
6	45,000	30,000

a. Calculate the payback period for each project.
b. Calculate the NPV of each project at 0%.
c. Calculate the NPV of each project at 9%.
d. Derive the IRR of each project.
e. Rank the projects by each of the techniques used. Make and justify a recommendation.

LG2 LG3 **9–17 Payback, NPV, and IRR** Rieger International is attempting to evaluate the feasibility of investing $95,000 in a piece of equipment that has a 5-year life. The firm has estimated the *cash inflows* associated with the proposal as shown in the following table. The firm has a 12% cost of capital.

Year (t)	Cash inflows (CF_t)
1	$20,000
2	25,000
3	30,000
4	35,000
5	40,000

a. Calculate the payback period for the proposed investment.
b. Calculate the net present value (NPV) for the proposed investment.
c. Calculate the internal rate of return (IRR), rounded to the nearest whole percent, for the proposed investment.
d. Evaluate the acceptability of the proposed investment using NPV and IRR. What recommendation would you make relative to implementation of the project? Why?

LG3 LG4 LG5

9–18 NPV, IRR, and NPV profiles Thomas Company is considering two mutually exclusive projects. The firm, which has a 12% cost of capital, has estimated its cash flows as shown in the following table.

	Project A	Project B
Initial investment (CF_0)	**$130,000**	**$85,000**
Year (t)	**Cash inflows (CF_t)**	
1	$25,000	$40,000
2	35,000	35,000
3	45,000	30,000
4	50,000	10,000
5	55,000	5,000

a. Calculate the NPV of each project, and assess its acceptability.
b. Calculate the IRR for each project, and assess its acceptability.
c. Draw the NPV profiles for both projects on the same set of axes.
d. Evaluate and discuss the rankings of the two projects on the basis of your findings in parts **a, b,** and **c.**
e. Explain your findings in part **d** in light of the pattern of cash inflows associated with each project.

LG2 LG3 LG4 LG5 LG6

9–19 All techniques—Decision among mutually exclusive investments Pound Industries is attempting to select the best of three mutually exclusive projects. The initial investment and after-tax cash inflows associated with these projects are shown in the following table.

Cash flows	Project A	Project B	Project C
Initial investment (CF_0)	$60,000	$100,000	$110,000
Cash inflows (CF_t), $t = 1$ to 5	$20,000	$ 31,500	$ 32,500

a. Calculate the payback period for each project.

b. Calculate the net present value (NPV) of each project, assuming that the firm has a cost of capital equal to 13%.
c. Calculate the internal rate of return (IRR) for each project.
d. Draw the net present value profiles for both projects on the same set of axes, and discuss any conflict in ranking that may exist between NPV and IRR.
e. Summarize the preferences dictated by each measure, and indicate which project you would recommend. Explain why.

LG2 LG3 LG4 LG5 LG6

9–20 **All techniques with NPV profile—Mutually exclusive projects** Projects A and B, of equal risk, are alternatives for expanding the Rosa Company's capacity. The firm's cost of capital is 13%. The cash flows for each project are shown in the following table.

	Project A	Project B
Initial investment (CF_0)	$80,000	$50,000
Year (t)	**Cash inflows (CF_t)**	
1	$15,000	$15,000
2	20,000	15,000
3	25,000	15,000
4	30,000	15,000
5	35,000	15,000

a. Calculate each project's payback period.
b. Calculate the net present value (NPV) for each project.
c. Calculate the internal rate of return (IRR) for each project.
d. Draw the net present value profiles for both projects on the same set of axes, and discuss any conflict in ranking that may exist between NPV and IRR.
e. Summarize the preferences dictated by each measure, and indicate which project you would recommend. Explain why.

LG2 LG3 LG4

9–21 **Integrative—Complete investment decision** Wells Printing is considering the purchase of a new printing press. The total installed cost of the press is $2.2 million. This outlay would be partially offset by the sale of an existing press. The old press has zero book value, cost $1 million 10 years ago, and can be sold currently for $1.2 million before taxes. As a result of acquisition of the new press, sales in each of the next 5 years are expected to increase by $1.6 million, but product costs (excluding depreciation) will represent 50% of sales. The new press will not affect the firm's net working capital requirements. The new press will be depreciated under MACRS using a 5-year recovery period (see Table 3.2 on page 100). The firm is subject to a 40% tax rate on both ordinary income and capital gains. Wells Printing's cost of capital is 11%. (*Note:* Assume that both the old and the new press will have terminal values of $0 at the end of year 6.)
a. Determine the initial investment required by the new press.
b. Determine the operating cash inflows attributable to the new press. (*Note:* Be sure to consider the depreciation in year 6.)
c. Determine the payback period.
d. Determine the net present value (NPV) and the internal rate of return (IRR) related to the proposed new press.

e. Make a recommendation to accept or reject the new press, and justify your answer.

LG3 LG4 LG5

9–22 **Integrative—Investment decision** Holliday Manufacturing is considering the replacement of an existing machine. The new machine costs $1.2 million and requires installation costs of $150,000. The existing machine can be sold currently for $185,000 before taxes. It is 2 years old, cost $800,000 new, and has a $384,000 book value and a remaining useful life of 5 years. It was being depreciated under MACRS using a 5-year recovery period (see Table 3.2 on page 100) and therefore has the final 4 years of depreciation remaining. If it is held until the end of 5 years, the machine's market value will be $0. Over its 5-year life, the new machine should reduce operating costs by $350,000 per year. The new machine will be depreciated under MACRS using a 5-year recovery period (see Table 3.2 on page 100). The new machine can be sold for $200,000 net of removal and clean up costs at the end of 5 years. An increased investment in net working capital of $25,000 will be needed to support operations if the new machine is acquired. Assume that the firm has adequate operating income against which to deduct any loss experienced on the sale of the existing machine. The firm has a 9% cost of capital and is subject to a 40% tax rate on both ordinary income and capital gains.

a. Develop the relevant cash flows needed to analyze the proposed replacement.
b. Determine the net present value (NPV) of the proposal.
c. Determine the internal rate of return (IRR) of the proposal.
d. Make a recommendation to accept or reject the replacement proposal, and justify your answer.
e. What is the highest cost of capital that the firm could have and still accept the proposal? Explain.

CHAPTER 9 CASE Making Norwich Tool's Lathe Investment Decision

Norwich Tool, a large machine shop, is considering replacing one of its lathes with either of two new lathes—lathe A or lathe B. Lathe A is a highly automated, computer-controlled lathe; lathe B is a less expensive lathe that uses standard technology. To analyze these alternatives, Mario Jackson, a financial analyst, prepared estimates of the initial investment and incremental (relevant) cash inflows associated with each lathe. These are shown in the following table.

	Lathe A	Lathe B
Initial investment (CF_0)	**$660,000**	**$360,000**
Year (t)	**Cash inflows (CF_t)**	
1	$128,000	$ 88,000
2	182,000	120,000
3	166,000	96,000
4	168,000	86,000
5	450,000	207,000

Note that Mario plans to analyze both lathes over a 5-year period. At the end of that time, the lathes would be sold, thus accounting for the large fifth-year cash inflows.

Mario believes that the two lathes are equally risky and that the acceptance of either of them will not change the firm's overall risk. He therefore decides to apply the firm's 13% cost of capital when analyzing the lathes. Norwich Tool requires all projects to have a maximum payback period of 4.0 years.

Required

a. Use the payback period to assess the acceptability and relative ranking of each lathe.
b. Assuming equal risk, use the following sophisticated capital budgeting techniques to assess the acceptability and relative ranking of each lathe:
(1) Net present value (NPV).
(2) Internal rate of return (IRR).
c. Summarize the preferences indicated by the techniques used in parts **a** and **b.** Do the projects have conflicting rankings?
d. Draw the net present value profiles for both projects on the same set of axes, and discuss any conflict in rankings that may exist between NPV and IRR. Explain any observed conflict in terms of the relative differences in the magnitude and timing of each project's cash flows.
e. Use your findings in parts **a** through **d** to indicate, on both (1) a theoretical and (2) a practical basis, which lathe would be preferred. Explain any difference in recommendations.

WEB EXERCISE

Go to the Web site *www.arachnoid.com/lutusp/finance_old.html*. Page down to the portion of this screen that contains the financial calculator.

1. To determine the internal rate of return (IRR) of a project whose initial investment was $5,000 and whose cash inflows are $1,000 per year for the next 10 years, perform the steps outlined below. By entering various interest rates, you will eventually get a present value of $5,000. When this happens you have determined the IRR of the project.

   To get started, into **PV**, enter 0; into **FV**, enter 0; into **np**, enter 1000; into **pmt**, enter 10; and then into **ir**, enter 8. Click on **Calculate PV**. This gives you a number much greater than $5,000. Now change **ir** to 20 and then click on **Calculate PV**. Keeping changing the **ir** until PV = $5,000, the same as the initial investment.
2. Try another project. The initial investment is $10,000. The cash inflows are $2,500 per year for the next 6 years. What is its IRR?
3. To calculate the IRR of an investment of $3,000 with a single cash inflow of $4,800 to be received exactly 3 years after the investment, do the following: Into **FV**, enter 4800; into **np**, enter 3; into **pmt**, enter 0; and then into **ir**, enter 8. Then click on **Calculate PV**. As before, keep changing **ir** until the PV is equal to the initial investment of $3,000. What is this investment's IRR?

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

CHAPTER

10

Risk and Refinements in Capital Budgeting

LEARNING GOALS

- LG1 Understand the importance of explicitly recognizing risk in the analysis of capital budgeting projects.
- LG2 Discuss breakeven cash inflow, sensitivity and scenario analysis, and simulation as behavioral approaches for dealing with risk.
- LG3 Discuss the unique risks that multinational companies face.
- LG4 Describe the determination and use of risk-adjusted discount rates (RADRs), portfolio effects, and the practical aspects of RADRs.
- LG5 Recognize the problem caused by unequal-lived mutually exclusive projects and the use of annualized net present values (ANPVs) to resolve it.
- LG6 Explain the role of real options and the objective of, and basic approaches to, project selection under capital rationing.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand the risk caused by the variability of cash flows, how to compare projects with unequal lives, and how to measure project returns when capital must be rationed.

Information systems: You need to understand how risk is incorporated into capital budgeting techniques, and how those techniques may be refined in the face of special circumstances, in order to design decision modules that help analyze proposed capital projects.

Management: You need to understand behavioral approaches for dealing with risk, including international risk, in capital budgeting decisions; how to refine capital budgeting techniques when projects have unequal lives or when capital must be rationed; and how to recognize real options embedded in capital projects.

Marketing: You need to understand how the risk of proposed projects is measured in capital budgeting, how mutually exclusive projects with unequal lives will be evaluated, what real options may be embedded in proposed projects and how those options may affect project implementation, and how projects will be evaluated when capital must be rationed.

Operations: You need to understand how proposals for the acquisition of new equipment and plants will be evaluated by the firm's decision makers, especially projects that are risky, have unequal lives, or may need to be abandoned or slowed, or when capital is limited.

BESTFOODS

BESTFOODS' RECIPE FOR RISK

With future volume growth in North America and Western Europe limited to 3 percent at most, executives at **Bestfoods** (now a unit of the Anglo-Dutch conglomerate **Unilever**) decided to look for more promising markets. Whereas other food manufacturers were hesitant to take the international plunge, Bestfoods took its popular brands, such as Hellman's/Best Foods, Knorr, Mazola, and Skippy, where the growth was—emerging markets like Latin America, where the company could grow at a rate of 15 percent a year. At the time it was acquired by Unilever, Bestfoods derived about 22 percent of its revenues outside the United States and Western Europe, producing mayonnaise, soups, and other foods for 110 different markets at 130 manufacturing plants worldwide.

Bestfoods' international expansion succeeded because the company developed ways to incorporate the risks and rewards of its foreign investments into project analyses. These risks included exchange rate and political risks, as well as tax and legal considerations and strategic issues. First, it increased its familiarity with the foreign market by partnering with other companies whenever possible and by developing local management and experience. From this knowledge base, Bestfoods was willing to take calculated risks. Working with consultants Stern Stewart, developers of the economic value added (EVA®) model, the company created its own analytical model to set discount rates for different markets.

Some companies attempt to quantify the risk of foreign projects by arbitrarily assigning a premium to the discount rate they use for domestic projects. Executives who rely on this subjective method may overestimate the costs of doing business overseas and rule out good projects. Unlike these companies, Bestfoods took the time to develop specific costs of capital for international markets. To incorporate the benefits of diversification for a multinational company like Bestfoods, the company adapted the capital asset pricing model (CAPM). The model factors in elements of economic and political risk to obtain the country's risk premium and develops betas for each country on the basis of the local market's volatility and its correlation to the U.S. market. For example, the high volatility of Brazil's market has a low correlation to the U.S. market, so the country beta was .81. With the risk-free rates and country betas, Bestfoods could calculate local and global costs of capital.

This more sophisticated approach gave Bestfoods the confidence to pursue an aggressive international strategy that increased shareholder value and resulted in Unilever offering a substantial premium to acquire the company. In this chapter we'll look at other techniques that companies use to incorporate risk into the capital budgeting process.

LG1 10.1 Introduction to Risk in Capital Budgeting

The capital budgeting techniques introduced in Chapter 9 were applied in an environment we assumed to be certain. All of the projects' relevant cash flows, developed using techniques presented in Chapter 8, were assumed to have the same level of risk as the firm. In other words, all mutually exclusive projects were equally risky, and the acceptance of any project would not change the firm's overall risk. In actuality, these situations are rare—project cash flows typically have different levels of risk, and the acceptance of a project generally does affect the firm's overall risk, though often in a minor way. We begin this chapter by relaxing the assumptions of a certain environment and equal-risk projects, in order to focus on the incorporation of risk into the capital budgeting decision process.

For convenience, in this chapter, we continue the Bennett Company example that was used in Chapter 9. The relevant cash flows and NPVs for Bennett Company's two mutually exclusive projects—A and B—are summarized in Table 10.1.

In the following three sections, we use the basic risk concepts presented in Chapter 5 to demonstrate behavioral approaches for dealing with risk, international risk considerations, and the use of risk-adjusted discount rates to explicitly recognize risk in the analysis of capital budgeting projects.

Review Question

10–1 Are most mutually exclusive capital budgeting projects equally risky? How can the acceptance of a project change a firm's overall risk?

TABLE 10.1 Relevant Cash Flows and NPVs for Bennett Company's Projects

	Project A	Project B
A. Relevant Cash Flows		
Initial Investment	**$42,000**	**$45,000**
Year	Operating cash inflows	
1	$14,000	$28,000
2	14,000	12,000
3	14,000	10,000
4	14,000	10,000
5	14,000	10,000
B. Decision Technique		
NPV @ 10% cost of capital[a]	$11,071	$10,924

[a]From Figure 9.2 on page 402; calculated using a financial calculator.

LG2 10.2 Behavioral Approaches for Dealing with Risk

Behavioral approaches can be used to get a "feel" for the level of project risk, whereas other approaches explicitly recognize project risk. Here we present a few behavioral approaches for dealing with risk in capital budgeting: risk and cash inflows, sensitivity and scenario analysis, and simulation. In a later section, we consider a popular approach that explicitly recognizes risk.

Risk and Cash Inflows

risk (in capital budgeting)
The chance that a project will prove unacceptable or, more formally, the degree of variability of cash flows.

In the context of capital budgeting, the term **risk** refers to the chance that a project will prove unacceptable—that is, NPV < \$0 or IRR < cost of capital. More formally, risk in capital budgeting is the degree of variability of cash flows. Projects with a small chance of acceptability and a broad range of expected cash flows are more risky than projects that have a high chance of acceptability and a narrow range of expected cash flows.

In the conventional capital budgeting projects assumed here, risk stems almost entirely from *cash inflows,* because the initial investment is generally known with relative certainty. These inflows, of course, derive from a number of variables related to revenues, expenditures, and taxes. Examples include the level of sales, the cost of raw materials, labor rates, utility costs, and tax rates. We will concentrate on the risk in the cash inflows, but remember that this risk actually results from the interaction of these underlying variables. Therefore, to assess the risk of a proposed capital expenditure, the analyst needs to evaluate the probability that the cash inflows will be large enough to provide for project acceptance.

EXAMPLE

Treadwell Tire Company, a tire retailer with a 10% cost of capital, is considering investing in either of two mutually exclusive projects, A and B. Each requires a \$10,000 initial investment, and both are expected to provide equal annual cash inflows over their 15-year lives. For either project to be acceptable according to the net present value technique, its NPV must be greater than zero. If we let CF equal the annual cash inflow and let CF_0 equal the initial investment, the following condition must be met for projects with annuity cash inflows, such as A and B, to be acceptable.

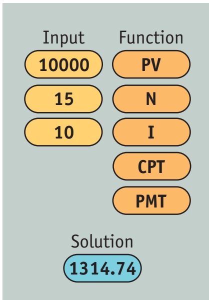
$$\text{NPV} = [CF \times (PVIFA_{k,n})] - CF_0 > \$0 \qquad (10.1)$$

breakeven cash inflow
The minimum level of cash inflow necessary for a project to be acceptable, that is, NPV > \$0.

By substituting $k = 10\%$, $n = 15$ years, and $CF_0 = \$10{,}000$, we can find the **breakeven cash inflow**—the minimum level of cash inflow necessary for Treadwell's projects to be acceptable.

Table Use The present value interest factor for an ordinary annuity at 10% for 15 years ($PVIFA_{10\%,15\text{yrs}}$) found in Table A–4 is 7.606. Substituting this value and the initial investment (CF_0) of \$10,000 into Equation 10.1 and solving for the breakeven cash inflow (CF), we get

$$[CF \times (PVIFA_{10\%,15\text{yrs}})] - \$10{,}000 > \$0$$
$$CF \times (7.606) > \$10{,}000$$
$$CF > \frac{\$10{,}000}{7.606} = \underline{\underline{\$1{,}314.75}}$$



Calculator Use Recognizing that the initial investment (CF_0) is the present value (PV), we can use the calculator inputs shown at the left to find the breakeven cash inflow (CF), which is an ordinary annuity (PMT).

Spreadsheet Use The breakeven cash inflow also can be calculated as shown on the following Excel spreadsheet.

	A	B
1	BREAKEVEN CASH INFLOW	
2	Cost of capital	10%
3	Number of years	15
4	Initial investment	$10,000
5	Breakeven cash inflow	$1,314.74

Entry in Cell B5 is =PMT(B2,B3,–B4).
The minus sign appears before B4 because the initial investment is a cash outflow.

The table, calculator, and spreadsheet values indicate that for the projects to be acceptable, they must have annual cash inflows of at least $1,315. Given this breakeven level of cash inflows, the risk of each project could be assessed by determining the probability that the project's cash inflows will equal or exceed this breakeven level. The various statistical techniques that would determine that probability are covered in more advanced courses.[1] For now, we can simply assume that such a statistical analysis results in the following:

Probability of $CF_A > \$1{,}315 \rightarrow 100\%$
Probability of $CF_B > \$1{,}315 \rightarrow 65\%$

Because project A is certain (100% probability) to have a positive net present value, whereas there is only a 65% chance that project B will have a positive NPV, project A is less risky than project B. Of course, the expected level of annual cash inflow and NPV associated with each project must be evaluated in view of the firm's risk preference before the preferred project is selected.

The example clearly identifies risk as it is related to the chance that a project is acceptable, but it does not address the issue of cash flow variability. Even though project B has a greater chance of loss than project A, it might result in higher potential NPVs. Recall from Chapters 5 through 7 that it is the *combination* of risk and return that determines value. Similarly, the worth of a capital expenditure and its impact on the firm's value must be viewed in light of both risk and return. The analyst must therefore consider the *variability* of cash inflows and NPVs to assess project risk and return fully.

Sensitivity and Scenario Analysis

Two approaches for dealing with project risk to capture the variability of cash inflows and NPVs are sensitivity analysis and scenario analysis. As noted in Chapter 5, *sensitivity analysis* is a behavioral approach that uses several possi-

1. Normal distributions are commonly used to develop the concept of the probability of success—that is, of a project having a positive NPV. The reader interested in learning more about this technique should see any second- or MBA-level managerial finance text.

In Practice

FOCUS ON e-FINANCE Putting the "R" Back into ROI

Ever since the economy faltered in late 2001, information technology (IT) managers have faced increased pressure to measure returns on technology investments and to show higher ROIs and faster project implementation. Managers must justify projects, proving that they support strategic business goals, and then track progress against expectations. Another key trend: Companies are moving IT approvals to more senior levels of management in order to evaluate better the projects' overall impact on the company's business.

In a poll of *Computerworld*'s "Premier 100" IT companies, almost half of the respondents said they do not perform ROI analysis on proposed IT projects. For the 43 percent who calculate potential paybacks, nonfinancial, "soft" factors are an important part of the analysis. The chief information officer (CIO) may consider certain projects—for example, business-to-business (B2B) commerce—essential to the company's future.

Methods and metrics to assess ROI vary among companies. Illinois communications equipment maker **Tellabs Inc**. established a stringent proposal-and-approval process for IT projects. This formal analysis now includes project comparisons. Another important change is accountability. "In the past, we haven't gone back and done measurements after a project went live to see how much we did save or how much we didn't," says Cathie Kozik, CIO and senior vice president.

Tyco Capital, a New Jersey financial services company, takes a different approach. To reduce risk and boost returns, CIO Robert Plante divides large projects into smaller phases and measures ROI along the way, not just on the total project. This "plan, do, test, react" process enables the company to test the waters to make sure that new projects will be successful. "We're not going in with guns blazing, but reducing scale to reduce risk and size out [IT] investments appropriately," Plante says. For example, installation of a customer relationship management (CRM) application took 18 months. Before the company started each new phase, previous phases had to show positive ROIs.

Sources: Adapted from Gary H. Anthes, "Premier 100: ROI for IT Projects Necessary, But Not Easy," *Computerworld* (May 23, 2001), downloaded from *www.computerworld.com;* Julia King, "ROI: Make It Bigger, Better, Faster," *Computerworld* (January 1, 2002), downloaded from *www.computerworld.com;* Thornton A. May, "Return on Rebellion," *Computerworld* (May 14, 2001), downloaded from *www.computerworld.com.*

ble values for a given variable, such as cash inflows, to assess that variable's impact on the firm's return, measured here by NPV. This technique is often useful in getting a feel for the variability of return in response to changes in a key variable. In capital budgeting, one of the most common sensitivity approaches is to estimate the NPVs associated with pessimistic (worst), most likely (expected), and optimistic (best) estimates of cash inflow. The *range* can be determined by subtracting the pessimistic-outcome NPV from the optimistic-outcome NPV.

EXAMPLE Continuing with Treadwell Tire Company, assume that the financial manager made pessimistic, most likely, and optimistic estimates of the cash inflows for each project. The cash inflow estimates and resulting NPVs in each case are summarized in Table 10.2. Comparing the ranges of cash inflows ($1,000 for project A and $4,000 for B) and, more important, the ranges of NPVs ($7,606 for project A and $30,424 for B) makes it clear that project A is less risky than project B. Given that both projects have the same most likely NPV of $5,212, the assumed risk-averse decision maker will take project A because it has less risk and no possibility of loss.

TABLE 10.2 Sensitivity Analysis of Treadwell's Projects A and B

	Project A	Project B
Initial investment	$10,000	$10,000
	Annual cash inflows	
Outcome		
Pessimistic	$1,500	$ 0
Most likely	2,000	2,000
Optimistic	2,500	4,000
Range	$1,000	$ 4,000
	Net present values[a]	
Outcome		
Pessimistic	$1,409	−$10,000
Most likely	5,212	5,212
Optimistic	9,015	20,424
Range	$7,606	$30,424

[a]These values were calculated by using the corresponding annual cash inflows. A 10% cost of capital and a 15-year life for the annual cash inflows were used.

scenario analysis
A behavioral approach that evaluates the impact on the firm's return of simultaneous changes in *a number of variables.*

Scenario analysis is a behavioral approach similar to sensitivity analysis but broader in scope. It evaluates the impact on the firm's return of simultaneous changes in *a number of variables*, such as cash inflows, cash outflows, and the cost of capital. For example, the firm could evaluate the impact of both high inflation (scenario 1) and low inflation (scenario 2) on a project's NPV. Each scenario will affect the firm's cash inflows, cash outflows, and cost of capital, thereby resulting in different levels of NPV. The decision maker can use these NPV estimates to assess the risk involved with respect to the level of inflation. The widespread availability of computers and spreadsheets has greatly enhanced the use of both scenario and sensitivity analysis.

Simulation

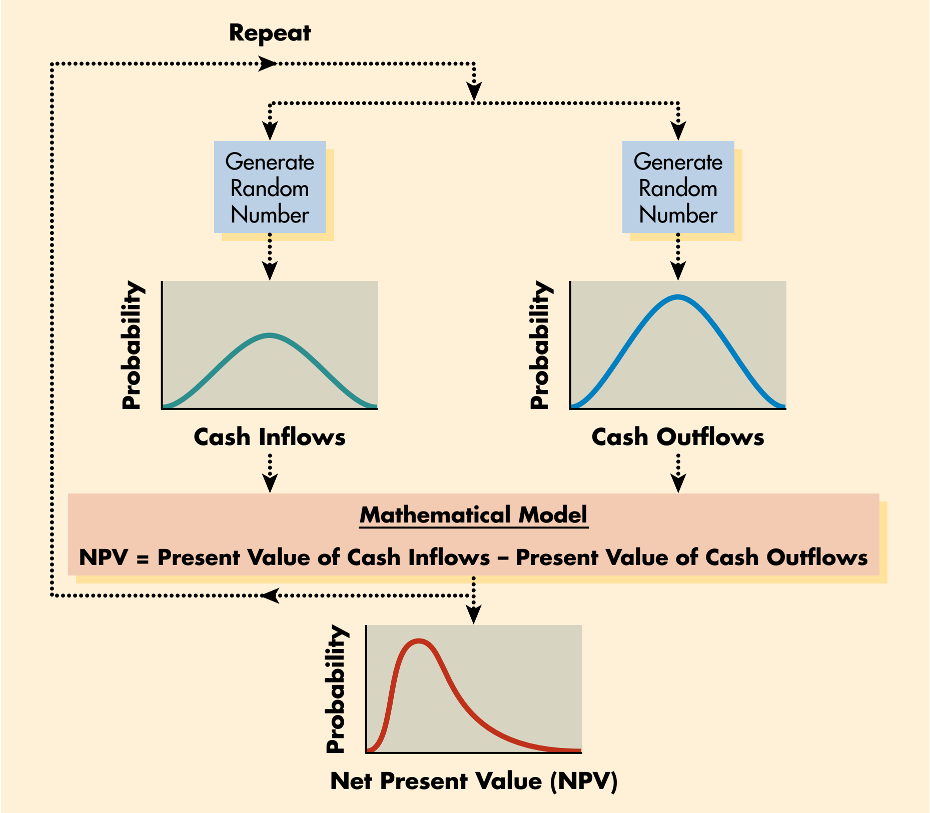
simulation
A statistics-based behavioral approach that applies predetermined probability distributions and random numbers to estimate risky outcomes.

Simulation is a statistics-based behavioral approach that applies predetermined probability distributions and random numbers to estimate risky outcomes. By tying the various cash flow components together in a mathematical model and repeating the process numerous times, the financial manager can develop a probability distribution of project returns. Figure 10.1 presents a flowchart of the simulation of the net present value of a project. The process of generating random numbers and using the probability distributions for cash inflows and cash outflows enables the financial manager to determine values for each of these variables. Substituting these values into the mathematical model results in an NPV.

FIGURE 10.1

NPV Simulation

Flowchart of a net present value simulation



Hint These behavioral approaches may seem a bit imprecise to one who has not used them. But repeated use and an "after-the-fact" review of previous analyses improve the accuracy of the users.

By repeating this process perhaps a thousand times, managers can create a probability distribution of net present values.

Although only gross cash inflows and cash outflows are simulated in Figure 10.1, more sophisticated simulations using individual inflow and outflow components, such as sales volume, sale price, raw material cost, labor cost, maintenance expense, and so on, are quite common. From the distribution of returns, the decision maker can determine not only the expected value of the return but also the probability of achieving or surpassing a given return. The use of computers has made the simulation approach feasible. The output of simulation provides an excellent basis for decision making, because it enables the decision maker to view a continuum of risk–return tradeoffs rather than a single-point estimate.

Review Questions

10–2 Define *risk* in terms of the cash inflows from a capital budgeting project. How can determination of the *breakeven cash inflow* be used to gauge project risk?

10–3 Describe how each of the following behavioral approaches can be used to deal with project risk: (**a**) sensitivity analysis, (**b**) scenario analysis, and (**c**) simulation.

LG3 10.3 International Risk Considerations

Although the basic techniques of capital budgeting are the same for multinational companies (MNCs) as for purely domestic firms, firms that operate in several countries face risks that are unique to the international arena. Two types of risk are particularly important: exchange rate risk and political risk.

exchange rate risk
The danger that an unexpected change in the exchange rate between the dollar and the currency in which a project's cash flows are denominated will reduce the market value of that project's cash flow.

Exchange rate risk reflects the danger that an unexpected change in the exchange rate between the dollar and the currency in which a project's cash flows are denominated will reduce the market value of that project's cash flow. The dollar value of future cash inflows can be dramatically altered if the local currency depreciates against the dollar. In the short term, specific cash flows can be hedged by using financial instruments such as currency futures and options. Long-term exchange rate risk can best be minimized by financing the project, in whole or in part, in local currency.

Political risk is much harder to protect against. Once a foreign project is accepted, the foreign government can block the return of profits, seize the firm's assets, or otherwise interfere with a project's operation. The inability to manage political risk after the fact makes it even more important that managers account for political risks before making an investment. They can do so either by adjusting a project's expected cash inflows to account for the probability of political interference or by using risk-adjusted discount rates (discussed later in this chapter) in capital budgeting formulas. In general, it is much better to adjust individual project cash flows for political risk subjectively than to use a blanket adjustment for all projects.

In addition to unique risks that MNCs must face, several other special issues are relevant only for international capital budgeting. One of these special issues is *taxes*. Because only after-tax cash flows are relevant for capital budgeting, financial managers must carefully account for taxes paid to foreign governments on profits earned within their borders. They must also assess the impact of these tax payments on the parent company's U.S. tax liability.

transfer prices
Prices that subsidiaries charge each other for the goods and services traded between them.

Another special issue in international capital budgeting is *transfer pricing*. Much of the international trade involving MNCs is, in reality, simply the shipment of goods and services from one of a parent company's subsidiaries to another subsidiary located abroad. The parent company therefore has great discretion in setting **transfer prices,** the prices that subsidiaries charge each other for the goods and services traded between them. The widespread use of transfer pricing in international trade makes capital budgeting in MNCs very difficult unless the transfer prices that are used accurately reflect actual costs and incremental cash flows.

Finally, MNCs often must approach international capital projects from a *strategic point of view,* rather than from a strictly financial perspective. For example, an MNC may feel compelled to invest in a country to ensure continued access, even if the project itself may not have a positive net present value. This motivation was important for Japanese automakers who set up assembly plants in the United States in the early 1980s. For much the same reason, U.S. investment in Europe surged during the years before the market integration of the European Community in 1992. MNCs often invest in production facilities in the home country of major rivals to deny these competitors an uncontested home market. MNCs also may feel compelled to invest in certain industries or countries to achieve a broad corporate objective such as completing a product line or diversifying raw material sources, even when the project's cash flows may not be sufficiently profitable.

Review Question

10–4 Briefly explain how the following items affect the capital budgeting decisions of multinational companies: (**a**) exchange rate risk; (**b**) political risk; (**c**) tax law differences; (**d**) transfer pricing; and (**e**) a strategic rather than a strict financial viewpoint.

LG4 10.4 Risk-Adjusted Discount Rates

The approaches for dealing with risk that have been presented so far enable the financial manager to get a "feel" for project risk. Unfortunately, they do not explicitly recognize project risk. We will now illustrate the most popular risk-adjustment technique that employs the net present value (NPV) decision method.[2] The NPV decision rule of accepting only those projects with NPVs > \$0 will continue to hold. Close examination of the basic equation for NPV, Equation 9.1, should make it clear that because the initial investment (CF_0) is known with certainty, a project's risk is embodied in the present value of its cash inflows:

$$\sum_{t=1}^{n} \frac{CF_t}{(1+k)^t}$$

Two opportunities to adjust the present value of cash inflows for risk exist: (1) The cash inflows (CF_t) can be adjusted, or (2) the discount rate (k) can be adjusted. Adjusting the cash inflows is highly subjective, so here we describe the more popular process of adjusting the discount rate. In addition, we consider the portfolio effects of project analysis as well as the practical aspects of the risk-adjusted discount rate.

Determining Risk-Adjusted Discount Rates (RADRs)

A popular approach for risk adjustment involves the use of *risk-adjusted discount rates (RADRs)*. This approach uses Equation 9.1 but employs a risk-adjusted discount rate, as noted in the following expression:[3]

$$\text{NPV} = \sum_{t=1}^{n} \frac{CF_t}{(1+\text{RADR})^t} - CF_0 \qquad (10.2)$$

2. The IRR could just as well have been used, but because NPV is theoretically preferable, it is used instead.

3. The risk-adjusted discount rate approach can be applied in using the internal rate of return as well as the net present value. When the IRR is used, the risk-adjusted discount rate becomes the cutoff rate that must be exceeded by the IRR for the project to be accepted. When NPV is used, the projected cash inflows are merely discounted at the risk-adjusted discount rate.

risk-adjusted discount rate (RADR)
The rate of return that must be earned on a given project to compensate the firm's owners adequately—that is, to maintain or improve the firm's share price.

The **risk-adjusted discount rate (RADR)** is the rate of return that must be earned on a given project to compensate the firm's owners adequately—that is, to maintain or improve the firm's share price. The higher the risk of a project, the higher the RADR, and therefore the lower the net present value for a given stream of cash inflows. Because the logic underlying the use of RADRs is closely linked to the capital asset pricing model (CAPM) developed in Chapter 5, here we review CAPM and discuss its use in finding RADRs.

Review of CAPM

In Chapter 5, the *capital asset pricing model (CAPM)* was used to link the *relevant* risk and return for all assets traded in *efficient markets*. In the development of the CAPM, the *total risk* of an asset was defined as

$$\text{Total risk} = \text{Nondiversifiable risk} + \text{Diversifiable risk} \tag{10.3}$$

For assets traded in an efficient market, the *diversifiable risk,* which results from uncontrollable or random events, can be eliminated through diversification. The relevant risk is therefore the *nondiversifiable risk*—the risk for which owners of these assets are rewarded. Nondiversifiable risk for securities is commonly measured by using *beta,* which is an index of the degree of movement of an asset's return in response to a change in the market return.

Using beta, b_j, to measure the relevant risk of any asset j, the CAPM is

$$k_j = R_F + [b_j \times (k_m - R_F)] \tag{10.4}$$

where

k_j = required return on asset j
R_F = risk-free rate of return
b_j = beta coefficient for asset j
k_m = return on the market portfolio of assets

In Chapter 5, we demonstrated that the required return on any asset could be determined by substituting values of R_F, b_j, and k_m into the CAPM—Equation 10.4. Any security that is expected to earn in excess of its required return would be acceptable, and those that are expected to earn an inferior return would be rejected.

Using CAPM to Find RADRs

If we assume for a moment that real corporate assets such as computers, machine tools, and special-purpose machinery are traded in efficient markets, the CAPM can be redefined as noted in Equation 10.5:

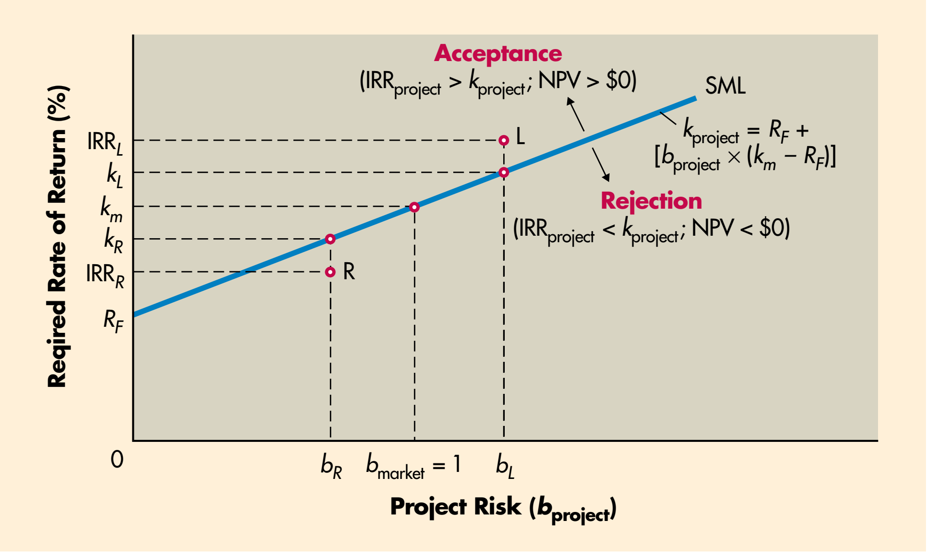
$$k_{\text{project } j} = R_F + [b_{\text{project } j} \times (k_m - R_F)] \tag{10.5}$$

The *security market line* (SML)—the graphical depiction of the CAPM—is shown for Equation 10.5 in Figure 10.2. Any project having an IRR above the SML would be acceptable, because its IRR would exceed the required return, k_{project}; any project with an IRR below k_{project} would be rejected. In terms of NPV, any

FIGURE 10.2

CAPM and SML

CAPM and SML in capital budgeting decision making



project falling above the SML would have a positive NPV, and any project falling below the SML would have a negative NPV.[4]

EXAMPLE

Two projects, L and R, are shown in Figure 10.2. Project L has a beta, b_L, and generates an internal rate of return, IRR_L. The required return for a project with risk b_L is k_L. Because project L generates a return greater than that required ($IRR_L > k_L$), project L is acceptable. Project L will have a positive NPV when its cash inflows are discounted at its required return, k_L. Project R, on the other hand, generates an IRR below that required for its risk, b_R ($IRR_R < k_R$). This project will have a negative NPV when its cash inflows are discounted at its required return, k_R. Project R should be rejected.

Applying RADRs

Because the CAPM is based on an assumed efficient market, which does *not* exist for real corporate (nonfinancial) assets such as plant and equipment, the CAPM is not directly applicable in making capital budgeting decisions. Financial managers therefore assess the *total risk* of a project and use it to determine the risk-adjusted discount rate (RADR), which can be used in Equation 10.2 to find the NPV.

In order not to damage its market value, the firm must use the correct discount rate to evaluate a project. If a firm discounts a risky project's cash inflows at too low a rate and accepts the project, the firm's market price may drop as investors recognize that the firm itself has become more risky. On the other hand,

4. As noted earlier, whenever the IRR is above the cost of capital or required return (IRR > k), the NPV is positive, and whenever the IRR is below the cost of capital or required return (IRR < k), the NPV is negative. Because by definition the IRR is the discount rate that causes NPV to equal zero and the IRR and NPV always agree on accept–reject decisions, the relationship noted in Figure 10.2 logically follows.

if the firm discounts a project's cash inflows at too high a rate, it will reject acceptable projects. Eventually the firm's market price may drop, because investors who believe that the firm is being overly conservative will sell their stock, putting downward pressure on the firm's market value.

Unfortunately, there is no formal mechanism for linking total project risk to the level of required return. As a result, most firms subjectively determine the RADR by adjusting their existing required return. They adjust it up or down depending on whether the proposed project is more or less risky, respectively, than the average risk of the firm. This CAPM-type of approach provides a "rough estimate" of the project risk and required return because both the project risk measure and the linkage between risk and required return are estimates.

EXAMPLE Bennett Company wishes to use the risk-adjusted discount rate approach to determine, according to NPV, whether to implement project A or project B. In addition to the data presented in part A of Table 10.1, Bennett's management after much analysis assigned a "risk index" of 1.6 to project A and of 1.0 to project B. The risk index is merely a numerical scale used to classify project risk: Higher index values are assigned to higher-risk projects, and vice versa. The CAPM-type relationship used by the firm to link risk (measured by the risk index) and the required return (RADR) is shown in the following table.

	Risk index	Required return (RADR)
	0.0	6% (risk-free rate, R_F)
	0.2	7
	0.4	8
	0.6	9
	0.8	10
Project B →	1.0	11
	1.2	12
	1.4	13
Project A →	1.6	14
	1.8	16
	2.0	18

Because project A is riskier than project B, its RADR of 14% is greater than project B's 11%. The net present value of each project, calculated using its RADR, is found as shown on the time lines in Figure 10.3. The results clearly show that project B in preferable, because its risk-adjusted NPV of $9,798 is greater than the $6,063 risk-adjusted NPV for project A. As reflected by the NPVs in part B of Table 10.1, if the discount rates were not adjusted for risk, project A would be preferred to project B.

Calculator Use We can again use the preprogrammed NPV function in a financial calculator to simplify the NPV calculation. The keystrokes for project A—the annuity—typically are as shown at the top of the next page. The keystrokes for project B—the mixed stream—are also shown at the top of the next page.

The calculated NPVs for projects A and B of \$6,063 and \$9,798, respectively, agree with those shown in Figure 10.3.

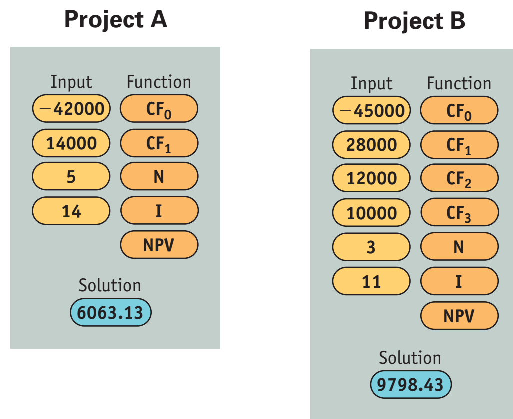
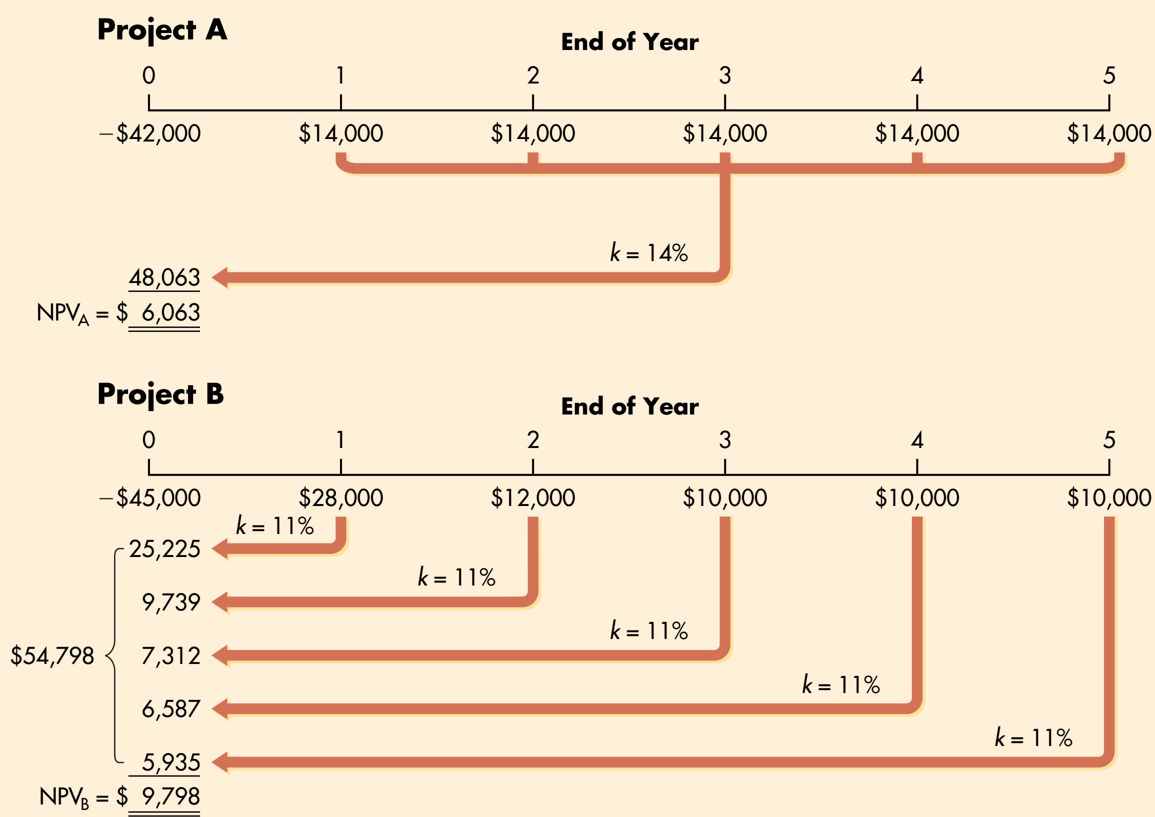


FIGURE 10.3 **Calculation of NPVs for Bennett Company's Capital Expenditure Alternatives using RADRs**

Time lines depicting the cash flows and NPV calculations using RADRs for projects A and B



Note: When we use the risk indexes of 1.6 and 1.0 for projects A and B, respectively, along with the table in the middle of the preceding page, a risk-adjusted discount rate (RADR) of 14% results for project A and a RADR of 11% results for project B.

Spreadsheet Use Analysis of projects using risk-adjusted discount rates (RADRs) also can be calculated as shown on the following Excel spreadsheet.

	A	B	C	D
1	ANALYSIS OF PROJECTS USING RISK-ADJUSTED DISCOUNT RATES			
2	Year	Cash Inflow	Present Value	Formulas for Calculated Values in Column C
3	**Project A**			
4	1-5	$ 14,000	$48,063	–PV(C7,5,B4,0)
5	Initial Investment		$42,000	
6	Net Present Value		**$ 6,063**	C4–C5
7	Required Return (RADR)		14%	
8	**Project B**			
9	1	$ 28,000	$25,225	–PV(C17,A9,0,B9,0)
10	2	12,000	9,739	–PV(C17,A10,0,B10,0)
11	3	10,000	7,312	–PV(C17,A11,0,B11,0)
12	4	10,000	6,587	–PV(C17,A12,0,B12,0)
13	5	10,000	5,935	–PV(C17,A13,0,B13,0)
14	Present value		$54,798	SUM(C9:C13) or NPV(C17,B9:B13)
15	Initial Investment		$45,000	
16	Net Present Value		**$ 9,798**	C14–C15
17	Required Return (RADR)		11%	
18	**Choice of project**		**B**	IF(C6>=C16,"A","B")

The minus signs appear before the entries in Cells C4 and C9:C13 to convert the results to positive values.

The usefulness of risk-adjusted discount rates should now be clear. The real difficulty lies in estimating project risk and linking it to the required return (RADR).

Portfolio Effects

As noted in Chapter 5, because investors are not rewarded for taking diversifiable risk, they should hold a diversified portfolio of securities. Because a business firm can be viewed as a portfolio of assets, is it similarly important that the firm maintain a diversified portfolio of assets?

It seems logical that by holding a diversified portfolio the firm could reduce the variability of its cash flows. By combining two projects with negatively correlated cash inflows, the firm could reduce the combined cash inflow variability—and therefore the risk.

Are firms rewarded for diversifying risk in this fashion? If they are, the value of the firm could be enhanced through diversification into other lines of business. Surprisingly, the value of the stock of firms whose shares are traded publicly in an efficient marketplace is generally *not* affected by diversification. In other words, diversification is not normally rewarded and therefore is generally not necessary.

Why are firms not rewarded for diversification? Because investors themselves can diversify by holding securities in a variety of firms; they do not need the firm

In Practice

FOCUS ON PRACTICE Brand Ad-vantages

Advertising has always been an easy target for cost cutting when times are tough, because few companies can reliably track or predict the return on investment (ROI) for such spending. This is changing, however, as consultants and financial and marketing managers develop quantitative methodologies to measure returns from advertising and brand communications. Here are two different approaches to this capital budgeting dilemma.

Isolating advertising's contribution to revenues is much harder than analyzing increased volume or revenue from other types of capital expenditures, especially for manufacturers. Because it considers strong brands critical to differentiating itself from the competition, **General Mills'** Big G cereal division has developed a way to measure brand value and advertising effectiveness. Big G's analysts look at such factors as the brand's historical performance, market research on previous advertising effectiveness, and growth versus the competition. Then the company determines how much money to allocate to brand-specific advertising. "We look at each specific brand to determine the income for each," says Keith Woodward, vice president of finance. "There has to be an opportunity for growth, or else we won't invest." After the ad campaigns start, revenue and market data are tracked to measure performance.

The consulting firm **Interbrand** offers its clients proprietary ROI techniques that use net present value (NPV) analysis to value brands on the basis of their future earning power. After determining what percentage of overall revenues the brand generates, Interbrand develops earnings projections for that business segment and subtracts a charge that represents the cost of tangible assets. The remaining income is the economic value derived from intangibles (patents, customer lists, the brand). Interbrand uses qualitative techniques such as market research and interviews to separate the brand's value from the other intangibles. Finally, Interbrand considers seven factors—among them market leadership, stability, and global and cross-cultural reach—to develop a risk-adjusted discount rate to calculate the NPV of the brand's projected earnings stream.

Sources: Adapted from "Best Global Brands: The 100 Top Brands," *Business Week* (August 6, 2001), p. 60; and Kris Frieswick, "ROI: New Brand Day," *CFO.com* (November 28, 2001), downloaded from *www.cfo.com.*

to do it for them. And investors can diversify more readily—they can make transactions more easily and at a lower cost because of the greater availability of information and trading mechanisms.

Of course, if a firm acquires a new line of business and its cash flows tend to respond more to changing economic conditions (that is, greater nondiversifiable risk), greater returns would be expected. If, for the additional risk, the firm earned a return in excess of that required (IRR $> k$), the value of the firm could be enhanced. Also, other benefits, such as increased cash, greater borrowing capacity, guaranteed availability of raw materials, and so forth, could result from and therefore justify diversification, in spite of any immediate impact on cash flow.

Although a strict theoretical view supports the use of a technique that relies on the CAPM framework, the presence of market imperfections causes the market for real corporate assets to be inefficient. The relative inefficiency of this market, coupled with difficulties associated with measurement of nondiversifiable project risk and its relationship to return, tend to favor the use of total risk to evaluate capital budgeting projects. Therefore, the use of *total risk* as an approximation for the relevant risk does tend to have widespread practical appeal.

RADRs in Practice

In spite of the appeal of total risk, *RADRs are often used in practice*. Their popularity stems from two facts: (1) They are consistent with the general disposition of financial decision makers toward rates of return,[5] and (2) they are easily estimated and applied. The first reason is clearly a matter of personal preference, but the second is based on the computational convenience and well-developed procedures involved in the use of RADRs.

Hint The use of risk classes is consistent with the concept that risk-averse investors require a greater return for greater risks. In order to increase shareholders' wealth—and hence warrant acceptance—risky projects must earn greater returns.

In practice, firms often establish a number of *risk classes,* with an RADR assigned to each. Each project is then subjectively placed in the appropriate risk class, and the corresponding RADR is used to evaluate it. This is sometimes done on a division-by-division basis, in which case each division has its own set of risk classes and associated RADRs, similar to those for Bennett Company in Table 10.3. The use of *divisional costs of capital* and associated risk classes enables a large multidivisional firm to incorporate differing levels of divisional risk into the capital budgeting process and still recognize differences in the levels of individual project risk.

EXAMPLE Assume that the management of Bennett Company decided to use risk classes to analyze projects and so placed each project in one of four risk classes according to its perceived risk. The classes ranged from I for the lowest-risk projects to IV for the highest-risk projects. Associated with each class was an RADR appropriate to the level of risk of projects in the class, as given in Table 10.3. Bennett classified as lower-risk those projects that tend to involve routine replacement or

TABLE 10.3 Bennett Company's Risk Classes and RADRs

Risk class	Description	Risk-adjusted discount rate, RADR
I	*Below-average risk:* Projects with low risk. Typically involve routine replacement without renewal of existing activities.	8%
II	*Average risk:* Projects similar to those currently implemented. Typically involve replacement or renewal of existing activities.	10%[a]
III	*Above-average risk:* Projects with higher than normal, but not excessive, risk. Typically involve expansion of existing or similar activities.	14%
IV	*Highest risk:* Projects with very high risk. Typically involve expansion into new or unfamiliar activities.	20%

[a]This RADR is actually the firm's cost of capital, which is discussed in detail in Chapter 11. It represents the firm's required return on its existing portfolio of projects, which is assumed to be unchanged with acceptance of the "average risk" project.

5. Recall that although NPV was the theoretically preferred evaluation technique, IRR was more popular in actual business practice because of the general preference of businesspeople for rates of return rather than pure dollar returns. The popularity of RADRs is therefore consistent with the preference for IRR over NPV.

renewal activities; higher-risk projects involve expansion, often into new or unfamiliar activities.

The financial manager of Bennett has assigned project A to class III and project B to class II. The cash flows for project A would be evaluated using a 14% RADR, and project B's would be evaluated using a 10% RADR.[6] The NPV of project A at 14% was calculated in Figure 10.3 to be $6,063, and the NPV for project B at a 10% RADR was shown in Table 10.1 to be $10,924. Clearly, with RADRs based on the use of risk classes, project B is preferred over project A. As noted earlier, this result is contrary to the preferences shown in Table 10.1, where differing risks of projects A and B were not taken into account.

Review Questions

10–5 Describe the basic procedures involved in using *risk-adjusted discount rates (RADRs)*. How is this approach related to the *capital asset pricing model (CAPM)?*

10–6 Explain why a firm whose stock is actively traded in the securities markets need not concern itself with diversification. In spite of this, how is the risk of capital budgeting projects frequently measured? Why?

10–7 How are risk classes often used to apply RADRs?

LG5 LG6

10.5 Capital Budgeting Refinements

Refinements must often be made in the analysis of capital budgeting projects to accommodate special circumstances. These adjustments permit the relaxation of certain simplifying assumptions presented earlier. Three areas in which special forms of analysis are frequently needed are (1) comparison of mutually exclusive projects having unequal lives, (2) recognition of real options, and (3) capital rationing caused by a binding budget constraint.

Comparing Projects with Unequal Lives

The financial manager must often select the best of a group of unequal-lived projects. If the projects are independent, the length of the project lives is not critical. But when unequal-lived projects are mutually exclusive, the impact of differing lives must be considered because the projects do not provide service over comparable time periods. This is especially important when continuing service is needed from the project under consideration. The discussions that follow assume that the unequal-lived, mutually exclusive projects being compared *are ongoing*. If they were not, the project with the highest NPV would be selected.

6. Note that the 10% RADR for project B using the risk classes in Table 10.3 differs from the 11% RADR used in the preceding example for project B. This difference is attributable to the less precise nature of the use of risk classes.

The Problem

A simple example will demonstrate the basic problem of noncomparability caused by the need to select the best of a group of mutually exclusive projects with differing usable lives.

EXAMPLE

The AT Company, a regional cable television company, is evaluating two projects, X and Y. The relevant cash flows for each project are given in the following table. The applicable cost of capital for use in evaluating these equally risky projects is 10%.

	Project X	Project Y
Initial investment	$70,000	$85,000
Year	**Annual cash inflows**	
1	$28,000	$35,000
2	33,000	30,000
3	38,000	25,000
4	—	20,000
5	—	15,000
6	—	10,000

Project X

Input	Function
−70000	CF_0
28000	CF_1
33000	CF_2
38000	CF_3
10	I
	NPV

Solution
11277.24

Table Use The net present value of each project at the 10% cost of capital is calculated by finding the present value of each cash inflow, summing them, and subtracting the initial investment from the sum of the present values.

$$\begin{aligned}
NPV_X &= [\$28{,}000 \times (0.909)] + [\$33{,}000 \times (0.826)] + [\$38{,}000 \times (0.751)] - \$70{,}000\\
&= (\$25{,}452 + \$27{,}258 + \$28{,}538) - \$70{,}000\\
&= \$81{,}248 - \$70{,}000\\
&= \underline{\underline{\$11{,}248}}
\end{aligned}$$

Project Y

Input	Function
−85000	CF_0
35000	CF_1
30000	CF_2
25000	CF_3
20000	CF_4
15000	CF_5
10000	CF_6
10	I
	NPV

Solution
19013.27

$$\begin{aligned}
NPV_Y = &[\$35{,}000 \times (0.909)] + [\$30{,}000 \times (0.826)] + [\$25{,}000 \times (0.751)]\\
&+ [\$20{,}000 \times (0.683)] + [\$15{,}000 \times (0.621)] + [\$10{,}000 \times (0.564)] - \$85{,}000\\
&= (\$31{,}815 + \$24{,}780 + \$18{,}775 + \$13{,}660 + \$9{,}315 + \$5{,}640) - \$85{,}000\\
&= \$103{,}985 - \$85{,}000\\
&= \underline{\underline{\$18{,}985}}
\end{aligned}$$

The NPV for project X is $11,248; that for project Y is $18,985.

Calculator Use Employing the preprogrammed NPV function in a financial calculator, we use the keystrokes shown at the left for project X and for project Y to find their respective NPVs of $11,277.24 and $19,013.27.

Spreadsheet Use Comparison of the net present values of two projects with unequal lives also can be calculated as shown on the following Excel spreadsheet.

	A	B	C
1	COMPARISON OF NET PRESENT VALUES OF TWO PROJECTS WITH UNEQUAL LIVES		
2		Cost of Capital	10%
3		Year-End Cash Flows	
4	Year	Project X	Project Y
5	0	$ (70,000)	$ (85,000)
6	1	$ 28,000	$ 35,000
7	2	$ 33,000	$ 30,000
8	3	$ 38,000	$ 25,000
9	4		$ 20,000
10	5		$ 15,000
11	6		$ 10,000
12	NPV	$ 11,277.24	$ 19,013.27
13	Choice of Project		Project Y

Entry in Cell B12 is =NPV(C2,B6:B11)+B5.
Copy the entry in Cell B12 to Cell C12.
Entry in Cell C13 is =IF(B12>=C12,B4,C4).

Ignoring the differences in project lives, we can see that both projects are acceptable (both NPVs are greater than zero) and that project Y is preferred over project X. If the projects were independent and only one could be accepted, project Y—with the larger NPV—would be preferred. On the other hand, if the projects were mutually exclusive, their differing lives would have to be considered. Project Y provides 3 more years of service than project X.

The analysis in the above example is incomplete if the projects are mutually exclusive (which will be our assumption throughout the remaining discussions). To compare these unequal-lived, mutually exclusive projects correctly, we must consider the differing lives in the analysis; an incorrect decision could result from simply using NPV to select the better project. Although a number of approaches are available for dealing with unequal lives, here we present the most efficient technique—the annualized net present value (ANPV) approach.

Annualized Net Present Value (ANPV) Approach

annualized net present value (ANPV) approach
An approach to evaluating unequal-lived projects that converts the net present value of unequal-lived, mutually exclusive projects into an equivalent annual amount (in NPV terms).

The **annualized net present value (ANPV) approach** converts the net present value of unequal-lived projects into an equivalent annual amount (in NPV terms) that can be used to select the best project.[7] This net present value based approach can be applied to unequal-lived, mutually exclusive projects by using the following steps:

Step 1 Calculate the net present value of each project j, NPV_j, over its life, n_j, using the appropriate cost of capital, k.

7. The theory underlying this as well as other approaches for comparing projects with unequal lives assumes that each project can be replaced in the future for the same initial investment and that each will provide the same expected future cash inflows. Although changing technology and inflation will affect the initial investment and expected cash inflows, the lack of specific attention to them does not detract from the usefulness of this technique.

Step 2 Divide the net present value of each project having a positive NPV by the present value interest factor for an annuity at the given cost of capital and the project's life to get the annualized net present value for each project j, $ANPV_j$, as shown below:

$$ANPV_j = \frac{NPV_j}{PVIFA_{k,n_j}} \tag{10.6}$$

Step 3 Select the project that has the highest ANPV.

EXAMPLE By using the AT Company data presented earlier for projects X and Y, we can apply the three-step ANPV approach as follows:

Step 1 The net present values of projects X and Y discounted at 10%—as calculated in the preceding example for a single purchase of each asset—are

$$NPV_X = \$11{,}248 \text{ (calculator/spreadsheet value} = \$11{,}277.24)$$

$$NPV_Y = \$18{,}985 \text{ (calculator/spreadsheet value} = \$19{,}013.27)$$

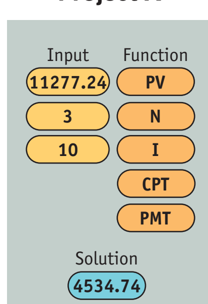
Step 2 **Table Use** Calculate the annualized net present value for each project by applying Equation 10.6 to the NPVs.

$$ANPV_X = \frac{\$11{,}248}{PVIFA_{10\%,3\text{yrs}}} = \frac{\$11{,}248}{2.487} = \underline{\underline{\$4{,}523}}$$

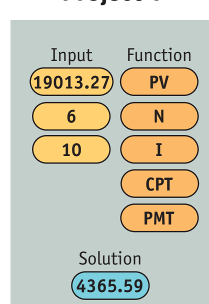
$$ANPV_Y = \frac{\$18{,}985}{PVIFA_{10\%,6\text{yrs}}} = \frac{\$18{,}985}{4.355} = \underline{\underline{\$4{,}359}}$$

Calculator Use The keystrokes required to find the ANPV on a financial calculator are identical to those demonstrated in Chapter 4 for finding the annual payments on an installment loan. These keystrokes are shown below for project X and for project Y. The resulting ANPVs for projects X and Y are $4,534.74 and $4,365.59, respectively.

Project X



Project Y



Spreadsheet Use Comparison of the annualized net present values of two projects with unequal lives also can be calculated as shown on the following Excel spreadsheet.

	A	B	C
1	COMPARISON OF ANNUALIZED NET PRESENT VALUES OF TWO PROJECTS WITH UNEQUAL LIVES		
2	Cost of Capital		10%
3		Year-End Cash Flows	
4	Year	Project X	Project Y
5	0	$ (70,000)	$ (85,000)
6	1	$ 28,000	$ 35,000
7	2	$ 33,000	$ 30,000
8	3	$ 38,000	$ 25,000
9	4		$ 20,000
10	5		$ 15,000
11	6		$ 10,000
12	NPV	$ 11,277.24	$ 19,013.27
13	ANPV	$ 4,534.74	$ 4,365.59
14	Choice of project		Project X

Entry in Cell B12 is
=NPV(C2,B6:B11)+B5.
Copy the entry in Cell B12 to Cell C12.
Entry in Cell B13 is =B12/PV(C2,3,–1).
Entry in Cell C13 is =C12/PV(C2,6,–1).
Entry in Cell C14 is =IF(B13>=C13,B4,C4)

Step 3 Reviewing the ANPVs calculated in Step 2, we can see that project X would be preferred over project Y. Given that projects X and Y are mutually exclusive, project X would be the recommended project because it provides the higher annualized net present value.

Recognizing Real Options

The procedures described in Chapters 8 and 9 and thus far in this chapter suggest that to make capital budgeting decisions, we must (1) estimate relevant cash flows, (2) apply an appropriate decision technique such as NPV or IRR to those cash flows, and (3) recognize and adjust the decision technique for project risk. Although this traditional procedure is believed to yield good decisions, a more *strategic approach* to these decisions has emerged in recent years. This more modern view considers any **real options**—opportunities that are embedded in capital projects ("real," rather than financial, asset investments) that enable managers to alter their cash flows and risk in a way that affects project acceptability (NPV). Because these opportunities are more likely to exist in, and be more important to, large "strategic" capital budgeting projects, they are sometimes called *strategic options*.

real options
Opportunities that are embedded in capital projects that enable managers to alter their cash flows and risk in a way that affects project acceptability (NPV). Also called *strategic options.*

Some of the more common types of real options—abandonment, flexibility, growth, and timing—are briefly described in Table 10.4. It should be clear from their descriptions that each of these types of options could be embedded in a

TABLE 10.4 Major Types of Real Options

Option type	Description
Abandonment option	The option to abandon or terminate a project prior to the end of its planned life. This option allows management to avoid or minimize losses on projects that turn bad. Explicitly recognizing the abandonment option when evaluating a project often increases its NPV.
Flexibility option	The option to incorporate flexibility into the firm's operations, particularly production. It generally includes the opportunity to design the production process to accept multiple inputs, use flexible production technology to create a variety of outputs by reconfiguring the same plant and equipment, and purchase and retain excess capacity in capital-intensive industries subject to wide swings in output demand and long lead time in building new capacity from scratch. Recognition of this option embedded in a capital expenditure should increase the NPV of the project.
Growth option	The option to develop follow-on projects, expand markets, expand or retool plants, and so on, that would not be possible without implementation of the project that is being evaluated. If a project being considered has the measurable potential to open new doors if successful, then recognition of the cash flows from such opportunities should be included in the initial decision process. Growth opportunities embedded in a project often increase the NPV of the project in which they are embedded.
Timing option	The option to determine when various actions with respect to a given project are taken. This option recognizes the firm's opportunity to delay acceptance of a project for one or more periods, to accelerate or slow the process of implementing a project in response to new information, or to shut down a project temporarily in response to changing product market conditions or competition. As in the case of the other types of options, the explicit recognition of timing opportunities can improve the NPV of a project that fails to recognize this option in an investment decision.

capital budgeting decision and that explicit recognition of them would probably alter the cash flow and risk of a project and change its NPV.

By explicitly recognizing these options when making capital budgeting decisions, managers can make improved, more strategic decisions that consider in advance the economic impact of certain contingent actions on project cash flow and risk. The explicit recognition of real options embedded in capital budgeting projects will cause the project's *strategic NPV* to differ from its *traditional NPV* as indicated by Equation 10.7.

$$\text{NPV}_{\text{strategic}} = \text{NPV}_{\text{traditional}} + \text{Value of real options} \tag{10.7}$$

Application of this relationship is illustrated in the following example.

EXAMPLE Assume that a strategic analysis of Bennett Company's projects A and B (see cash flows and NPVs in Table 10.1) finds no real options embedded in project A and two real options embedded in project B. The two real options in project B are as follows: (1) The project would have, during the first two years, some downtime that would result in unused production capacity that could be used to perform contract manufacturing for another firm, and (2) the project's computerized control system could, with some modification, control two other machines, thereby reducing labor cost, without affecting operation of the new project.

Bennett's management estimated the NPV of the contract manufacturing over the 2 years following implementation of project B to be \$1,500 and the NPV of the computer control sharing to be \$2,000. Management felt there was a 60% chance that the contract manufacturing option would be exercised and only a 30% chance that the computer control sharing option would be exercised. The combined value of these two real options would be the sum of their expected values.

$$\begin{aligned}\text{Value of real options for project B} &= (0.60 \times \$1{,}500) + (0.30 \times \$2{,}000)\\ &= \$900 + \$600 = \$1{,}500\end{aligned}$$

Substituting the \$1,500 real options value along with the traditional NPV of \$10,924 for project B (from Table 10.1) into Equation 10.7, we get the strategic NPV for project B.

$$\text{NPV}_{\text{strategic}} = \$10{,}924 + \$1{,}500 = \underline{\underline{\$12{,}424}}$$

Bennett Company's project B therefore has a strategic NPV of \$12,424, which is above its traditional NPV and now exceeds project A's NPV of \$11,071. Clearly, recognition of project B's real options improved its NPV (from \$10,924 to \$12,424) and causes it to be preferred over project A (NPV of \$12,424 for B > NPV of \$11,071 for A), which has no real options embedded in it.

It is important to realize that the recognition of attractive real options when determining NPV could cause an otherwise unacceptable project ($\text{NPV}_{\text{traditional}} <$ \$0) to become acceptable ($\text{NPV}_{\text{strategic}} >$ \$0). The failure to recognize the value of real options could therefore cause management to reject projects that are acceptable. Although doing so requires more strategic thinking and analysis, it is important for the financial manager to identify and incorporate real options in the NPV process. The procedures for doing this efficiently are emerging, and the use of the strategic NPV that incorporates real options is expected to become more commonplace in the future.

Capital Rationing

Hint **Because everyone in the firm knows that long-term funds are rationed and they want a portion of them, there is *intense competition* for those funds. This competition increases the need for the firm to be objective and proficient in its analysis. Knowing how to use the techniques discussed in this chapter to justify your needs will help you get your share of the available long-term funds.**

Firms commonly operate under *capital rationing*—they have more acceptable independent projects than they can fund. *In theory,* capital rationing should not exist. Firms should accept all projects that have positive NPVs (or IRRs > the cost of capital). However, *in practice,* most firms operate under capital rationing. Generally, firms attempt to isolate and select the best acceptable projects subject to a capital expenditure budget set by management. Research has found that management internally imposes capital expenditure constraints to avoid what it deems to be "excessive" levels of new financing, particularly debt. Although failing to fund all acceptable independent projects is theoretically inconsistent with the goal of maximizing owner wealth, here we will discuss capital rationing procedures because they are widely used in practice.

The objective of *capital rationing* is to select the group of projects that provides the *highest overall net present value* and does not require more dollars than are budgeted. As a prerequisite to capital rationing, the best of any mutually exclusive projects must be chosen and placed in the group of independent projects. Two basic approaches to project selection under capital rationing are discussed here.

internal rate of return approach
An approach to capital rationing that involves graphing project IRRs in descending order against the total dollar investment to determine the group of acceptable projects.

investment opportunities schedule (IOS)
The graph that plots project IRRs in descending order against total dollar investment.

Internal Rate of Return Approach

The **internal rate of return approach** involves graphing project IRRs in descending order against the total dollar investment. This graph, which is discussed in more detail in Chapter 11, is called the **investment opportunities schedule (IOS).** By drawing the cost-of-capital line and then imposing a budget constraint, the financial manager can determine the group of acceptable projects. The problem with this technique is that it does not guarantee the maximum dollar return to the firm. It merely provides a satisfactory solution to capital-rationing problems.

EXAMPLE

Tate Company, a fast-growing plastics company, is confronted with six projects competing for its fixed budget of $250,000. The initial investment and IRR for each project are as follows:

Project	Initial investment	IRR
A	$ 80,000	12%
B	70,000	20
C	100,000	16
D	40,000	8
E	60,000	15
F	110,000	11

The firm has a cost of capital of 10%. Figure 10.4 presents the IOS that results from ranking the six projects in descending order on the basis of their IRRs. According to the schedule, only projects B, C, and E should be accepted. Together they will absorb $230,000 of the $250,000 budget. Projects A and F are acceptable but cannot be chosen because of the budget constraint. Project D is not worthy of consideration; its IRR is less than the firm's 10% cost of capital.

The drawback of this approach is that there is no guarantee that the acceptance of projects B, C, and E will maximize *total dollar returns* and therefore owners' wealth.

net present value approach
An approach to capital rationing that is based on the use of present values to determine the group of projects that will maximize owners' wealth.

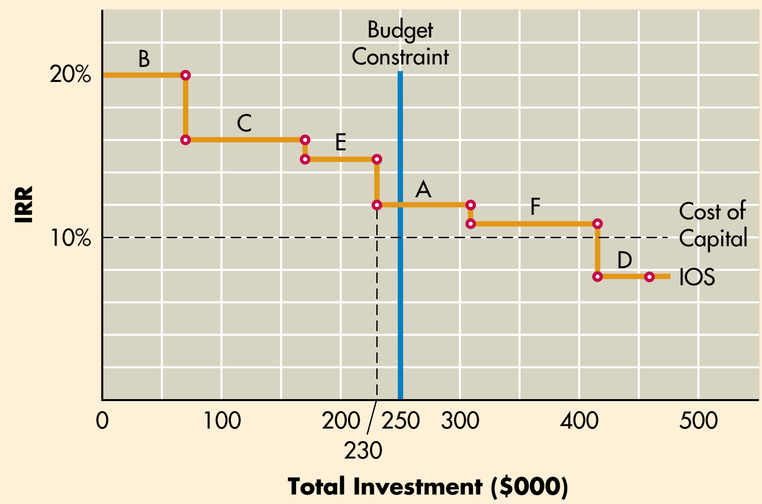
Net Present Value Approach

The **net present value approach** is based on the use of present values to determine the group of projects that will maximize owners' wealth. It is implemented by ranking projects on the basis of IRRs and then evaluating the present value of the benefits from each potential project to determine *the combination of projects*

FIGURE 10.4

Investment Opportunities Schedule

Investment opportunities schedule (IOS) for Tate Company projects



with the highest overall present value. This is the same as maximizing net present value, in which the entire budget is viewed as the total initial investment. Any portion of the firm's budget that is not used does not increase the firm's value. At best, the unused money can be invested in marketable securities or returned to the owners in the form of cash dividends. In either case, the wealth of the owners is not likely to be enhanced.

EXAMPLE

The group of projects described in the preceding example is ranked in Table 10.5 on the basis of IRRs. The present value of the cash inflows associated with the projects is also included in the table. Projects B, C, and E, which together require $230,000, yield a present value of $336,000. However, if projects B, C, and A were implemented, the total budget of $250,000 would be used, and the present value of the cash inflows would be $357,000. This is greater than the return expected from selecting the projects on the basis of the highest IRRs. Implementing

TABLE 10.5 Rankings for Tate Company Projects

Project	Initial investment	IRR	Present value of inflows at 10%	
B	$ 70,000	20%	$112,000	
C	100,000	16	145,000	
E	60,000	15	79,000	
A	80,000	12	100,000	
F	110,000	11	126,500	Cutoff point (IRR < 10%)
D	40,000	8	36,000	

B, C, and A is preferable, because they maximize the present value for the given budget. *The firm's objective is to use its budget to generate the highest present value of inflows.* Assuming that any unused portion of the budget does not gain or lose money, the total NPV for projects B, C, and E would be $106,000 ($336,000 − $230,000), whereas for projects B, C, and A the total NPV would be $107,000 ($357,000 − $250,000). Selection of projects B, C, and A will therefore maximize NPV.

Review Questions

10–8 Explain why a mere comparison of the NPVs of unequal-lived, ongoing, mutually exclusive projects is inappropriate. Describe the *annualized net present value (ANPV)* approach for comparing unequal-lived, mutually exclusive projects.

10–9 What are *real options?* What are some major types of real options?

10–10 What is the difference between the *strategic NPV* and the *traditional NPV?* Do they always result in the same accept–reject decisions?

10–11 What is *capital rationing?* In theory, should capital rationing exist? Why does it frequently occur in practice?

10–12 Compare and contrast the *internal rate of return approach* and the *net present value approach* to capital rationing. Which is better? Why?

Summary

FOCUS ON VALUE

Not all capital budgeting projects have the same level of risk as the firm's existing portfolio of projects. In addition, mutually exclusive projects often possess differing levels of risk. The financial manager must therefore adjust projects for differences in risk when evaluating their acceptability. Without such adjustment, management could mistakenly accept projects that destroy shareholder value or could reject projects that create shareholder value. To ensure that neither of these outcomes occurs, the financial manager must make sure that only those projects that create shareholder value are recommended.

Risk-adjusted discounts rates (RADRs) provide a mechanism for adjusting the discount rate so that it is consistent with the risk–return preferences of market participants and thereby accepting only value-creating projects. Procedures for comparing projects with unequal lives, procedures for explicitly recognizing real options embedded in capital projects, and procedures for selecting projects under capital rationing enable the financial manager to refine the capital budgeting process further. These procedures, along with risk-adjustment techniques, should enable the financial manager to make capital budgeting decisions that are consistent with the firm's goal of **maximizing stock price.**

REVIEW OF LEARNING GOALS

LG1 **Understand the importance of explicitly recognizing risk in the analysis of capital budgeting projects.** The cash flows associated with capital budgeting projects typically have different levels of risk, and the acceptance of a project generally affects the firm's overall risk. Thus it is important to incorporate risk considerations in capital budgeting. Various behavioral approaches can be used to get a "feel" for the level of project risk, whereas other approaches explicitly recognize project risk in the analysis of capital budgeting projects.

LG2 **Discuss breakeven cash inflow, sensitivity and scenario analysis, and simulation as behavioral approaches for dealing with risk.** Risk in capital budgeting is the chance that a project will prove unacceptable or, more formally, the degree of variability of cash flows. Finding the breakeven cash inflow and assessing the probability that it will be realized make up one behavioral approach that is used to assess the chance of success. Sensitivity analysis and scenario analysis are also behavioral approaches for dealing with project risk to capture the variability of cash inflows and NPVs. Simulation is a statistically based approach that results in a probability distribution of project returns. It usually requires a computer and allows the decision maker to understand the risk-return tradeoffs involved in a proposed investment.

LG3 **Discuss the unique risks that multinational companies face.** Although the basic capital budgeting techniques are the same for multinational and purely domestic companies, firms that operate in several countries must also deal with both exchange rate and political risks, tax law differences, transfer pricing, and strategic rather than strictly financial issues.

LG4 **Describe the determination and use of risk-adjusted discount rates (RADRs), portfolio effects, and the practical aspects of RADRs.** The risk of a project whose initial investment is known with certainty is embodied in the present value of its cash inflows, using NPV. Two opportunities to adjust the present value of cash inflows for risk exist—adjust the cash inflows or adjust the discount rate. Because adjusting the cash inflows is highly subjective, adjusting discount rates is more popular. The RADRs use a market-based adjustment of the discount rate to calculate NPV. The RADR is closely linked to CAPM, but because real corporate assets are generally not traded in an efficient market, the CAPM cannot be applied directly to capital budgeting. Instead, firms develop some CAPM-type of relationship to link a project's risk to its required return, which is used as the discount rate. Often, for convenience, firms will rely on total risk as an approximation for relevant risk when estimating required project returns. RADRs are commonly used in practice, because decision makers prefer rates of return and find them easy to estimate and apply.

LG5 **Recognize the problem caused by unequal-lived mutually exclusive projects and the use of annualized net present values (ANPVs) to resolve it.** The problem in comparing unequal-lived mutually exclusive projects is that the projects do not provide service over comparable time periods. The annualized net present value (ANPV) approach is the most efficient method of comparing ongoing mutually exclusive projects that have unequal usable lives. It converts the NPV of each unequal-lived project into an equivalent annual amount—its ANPV. The ANPV can be calculated using financial tables by dividing each project's NPV by the present value interest factor for an annuity at the given cost of capital and project life. Alternatively, it can be calculated using a financial calculator—the keystrokes are identical to those used to find the annual payment on an installment loan—or spreadsheet. The project with the highest ANPV is best.

LG6 **Explain the role of real options and the objective of, and basic approaches to, project selection under capital rationing.** By explicitly recognizing real options—opportunities that are embedded in capital projects and that allow managers to alter their cash flow and risk in a way that affects project acceptability (NPV)—the financial manager can find a project's strategic NPV. Some of the more common types of real options are abandonment, flexibility, growth, and timing options. The strategic NPV explicitly recognizes the value of real options and thereby improves the quality of the capital budgeting decision.

Capital rationing exists when firms have more acceptable independent projects than they can fund. Although, in theory, capital rationing should not exist, in practice it commonly occurs. Its objective is to select from all acceptable projects the group that provides the highest overall net present value and does not require more dollars than are budgeted. The two basic approaches for choosing projects under capital rationing are the internal rate of return approach and the net present value approach. The NPV approach better achieves the objective of using the budget to generate the highest present value of inflows.

SELF-TEST PROBLEM (Solution in Appendix B)

LG4 **ST 10–1** **Risk-adjusted discount rates** CBA Company is considering two mutually exclusive projects, A and B. The following table shows the CAPM-type relationship between a risk index and the required return (RADR) applicable to CBA Company.

Risk index	Required return (RADR)
0.0	7.0% (risk-free rate, R_F)
0.2	8.0
0.4	9.0
0.6	10.0
0.8	11.0
1.0	12.0
1.2	13.0
1.4	14.0
1.6	15.0
1.8	16.0
2.0	17.0

Project data are shown as follows:

	Project A	Project B
Initial investment (CF_0)	\$15,000	\$20,000
Project life	3 years	3 years
Annual cash inflow (CF)	\$7,000	\$10,000
Risk index	0.4	1.8

a. Ignoring any differences in risk and assuming that the firm's cost of capital is 10%, calculate the net present value (NPV) of each project.

b. Use NPV to evaluate the projects, using *risk-adjusted discount rates* (*RADRs*) to account for risk.
c. Compare, contrast, and explain your findings in parts **a** and **b.**

PROBLEMS

LG1 **10–1** **Recognizing risk** Caradine Corp., a media services firm with net earnings of $3,200,000 in the last year, is considering several projects.

Project	Initial Investment	Details
A	$ 35,000	Replace existing office furnishings.
B	500,000	Purchase digital film-editing equipment for use with several existing accounts.
C	450,000	Develop proposal to bid for a $2,000,000 per year 10-year contract with the U.S. Navy, not now an account.
D	685,000	Purchase the exclusive rights to market a quality educational television program in syndication to local markets in the European Union, a part of the firm's existing business activities.

The media services business is cyclical and highly competitive. The board of directors has asked you, as chief financial officer, to
a. Evaluate the risk of each proposed project and rank it "low," "medium," or "high."
b. Comment on why you chose each ranking.

LG2 **10–2** **Breakeven cash inflows** Etsitty Arts, Inc., a leading producer of fine cast silver jewelry, is considering the purchase of new casting equipment that will allow it to expand the product line into award plaques. The proposed initial investment is $35,000. The company expects that the equipment will produce steady income throughout its 12-year life.
a. If Etsitty requires a 14% return on its investment, what minimum yearly cash inflow will be necessary for the company to go forward with this project?
b. How would the minimum yearly cash inflow change if the company required a 10% return on its investment?

LG2 **10–3** **Breakeven cash inflows and risk** Pueblo Enterprises is considering investing in either of two mutually exclusive projects, X and Y. Project X requires an initial investment of $30,000; project Y requires $40,000. Each project's cash inflows are 5-year annuities; project X's inflows are $10,000 per year; project Y's are $15,000. The firm has unlimited funds and, in the absence of risk differences, accepts the project with the highest NPV. The cost of capital is 15%.
a. Find the NPV for each project. Are the projects acceptable?
b. Find the *breakeven cash inflow* for each project.

c. The firm has estimated the probabilities of achieving various ranges of cash inflows for the two projects, as shown in the following table. What is the probability that each project will achieve the breakeven cash inflow found in part **b**?

	Probability of achieving cash inflow in given range	
Range of cash inflow	**Project X**	**Project Y**
$0 to $5,000	0%	5%
$5,000 to $7,500	10	10
$7,500 to $10,000	60	15
$10,000 to $12,500	25	25
$12,500 to $15,000	5	20
$15,000 to $20,000	0	15
Above $20,000	0	10

d. Which project is more risky? Which project has the potentially higher NPV? Discuss the risk-return tradeoffs of the two projects.

e. If the firm wished to minimize losses (that is, NPV < $0), which project would you recommend? Which would you recommend if the goal, instead, was achieving the higher NPV?

LG2 **10–4** **Basic sensitivity analysis** Murdock Paints is in the process of evaluating two mutually exclusive additions to its processing capacity. The firm's financial analysts have developed pessimistic, most likely, and optimistic estimates of the annual cash inflows associated with each project. These estimates are shown in the following table.

	Project A	**Project B**
Initial investment (CF_0)	**$8,000**	**$8,000**
Outcome	**Annual cash inflows (*CF*)**	
Pessimistic	$ 200	$ 900
Most likely	1,000	1,000
Optimistic	1,800	1,100

a. Determine the *range* of annual cash inflows for each of the two projects.

b. Assume that the firm' s cost of capital is 10% and that both projects have 20-year lives. Construct a table similar to this for the NPVs for each project. Include the *range* of NPVs for each project.

c. Do parts **a** and **b** provide consistent views of the two projects? Explain.

d. Which project do you recommend? Why?

LG2 **10–5** **Sensitivity analysis** James Secretarial Services is considering the purchase of one of two new personal computers, P and Q. Both are expected to provide benefits over a 10-year period, and each has a required investment of $3,000. The firm uses a 10% cost of capital. Management has constructed the following table of estimates of annual cash inflows for pessimistic, most likely, and optimistic results.

	Computer P	Computer Q
Initial investment (CF_0)	**\$3,000**	**\$3,000**
Outcome	**Annual cash inflows (CF)**	
Pessimistic	\$ 500	\$ 400
Most likely	750	750
Optimistic	1,000	1,200

a. Determine the *range* of annual cash inflows for each of the two computers.
b. Construct a table similar to this for the NPVs associated with each outcome for both computers.
c. Find the *range* of NPVs, and subjectively compare the risks associated with purchasing these computers.

LG2 **10–6 Simulation** Ogden Corporation has compiled the following information on a capital expenditure proposal:
(1) The projected cash *inflows* are normally distributed with a mean of \$36,000 and a standard deviation of \$9,000.
(2) The projected cash *outflows* are normally distributed with a mean of \$30,000 and a standard deviation of \$6,000.
(3) The firm has an 11% cost of capital.
(4) The probability distributions of cash inflows and cash outflows are not expected to change over the project's 10-year life.
a. Describe how the foregoing data can be used to develop a simulation model for finding the net present value of the project.
b. Discuss the advantages of using a simulation to evaluate the proposed project.

LG4 **10–7 Risk-adjusted discount rates—Basic** Country Wallpapers is considering investing in one of three mutually exclusive projects, E, F, and G. The firm's cost of capital, k, is 15%, and the risk-free rate, R_F, is 10%. The firm has gathered the following basic cash flow and risk index data for each project.

	Project (j)		
	E	F	G
Initial investment (CF_0)	**\$15,000**	**\$11,000**	**\$19,000**
Year (t)	**Cash inflows (CF_t)**		
1	\$ 6,000	\$ 6,000	\$ 4,000
2	6,000	4,000	6,000
3	6,000	5,000	8,000
4	6,000	2,000	12,000
Risk index (RI_j)	1.80	1.00	0.60

a. Find the net present value (NPV) of each project using the firm's cost of capital. Which project is preferred in this situation?

b. The firm uses the following equation to determine the risk-adjusted discount rate, RADR_j, for each project *j*:

$$\text{RADR}_j = R_F + [RI_j \times (k - R_F)]$$

where

R_F = risk-free rate of return
RI_j = risk index for project *j*
k = cost of capital

Substitute each project's risk index into this equation to determine its RADR.

c. Use the RADR for each project to determine its risk-adjusted NPV. Which project is preferable in this situation?

d. Compare and discuss your findings in parts **a** and **c.** Which project do you recommend that the firm accept?

LG4 **10–8 Risk-adjusted discount rates—Tabular** After a careful evaluation of investment alternatives and opportunities, Masters School Supplies has developed a CAPM-type relationship linking a risk index to the required return (RADR), as shown in the following table.

Risk index	Required return (RADR)
0.0	7.0% (risk-free rate, R_F)
0.2	8.0
0.4	9.0
0.6	10.0
0.8	11.0
1.0	12.0
1.2	13.0
1.4	14.0
1.6	15.0
1.8	16.0
2.0	17.0

The firm is considering two mutually exclusive projects, A and B. The following are the data the firm has been able to gather about the projects.

	Project A	Project B
Initial investment (CF_0)	\$20,000	\$30,000
Project life	5 years	5 years
Annual cash inflow (CF)	\$7,000	\$10,000
Risk index	0.2	1.4

All the firm's cash inflows have already been adjusted for taxes.

a. Evaluate the projects using *risk-adjusted discount rates*.

b. Discuss your findings in part **a,** and recommend the preferred project.

LG4 **10–9 Risk-adjusted rates of return using CAPM** Centennial Catering, Inc., is considering two mutually exclusive investments. The company wishes to use a risk-adjusted rate of return in its analysis. Centennial's cost of capital (similar to the market return in CAPM) is 12%, and the current risk-free rate of return is 7%. Cash flows associated with the two projects are as follows:

	Project X	Project Y
Initial investment (CF_0)	$70,000	$78,000
Year (t)	**Cash inflows (CF_t)**	
1	$30,000	$22,000
2	30,000	32,000
3	30,000	38,000
4	30,000	46,000

a. Use a risk-adjusted rate of return approach to calculate the net present value of each project, given that Project X has a RADR factor of 1.20 and Project Y has a RADR factor of 1.40. The RADR factors are similar to project betas. (Use Equation 10.5 to calculate the required project return for each.)

b. Discuss your findings in part **a,** and recommend the preferred project.

LG4 **10–10 Risk classes and RADR** Moses Manufacturing is attempting to select the best of three mutually exclusive projects, X, Y, and Z. Though all the projects have 5-year lives, they possess differing degrees of risk. Project X is in class V, the highest-risk class; project Y is in class II, the below-average-risk class; and project Z is in class III, the average-risk class. The basic cash flow data for each project and the risk classes and risk-adjusted discount rates (RADRs) used by the firm are shown in the following tables.

	Project X	Project Y	Project Z
Initial investment (CF_0)	$180,000	$235,000	$310,000
Year (t)	**Cash inflows (CF_t)**		
1	$80,000	$50,000	$90,000
2	70,000	60,000	90,000
3	60,000	70,000	90,000
4	60,000	80,000	90,000
5	60,000	90,000	90,000

Risk Classes and RADRs		
Risk Class	**Description**	**Risk-adjusted discount rate (RADR)**
I	Lowest risk	10%
II	Below-average risk	13
III	Average risk	15
IV	Above-average risk	19
V	Highest risk	22

a. Find the risk-adjusted NPV for each project.
b. Which project, if any, would you recommend that the firm undertake?

LG5 **10–11 Unequal lives—ANPV approach** Evans Industries wishes to select the best of three possible machines, each of which is expected to satisfy the firm's ongoing need for additional aluminum-extrusion capacity. The three machines—A, B, and C—are equally risky. The firm plans to use a 12% cost of capital to evaluate each of them. The initial investment and annual cash inflows over the life of each machine are shown in the following table.

	Machine A	Machine B	Machine C
Initial investment (CF_0)	**\$92,000**	**\$65,000**	**\$100,500**
Year (t)	**Cash inflows (CF_t)**		
1	\$12,000	\$10,000	\$30,000
2	12,000	20,000	30,000
3	12,000	30,000	30,000
4	12,000	40,000	30,000
5	12,000	—	30,000
6	12,000	—	—

a. Calculate the NPV for each machine over its life. Rank the machines in descending order on the basis of NPV.
b. Use the *annualized net present value (ANPV)* approach to evaluate and rank the machines in descending order on the basis of ANPV.
c. Compare and contrast your findings in parts **a** and **b.** Which machine would you recommend that the firm acquire? Why?

LG5 **10–12 Unequal lives—ANPV approach** Portland Products is considering the purchase of one of three mutually exclusive projects for increasing production efficiency. The firm plans to use a 14% cost of capital to evaluate these equal-risk projects. The initial investment and annual cash inflows over the life of each project are shown in the following table.

	Project X	Project Y	Project Z
Initial investment (CF_0)	$78,000	$52,000	$66,000
Year (t)	Cash inflows (CF_t)		
1	$17,000	$28,000	$15,000
2	25,000	38,000	15,000
3	33,000	—	15,000
4	41,000	—	15,000
5	—	—	15,000
6	—	—	15,000
7	—	—	15,000
8	—	—	15,000

a. Calculate the NPV for each project over its life. Rank the projects in descending order on the basis of NPV.
b. Use the *annualized net present value (ANPV)* approach to evaluate and rank the projects in descending order on the basis of ANPV.
c. Compare and contrast your findings in parts **a** and **b.** Which project would you recommend that the firm purchase? Why?

LG5 **10–13** **Unequal lives—ANPV approach** JBL Co. has designed a new conveyor system. Management must choose among three alternative courses of action: (1) The firm can sell the design outright to another corporation with payment over 2 years. (2) It can license the design to another manufacturer for a period of 5 years, its likely product life. (3) It can manufacture and market the system itself. The company has a cost of capital of 12%. Cash flows associated with each alternative are as follows:

Alternative	Sell	License	Manufacture
Initial investment (CF_0)	$200,000	$200,000	$450,000
Year (t)	Cash inflows (CF_t)		
1	$200,000	$250,000	$200,000
2	250,000	100,000	250,000
3	—	80,000	200,000
4	—	60,000	200,000
5	—	40,000	200,000
6	—	—	200,000

a. Calculate the net present value of each alternative and rank the alternatives on the basis of NPV.
b. Calculate the *annualized net present value (ANPV)* of each alternative and rank them accordingly.
c. Why is ANPV preferred over NPV when ranking projects with unequal lives?

LG6 **10–14 Real options and the strategic NPV** Jenny Rene, the CFO of Asor Products, Inc., has just completed an evaluation of a proposed capital expenditure for equipment that would expand the firm's manufacturing capacity. Using the traditional NPV methodology, she found the project unacceptable because

$$NPV_{traditional} = -\$1{,}700 < \$0$$

Before recommending rejection of the proposed project, she has decided to assess whether there might be real options embedded in the firm's cash flows. Her evaluation uncovered the following three options.

Option 1: Abandonment—The project could be abandoned at the end of 3 years, resulting in an addition to NPV of $1,200.

Option 2: Expansion—If the projected outcomes occurred, an opportunity to expand the firm's product offerings further would occur at the end of 4 years. Exercise of this option is estimated to add $3,000 to the project's NPV.

Option 3: Delay—Certain phases of the proposed project could be delayed if market and competitive conditions caused the firm's forecast revenues to develop more slowly than planned. Such a delay in implementation at that point has a NPV of $10,000.

Rene estimated that there was a 25% chance that the abandonment option would need to be exercised, a 30% chance the expansion option would be exercised, and only a 10% chance that the implementation of certain phases of the project would have to be delayed.

a. Use the information provided to calculate the strategic NPV, $NPV_{strategic}$, for Asor Products' proposed equipment expenditure.

b. Judging on the basis of your findings in part **a,** what action should Rene recommend to management with regard to the proposed equipment expenditures?

c. In general, how does this problem demonstrate the importance of considering real options when making capital budgeting decisions?

LG6 **10–15 Capital rationing—IRR and NPV approaches** Valley Corporation is attempting to select the best of a group of independent projects competing for the firm's fixed capital budget of $4.5 million. The firm recognizes that any unused portion of this budget will earn less than its 15% cost of capital, thereby resulting in a present value of inflows that is less than the initial investment. The firm has summarized the key data to be used in selecting the best group of projects in the following table.

Project	Initial investment	IRR	Present value of inflows at 15%
A	$5,000,000	17%	$5,400,000
B	800,000	18	1,100,000
C	2,000,000	19	2,300,000
D	1,500,000	16	1,600,000
E	800,000	22	900,000
F	2,500,000	23	3,000,000
G	1,200,000	20	1,300,000

a. Use the *internal rate of return (IRR) approach* to select the best group of projects.
b. Use the *net present value (NPV) approach* to select the best group of projects.
c. Compare, contrast, and discuss your findings in parts **a** and **b.**
d. Which projects should the firm implement? Why?

LG6 **10–16** **Capital rationing—NPV approach** A firm with a 13% cost of capital must select the optimal group of projects from those shown in the following table, given its capital budget of $1 million.

Project	Initial investment	NPV at 13% cost of capital
A	$300,000	$ 84,000
B	200,000	10,000
C	100,000	25,000
D	900,000	90,000
E	500,000	70,000
F	100,000	50,000
G	800,000	160,000

a. Calculate the *present value of cash inflows* associated with each project.
b. Select the optimal group of projects, keeping in mind that unused funds are costly.

CHAPTER 10 CASE Evaluating Cherone Equipment's Risky Plans for Increasing Its Production Capacity

Cherone Equipment, a manufacturer of electronic fitness equipment, wishes to evaluate two alternative plans for increasing its production capacity to meet the rapidly growing demand for its key product—the Cardiocycle. After months of investigation and analysis, the firm has pruned the list of alternatives down to the following two plans, either of which would allow it to meet the forecast product demand.

Plan X Use current proven technology to expand the existing plant and semiautomated production line. This plan is viewed as only slightly more risky than the firm's current average level of risk.

Plan Y Install new, just-developed automatic production equipment in the existing plant to replace the current semiautomated production line. Because this plan eliminates the need to expand the plant, it is less expensive than Plan X, but it is believed to be far more risky because of the unproven nature of the technology.

Cherone, which routinely uses NPV to evaluate capital budgeting projects, has a cost of capital of 12%. Currently the risk-free rate of interest, R_F, is 9%. The firm has decided to evaluate the two plans over a 5-year time period, at the end of which each plan would be liquidated. The relevant cash flows associated with each plan are summarized in the accompanying table.

	Plan X	Plan Y
Initial investment (CF_0)	**\$2,700,000**	**\$2,100,000**
Year (t)	**Cash inflows (CF_t)**	
1	\$ 470,000	\$ 380,000
2	610,000	700,000
3	950,000	800,000
4	970,000	600,000
5	1,500,000	1,200,000

The firm has determined the risk-adjusted discount rate (RADR) applicable to each plan.

Plan	Risk-adjusted discount rate (RADR)
X	13%
Y	15%

Further analysis of the two plans has disclosed that each has a real option embedded within its cash flows.

Plan X Real Option—At the end of 3 years the firm could abandon this plan and then install the automatic equipment, which would then have a proven track record. This *abandonment option* is expected to add \$100,000 of NPV and has a 25% chance of being exercised.

Plan Y Real Option—Because plan Y does not require current expansion of the plant, it creates an improved opportunity for future plant expansion. This option allows the firm to grow its business into related areas more easily if business and economic conditions continue to improve. This *expansion option* is estimated to be worth \$500,000 of NPV and has a 20% chance of being exercised.

Required

a. Assuming that the two plans have the same risk as the firm, use the following capital budgeting techniques and the firm's cost of capital to evaluate their acceptability and relative ranking.
(1) Net present value (NPV).
(2) Internal rate of return (IRR).

b. Recognizing the differences in plan risk, use the NPV method, the risk-adjusted discount rates (RADRs), and the data given earlier to evaluate the acceptability and relative ranking of the two plans.

c. Compare and contrast your finding in parts **a** and **b.** Which plan would you recommend? Did explicit recognition of the risk differences of the plans affect this recommendation?
d. Use the real-options data given above for each plan to find the strategic NPV, $NPV_{strategic}$, for each plan.
e. Compare and contrast your findings in part **d** with those in part **b.** Did explicit recognition of the real options in each plan affect your recommendation?
f. Would your recommendations in parts **a, b,** and **d** be changed if the firm were operating under capital rationing? Explain.

WEB EXERCISE

Go to the Contingency Analysis Web site, *www.contingencyanalysis.com*. Scroll down the page and click **Fundamentals**. Then click on **Risk Intuition**.

1. Take the seven-question quiz. Were you surprised at the answers?

Return to the **Fundamentals** page and click on **Risk Measures**.

2. Describe the three categories of risk measures and how they could be used in capital budgeting analysis.

Scroll down the Risk Measures menu in the lower left frame and click on **Asset Liability Analysis.**

3. Why are statistical risk measures less satisfactory in determining asset risk?
4. Summarize the steps to analyze asset risk.
5. Using the following project description, explain how you would analyze the risk.

Purchase of Automated Equipment for a New Assembly Line	
Initial cost: $6,600,000	
Expected incremental cash inflows:	
Year 1	$1,280,000
Year 2	1,640,000
Year 3	1,820,000
Year 4	2,030,000
Year 5	2,450,000

6. What types of assumptions would you change to create new cash flows? Consider various market factors such as timing for project implementation, inflation, capital costs, and so forth.

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

INTEGRATIVE CASE 3

Lasting Impressions Company

Lasting Impressions (LI) Company is a medium-sized commercial printer of promotional advertising brochures, booklets, and other direct-mail pieces. The firm's major clients are New York– and Chicago-based ad agencies. The typical job is characterized by high quality and production runs of over 50,000 units. LI has not been able to compete effectively with larger printers because of its existing older, inefficient presses. The firm is currently having problems cost effectively meeting run length requirements as well as meeting quality standards.

The general manager has proposed the purchase of one of two large six-color presses designed for long, high-quality runs. The purchase of a new press would enable LI to reduce its cost of labor and therefore the price to the client, putting the firm in a more competitive position. The key financial characteristics of the old press and of the two proposed presses are summarized in what follows.

Old press Originally purchased 3 years ago at an installed cost of $400,000, it is being depreciated under MACRS using a 5-year recovery period. The old press has a remaining economic life of 5 years. It can be sold today to net $420,000 before taxes; if it is retained, it can be sold to net $150,000 before taxes at the end of 5 years.

Press A This highly automated press can be purchased for $830,000 and will require $40,000 in installation costs. It will be depreciated under MACRS using a 5-year recovery period. At the end of the 5 years, the machine could be sold to net $400,000 before taxes. If this machine is acquired, it is anticipated that the following current account changes would result.

Cash	+ $ 25,400
Accounts receivable	+ 120,000
Inventories	− 20,000
Accounts payable	+ 35,000

Press B This press is not as sophisticated as press A. It costs $640,000 and requires $20,000 in installation costs. It will be depreciated under MACRS using a 5-year recovery period. At the end of 5 years, it can be sold to net $330,000 before taxes. Acquisition of this press will have no effect on the firm's net working capital investment.

Table 1

Profits Before Depreciation and Taxes for Lasting Impressions Company's Presses

Year	Old press	Press A	Press B
1	$120,000	$250,000	$210,000
2	120,000	270,000	210,000
3	120,000	300,000	210,000
4	120,000	330,000	210,000
5	120,000	370,000	210,000

The firm estimates that its profits before depreciation and taxes with the old press and with press A or press B for each of the 5 years would be as shown in Table 1. The firm is subject to a 40% tax rate on both ordinary income and capital gains. The firm's cost of capital, *k,* applicable to the proposed replacement is 14%.

Required

a. For each of the two proposed replacement presses, determine:
   (1) Initial investment.
   (2) Operating cash inflows. (*Note:* Be sure to consider the depreciation in year 6.)
   (3) Terminal cash flow. (*Note:* This is at the end of year 5.)

b. Using the data developed in part **a**, find and depict on a time line the relevant cash flow stream associated with each of the two proposed replacement presses, assuming that each is terminated at the end of 5 years.

c. Using the data developed in part **b**, apply each of the following decision techniques:
   (1) Payback period. (*Note:* For year 5, use only the operating cash inflows—that is, exclude terminal cash flow—when making this calculation.)
   (2) Net present value (NPV).
   (3) Internal rate of return (IRR).

d. Draw net present value profiles for the two replacement presses on the same set of axes, and discuss conflicting rankings of the two presses, if any, resulting from use of NPV and IRR decision techniques.

e. Recommend which, if either, of the presses the firm should acquire if the firm has (1) unlimited funds or (2) capital rationing.

f. What is the impact on your recommendation of the fact that the operating cash inflows associated with press A are characterized as very risky in contrast to the low-risk operating cash inflows of press B?

PART 4

LONG-TERM FINANCIAL DECISIONS

CHAPTERS IN THIS PART

CHAPTER

11

THE COST OF CAPITAL

LEARNING GOALS

LG1 Understand the key assumptions that underlie cost of capital, the basic concept of cost of capital, and the specific sources of capital that it includes.

LG2 Determine the cost of long-term debt and the cost of preferred stock.

LG3 Calculate the cost of common stock equity and convert it into the cost of retained earnings and the cost of new issues of common stock.

LG4 Calculate the weighted average cost of capital (WACC) and discuss the alternative weighting schemes.

LG5 Describe the procedures used to determine break points and the weighted marginal cost of capital (WMCC).

LG6 Explain how the weighted marginal cost of capital (WMCC) can be used with the investment opportunities schedule (IOS) to make the firm's financing/investment decisions.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand the various sources of capital and how their costs are calculated in order to provide data used in determining the firm's overall cost of capital.

Information systems: You need to understand the various sources of capital and how their costs are calculated in order to develop systems that will estimate the costs of those sources of capital, as well as the overall cost of capital.

Management: You need to understand the cost of capital in order to assess the acceptability and relative rankings of proposed long-term investments.

Marketing: You need to understand what the firm's cost of capital is because proposed projects will face rejection if their promised returns are less than the firm's cost of capital.

Operations: You need to understand the cost of capital in order to assess the economic viability of investments in plant and equipment needed to improve or expand the firm's capacity.

NEXTEL

ANSWERING THE CALL FOR FUNDS

Nextel, the fifth largest mobile-phone company in the United States, offers its customers unique technology that combines a variety of wireless services on one handset. Despite its dominance in the business market and its high revenue growth, through early 2002 the company was still in a net-loss position. Its continued march toward profitability requires large capital expenditures; in 2000 alone, it spent $3.5 billion to keep up with technological advances and add new features. To fund its growth, Nextel raised well over $20 billion in new debt and equity financing from 1996 to 2000.

Searching for new sources of capital and finding the most appropriate sources for different purposes can keep costs of capital in line. Nextel aggressively raises capital whenever it sees an opportunity, so that money will always be available for expansion. The firm combines different financing instruments to create a healthy balance between debt and equity. The type of financing is tied to market conditions. When the high-yield debt markets tightened in 1998 as a consequence of the international financial situation, the private markets proved to be a better, more reasonably priced choice. The company also issued convertible bonds and preferred stock when market conditions were right. In 2000 Nextel was able to tap strong equity markets to issue $2.8 billion of common equity, which helped it to stay within existing debt provisions. This turned out to be a good move; the market for telecommunications and other technology stocks collapsed soon after.

Choosing cost-effective financing instruments so that Nextel can work toward a balanced capital structure is no easy task in today's volatile capital markets. If the equity markets are closed, the company may have no choice but to issue debt, regardless of cost, in order to secure adequate funding for its capital projects.

In this chapter we'll demonstrate how to calculate the cost of specific sources of capital and how to combine them to arrive at a *weighted cost of capital* that firms can use to evaluate investment opportunities.

LG1 11.1 An Overview of the Cost of Capital

cost of capital
The rate of return that a firm must earn on the projects in which it invests to maintain its market value and attract funds.

The **cost of capital** is the rate of return that a firm must earn on the projects in which it invests to maintain the market value of its stock. It can also be thought of as the rate of return required by the market suppliers of capital to attract their funds to the firm. If risk is held constant, projects with a rate of return above the cost of capital will increase the value of the firm, and projects with a rate of return below the cost of capital will decrease the value of the firm.

The cost of capital is an extremely important financial concept. It acts as a major link between the firm's long-term investment decisions (discussed in Part 3) and the wealth of the owners as determined by investors in the marketplace. It is in effect the "magic number" that is used to decide whether a proposed corporate investment will increase or decrease the firm's stock price. Clearly, only those investments that are expected to increase stock price (NPV > \$0, or IRR > cost of capital) would be recommended. Because of its key role in financial decision making, the importance of the cost of capital cannot be overemphasized.

Some Key Assumptions

The cost of capital is a dynamic concept affected by a variety of economic and firm-specific factors. To isolate the basic structure of the cost of capital, we make some key assumptions relative to risk and taxes:

business risk
The risk to the firm of being unable to cover operating costs.

financial risk
The risk to the firm of being unable to cover required financial obligations (interest, lease payments, preferred stock dividends).

1. **Business risk**—the risk to the firm of being unable to cover operating costs—*is assumed to be unchanged*. This assumption means that the firm's acceptance of a given project does not affect its ability to meet operating costs.
2. **Financial risk**—the risk to the firm of being unable to cover required financial obligations (interest, lease payments, preferred stock dividends)—*is assumed to be unchanged*. This assumption means that projects are financed in such a way that the firm's ability to meet required financing costs is unchanged.
3. After-tax costs are considered relevant. In other words, *the cost of capital is measured on an after-tax basis*. This assumption is consistent with the framework used to make capital budgeting decisions.

Hint Because of the positive relationship between risk and return, a firm's financing cost (cost of capital) will change if the acceptance of a project changes the firm's business or financial risk. The cost of capital can therefore be more easily measured by assuming that new projects do not change these risks.

The Basic Concept

target capital structure
The desired optimal mix of debt and equity financing that most firms attempt to maintain.

The cost of capital is estimated at a given point in time. It reflects the expected average future cost of funds over the long run. Although firms typically raise money in lumps, the cost of capital should reflect the interrelatedness of financing activities. For example, if a firm raises funds with debt (borrowing) today, it is likely that some form of equity, such as common stock, will have to be used the next time it needs funds. Most firms attempt to maintain a desired optimal mix of debt and equity financing. This mix is commonly called a **target capital structure**—a topic that will be addressed in Chapter 12. Here, it is sufficient to say that although firms raise money in lumps, they tend toward some desired *mix of financing*.

To capture the interrelatedness of financing assuming the presence of a target capital structure, we need to look at the *overall cost of capital* rather than the cost of the specific source of funds used to finance a given expenditure.

EXAMPLE A firm is *currently* faced with an investment opportunity. Assume the following:

Best project available today

Cost = \$100,000
Life = 20 years
IRR = 7%

Cost of least-cost financing source available

Debt = 6%

Because it can earn 7% on the investment of funds costing only 6%, the firm undertakes the opportunity. Imagine that *1 week later* a new investment opportunity is available:

Best project available 1 week later

Cost = \$100,000
Life = 20 years
IRR = 12%

Cost of least-cost financing source available

Equity = 14%

In this instance, the firm rejects the opportunity, because the 14% financing cost is greater than the 12% expected return.

Were the firm's actions in the best interests of its owners? No; it accepted a project yielding a 7% return and rejected one with a 12% return. Clearly, there should be a better way, and there is: The firm can use a combined cost, which over the long run will yield better decisions. By weighting the cost of each source of financing by its *target proportion* in the firm's capital structure, the firm can obtain a *weighted average cost* that reflects the interrelationship of financing decisions. Assuming that a 50–50 mix of debt and equity is targeted, the weighted average cost here would be 10% [(0.50 × 6% debt) + (0.50 × 14% equity)]. With this cost, the first opportunity would have been rejected (7% IRR < 10% weighted average cost), and the second would have been accepted (12% IRR > 10% weighted average cost). Such an outcome would clearly be more desirable.

The Cost of Specific Sources of Capital

This chapter focuses on finding the costs of specific sources of capital and combining them to determine the weighted average cost of capital. Our concern is only with the *long-term* sources of funds available to a business firm, because these sources supply the permanent financing. Long-term financing supports the firm's fixed-asset investments.[1] We assume throughout the chapter that such investments are selected by using appropriate capital budgeting techniques.

There are four basic sources of long-term funds for the business firm: long-term debt, preferred stock, common stock, and retained earnings. The right-hand side of a balance sheet can be used to illustrate these sources:

Balance Sheet		
Assets	Current liabilities	
	Long-term debt	Sources of long-term funds
	Stockholders' equity Preferred stock Common stock equity Common stock Retained earnings	

Although not every firm will use all of these methods of financing, each firm is expected to have funds from some of these sources in its capital structure.

The *specific cost* of each source of financing is the *after-tax* cost of obtaining the financing *today,* not the historically based cost reflected by the existing financing on the firm's books. Techniques for determining the specific cost of each source of long-term funds are presented on the following pages. Although these techniques tend to develop precisely calculated values, the resulting values are at best *rough approximations* because of the numerous assumptions and forecasts that underlie them. Although we round calculated costs to the nearest 0.1 percent throughout this chapter, it is not unusual for practicing financial managers to use costs rounded to the nearest 1 percent because these values are merely estimates.

Review Questions

11–1 What is the *cost of capital?* What role does it play in long-term investment decisions?

11–2 Why do we assume that *business risk* and *financial risk* are unchanged when evaluating the cost of capital? Discuss the implications of these assumptions on the acceptance and financing of new projects.

11–3 Why is the cost of capital measured on an *after-tax basis?* Why is use of a weighted average cost of capital rather than the cost of the specific source of funds recommended?

11–4 You have just been told, "Because we are going to finance this project with debt, its required rate of return must exceed the cost of debt." Do you agree or disagree? Explain.

1. The role of both long-term and short-term financing in supporting both fixed- and current-asset investments is addressed in Chapter 14. Suffice it to say that long-term funds are at minimum used to finance fixed assets.

LG2

11.2 The Cost of Long-Term Debt

cost of long-term debt, k_i
The after-tax cost today of raising long-term funds through borrowing.

The **cost of long-term debt, k_i,** is the after-tax cost today of raising long-term funds through borrowing. For convenience, we typically assume that the funds are raised through the sale of bonds. In addition, as we did in Chapter 6, we assume that the bonds pay *annual* (rather than *semiannual*) interest.

Net Proceeds

net proceeds
Funds actually received from the sale of a security.

flotation costs
The total costs of issuing and selling a security.

Most corporate long-term debts are incurred through the sale of bonds. The **net proceeds** from the sale of a bond, or any security, are the funds that are actually received from the sale. **Flotation costs**—the total costs of issuing and selling a security—reduce the net proceeds from the sale. These costs apply to all public offerings of securities—debt, preferred stock, and common stock. They include two components: (1) *underwriting costs*—compensation earned by investment bankers for selling the security, and (2) *administrative costs*—issuer expenses such as legal, accounting, printing, and other expenses.

EXAMPLE

Duchess Corporation, a major hardware manufacturer, is contemplating selling \$10 million worth of 20-year, 9% coupon (stated *annual* interest rate) bonds, each with a par value of \$1,000. Because similar-risk bonds earn returns greater than 9%, the firm must sell the bonds for \$980 to compensate for the lower coupon interest rate. The flotation costs are 2% of the par value of the bond ($0.02 \times \$1{,}000$), or \$20. The net proceeds to the firm from the sale of each bond are therefore \$960 ($\$980 - \$20$).

Before-Tax Cost of Debt

The before-tax cost of debt, k_d, for a bond can be obtained in any of three ways: quotation, calculation, or approximation.

Using Cost Quotations

Hint From the issuer's perspective, the IRR on a bond's cash flows is its *cost to maturity;* from the investor's perspective, the IRR on a bond's cash flows is its *yield to maturity* (*YTM*), as explained in Chapter 6. These two measures are conceptually similarly, although their point of view is different.

When the net proceeds from sale of a bond equal its par value, the before-tax cost just equals the coupon interest rate. For example, a bond with a 10 percent coupon interest rate that nets proceeds equal to the bond's \$1,000 par value would have a before-tax cost, k_d, of 10 percent.

A second quotation that is sometimes used is the *yield to maturity* (*YTM*) on a similar-risk bond[2] (see Chapter 6). For example, if a similar-risk bond has a YTM of 9.7 percent, this value can be used as the before-tax cost of debt, k_d.

Calculating the Cost

This approach finds the before-tax cost of debt by calculating the *internal rate of return* (*IRR*) on the bond cash flows. From the issuer's point of view, this value is the *cost to maturity* of the cash flows associated with the debt. The cost to

2. Generally, the yield to maturity of bonds with a similar "rating" is used. Bond ratings, which are published by independent agencies, were discussed in Chapter 6.

In Practice

FOCUS ON e-FINANCE Sold to the Lowest Bidder

In August 2000, **Dow Chemical** became the first industrial corporation to price and distribute bonds online. **WR Hambrecht + Co.**, a pioneer in online equity IPOs, conducted the 2-hour Dutch auction at its OpenBook auction Web site. In a Dutch auction (long used to price and sell Treasury bonds), investors place bids to buy a particular amount of a security at a specific price within a spread set by the issuer before the auction. The underwriter accepts the lowest price at which there is enough demand to sell all the bonds offered (the clearing price). Investors who bid that price or higher get their requested allocations at the clearing price.

Dow's open bond auction of $300 million in 5-year bonds was well received, attracting a broader investor base that could reduce volatility in the secondary market. The interest rate on the issue was similar to what Dow would have paid using the traditional syndication process, but the underwriting fee was over 50 percent lower. "To me, it's a no-brainer," said Dow treasurer Geoffery Merszei.

In the future, market watchers expect Internet auctions to lower issuance costs for debt capital through more efficient pricing that reflects market demand. All bidders have equal access to securities, and investors can see a real-time, fully visible demand curve for a bond issue as it unfolds, resulting in improved distribution and enhanced liquidity.

Despite Dow's success, few corporations have followed it online. **Ford Motor Credit** issued $750 million of 3-year notes in March 2001. In February 2001, government-sponsored residential mortgage agency **Freddie Mac** announced that it would use OpenBook for eight auctions. So far, most major investment bankers have resisted endorsing a method that would undercut their more lucrative traditional underwriting business. However, both proponents and opponents of online Dutch auctions of corporate debt believe that this method works best for large, standard-issue bonds from investment-grade issuers.

Sources: Adapted from Shella Calamba, "Wall St. Ignores Online Bond Deals at Its Peril," *Dow Jones Newswires* (August 18, 2000), downloaded from *www.wrhambrecht.com/inst/openbook/media.html;* Emily S. Plishner, "E-bonds: Will They Fly?" *CFO* (March 1, 2001); and "WR Hambrecht + Co's Core Technology to Support the First Dutch Auction of Freddie Mac Two- and Three-Year Reference Notes," press release from WR Hambrecht + Co. (February 8, 2001), downloaded from *www.wrhambrecht.com/inst/openbook/media.html.*

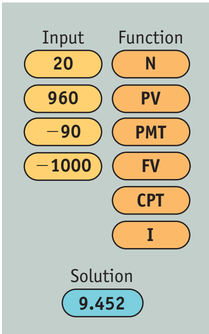
maturity can be calculated by using either a trial-and-error technique[3] or a financial calculator. It represents the annual before-tax percentage cost of the debt.

EXAMPLE

In the preceding example, the net proceeds of a $1,000, 9% coupon interest rate, 20-year bond were found to be $960. The calculation of the annual cost is quite simple. The cash flow pattern is exactly the opposite of a conventional pattern; it consists of an initial inflow (the net proceeds) followed by a series of annual outlays (the interest payments). In the final year, when the debt is retired, an outlay representing the repayment of the principal also occurs. The cash flows associated with Duchess Corporation's bond issue are as follows:

End of year(s)	Cash flow
0	$ 960
1–20	−$ 90
20	−$1,000

3. The trial-and-error technique is presented at the book's Web site, www.aw.com/gitman.



The initial \$960 inflow is followed by annual interest outflows of \$90 (9% coupon interest rate × \$1,000 par value) over the 20-year life of the bond. In year 20, an outflow of \$1,000 (the repayment of the principal) occurs. We can determine the cost of debt by finding the IRR, which is the discount rate that equates the present value of the outflows to the initial inflow.

Calculator Use [*Note:* Most calculators require either the present (net proceeds) or the future (annual interest payments and repayment of principal) values to be input as negative numbers when we calculate cost to maturity. That approach is used here.] Using the calculator and the inputs shown at the left, you should find the before-tax cost (cost to maturity) to be 9.452%.

Approximating the Cost

The before-tax cost of debt, k_d, for a bond with a \$1,000 par value can be approximated by using the following equation:

$$k_d = \frac{I + \dfrac{\$1{,}000 - N_d}{n}}{\dfrac{N_d + \$1{,}000}{2}} \tag{11.1}$$

where

I = annual interest in dollars
N_d = net proceeds from the sale of debt (bond)
n = number of years to the bond's maturity

EXAMPLE Substituting the appropriate values from the Duchess Corporation example into the approximation formula given in Equation 11.1, we get

$$k_d = \frac{I + \dfrac{\$1{,}000 - \$960}{20}}{\dfrac{\$960 + \$1{,}000}{2}} = \frac{\$90 + 2}{\$980}$$

$$= \frac{\$92}{\$980} = \underline{\underline{9.4}}\%$$

This approximate before-tax cost of debt is close to the 9.452% value calculated precisely in the preceding example.

After-Tax Cost of Debt

However, as indicated earlier, the *specific cost* of financing must be stated on an after-tax basis. Because interest on debt is tax deductible, it reduces the firm's taxable income. The after-tax cost of debt, k_i, can be found by multiplying the before-tax cost, k_d, by 1 minus the tax rate, T, as stated in the following equation:

$$k_i = k_d \times (1 - T) \tag{11.2}$$

EXAMPLE Duchess Corporation has a 40% tax rate. Using the 9.4% before-tax debt cost calculated above, and applying Equation 11.2, we find an after-tax cost of debt of 5.6% [9.4% × (1 − 0.40)]. Typically, the explicit cost of long-term debt is less than the explicit cost of any of the alternative forms of long-term financing, primarily because of the tax deductibility of interest.

Review Questions

11–5 What are the *net proceeds* from the sale of a bond? What are *flotation costs* and how do they affect a bond's net proceeds?
11–6 What three methods can be used to find the before-tax cost of debt?
11–7 How is the before-tax cost of debt converted into the after-tax cost?

LG2

11.3 The Cost of Preferred Stock

Preferred stock represents a special type of ownership interest in the firm. It gives preferred stockholders the right to receive their *stated* dividends before any earnings can be distributed to common stockholders. Because preferred stock is a form of ownership, the proceeds from its sale are expected to be held for an infinite period of time. The key characteristics of preferred stock were described in Chapter 7. However, the one aspect of preferred stock that requires review is dividends.

Preferred Stock Dividends

Most preferred stock dividends are stated as a *dollar amount:* "x dollars per year." When dividends are stated this way, the stock is often referred to as "x-dollar preferred stock." Thus a "$4 preferred stock" is expected to pay preferred stockholders $4 in dividends each year on each share of preferred stock owned.

Sometimes preferred stock dividends are stated as an *annual percentage rate.* This rate represents the percentage of the stock's par value, or face value, that equals the annual dividend. For instance, an 8 percent preferred stock with a $50 par value would be expected to pay an annual dividend of $4 a share (0.08 × $50 par = $4). Before the cost of preferred stock is calculated, any dividends stated as percentages should be converted to annual dollar dividends.

Calculating the Cost of Preferred Stock

cost of preferred stock, k_p The ratio of the preferred stock dividend to the firm's net proceeds from the sale of preferred stock; calculated by dividing the annual dividend, D_p, by the net proceeds from the sale of the preferred stock, N_p.

The **cost of preferred stock, k_p,** is the ratio of the preferred stock dividend to the firm's net proceeds from the sale of the preferred stock. The net proceeds represents the amount of money to be received minus any flotation costs. Equation 11.3 gives the cost of preferred stock, k_p, in terms of the annual dollar dividend, D_p, and the net proceeds from the sale of the stock, N_p:

$$k_p = \frac{D_p}{N_p} \tag{11.3}$$

Because preferred stock dividends are paid out of the firm's *after-tax* cash flows, a tax adjustment is not required.

EXAMPLE

Duchess Corporation is contemplating issuance of a 10% preferred stock that is expected to sell for its \$87-per-share par value.[4] The cost of issuing and selling the stock is expected to be \$5 per share. The first step in finding the cost of the stock is to calculate the dollar amount of the annual preferred dividend, which is \$8.70 ($0.10 \times \$87$). The net proceeds per share from the proposed sale of stock equals the sale price minus the flotation costs ($\$87 - \$5 = \$82$). Substituting the annual dividend, D_p, of \$8.70 and the net proceeds, N_p, of \$82 into Equation 11.3 gives the cost of preferred stock, 10.6% ($\$8.70 \div \$82$).

The cost of Duchess's preferred stock (10.6%) is much greater than the cost of its long-term debt (5.6%). This difference exists primarily because the cost of long-term debt (the interest) is tax deductible.

Review Question

11–8 How would you calculate the cost of preferred stock?

LG3

11.4 The Cost of Common Stock

The *cost of common stock* is the return required on the stock by investors in the marketplace. There are two forms of common stock financing: (1) retained earnings and (2) new issues of common stock. As a first step in finding each of these costs, we must estimate the cost of common stock equity.

cost of common stock equity, k_s
The rate at which investors discount the expected dividends of the firm to determine its share value.

constant-growth valuation (Gordon) model
Assumes that the value of a share of stock equals the present value of all future dividends (assumed to grow at a constant rate) that it is expected to provide over an infinite time horizon.

Finding the Cost of Common Stock Equity

The **cost of common stock equity, k_s,** is the rate at which investors discount the expected dividends of the firm to determine its share value. Two techniques are used to measure the cost of common stock equity.[5] One relies on the constant-growth valuation model, the other on the capital asset pricing model (CAPM).

Using the Constant-Growth Valuation (Gordon) Model

In Chapter 7 we found the value of a share of stock to be equal to the present value of all future dividends, which in one model were assumed to grow at a constant annual rate over an infinite time horizon. This is the **constant-growth valuation**

4. For simplicity, the preferred stock in this example is assumed to be sold for its par value. In practice, particularly for subsequent issues of already outstanding preferred stock, it is typically sold at a price that differs from its par value.

5. Other, more subjective techniques are available for estimating the cost of common stock equity. One popular technique is the *bond yield plus a premium;* it estimates the cost of common stock equity by adding a premium, typically between 3% and 5%, to the firm's current cost of long-term debt. Another, even more subjective technique uses the firm's *expected return on equity (ROE)* as a measure of its cost of common stock equity. Here we focus only on the more theoretically based techniques.

model, also known as the **Gordon model.** The key expression derived for this model was presented as Equation 7.5 and is restated here:

$$P_0 = \frac{D_1}{k_s - g} \tag{11.4}$$

where

P_0 = value of common stock
D_1 = per-share dividend *expected* at the end of year 1
k_s = required return on common stock
g = constant rate of growth in dividends

Solving Equation 11.4 for k_s results in the following expression for the *cost of common stock equity:*

$$k_s = \frac{D_1}{P_0} + g \tag{11.5}$$

Equation 11.5 indicates that the cost of common stock equity can be found by dividing the dividend expected at the end of year 1 by the current price of the stock and adding the expected growth rate. Because common stock dividends are paid from *after-tax* income, no tax adjustment is required.

EXAMPLE

Duchess Corporation wishes to determine its cost of common stock equity, k_s. The market price, P_0, of its common stock is \$50 per share. The firm expects to pay a dividend, D_1, of \$4 at the end of the coming year, 2004. The dividends paid on the outstanding stock over the past 6 years (1998–2003) were as follows:

Year	Dividend
2003	\$3.80
2002	3.62
2001	3.47
2000	3.33
1999	3.12
1998	2.97

Using the table for the present value interest factors, *PVIF* (Table A–2), or a financial calculator in conjunction with the technique described for finding growth rates in Chapter 4, we can calculate the annual growth rate of dividends, g. It turns out to be approximately 5% (more precisely, it is 5.05%). Substituting $D_1 = \$4$, $P_0 = \$50$, and $g = 5\%$ into Equation 11.5 yields the cost of common stock equity:

$$k_s = \frac{\$4}{\$50} + 0.05 = 0.08 + 0.05 = 0.130, \text{ or } \underline{\underline{13.0}}\%$$

The 13.0% cost of common stock equity represents the return required by *existing* shareholders on their investment. If the actual return is less than that, shareholders are likely to begin selling their stock.

Using the Capital Asset Pricing Model (CAPM)

capital asset pricing model (CAPM)
Describes the relationship between the required return, k_s, and the nondiversifiable risk of the firm as measured by the beta coefficient, b.

Recall from Chapter 5 that the **capital asset pricing model (CAPM)** describes the relationship between the required return, k_s, and the nondiversifiable risk of the firm as measured by the beta coefficient, b. The basic CAPM is

$$k_s = R_F + [b \times (k_m - R_F)] \tag{11.6}$$

where

R_F = risk-free rate of return
k_m = market return; return on the market portfolio of assets

Using CAPM indicates that the cost of common stock equity is the return required by investors as compensation for the firm's nondiversifiable risk, measured by beta.

EXAMPLE Duchess Corporation now wishes to calculate its cost of common stock equity, k_s, by using the capital asset pricing model. The firm's investment advisers and its own analyses indicate that the risk-free rate, R_F, equals 7%; the firm's beta, b, equals 1.5; and the market return, k_m, equals 11%. Substituting these values into Equation 11.6, the company estimates the cost of common stock equity, k_s, to be

$$k_s = 7.0\% + [1.5 \times (11.0\% - 7.0\%)] = 7.0\% + 6.0\% = \underline{\underline{13.0}}\%$$

The 13.0% cost of common stock equity represents the required return of investors in Duchess Corporation common stock. It is the same as that found by using the constant-growth valuation model.

Comparing the Constant-Growth and CAPM Techniques

The CAPM technique differs from the constant-growth valuation model in that it directly considers the firm's risk, as reflected by beta, in determining the *required* return or cost of common stock equity. The constant-growth model does not look at risk; it uses the market price, P_0, as a reflection of the *expected* risk–return preference of investors in the marketplace. The constant-growth valuation and CAPM techniques for finding k_s are theoretically equivalent. But it is difficult to demonstrate that equivalency because of measurement problems associated with growth, beta, the risk-free rate (what maturity of government security to use), and the market return. The use of the constant-growth valuation model is often preferred because the data required are more readily available.

Another difference is that when the constant-growth valuation model is used to find the cost of common stock equity, it can easily be adjusted for flotation costs to find the cost of new common stock; the CAPM does not provide a simple adjustment mechanism. The difficulty in adjusting the cost of common stock equity calculated by using CAPM occurs because in its common form the model does not include the market price, P_0, a variable needed to make such an adjustment. Although CAPM has a stronger theoretical foundation, the computational appeal of the traditional constant-growth valuation model justifies its use throughout this text to measure common stock costs.

The Cost of Retained Earnings

cost of retained earnings, k_r
The same as the cost of an *equivalent fully subscribed issue of additional common stock,* which is equal to the cost of common stock equity, k_s.

Hint Using retained earnings as a major source of financing for capital expenditures does not give away control of the firm and does not dilute present earnings per share, as would occur if new common stock were issued. However, the firm must effectively manage retained earnings, in order to produce profits that increase future retained earnings.

As you know, dividends are paid out of a firm's earnings. Their payment, made in cash to common stockholders, reduces the firm's retained earnings. Let's say a firm needs common stock equity financing of a certain amount; it has two choices relative to retained earnings: It can issue additional common stock in that amount and still pay dividends to stockholders out of retained earnings. Or it can increase common stock equity by retaining the earnings (not paying the cash dividends) in the needed amount. In a strict accounting sense, the retention of earnings increases common stock equity in the same way that the sale of additional shares of common stock does. Thus the **cost of retained earnings, k_r**, to the firm is the same as the cost of an *equivalent fully subscribed issue of additional common stock*. Stockholders find the firm's retention of earnings acceptable only if they expect that it will earn at least their required return on the reinvested funds.

Viewing retained earnings as a fully subscribed issue of additional common stock, we can set the firm's cost of retained earnings, k_r, equal to the cost of common stock equity as given by Equations 11.5 and 11.6.[6]

$$k_r = k_s \tag{11.7}$$

It is not necessary to adjust the cost of retained earnings for flotation costs, because by retaining earnings, the firm "raises" equity capital without incurring these costs.

EXAMPLE

The cost of retained earnings for Duchess Corporation was actually calculated in the preceding examples: It is equal to the cost of common stock equity. Thus k_r equals 13.0%. As we will show in the next section, the cost of retained earnings is always lower than the cost of a new issue of common stock, because it entails no flotation costs.

The Cost of New Issues of Common Stock

cost of a new issue of common stock, k_n
The cost of common stock, net of underpricing and associated flotation costs.

underpriced
Stock sold at a price below its current market price, P_0.

Our purpose in finding the firm's overall cost of capital is to determine the after-tax cost of *new* funds required for financing projects. The **cost of a new issue of common stock, k_n,** is determined by calculating the cost of common stock, net of underpricing and associated flotation costs. Normally, for a new issue to sell, it has to be **underpriced**—sold at a price below its current market price, P_0.

Firms underprice new issues for a variety of reasons. First, when the market is in equilibrium (that is, the demand for shares equals the supply of shares), additional demand for shares can be achieved only at a lower price. Second, when additional shares are issued, each share's percent of ownership in the firm is diluted, thereby justifying a lower share value. Finally, many investors view the issuance of additional shares as a signal that management is using common stock equity financing because it believes that the shares are currently overpriced. Recognizing this information, they will buy shares only at a price below the current market price. Clearly, these and other factors necessitate underpricing of new

6. Technically, if a stockholder received dividends and wished to invest them in additional shares of the firm's stock, he or she would first have to pay personal taxes on the dividends and then pay brokerage fees before acquiring additional shares. By using *pt* as the average stockholder's personal tax rate and *bf* as the average brokerage fees stated as a percentage, we can specify the cost of retained earnings, k_r, as $k_r = k_s \times (1 - pt) \times (1 - bf)$. Because of the difficulty in estimating *pt* and *bf*, only the simpler definition of k_r given in Equation 11.7 is used here.

offerings of common stock. Flotation costs paid for issuing and selling the new issue will further reduce proceeds.

We can use the constant-growth valuation model expression for the cost of existing common stock, k_s, as a starting point. If we let N_n represent the net proceeds from the sale of new common stock after subtracting underpricing and flotation costs, the cost of the new issue, k_n, can be expressed as follows:[7]

$$k_n = \frac{D_1}{N_n} + g \tag{11.8}$$

The net proceeds from sale of new common stock, N_n, will be less than the current market price, P_0. Therefore, the cost of new issues, k_n, will always be greater than the cost of existing issues, k_s, which is equal to the cost of retained earnings, k_r. *The cost of new common stock is normally greater than any other long-term financing cost.* Because common stock dividends are paid from after-tax cash flows, no tax adjustment is required.

EXAMPLE In the constant-growth valuation example, we found Duchess Corporation's cost of common stock equity, k_s, to be 13%, using the following values: an expected dividend, D_1, of \$4; a current market price, P_0, of \$50; and an expected growth rate of dividends, g, of 5%.

To determine its cost of *new* common stock, k_n, Duchess Corporation has estimated that on the average, new shares can be sold for \$47. The \$3-per-share underpricing is due to the competitive nature of the market. A second cost associated with a new issue is flotation costs of \$2.50 per share that would be paid to issue and sell the new shares. The total underpricing and flotation costs per share are therefore expected to be \$5.50.

Subtracting the \$5.50 per share underpricing and flotation cost from the current \$50 share price results in expected net proceeds of \$44.50 per share (\$50.00 − \$5.50). Substituting $D_1 = \$4$, $N_n = \$44.50$, and $g = 5\%$ into Equation 11.8 results in a cost of new common stock, k_n, as follows:

$$k_n = \frac{\$4.00}{\$44.50} + 0.05 = 0.09 + 0.05 = 0.140, \text{ or } \underline{\underline{14.0}}\%$$

Duchess Corporation's cost of new common stock is therefore 14.0%. This is the value to be used in subsequent calculations of the firm's overall cost of capital.

Review Questions

11–9 What premise about share value underlies the constant-growth valuation (Gordon) model that is used to measure the cost of common stock equity, k_s?

7. An alternative, but computationally less straightforward, form of this equation is

$$k_n = \frac{D_1}{P_0 \times (1 - f)} + g \tag{11.8a}$$

where f represents the *percentage* reduction in current market price expected as a result of underpricing and flotation costs. Simply stated, N_n in Equation 11.8 is equivalent to $P_0 \times (1 - f)$ in Equation 11.8a. For convenience, Equation 11.8 is used to define the cost of a new issue of common stock, k_n.

11–10 Why is the cost of financing a project with retained earnings less than the cost of financing it with a new issue of common stock?

LG4 11.5 The Weighted Average Cost of Capital

weighted average cost of capital (WACC), k_a
Reflects the expected average future cost of funds over the long run; found by weighting the cost of each specific type of capital by its proportion in the firm's capital structure.

Now that we have calculated the cost of specific sources of financing, we can determine the overall cost of capital. As noted earlier, the **weighted average cost of capital** (WACC), k_a, reflects the expected average future cost of funds over the long run. It is found by weighting the cost of each specific type of capital by its proportion in the firm's capital structure.

Calculating the Weighted Average Cost of Capital (WACC)

Calculating the weighted average cost of capital (WACC) is straightforward: Multiply the specific cost of each form of financing by its proportion in the firm's capital structure and sum the weighted values. As an equation, the weighted average cost of capital, k_a, can be specified as follows:

$$k_a = (w_i \times k_i) + (w_p \times k_p) + (w_s \times k_{r \text{ or } n}) \tag{11.9}$$

where

w_i = proportion of long-term debt in capital structure
w_p = proportion of preferred stock in capital structure
w_s = proportion of common stock equity in capital structure

$w_i + w_p + w_s = 1.0$

Three important points should be noted in Equation 11.9:

1. For computational convenience, it is best to convert the weights into decimal form and leave the specific costs in percentage terms.
2. *The sum of the weights must equal 1.0*. Simply stated, all capital structure components must be accounted for.
3. The firm's common stock equity weight, w_s, is multiplied by either the cost of retained earnings, k_r, or the cost of new common stock, k_n. Which cost is used depends on whether the firm's common stock equity will be financed using retained earnings, k_r, or new common stock, k_n.

EXAMPLE

In earlier examples, we found the costs of the various types of capital for Duchess Corporation to be as follows:

Cost of debt, k_i = 5.6%
Cost of preferred stock, k_p = 10.6%
Cost of retained earnings, k_r = 13.0%
Cost of new common stock, k_n = 14.0%

Hint For computational convenience, the financing proportion weights are listed in decimal form in column 1 and the specific costs are shown in percentage terms in column 2.

TABLE 11.1 Calculation of the Weighted Average Cost of Capital for Duchess Corporation

Source of capital	Weight (1)	Cost (2)	Weighted cost [(1) × (2)] (3)
Long-term debt	0.40	5.6%	2.2%
Preferred stock	0.10	10.6	1.1
Common stock equity	0.50	13.0	6.5
Totals	1.00		9.8%

Weighted average cost of capital = 9.8%

The company uses the following weights in calculating its weighted average cost of capital:

Source of capital	Weight
Long-term debt	40%
Preferred stock	10
Common stock equity	50
Total	100%

Because the firm expects to have a sizable amount of retained earnings available ($300,000), it plans to use its cost of retained earnings, k_r, as the cost of common stock equity. Duchess Corporation's weighted average cost of capital is calculated in Table 11.1. The resulting weighted average cost of capital for Duchess is 9.8%. Assuming an unchanged risk level, the firm should accept all projects that will earn a return greater than 9.8%.

Weighting Schemes

Weights can be calculated on the basis of either *book value* or *market value* and using either *historical* or *target* proportions.

Book Value Versus Market Value

book value weights
Weights that use accounting values to measure the proportion of each type of capital in the firm's financial structure.

market value weights
Weights that use market values to measure the proportion of each type of capital in the firm's financial structure.

Book value weights use accounting values to measure the proportion of each type of capital in the firm's financial structure. **Market value weights** measure the proportion of each type of capital at its market value. Market value weights are appealing, because the market values of securities closely approximate the actual dollars to be received from their sale. Moreover, because the costs of the various types of capital are calculated by using prevailing market prices, it seems reasonable to use market value weights. In addition, the long-term investment cash flows to which the cost of capital is applied are estimated in terms of current as well as future market values. *Market value weights are clearly preferred over book value weights.*

Historical Versus Target

historical weights
Either book or market value weights based on *actual* capital structure proportions.

Historical weights can be either book or market value weights based on *actual* capital structure proportions. For example, past or current book value proportions would constitute a form of historical weighting, as would past or current market value proportions. Such a weighting scheme would therefore be based on real—rather than desired—proportions.

target weights
Either book or market value weights based on *desired* capital structure proportions.

Target weights, which can also be based on either book or market values, reflect the firm's *desired* capital structure proportions. Firms using target weights establish such proportions on the basis of the "optimal" capital structure they wish to achieve. (The development of these proportions and the optimal structure are discussed in detail in Chapter 12.)

When one considers the somewhat approximate nature of the calculation of weighted average cost of capital, the choice of weights may not be critical. However, from a strictly theoretical point of view, the *preferred weighting scheme is target market value proportions,* and these are assumed throughout this chapter.

Review Questions

11–11 What is the *weighted average cost of capital (WACC),* and how is it calculated?

11–12 Describe the logic underlying the use of *target capital structure weights,* and compare and contrast this approach with the use of *historical weights*. What is the preferred weighting scheme?

LG5 LG6 11.6 The Marginal Cost and Investment Decisions

The firm's weighted average cost of capital is a key input to the investment decision-making process. As demonstrated earlier in the chapter, the firm should make only those investments for which the expected return is greater than the weighted average cost of capital. Of course, at any given time, the firm's financing costs and investment returns will be affected by the volume of financing and investment undertaken. The *weighted marginal cost of capital* and the *investment opportunities schedule* are mechanisms whereby financing and investment decisions can be made simultaneously.

The Weighted Marginal Cost of Capital (WMCC)

The weighted average cost of capital may vary over time, depending on the volume of financing that the firm plans to raise. *As the volume of financing increases, the costs of the various types of financing will increase, raising the firm's weighted*

weighted marginal cost of capital (WMCC)
The firm's weighted average cost of capital (WACC) associated with its *next dollar* of total new financing.

average cost of capital. Therefore, it is useful to calculate the **weighted marginal cost of capital (WMCC),** which is simply the firm's weighted average cost of capital (WACC) associated with its *next dollar* of total new financing. This marginal cost is relevant to current decisions.

The costs of the financing components (debt, preferred stock, and common stock) rise as larger amounts are raised. Suppliers of funds require greater returns in the form of interest, dividends, or growth as compensation for the increased risk introduced by larger volumes of *new* financing. The WMCC is therefore an increasing function of the level of total new financing.

Another factor that causes the weighted average cost of capital to increase is the use of common stock equity financing. New financing provided by common stock equity will be taken from available retained earnings until this supply is exhausted and then will be obtained through new common stock financing. Because retained earnings are a less expensive form of common stock equity financing than the sale of new common stock, the weighted average cost of capital will rise with the addition of new common stock.

Finding Break Points

break point
The level of *total* new financing at which the cost of one of the financing components rises, thereby causing an upward shift in the *weighted marginal cost of capital (WMCC)*.

To calculate the WMCC, we must calculate **break points,** which reflect the level of *total* new financing at which the cost of one of the financing components rises. The following general equation can be used to find break points:

$$BP_j = \frac{AF_j}{w_j} \tag{11.10}$$

where

BP_j = break point for financing source j
AF_j = amount of funds available from financing source j at a given cost
w_j = capital structure weight (stated in decimal form) for financing source j

EXAMPLE

When Duchess Corporation exhausts its \$300,000 of available retained earnings (at $k_r = 13.0\%$), it must use the more expensive new common stock financing (at $k_n = 14.0\%$) to meet its common stock equity needs. In addition, the firm expects that it can borrow only \$400,000 of debt at the 5.6% cost; additional debt will have an after-tax cost (k_i) of 8.4%. Two break points therefore exist: (1) when the \$300,000 of retained earnings costing 13.0% is exhausted, and (2) when the \$400,000 of long-term debt costing 5.6% is exhausted.

The break points can be found by substituting these values and the corresponding capital structure weights given earlier into Equation 11.10. We get the dollar amounts of *total* new financing at which the costs of the given financing sources rise:

$$BP_{\text{common equity}} = \frac{\$300{,}000}{0.50} = \$600{,}000$$

$$BP_{\text{long-term debt}} = \frac{\$400{,}000}{0.40} = \$1{,}000{,}000$$

Calculating the WMCC

Once the break points have been determined, the next step is to calculate the weighted average cost of capital over the range of total new financing between break points. First, we find the WACC for a level of total new financing between zero and the first break point. Next, we find the WACC for a level of total new financing between the first and second break points, and so on. By definition, for each of the ranges of total new financing between break points, certain component capital costs (such as debt or common equity) will increase. This will cause the weighted average cost of capital to increase to a higher level than that over the preceding range.

weighted marginal cost of capital (WMCC) schedule
Graph that relates the firm's weighted average cost of capital to the level of total new financing.

Together, these data can be used to prepare a **weighted marginal cost of capital (WMCC) schedule.** This is a graph that relates the firm's weighted average cost of capital to the level of total new financing.

EXAMPLE

Table 11.2 summarizes the calculation of the WACC for Duchess Corporation over the three ranges of total new financing created by the two break points—$600,000 and $1,000,000. Comparing the costs in column 3 of the table for each of the three ranges, we can see that the costs in the first range ($0 to $600,000) are those calculated in earlier examples and used in Table 11.1. The second range ($600,000 to $1,000,000) reflects the increase in the common stock equity cost to 14.0%. In the final range, the increase in the long-term debt cost to 8.4% is introduced.

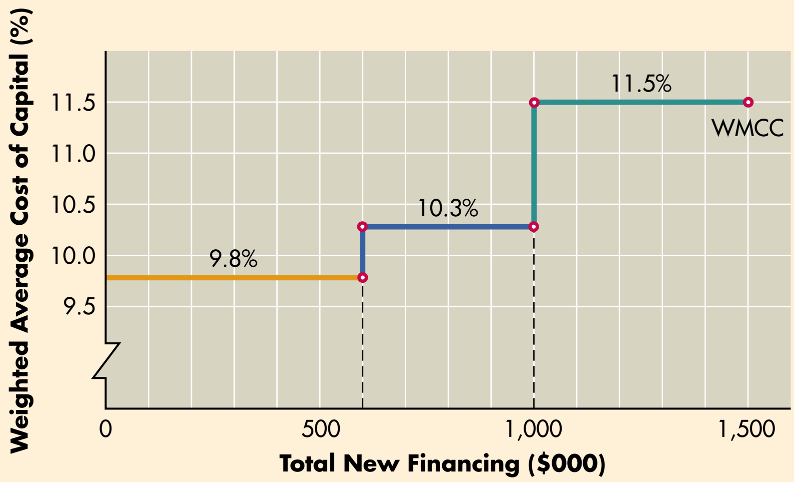
The weighted average costs of capital (WACC) for the three ranges are summarized in the table shown at the bottom of Figure 11.1. These data describe the

TABLE 11.2 Weighted Average Cost of Capital for Ranges of Total New Financing for Duchess Corporation

Range of total new financing	Source of capital (1)	Weight (2)	Cost (3)	Weighted cost [(2) × (3)] (4)
$0 to $600,000	Debt	.40	5.6%	2.2%
	Preferred	.10	10.6	1.1
	Common	.50	13.0	6.5
	Weighted average cost of capital			9.8%
$600,000 to $1,000,000	Debt	.40	5.6%	2.2%
	Preferred	.10	10.6	1.1
	Common	.50	14.0	7.0
	Weighted average cost of capital			10.3%
$1,000,000 and above	Debt	.40	8.4%	3.4%
	Preferred	.10	10.6	1.1
	Common	.50	14.0	7.0
	Weighted average cost of capital			11.5%

FIGURE 11.1

WMCC Schedule
Weighted marginal cost of capital (WMCC) schedule for Duchess Corporation



Range of total new financing	WACC
$0 to $600,000	9.8%
$600,000 to $1,000,000	10.3
$1,000,000 and above	11.5

weighted marginal cost of capital (WMCC), which increases as levels of total new financing increase. Figure 11.1 presents the WMCC schedule. Again, it is clear that the WMCC is an increasing function of the amount of total new financing raised.

The Investment Opportunities Schedule (IOS)

investment opportunities schedule (IOS)
A ranking of investment possibilities from best (highest return) to worst (lowest return).

At any given time, a firm has certain investment opportunities available to it. These opportunities differ with respect to the size of investment, risk, and return.[8] The firm's **investment opportunities schedule (IOS)** is a ranking of investment possibilities from best (highest return) to worst (lowest return). Generally, the first project selected will have the highest return, the next project the second highest, and so on. The return on investments will *decrease* as the firm accepts additional projects.

EXAMPLE

Column 1 of Table 11.3 shows Duchess Corporation's current investment opportunities schedule (IOS) listing the investment possibilities from best (highest return) to worst (lowest return). Column 2 of the table shows the initial investment required by each project. Column 3 shows the cumulative total invested

8. Because the calculated weighted average cost of capital does not apply to risk-changing investments, we assume that all opportunities have equal risk similar to the firm's risk.

TABLE 11.3 Investment Opportunities Schedule (IOS) for Duchess Corporation

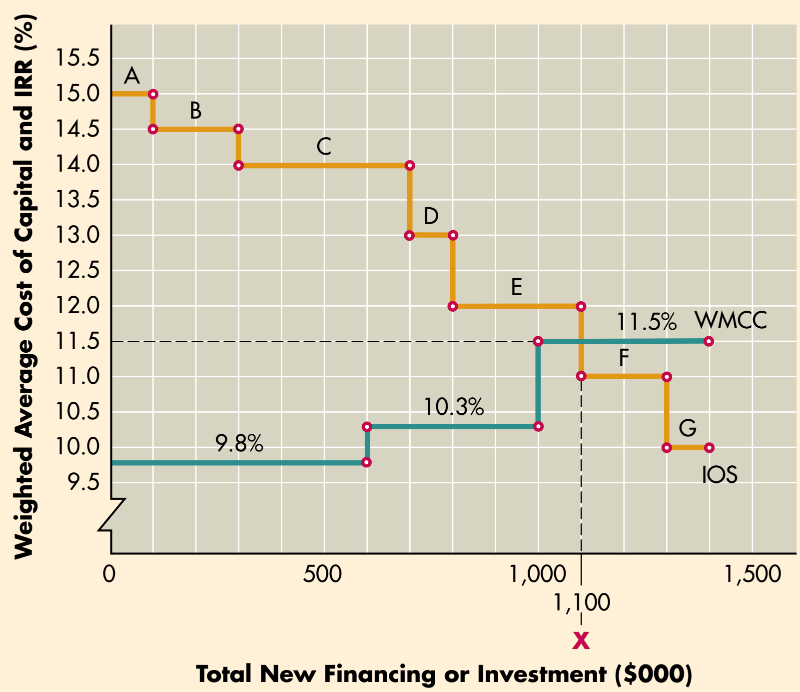
Investment opportunity	Internal rate of return (IRR) (1)	Initial investment (2)	Cumulative investment[a] (3)
A	15.0%	$100,000	$ 100,000
B	14.5	200,000	300,000
C	14.0	400,000	700,000
D	13.0	100,000	800,000
E	12.0	300,000	1,100,000
F	11.0	200,000	1,300,000
G	10.0	100,000	1,400,000

[a]The cumulative investment represents the total amount invested in projects with higher returns plus the investment required for the corresponding investment opportunity.

FIGURE 11.2

IOS and WMCC Schedules

Using the IOS and WMCC to select projects for Duchess Corporation



funds necessary to finance all projects better than and including the corresponding investment opportunity. Plotting the project returns against the cumulative investment (column 1 against column 3) results in the firm's investment opportunities schedule (IOS). A graph of the IOS for Duchess Corporation is given in Figure 11.2.

In Practice

FOCUS ON PRACTICE Theory or Practice?

Do major U.S. corporations practice what your professors teach? A recent survey of the cost of capital techniques at Fortune 1000 firms showed that financial managers today pay more attention to the cost of capital and its role in capital budgeting and valuation of the firm than they did 15 years ago. A contributing factor is the growing popularity of performance evaluation models that use cost of capital in their formulas, such as economic value added (EVA®, discussed in Chapter 9).

The survey, which updated a study conducted in 1982, revealed that companies are becoming more sophisticated in their knowledge and use of financial techniques. Here are the key findings from the 111 respondents, of whom 41 percent were manufacturers, 46 percent suppliers of services, and 13 percent distributors.

- Most firms calculate the cost of capital using long-term debt and equity, although some exclude capital leases and preferred stock.
- Over 90 percent use a weighted average cost of capital (WACC); about half base the calculation on target weights, another 35 percent on current market value weights.
- The current capital structure of most respondents is consistent with their target capital structure. The average capital structure at the time of the survey was 34 percent debt, 5 percent preferred stock, and 61 percent common stock.
- Firms use more than one method to calculate cost of equity; most employ the investors' required return, calculated using CAPM.
- Over 60 percent of firms differentiate project risk on an individual project basis and adjust the discount rate rather than cash flows.
- About half of the respondents recalculate their cost of capital when environmental conditions (shifts in long-term rates) warrant; another 27 percent recompute it annually.
- Most firms use one cost of capital regardless of the total amount of financing they require. Nearly all use the cost of capital for all new-project decisions; over three-quarters use it to estimate the firm's value.

Source: Lawrence J. Gitman and Pieter A. Vandenberg, "Cost of Capital Techniques Used by Major U.S. Firms: 1997 vs. 1980," *Financial Practice and Education* (Fall/Winter 2000), pp. 53–68.

Using the WMCC and IOS to Make Financing/Investment Decisions

As long as a project's internal rate of return is greater than the weighted marginal cost of new financing, the firm should accept the project.[9] The return will decrease with the acceptance of more projects, and the weighted marginal cost of capital will increase because greater amounts of financing will be required. The decision rule therefore would be: *Accept projects up to the point at which the marginal return on an investment equals its weighted marginal cost of capital.* Beyond that point, its investment return will be less than its capital cost.[10]

This approach is consistent with the maximization of net present value (NPV) for conventional projects for two reasons: (1) The NPV is positive as long as the IRR exceeds the weighted average cost of capital, k_a. (2) The larger the difference between the IRR and k_a, the larger the resulting NPV. Therefore, the acceptance of projects beginning with those that have the greatest positive difference between

9. Although net present value could be used to make these decisions, the internal rate of return is used here because of the ease of comparison it offers.

10. So as not to confuse the discussion presented here, the fact that using the IRR for selecting projects may not yield optimal decisions is ignored. The problems associated with the use of IRR in capital rationing were discussed in greater detail in Chapter 10.

IRR and k_a, down to the point at which IRR just equals k_a, should result in the maximum total NPV for all independent projects accepted. Such an outcome is completely consistent with the firm's goal of maximizing owner wealth.

EXAMPLE Figure 11.2 shows Duchess Corporation's WMCC schedule and IOS on the same set of axes. By raising $1,100,000 of new financing and investing these funds in projects A, B, C, D, and E, the firm should maximize the wealth of its owners, because these projects result in the maximum total net present value. Note that the 12.0% return on the last dollar invested (in project E) *exceeds* its 11.5% weighted average cost. Investment in project F is not feasible, because its 11.0% return is *less than* the 11.5% cost of funds available for investment.

The firm's optimal capital budget of $1,100,000 is marked with an **X** in Figure 11.2. At that point, the IRR equals the weighted average cost of capital, and the firm's size as well as its shareholder value will be optimized. In a sense, the size of the firm is determined by the market—the availability of and returns on investment opportunities, and the availability and cost of financing.

In practice, most firms operate under *capital rationing*. That is, management imposes constraints that keep the capital expenditure budget below optimal (where IRR $= k_a$). Because of this, a gap frequently exists between the theoretically optimal capital budget and the firm's actual level of financing/investment.

Review Questions

11–13 What is the *weighted marginal cost of capital (WMCC)?* What does the *WMCC schedule* represent? Why does this schedule increase?

11–14 What is the *investment opportunities schedule (IOS)?* Is it typically depicted as an increasing or a decreasing function? Why?

11–15 How can the WMCC schedule and the IOS be used to find the level of financing/investment that maximizes owner wealth? Why do many firms finance/invest at a level below this optimum?

SUMMARY

FOCUS ON VALUE

The cost of capital is an extremely important rate of return used by the firm in the long-term decision process, particularly in capital budgeting decisions. It is the expected average future cost to the firm of funds over the long run. Because the cost of capital is the pivotal rate of return used in the investment decision process, its accuracy can significantly affect the quality of these decisions.

Even with good estimates of project cash flows, the application of NPV and IRR decision techniques, and adequate consideration of project risk, a poorly estimated cost of capital can result in the destruction of shareholder value. Underestimation of the cost of capital can result in the mistaken acceptance of poor projects, whereas overestimation can cause good projects to be rejected. In either situation, the firm's action could be detrimental to the firm's value. By applying the techniques presented in this chapter to estimate the firm's cost of capital, the financial manager will improve the likelihood that the firm's long-term decisions are consistent with the firm's overall goal of **maximizing stock price (owner wealth).**

REVIEW OF LEARNING GOALS

LG1 **Understand the key assumptions that underlie cost of capital, the basic concept of cost of capital, and the specific sources of capital that it includes.** The cost of capital is the rate of return that a firm must earn on its investments to maintain its market value and attract needed funds. It is affected by business and financial risks, which are assumed to be unchanged. To capture the interrelatedness of financing, a weighted average cost of capital should be used to find the expected average future cost of funds over the long run. The specific costs of the basic sources of capital (long-term debt, preferred stock, retained earnings, and common stock) can be calculated individually.

LG2 **Determine the cost of long-term debt and the cost of preferred stock.** The cost of long-term debt is the after-tax cost today of raising long-term funds through borrowing. Cost quotations, calculation (using either a trial-and-error technique or a financial calculator), or an approximation can be used to find the before-tax cost of debt, which must then be tax-adjusted. The cost of preferred stock is the ratio of the preferred stock dividend to the firm's net proceeds from the sale of preferred stock. The key formulas for the before- and after-tax cost of debt and the cost of preferred stock are given in Table 11.4.

LG3 **Calculate the cost of common stock equity and convert it into the cost of retained earnings and the cost of new issues of common stock.** The cost of common stock equity can be calculated by using the constant-growth valuation (Gordon) model or the CAPM. The cost of retained earnings is equal to the cost of common stock equity. An adjustment in the cost of common stock equity to reflect underpricing and flotation costs is necessary to find the cost of new issues of common stock. The key formulas for the cost of common stock equity, the cost of retained earnings, and the cost of new issues of common stock are given in Table 11.4.

LG4 **Calculate the weighted average cost of capital (WACC) and discuss the alternative weighting schemes.** The firm's WACC reflects the expected average future cost of funds over the long run. It can be determined by combining the costs of specific types of capital after weighting each of them by its proportion using historical book or market value weights, or target book or market value weights. The theoretically preferred approach uses target weights based on market values. The key formula for WACC is given in Table 11.4.

LG5 **Describe the procedures used to determine break points and the weighted marginal cost of capital (WMCC).** As the volume of total new financing increases, the costs of the various types of financing will increase, raising the firm's WACC. The WMCC is the firm's WACC associated with its next dollar of total new financing. Break points represent the level of total new financing at which the cost of one of the financing components rises, causing an upward shift in the WMCC. The general formula for break points is given in Table 11.4. The WMCC schedule relates the WACC to each level of total new financing.

LG6 **Explain how the weighted marginal cost of capital (WMCC) can be used with the investment opportunities schedule (IOS) to make the firm's financing/investment decisions.** The IOS presents a ranking of currently available investments from best (highest return) to worst (lowest return). It is used in combination with the WMCC to find the level of financing/investment that maximizes owner wealth. The firm accepts projects up to the point at which the marginal return on its investment equals its weighted marginal cost of capital.

TABLE 11.4 Summary of Key Definitions and Formulas for Cost of Capital

Definitions of variables

AF_j = amount of funds available from financing source j at a given cost
b = beta coefficient or measure of nondiversifiable risk
BP_j = break point for financing source j
D_1 = per share dividend *expected* at the end of year 1
D_p = annual preferred stock dividend (in dollars)
g = constant rate of growth in dividends
I = annual interest in dollars
k_a = weighted average cost of capital
k_d = before-tax cost of debt
k_i = after-tax cost of debt
k_m = required return on the market portfolio
k_n = cost of a new issue of common stock
k_p = cost of preferred stock
k_r = cost of retained earnings
k_s = required return on common stock
n = number of years to the bond's maturity
N_d = net proceeds from the sale of debt (bond)
N_n = net proceeds from the sale of new common stock
N_p = net proceeds from the sale of preferred stock
P_0 = value of common stock
R_F = risk-free rate of return
T = firm's tax rate
w_i = proportion of long-term debt in capital structure
w_j = capital structure proportion (historical or target, stated in decimal form) for financing source j
w_p = proportion of preferred stock in capital structure
w_s = proportion of common stock equity in capital structure

Cost of capital formulas

Before-tax cost of debt (approximation):

$$k_d = \frac{I + \dfrac{\$1{,}000 - N_d}{n}}{\dfrac{N_d + \$1{,}000}{2}} \qquad \text{[Eq. 11.1]}$$

After-tax cost of debt:

$$k_i = k_d \times (1 - T) \qquad \text{[Eq. 11.2]}$$

Cost of preferred stock:

$$k_p = \frac{D_p}{N_p} \qquad \text{[Eq. 11.3]}$$

Cost of common stock equity:

Using constant-growth valuation model:

$$k_s = \frac{D_1}{P_0} + g \qquad \text{[Eq. 11.5]}$$

Using CAPM:

$$k_s = R_F + [b \times (k_m - R_F)] \qquad \text{[Eq. 11.6]}$$

Cost of retained earnings:

$$k_r = k_s \qquad \text{[Eq. 11.7]}$$

Cost of new issues of common stock:

$$k_n = \frac{D_1}{N_n} + g \qquad \text{[Eq. 11.8]}$$

Weighted average cost of capital (WACC):

$$k_a = (w_i \times k_i) + (w_p \times k_p) + (w_s \times k_{r \text{ or } n}) \qquad \text{[Eq. 11.9]}$$

Break point:

$$BP_j = \frac{AF_j}{w_j} \qquad \text{[Eq. 11.10]}$$

SELF-TEST PROBLEM (Solution in Appendix B)

LG2 LG3 LG4 LG5 LG6

ST 11–1 **Specific costs, WACC, WMCC, and IOS** Humble Manufacturing is interested in measuring its overall cost of capital. The firm is in the 40% tax bracket. Current investigation has gathered the following data:

Debt The firm can raise an unlimited amount of debt by selling \$1,000-par-value, 10% coupon interest rate, 10-year bonds on which *annual interest* payments will be made. To sell the issue, an average discount of \$30 per bond must be given. The firm must also pay flotation costs of \$20 per bond.

Preferred stock The firm can sell 11% (annual dividend) preferred stock at its \$100-per-share par value. The cost of issuing and selling the preferred stock is expected to be \$4 per share. An unlimited amount of preferred stock can be sold under these terms.

Common stock The firm's common stock is currently selling for \$80 per share. The firm expects to pay cash dividends of \$6 per share next year. The firm's dividends have been growing at an annual rate of 6%, and this rate is expected to continue in the future. The stock will have to be underpriced by \$4 per share, and flotation costs are expected to amount to \$4 per share. The firm can sell an unlimited amount of new common stock under these terms.

Retained earnings The firm expects to have \$225,000 of retained earnings available in the coming year. Once these retained earnings are exhausted, the firm will use new common stock as the form of common stock equity financing.

a. Calculate the specific cost of each source of financing. (Round to the nearest 0.1%.)

b. The firm uses the weights shown in the following table, which are based on target capital structure proportions, to calculate its weighted average cost of capital. (Round to the nearest 0.1%.)

Source of capital	Weight
Long-term debt	40%
Preferred stock	15
Common stock equity	45
Total	100%

(1) Calculate the single break point associated with the firm's financial situation. *(Hint:* This point results from the exhaustion of the firm's retained earnings.)

(2) Calculate the weighted average cost of capital associated with total new financing below the break point calculated in part (1).

(3) Calculate the weighted average cost of capital associated with total new financing above the break point calculated in part (1).

c. Using the results of part **b** along with the information shown in the following table on the available investment opportunities, draw the firm's weighted marginal cost of capital (WMCC) schedule and investment opportunities schedule (IOS) on the same set of axes (total new financing or investment on the *x* axis and weighted average cost of capital and IRR on the *y* axis).

Investment opportunity	Internal rate of return (IRR)	Initial investment
A	11.2%	$100,000
B	9.7	500,000
C	12.9	150,000
D	16.5	200,000
E	11.8	450,000
F	10.1	600,000
G	10.5	300,000

d. Which, if any, of the available investments do you recommend that the firm accept? Explain your answer. How much total new financing is required?

PROBLEMS

LG1 **11–1 Concept of cost of capital** Wren Manufacturing is in the process of analyzing its investment decision-making procedures. The two projects evaluated by the firm during the past month were projects 263 and 264. The basic variables surrounding each project analysis, using the IRR decision technique, and the resulting decision actions are summarized in the following table.

Basic variables	Project 263	Project 264
Cost	$64,000	$58,000
Life	15 years	15 years
IRR	8%	15%
Least-cost financing		
Source	Debt	Equity
Cost (after-tax)	7%	16%
Decision		
Action	Accept	Reject
Reason	8% IRR > 7% cost	15% IRR < 16% cost

a. Evaluate the firm's decision-making procedures, and explain why the acceptance of project 263 and rejection of project 264 may not be in the owners' best interest.

b. If the firm maintains a capital structure containing 40% debt and 60% equity, find its weighted average cost using the data in the table.

c. Had the firm used the weighted average cost calculated in part **b,** what actions would have been indicated relative to projects 263 and 264?

d. Compare and contrast the firm's actions with your findings in part **c.** Which decision method seems more appropriate? Explain why.

LG2 **11–2** **Cost of debt using both methods** Currently, Warren Industries can sell 15-year, $1,000-par-value bonds paying *annual interest* at a 12% coupon rate. As a result of current interest rates, the bonds can be sold for $1,010 each; flotation costs of $30 per bond will be incurred in this process. The firm is in the 40% tax bracket.

a. Find the net proceeds from sale of the bond, N_d.

b. Show the cash flows from the firm's point of view over the maturity of the bond.

c. Use the *IRR approach* to calculate the before-tax and after-tax costs of debt.

d. Use the *approximation formula* to estimate the before-tax and after-tax costs of debt.

e. Compare and contrast the costs of debt calculated in parts **c** and **d.** Which approach do you prefer? Why?

LG2 **11–3** **Cost of debt using the approximation formula** For each of the following $1,000-par-value bonds, assuming *annual interest* payment and a 40% tax rate, calculate the *after-tax* cost to maturity using the *approximation formula.*

Bond	Life	Underwriting fee	Discount (−) or premium (+)	Coupon interest rate
A	20 years	$25	−$20	9%
B	16	40	+ 10	10
C	15	30	− 15	12
D	25	15	Par	9
E	22	20	− 60	11

LG2 **11–4** **The cost of debt using the approximation formula** Gronseth Drywall Systems, Inc., is in discussions with its investment bankers regarding the issuance of new bonds. The investment banker has informed the firm that different maturities will carry different coupon rates and sell at different prices. The firm must choose among several alternatives. In each case, the bonds will have a $1,000 par value and flotation costs will be $30 per bond. The company is taxed at 40%. Calculate the after-tax cost of financing with each of the following alternatives.

Alternative	Coupon rate	Time to maturity	Premium or discount
A	9%	16 years	$250
B	7	5	50
C	6	7	par
D	5	10	− 75

LG2 **11–5 Cost of preferred stock** Taylor Systems has just issued preferred stock. The stock has a 12% annual dividend and a \$100 par value and was sold at \$97.50 per share. In addition, flotation costs of \$2.50 per share must be paid.

a. Calculate the cost of the preferred stock.

b. If the firm sells the preferred stock with a 10% annual dividend and nets \$90.00 after flotation costs, what is its cost?

LG2 **11–6 Cost of preferred stock** Determine the cost for each of the following preferred stocks.

Preferred stock	Par value	Sale price	Flotation cost	Annual dividend
A	\$100	\$101	\$9.00	11%
B	40	38	\$3.50	8%
C	35	37	\$4.00	\$5.00
D	30	26	5% of par	\$3.00
E	20	20	\$2.50	9%

LG3 **11–7 Cost of common stock equity—CAPM** J&M Corporation common stock has a beta, b, of 1.2. The risk-free rate is 6%, and the market return is 11%.

a. Determine the risk premium on J&M common stock.

b. Determine the required return that J&M common stock should provide.

c. Determine J&M's cost of common stock equity using the CAPM.

LG3 **11–8 Cost of common stock equity** Ross Textiles wishes to measure its cost of common stock equity. The firm's stock is currently selling for \$57.50. The firm expects to pay a \$3.40 dividend at the end of the year (2004). The dividends for the past 5 years are shown in the following table.

Year	Dividend
2003	\$3.10
2002	2.92
2001	2.60
2000	2.30
1999	2.12

After underpricing and flotation costs, the firm expects to net \$52 per share on a new issue.

a. Determine the growth rate of dividends.

b. Determine the net proceeds, N_n, that the firm actually receives.

c. Using the constant-growth valuation model, determine the cost of retained earnings, k_r.
d. Using the constant-growth valuation model, determine the cost of new common stock, k_n.

LG3 **11–9 Retained earnings versus new common stock** Using the data for each firm shown in the following table, calculate the cost of retained earnings and the cost of new common stock using the constant-growth valuation model.

Firm	Current market price per share	Dividend growth rate	Projected dividend per share next year	Underpricing per share	Flotation cost per share
A	$50.00	8%	$2.25	$2.00	$1.00
B	20.00	4	1.00	0.50	1.50
C	42.50	6	2.00	1.00	2.00
D	19.00	2	2.10	1.30	1.70

LG2 LG4 **11–10 The effect of tax rate on WACC** Equity Lighting Corp. wishes to explore the effect on its cost of capital of the rate at which the company pays taxes. The firm wishes to maintain a capital structure of 30% debt, 10% preferred stock, and 60% common stock. The cost of financing with retained earnings is 14%, the cost of preferred stock financing is 9%, and the before-tax cost of debt financing is 11%. Calculate the weighted average cost of capital (WACC) given the tax rate assumptions in parts **a** to **c.**

a. Tax rate = 40%
b. Tax rate = 35%
c. Tax rate = 25%
d. Describe the relationship between changes in the rate of taxation and the weighted average cost of capital.

LG4 **11–11 WACC—Book weights** Ridge Tool has on its books the amounts and specific (after-tax) costs shown in the following table for each source of capital.

Source of capital	Book value	Specific cost
Long-term debt	$700,000	5.3%
Preferred stock	50,000	12.0
Common stock equity	650,000	16.0

a. Calculate the firm's weighted average cost of capital using book value weights.
b. Explain how the firm can use this cost in the investment decision-making process.

LG4 **11–12 WACC—Book weights and market weights** Webster Company has compiled the information shown in the following table.

Source of capital	Book value	Market value	After-tax cost
Long-term debt	$4,000,000	$3,840,000	6.0%
Preferred stock	40,000	60,000	13.0
Common stock equity	1,060,000	3,000,000	17.0
Totals	$5,100,000	$6,900,000	

a. Calculate the weighted average cost of capital using book value weights.
b. Calculate the weighted average cost of capital using market value weights.
c. Compare the answers obtained in parts **a** and **b.** Explain the differences.

LG4 **11–13 WACC and target weights** After careful analysis, Dexter Brothers has determined that its optimal capital structure is composed of the sources and target market value weights shown in the following table.

Source of capital	Target market value weight
Long-term debt	30%
Preferred stock	15
Common stock equity	55
Total	100%

The cost of debt is estimated to be 7.2%; the cost of preferred stock is estimated to be 13.5%; the cost of retained earnings is estimated to be 16.0%; and the cost of new common stock is estimated to be 18.0%. All of these are after-tax rates. The company's debt represents 25%, the preferred stock represents 10%, and the common stock equity represents 65% of total capital on the basis of the market values of the three components. The company expects to have a significant amount of retained earnings available and does not expect to sell any new common stock.
a. Calculate the weighted average cost of capital on the basis of historical market value weights.

b. Calculate the weighted average cost of capital on the basis of target market value weights.

LG4 LG5

11–14 Cost of capital and break point Edna Recording Studios, Inc., reported earnings available to common stock of $4,200,000 last year. From that, the company paid a dividend of $1.26 on each of its 1,000,000 common shares outstanding. The capital structure of the company includes 40% debt, 10% preferred stock, and 50% common stock. It is taxed at a rate of 40%.

a. If the market price of common stock is $40 and dividends are expected to grow at a rate of 6% a year for the foreseeable future, what is the company's cost of financing with retained earnings?

b. If flotation costs on new shares of common stock amount to $1.00 per share, what is the company's cost of new common stock financing?

c. The company can issue $2.00 dividend preferred stock for a market price of $25.00 per share. Flotation costs would amount to $3.00 per share. What is the cost of preferred stock financing?

d. The company can issue $1,000 par, 10% coupon, 5-year bonds that can be sold for $1,200 each. Flotation costs would amount to $25.00 per bond. Use the estimation formula to figure the approximate cost of new debt financing.

e. What is the maximum investment that Edna Recording can make in new projects before it must issue new common stock?

f. What is the WACC for projects with a cost at or below the amount calculated in part **e**?

g. What is the WMCC for projects with a cost above the amount calculated in part **e** (assuming that debt across all ranges remains at the percentage cost calculated in part **d**)?

LG2 LG3 LG4 LG5

11–15 Calculation of specific costs, WACC, and WMCC Dillon Labs has asked its financial manager to measure the cost of each specific type of capital as well as the weighted average cost of capital. The weighted average cost is to be measured by using the following weights: 40% long-term debt, 10% preferred stock, and 50% common stock equity (retained earnings, new common stock, or both). The firm's tax rate is 40%.

Debt The firm can sell for $980 a 10-year, $1,000-par-value bond paying *annual interest* at a 10% coupon rate. A flotation cost of 3% of the par value is required in addition to the discount of $20 per bond.

Preferred stock Eight percent (annual dividend) preferred stock having a par value of $100 can be sold for $65. An additional fee of $2 per share must be paid to the underwriters.

Common stock The firm's common stock is currently selling for $50 per share. The dividend expected to be paid at the end of the coming year (2004) is $4. Its dividend payments, which have been approximately 60% of earnings per share in each of the past 5 years, were as shown in the following table.

Year	Dividend
2003	$3.75
2002	3.50
2001	3.30
2000	3.15
1999	2.85

It is expected that in order to sell, new common stock must be underpriced $5 per share, and the firm must also pay $3 per share in flotation costs. Dividend payments are expected to continue at 60% of earnings.

a. Calculate the specific cost of each source of financing. (Assume that $k_r = k_s$.)
b. If earnings available to common shareholders are expected to be $7 million, what is the break point associated with the exhaustion of retained earnings?
c. Determine the weighted average cost of capital between zero and the break point calculated in part **b.**
d. Determine the weighted average cost of capital just beyond the break point calculated in part **b.**

LG2 LG3 LG4 LG5

11–16 **Calculation of specific costs, WACC, and WMCC** Lang Enterprises is interested in measuring its overall cost of capital. Current investigation has gathered the following data. The firm is in the 40% tax bracket.

Debt The firm can raise an unlimited amount of debt by selling $1,000-par-value, 8% coupon interest rate, 20-year bonds on which *annual interest* payments will be made. To sell the issue, an average discount of $30 per bond would have to be given. The firm also must pay flotation costs of $30 per bond.

Preferred stock The firm can sell 8% preferred stock at its $95-per-share par value. The cost of issuing and selling the preferred stock is expected to be $5 per share. An unlimited amount of preferred stock can be sold under these terms.

Common stock The firm's common stock is currently selling for $90 per share. The firm expects to pay cash dividends of $7 per share next year. The firm's dividends have been growing at an annual rate of 6%, and this is expected to continue into the future. The stock must be underpriced by $7 per share, and flotation costs are expected to amount to $5 per share. The firm can sell an unlimited amount of new common stock under these terms.

Retained earnings When measuring this cost, the firm does not concern itself with the tax bracket or brokerage fees of owners. It expects to have available $100,000 of retained earnings in the coming year; once these retained earnings are exhausted, the firm will use new common stock as the form of common stock equity financing.

a. Calculate the specific cost of each source of financing. (Round answers to the nearest 0.1%.)

Source of capital	Weight
Long-term debt	30%
Preferred stock	20
Common stock equity	50
Total	100%

b. The firm's capital structure weights used in calculating its weighted average cost of capital are shown in the table above. (Round answer to the nearest 0.1%.)

(1) Calculate the single break point associated with the firm's financial situation. (*Hint:* This point results from exhaustion of the firm's retained earnings.)

(2) Calculate the weighted average cost of capital associated with total new financing below the break point calculated in part (1).

(3) Calculate the weighted average cost of capital associated with total new financing above the break point calculated in part (1).

LG4 LG5 LG6

11–17 Integrative—WACC, WMCC, and IOS Cartwell Products has compiled the data shown in the following table for the current costs of its three basic sources of capital—long-term debt, preferred stock, and common stock equity—for various ranges of new financing.

Source of capital	Range of new financing	After-tax cost
Long-term debt	$0 to $320,000	6%
	$320,000 and above	8
Preferred stock	$0 and above	17%
Common stock equity	$0 to $200,000	20%
	$200,000 and above	24

The company's capital structure weights used in calculating its weighted average cost of capital are shown in the following table.

Source of capital	Weight
Long-term debt	40%
Preferred stock	20
Common stock equity	40
Total	100%

a. Determine the break points and ranges of *total* new financing associated with each source of capital.

b. Using the data developed in part **a,** determine the break points (levels of *total* new financing) at which the firm's weighted average cost of capital will change.

c. Calculate the weighted average cost of capital for each range of total new financing found in part **b.** (*Hint:* There are three ranges.)

d. Using the results of part **c,** along with the following information on the available investment opportunities, draw the firm's weighted marginal cost of capital (WMCC) schedule and investment opportunities schedule (IOS) on the same set of axes (total new financing or investment on the *x* axis and weighted average cost of capital and IRR on the *y* axis).

Investment opportunity	Internal rate of return (IRR)	Initial investment
A	19%	$200,000
B	15	300,000
C	22	100,000
D	14	600,000
E	23	200,000
F	13	100,000
G	21	300,000
H	17	100,000
I	16	400,000

e. Which, if any, of the available investments do you recommend that the firm accept? Explain your answer.

LG4 LG5 LG6

11–18 Integrative—WACC, WMCC, and IOC Grainger Corp., a supplier of fitness equipment, is trying to decide whether to undertake any or all of the proposed projects in its investment opportunities schedule (IOS). The firm's cost-of-capital schedule and investment opportunities schedules follow.

Cost-of-Capital Schedule			
Range of new financing	**Source**	**Weight**	**After-tax cost**
0–$600,000	Debt	.50	6.3%
	Preferred stock	.10	12.5
	Common stock	.40	15.3
$600,000–$1,000,000	Debt	.50	6.3%
	Preferred stock	.10	12.5
	Common stock	.40	16.4
$1,000,000 and above	Debt	.50	7.8%
	Preferred stock	.10	12.5
	Common stock	.40	16.4

Investment Opportunities Schedule		
Investment opportunity	Internal rate of return	Cost
Project H	14.5%	$200,000
Project G	13.0	700,000
Project K	12.8	500,000
Project M	11.4	600,000

a. Complete the cost-of-capital schedule by calculating the WACC and the WMCC schedule for the various ranges of new financing.
b. Identify those projects that you recommend that Grainger Corp. undertake in the next year.
c. Illustrate your recommendations by drawing a graph of Grainger's weighted average costs and investment opportunities similar to Figure 11.2.
d. Explain why certain projects are recommended and other(s) are not.

CHAPTER 11 CASE Making Star Products' Financing/Investment Decision

Star Products Company is a growing manufacturer of automobile accessories whose stock is actively traded on the over-the-counter exchange. During 2003, the Dallas-based company experienced sharp increases in both sales and earnings. Because of this recent growth, Melissa Jen, the company's treasurer, wants to make sure that available funds are being used to their fullest. Management policy is to maintain the current capital structure proportions of 30% long-term debt, 10% preferred stock, and 60% common stock equity for at least the next 3 years. The firm is in the 40% tax bracket.

Star's division and product managers have presented several competing investment opportunities to Ms. Jen. However, because funds are limited, choices of which projects to accept must be made. The investment opportunities schedule (IOS) is shown in the following table.

Investment Opportunities Schedule (IOS) for Star Products Company		
Investment opportunity	Internal rate of return (IRR)	Initial investment
A	15%	$400,000
B	22	200,000
C	25	700,000
D	23	400,000
E	17	500,000
F	19	600,000
G	14	500,000

To estimate the firm's weighted average cost of capital (WACC), Ms. Jen contacted a leading investment banking firm, which provided the financing cost data shown in the following table.

Financing Cost Data
Star Products Company

Long-term debt: The firm can raise $450,000 of additional debt by selling 15-year, $1,000-par-value, 9% coupon interest rate bonds that pay *annual interest*. It expects to net $960 per bond after flotation costs. Any debt in excess of $450,000 will have a before-tax cost, k_d, of 13%.

Preferred stock: Preferred stock, regardless of the amount sold, can be issued with a $70 par value and a 14% annual dividend rate and will net $65 per share after flotation costs.

Common stock equity: The firm expects dividends and earnings per share to be $0.96 and $3.20, respectively, in 2004 and to continue to grow at a constant rate of 11% per year. The firm's stock currently sells for $12 per share. Star expects to have $1,500,000 of retained earnings available in the coming year. Once the retained earnings have been exhausted, the firm can raise additional funds by selling new common stock, netting $9 per share after underpricing and flotation costs.

Required

a. Calculate the cost of each source of financing, as specified:
(1) Long-term debt, first $450,000.
(2) Long-term debt, greater than $450,000.
(3) Preferred stock, all amounts.
(4) Common stock equity, first $1,500,000.
(5) Common stock equity, greater than $1,500,000.

b. Find the break points associated with each source of capital, and use them to specify each of the ranges of total new financing over which the firm's weighted average cost of capital (WACC) remains constant.

c. Calculate the weighted average cost of capital (WACC) over each of the ranges of total new financing specified in part **b.**

d. Using your findings in part **c** along with the investment opportunities schedule (IOS), draw the firm's weighted marginal cost of capital (WMCC) and IOS on the same set of axes (total new financing or investment on the x axis and weighted average cost of capital and IRR on the y axis).

e. Which, if any, of the available investments would you recommend that the firm accept? Explain your answer.

WEB EXERCISE

Go to the St. Louis Federal Reserve Bank Web site *www.stls.frb.org*. Click on **Economic Research**; click on **Fred**; click on **Monthly Interest Rates**; and then click on **Bank Prime Loan Rate Changes—Historic Dates of Changes and Rates—1929**.

1. What was the prime interest rate in 1934?
2. What is the highest the prime interest rate has been? When was that?

3. What has been the highest prime interest rate since you were born?
4. What is the present prime interest rate?
5. Over the past 10 years, what was the lowest prime interest rate? What has been the highest prime interest rate over the past 10 years?

Now go to Barra's Web site *www.barra.com* and click on **Research + Indexes** and then on **S&P/Barra U.S. Equity Indexes**.

6. What was the average annual 10-year return on large-cap stocks, as measured by growth in the S&P 500 (annualized 10-year return)? How does this compare to your answers in question 5?

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

CHAPTER

12

LEVERAGE AND CAPITAL STRUCTURE

LEARNING GOALS

LG1 Discuss the role of breakeven analysis, the operating breakeven point, and the effect of changing costs on it.

LG2 Understand operating, financial, and total leverage and the relationships among them.

LG3 Describe the types of capital, external assessment of capital structure, the capital structure of non-U.S. firms, and capital structure theory.

LG4 Explain the optimal capital structure using a graphical view of the firm's cost-of-capital functions and a zero-growth valuation model.

LG5 Discuss the EBIT–EPS approach to capital structure.

LG6 Review the return and risk of alternative capital structures, their linkage to market value, and other important considerations related to capital structure.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand how to calculate and analyze operating and financial leverage and to be familiar with the tax effects of various capital structures.

Information systems: You need to understand the types of capital and what capital structure is, because you will provide much of the information needed in management's determination of the best capital structure for the firm.

Management: You need to understand leverage so that you can magnify returns for the firm's owners and to understand capital structure theory so that you can make decisions about the firm's optimal capital structure.

Marketing: You need to understand breakeven analysis, which you will use in pricing and product feasibility decisions.

Operations: You need to understand the impact of fixed and variable operating costs on the firm's breakeven point and its operating leverage, because these costs will have a major impact on the firm's risk and return.

Krispy Kreme

Investors Eat Up Krispy Kreme Stock

In April 2000, **Krispy Kreme Doughnuts** went public at $21 a share. Investors gobbled up the shares as fast as consumers did its hot-from-the-oven glazed doughnuts. In 2001 the stock split, and the company did a secondary offering that doubled the number of shares in the market. By the end of its fiscal year in January 2002, the company's market capitalization was over $2 billion.

Krispy Kreme used the proceeds from its equity issues to fund an aggressive expansion campaign to build stores in new U.S. and international markets. Its timing was particularly good: Investors were looking for an alternative to dot-com high fliers, and the company's popular brand and product appealed to many different types of consumers. Krispy Kreme's financial condition was also strong. Sales growth—24 percent for the period 1998–2001 and a projected 5-year rate of over 26 percent—was well above its peers in the retail restaurant industry. Net income and EPS were beginning to climb as the company brought new stores online. Its capital structure (the mix of debt and equity used to fund the company) at October 31, 2001, consisted of $9.7 million in long-term debt and $175.8 million in stockholders' equity. With a debt-to-equity ratio of just 5.2 percent (extremely low compared to the industry average of 92 percent) and a times interest earned ratio of 122, Krispy Kreme has plenty of flexibility in its capital structure.

Is a capital structure consisting mostly of equity better than one with a higher percentage of debt? Not necessarily. Capital structure varies among companies in the same industry and across industry groups. Within the restaurant sector, for example, you'll find **California Pizza Kitchen** and **Cheesecake Factory** with no debt; debt-to-equity ratios of 20–30 percent at **Wendy's** and **Applebee's; Papa John's** and **Dave & Buster's** at around 60 percent; **Chart House** and **McDonald's** with close to equal amounts of debt and equity; and **Atomic Burrito** with more than twice as much debt as equity.

A company's choice of debt versus equity depends on many factors. Conditions in the equity markets may be unfavorable when a company needs to raise funds. When interest rates are low, the debt markets become attractive. Before issuing debt, however, a company must be sure that it can generate cash flows adequate to repaying its debt obligations.

Each type of long-term capital has its advantages. As we learned in Chapter 11, debt costs less than equity. Adding debt, with its fixed rate, to the capital structure creates *financial leverage*, the use of fixed financial costs to magnify returns. Leverage also increases risk. This chapter will show that financial leverage and capital structure are closely related concepts that can minimize the cost of capital and maximize owners' wealth.

LG1 LG2 12.1 Leverage

leverage
Results from the use of fixed-cost assets or funds to magnify returns to the firm's owners.

capital structure
The mix of long-term debt and equity maintained by the firm.

Leverage results from the use of fixed-cost assets or funds to magnify returns to the firm's owners. Generally, increases in leverage result in increased return and risk, whereas decreases in leverage result in decreased return and risk. The amount of leverage in the firm's **capital structure**—the mix of long-term debt and equity maintained by the firm—can significantly affect its value by affecting return and risk. Unlike some causes of risk, management has almost complete control over the risk introduced through the use of leverage. Because of its effect on value, the financial manager must understand how to measure and evaluate leverage, particularly when making capital structure decisions.

The three basic types of leverage can best be defined with reference to the firm's income statement, as shown in the general income statement format in Table 12.1.

- *Operating leverage* is concerned with the relationship between the firm's sales revenue and its earnings before interest and taxes, or EBIT. (EBIT is a descriptive label for *operating profits*.)
- *Financial leverage* is concerned with the relationship between the firm's EBIT and its common stock earnings per share (EPS).
- *Total leverage* is concerned with the relationship between the firm's sales revenue and EPS.

We will examine the three types of leverage concepts in detail in sections that follow. First, though, we will look at breakeven analysis, which lays the foundation for leverage concepts by demonstrating the effects of fixed costs on the firm's operations.

TABLE 12.1 General Income Statement Format and Types of Leverage

Operating leverage	Sales revenue	Total leverage
	Less: Cost of goods sold	
	Gross profits	
	Less: Operating expenses	
	Earnings before interest and taxes (EBIT)	
Financial leverage	Less: Interest	
	Net profits before taxes	
	Less: Taxes	
	Net profits after taxes	
	Less: Preferred stock dividends	
	Earnings available for common stockholders	
	Earnings per share (EPS)	

Breakeven Analysis

breakeven analysis
Indicates the level of operations necessary to cover all operating costs and the profitability associated with various levels of sales.

operating breakeven point
The level of sales necessary to cover all *operating costs;* the point at which EBIT = $0.

Breakeven analysis, sometimes called *cost-volume-profit analysis,* is used by the firm (1) to determine the level of operations necessary to cover all operating costs and (2) to evaluate the profitability associated with various levels of sales. The firm's **operating breakeven point** is the level of sales necessary to cover all *operating costs.* At that point, earnings before interest and taxes equals $0.[1]

The first step in finding the operating breakeven point is to divide the cost of goods sold and operating expenses into fixed and variable operating costs. *Fixed costs* are a function of time, not sales volume, and are typically contractual; rent, for example, is a fixed cost. *Variable costs* vary directly with sales and are a function of volume, not time; shipping costs, for example, are a variable cost.[2]

The Algebraic Approach

Using the following variables, we can recast the operating portion of the firm's income statement given in Table 12.1 into the algebraic representation shown in Table 12.2.

P = sale price per unit
Q = sales quantity in units
FC = fixed operating cost per period
VC = variable operating cost per unit

Rewriting the algebraic calculations in Table 12.2 as a formula for earnings before interest and taxes yields Equation 12.1:

$$\text{EBIT} = (P \times Q) - FC - (VC \times Q) \tag{12.1}$$

Simplifying Equation 12.1 yields

$$\text{EBIT} = Q \times (P - VC) - FC \tag{12.2}$$

TABLE 12.2 Operating Leverage, Costs, and Breakeven Analysis

	Item	Algebraic representation
Operating leverage	Sales revenue	$(P \times Q)$
	Less: Fixed operating costs	$-\ FC$
	Less: Variable operating costs	$-(VC \times Q)$
	Earnings before interest and taxes	EBIT

1. Quite often, the breakeven point is calculated so that it represents the point at which *all operating and financial costs* are covered. Our concern in this chapter is not with this overall breakeven point.

2. Some costs, commonly called *semifixed* or *semivariable,* are partly fixed and partly variable. An example is sales commissions that are fixed for a certain volume of sales and then increase to higher levels for higher volumes. For convenience and clarity, we assume that all costs can be classified as either fixed or variable.

As noted above, the operating breakeven point is the level of sales at which all fixed and variable *operating costs* are covered—the level at which EBIT equals \$0. Setting EBIT equal to \$0 and solving Equation 12.2 for Q yield

$$Q = \frac{FC}{P - VC} \tag{12.3}$$

Q is the firm's operating breakeven point.[3]

EXAMPLE Assume that Cheryl's Posters, a small poster retailer, has fixed operating costs of \$2,500, its sale price per unit (poster) is \$10, and its variable operating cost per unit is \$5. Applying Equation 12.3 to these data yields

$$Q = \frac{\$2{,}500}{\$10 - \$5} = \frac{\$2{,}500}{\$5} = 500 \text{ units}$$

At sales of 500 units, the firm's EBIT should just equal \$0. The firm will have positive EBIT for sales greater than 500 units and negative EBIT, or a loss, for sales less than 500 units. We can confirm this by substituting values above and below 500 units, along with the other values given, into Equation 12.1.

The Graphical Approach

Figure 12.1 presents in graphical form the breakeven analysis of the data in the preceding example. The firm's operating breakeven point is the point at which its *total operating cost*—the sum of its fixed and variable operating costs—equals sales revenue. At this point, EBIT equals \$0. The figure shows that for sales *below* 500 units, total operating cost exceeds sales revenue, and EBIT is less than \$0 (a loss). For sales *above* the breakeven point of 500 units, sales revenue exceeds total operating cost, and EBIT is greater than \$0.

Changing Costs and the Operating Breakeven Point

A firm's operating breakeven point is sensitive to a number of variables: fixed operating cost (FC), the sale price per unit (P), and the variable operating cost per unit (VC). The effects of increases or decreases in these variables can be readily seen by referring to Equation 12.3. The sensitivity of the breakeven sales volume (Q) to an *increase* in each of these variables is summarized in Table 12.3. As might be expected, an increase in cost (FC or VC) tends to increase the operating breakeven point, whereas an increase in the sale price per unit (P) decreases the operating breakeven point.

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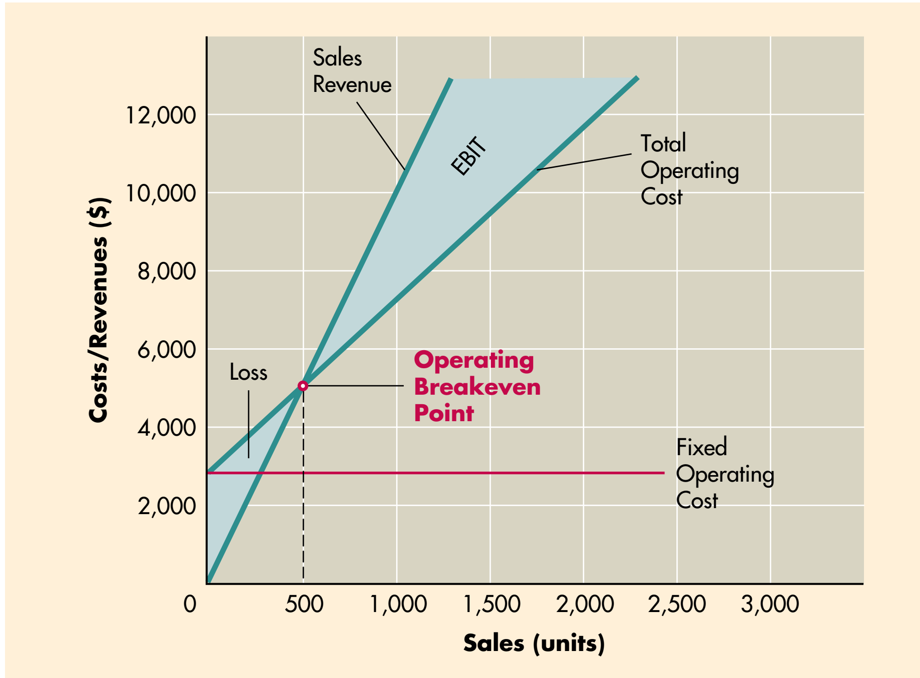
3. Because the firm is assumed to be a single-product firm, its operating breakeven point is found in terms of unit sales, Q. For multiproduct firms, the operating breakeven point is generally found in terms of dollar sales, S. This is done by substituting the contribution margin, which is 100% minus total variable operating costs as a percentage of total sales, denoted $VC\%$, into the denominator of Equation 12.3. The result is Equation 12.3a:

$$S = \frac{FC}{1 - VC\%} \tag{12.3a}$$

This multiproduct-firm breakeven point assumes that the firm's product mix remains the same at all levels of sales.

FIGURE 12.1

Breakeven Analysis
Graphical operating breakeven analysis



EXAMPLE

Assume that Cheryl's Posters wishes to evaluate the impact of several options: (1) increasing fixed operating costs to \$3,000, (2) increasing the sale price per unit to \$12.50, (3) increasing the variable operating cost per unit to \$7.50, and (4) simultaneously implementing all three of these changes. Substituting the appropriate data into Equation 12.3 yields the following results:

$$\text{(1) Operating breakeven point} = \frac{\$3{,}000}{\$10 - \$5} = 600 \text{ units}$$

$$\text{(2) Operating breakeven point} = \frac{\$2{,}500}{\$12.50 - \$5} = 333\tfrac{1}{3} \text{ units}$$

TABLE 12.3 Sensitivity of Operating Breakeven Point to Increases in Key Breakeven Variables

Increase in variable	Effect on operating breakeven point
Fixed operating cost *(FC)*	Increase
Sale price per unit *(P)*	Decrease
Variable operating cost per unit *(VC)*	Increase

Note: Decreases in each of the variables shown would have the opposite effect from their effect on operating breakeven point.

$$(3)\ \text{Operating breakeven point} = \frac{\$2{,}500}{\$10 - \$7.50} = 1{,}000 \text{ units}$$

$$(4)\ \text{Operating breakeven point} = \frac{\$3{,}000}{\$12.50 - \$7.50} = 600 \text{ units}$$

Comparing the resulting operating breakeven points to the initial value of 500 units, we can see that the cost increases (actions 1 and 3) raise the breakeven point, whereas the revenue increase (action 2) lowers the breakeven point. The combined effect of increasing all three variables (action 4) also results in an increased operating breakeven point.

We now turn our attention to the three types of leverage. It is important to recognize that the demonstrations of leverage that follow are conceptual in nature and that the measures presented are *not* routinely used by financial managers for decision-making purposes.

Operating Leverage

operating leverage
The potential use of *fixed operating costs* to magnify the effects of changes in sales on the firm's earnings before interest and taxes.

Operating leverage results from the existence of *fixed operating costs* in the firm's income stream. Using the structure presented in Table 12.2, we can define **operating leverage** as the potential use of *fixed operating costs* to magnify the effects of changes in sales on the firm's earnings before interest and taxes.

FIGURE 12.2

Operating Leverage
Breakeven analysis and operating leverage

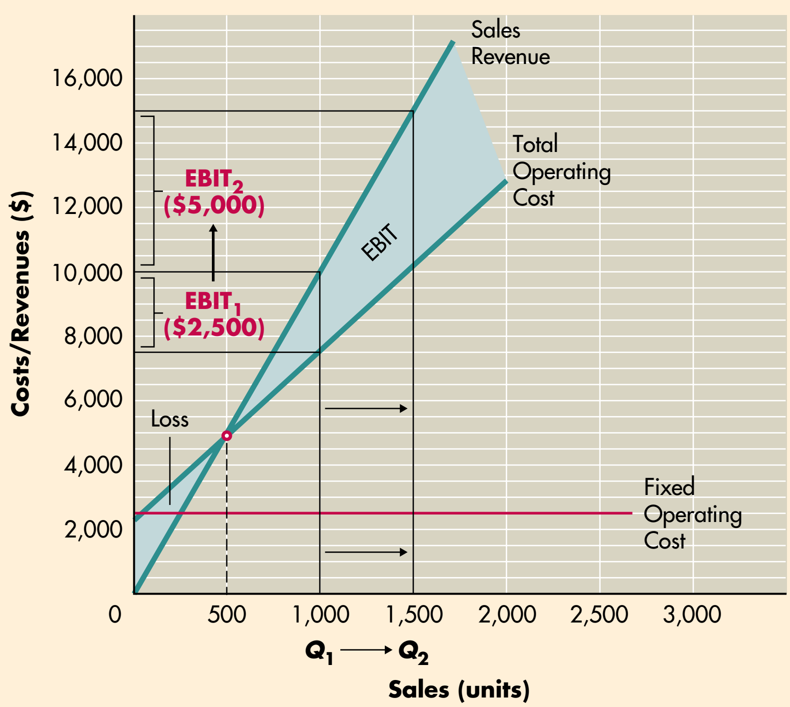


TABLE 12.4 The EBIT for Various Sales Levels

	Case 2		Case 1
	−50%		+50%
Sales (in units)	500	1,000	1,500
Sales revenue[a]	$5,000	$10,000	$15,000
Less: Variable operating costs[b]	2,500	5,000	7,500
Less: Fixed operating costs	2,500	2,500	2,500
Earnings before interest and taxes (EBIT)	$ 0	$ 2,500	$ 5,000
	−100%		+100%

[a]Sales revenue = $10/unit × sales in units.
[b]Variable operating costs = $5/unit × sales in units.

EXAMPLE Using the data for Cheryl's Posters (sale price, $P = \$10$ per unit; variable operating cost, $VC = \$5$ per unit; fixed operating cost, $FC = \$2{,}500$), Figure 12.2 presents the operating breakeven graph originally shown in Figure 12.1. The additional notations on the graph indicate that as the firm's sales increase from 1,000 to 1,500 units (Q_1 to Q_2), its EBIT increases from \$2,500 to \$5,000 (EBIT_1 to EBIT_2). In other words, a 50% increase in sales (1,000 to 1,500 units) results in a 100% increase in EBIT (\$2,500 to \$5,000). Table 12.4 includes the data for Figure 12.2 as well as relevant data for a 500-unit sales level. We can illustrate two cases using the 1,000-unit sales level as a reference point.

Case 1 A 50% *increase* in sales (from 1,000 to 1,500 units) results in a 100% *increase* in earnings before interest and taxes (from \$2,500 to \$5,000).

Case 2 A 50% *decrease* in sales (from 1,000 to 500 units) results in a 100% *decrease* in earnings before interest and taxes (from \$2,500 to \$0).

From the preceding example, we see that operating leverage works in *both directions*. When a firm has fixed operating costs, operating leverage is present. An increase in sales results in a more-than-proportional increase in EBIT; a decrease in sales results in a more-than-proportional decrease in EBIT.

degree of operating leverage (DOL)
The numerical measure of the firm's operating leverage.

Measuring the Degree of Operating Leverage (DOL)

The **degree of operating leverage** (DOL) is the numerical measure of the firm's operating leverage. It can be derived using the following equation:[4]

$$\text{DOL} = \frac{\text{Percentage change in EBIT}}{\text{Percentage change in sales}} \tag{12.4}$$

4. The degree of operating leverage also depends on the base level of sales used as a point of reference. The closer the base sales level used is to the operating breakeven point, the greater the operating leverage. *Comparison of the degree of operating leverage of two firms is valid only when the same base level of sales is used for both firms.*

Whenever the percentage change in EBIT resulting from a given percentage change in sales is greater than the percentage change in sales, operating leverage exists. This means that as long as DOL is greater than 1, there is operating leverage.

EXAMPLE Applying Equation 12.4 to cases 1 and 2 in Table 12.4 yields the following results:[5]

$$\textbf{Case 1:} \quad \frac{+100\%}{+50\%} = 2.0$$

$$\textbf{Case 2:} \quad \frac{-100\%}{-50\%} = 2.0$$

Because the result is greater than 1, operating leverage exists. For a given base level of sales, the higher the value resulting from applying Equation 12.4, the greater the degree of operating leverage.

A more direct formula for calculating the degree of operating leverage at a base sales level, Q, is shown in Equation 12.5.[6]

$$\text{DOL at base sales level } Q = \frac{Q \times (P - VC)}{Q \times (P - VC) - FC} \tag{12.5}$$

EXAMPLE Substituting $Q = 1{,}000$, $P = \$10$, $VC = \$5$, and $FC = \$2{,}500$ into Equation 12.5 yields the following result:

$$\text{DOL at 1,000 units} = \frac{1{,}000 \times (\$10 - \$5)}{1{,}000 \times (\$10 - \$5) - \$2{,}500} = \frac{\$5{,}000}{\$2{,}500} = 2.0$$

The use of the formula results in the same value for DOL (2.0) as that found by using Table 12.4 and Equation 12.4.[7]

Fixed Costs and Operating Leverage

Changes in fixed operating costs affect operating leverage significantly. Firms sometimes can incur fixed operating costs rather than variable operating costs and at other times may be able to substitute one type of cost for the other. For example, a firm could make fixed-dollar lease payments rather than payments equal to a specified percentage of sales. Or it could compensate sales representatives with a fixed salary and bonus rather than on a pure percent-of-sales com-

5. Because the concept of leverage is *linear,* positive and negative changes of equal magnitude will always result in equal degrees of leverage when the same base sales level is used as a point of reference. This relationship holds for all types of leverage discussed in this chapter.

6. Technically, the formula for DOL given in Equation 12.5 should include absolute value signs because it is possible to get a negative DOL when the EBIT for the base sales level is negative. Because we assume that the EBIT for the base level of sales is positive, we do not use the absolute value signs.

7. When total sales in dollars—instead of unit sales—are available, the following equation, in which TR = dollar level of base sales and TVC = total variable operating costs in dollars, can be used.

$$\text{DOL at base dollar sales } TR = \frac{TR - TVC}{TR - TVC - FC}$$

This formula is especially useful for finding the DOL for multiproduct firms. It should be clear that because in the case of a single-product firm, $TR = P \times Q$ and $TVC = VC \times Q$, substitution of these values into Equation 12.5 results in the equation given here.

In Practice

FOCUS ON PRACTICE Adobe's Design for Profitability

Adobe Systems, the second largest PC software company in the United States, dominates the graphic design, imaging, dynamic media, and authoring-tool software markets. Web site designers prefer its Photoshop and Illustrator software applications, and Adobe's Acrobat software has become a standard for sharing documents online.

Despite a sales slowdown in 2001, the company continued to meet its earnings targets. Its ability to manage discretionary expenses helped to keep its bottom line strong. As a software company, it has an additional advantage: *operating leverage,* the use of fixed operating costs to magnify the effect of changes in sales on earnings before interest and taxes (EBIT).

Adobe and its peers in the software industry incur the bulk of their costs early in a product's life cycle, in the research and development and initial marketing stages. The up-front development costs are fixed, regardless of how many copies of a program the company sells, and subsequent production costs are practically zero. The economies of scale are huge; once a company sells enough copies to cover its fixed costs, incremental revenue dollars go primarily to profit.

The following table demonstrates the impact of operating leverage on Adobe Systems in fiscal years (FYs) 2000 and 2001.

Operating leverage magnified the increase in EBIT in 2000. Sales growth of 24.7 percent resulted in EBIT growth of 56.9 percent. In 2001 a slight dip in sales—just under 3 percent—became a 7.4 percent drop in EBIT. Because the company has no long-term debt in its capital structure, its total leverage is derived only from fixed operating costs. When sales and EBIT again rise, the company's high operating leverage will boost EBIT growth. (It's important to remember that this example represents only 2 years and that Adobe's degree of operating leverage may change in the future.)

Sources: Adapted from Zeke Ashton, "The Software Advantage," *Motley Fool* (March 31, 2000), downloaded from *www.fool.com;* James K. Glassman, "Tech Still Has a Place in Portfolios," *Washington Post*, December 16, 2001, p. H1; Matt Richey, "EMC's Operating Leverage," *Motley Fool* (August 14, 2000); Mike Trigg, "Assessing Adobe's Valuation," *Motley Fool* (September 10, 2001); and "Operating Leverage Helps Adobe," *Motley Fool* (March 16, 2001), all downloaded from *www.fool.com*.

	FY 1999	FY 2000	FY 2001
Sales revenue (millions)	$1,015	$1,266	$1,230
EBIT (millions)	$260	$408	$378
(1) % change in sales		24.7	−2.9
(2) % change in EBIT		56.9	−7.4
DOL [(2) ÷ (1)]		2.3	2.6

mission basis. The effects of changes in fixed operating costs on operating leverage can best be illustrated by continuing our example.

EXAMPLE

Assume that Cheryl's Posters exchanges a portion of its variable operating costs for fixed operating costs by eliminating sales commissions and increasing sales salaries. This exchange results in a reduction in the variable operating cost per unit from $5 to $4.50 and an increase in the fixed operating costs from $2,500 to $3,000. Table 12.5 presents an analysis like that in Table 12.4, but using the new costs. Although the EBIT of $2,500 at the 1,000-unit sales level is the same as before the shift in operating cost structure, Table 12.5 shows that the firm has increased its operating leverage by shifting to greater fixed operating costs.

With the substitution of the appropriate values into Equation 12.5, the degree of operating leverage at the 1,000-unit base level of sales becomes

$$\text{DOL at 1,000 units} = \frac{1{,}000 \times (\$10 - \$4.50)}{1{,}000 \times (\$10 - \$4.50) - \$3{,}000} = \frac{\$5{,}500}{\$2{,}500} = 2.2$$

TABLE 12.5 Operating Leverage and Increased Fixed Costs

	Case 2		Case 1
	−50%		+50%
Sales (in units)	500	1,000	1,500
Sales revenue[a]	$5,000	$10,000	$15,000
Less: Variable operating costs[b]	2,250	4,500	6,750
Less: Fixed operating costs	3,000	3,000	3,000
Earnings before interest and taxes (EBIT)	−$ 250	$ 2,500	$ 5,250
	−110%		+110%

[a]Sales revenue was calculated as indicated in Table 12.4.
[b]Variable operating costs = $4.50/unit × sales in units.

Comparing this value to the DOL of 2.0 before the shift to more fixed costs makes it is clear that the higher the firm's fixed operating costs relative to variable operating costs, the greater the degree of operating leverage.

Financial Leverage

financial leverage
The potential use of *fixed financial costs* to magnify the effects of changes in earnings before interest and taxes on the firm's earnings per share.

Financial leverage results from the presence of *fixed financial costs* in the firm's income stream. Using the framework in Table 12.1, we can define **financial leverage** as the potential use of *fixed financial costs* to magnify the effects of changes in earnings before interest and taxes on the firm's earnings per share. The two fixed financial costs that may be found on the firm's income statement are (1) interest on debt and (2) preferred stock dividends. These charges must be paid regardless of the amount of EBIT available to pay them.[8]

EXAMPLE

Chen Foods, a small Oriental food company, expects EBIT of $10,000 in the current year. It has a $20,000 bond with a 10% (annual) coupon rate of interest and an issue of 600 shares of $4 (annual dividend per share) preferred stock outstanding. It also has 1,000 shares of common stock outstanding. The annual interest on the bond issue is $2,000 (0.10 × $20,000). The annual dividends on the preferred stock are $2,400 ($4.00/share × 600 shares). Table 12.6 presents the EPS corresponding to levels of EBIT of $6,000, $10,000, and $14,000, assuming that the firm is in the 40% tax bracket. Two situations are shown:

8. As noted in Chapter 7, although preferred stock dividends can be "passed" (not paid) at the option of the firm's directors, it is generally believed that payment of such dividends is necessary. *This text treats the preferred stock dividend as a contractual obligation, not only to be paid as a fixed amount, but also to be paid as scheduled.* Although failure to pay preferred dividends cannot force the firm into bankruptcy, it increases the common stockholders' risk because they cannot be paid dividends until the claims of preferred stockholders are satisfied.

TABLE 12.6 The EPS for Various EBIT Levels[a]

	Case 2		Case 1
	−40%		+40%
EBIT	$6,000	$10,000	$14,000
Less: Interest (I)	2,000	2,000	2,000
Net profits before taxes	$4,000	$ 8,000	$12,000
Less: Taxes ($T = 0.40$)	1,600	3,200	4,800
Net profits after taxes	$2,400	$ 4,800	$ 7,200
Less: Preferred stock dividends (PD)	2,400	2,400	2,400
Earnings available for common (EAC)	$ 0	$ 2,400	$ 4,800
Earnings per share (EPS)	$\frac{\$0}{1{,}000} = \$0$	$\frac{\$2{,}400}{1{,}000} = \$2.40$	$\frac{\$4{,}800}{1{,}000} = \$4.80$
	−100%		+100%

[a]As noted in Chapter 1, for accounting and tax purposes, interest is a *tax-deductible expense,* whereas dividends must be paid from after-tax cash flows.

Case 1 A 40% *increase* in EBIT (from $10,000 to $14,000) results in a 100% *increase* in earnings per share (from $2.40 to $4.80).

Case 2 A 40% *decrease* in EBIT (from $10,000 to $6,000) results in a 100% *decrease* in earnings per share (from $2.40 to $0).

The effect of financial leverage is such that an increase in the firm's EBIT results in a more-than-proportional increase in the firm's earnings per share, whereas a decrease in the firm's EBIT results in a more-than-proportional decrease in EPS.

Measuring the Degree of Financial Leverage (DFL)

degree of financial leverage (DFL)
The numerical measure of the firm's financial leverage.

The **degree of financial leverage (DFL)** is the numerical measure of the firm's financial leverage. Computing it is much like computing the degree of operating leverage. The following equation presents one approach for obtaining the DFL.[9]

$$\text{DFL} = \frac{\text{Percentage change in EPS}}{\text{Percentage change in EBIT}} \qquad (12.6)$$

Whenever the percentage change in EPS resulting from a given percentage change in EBIT is greater than the percentage change in EBIT, financial leverage exists. This means that whenever DFL is greater than 1, there is financial leverage.

9. This approach is valid only when the same base level of EBIT is used to calculate and compare these values. In other words, *the base level of EBIT must be held constant to compare the financial leverage associated with different levels of fixed financial costs.*

EXAMPLE Applying Equation 12.6 to cases 1 and 2 in Table 12.6 yields

$$\textbf{Case 1:} \quad \frac{+100\%}{+40\%} = 2.5$$

$$\textbf{Case 2:} \quad \frac{-100\%}{-40\%} = 2.5$$

In both cases, the quotient is greater than 1, so financial leverage exists. The higher this value, the greater the degree of financial leverage.

A more direct formula for calculating the degree of financial leverage at a base level of EBIT is given by Equation 12.7, where the notation from Table 12.6 is used.[10] Note that in the denominator, the term $1/(1-T)$ converts the after-tax preferred stock dividend to a before-tax amount for consistency with the other terms in the equation.

$$\text{DFL at base level EBIT} = \frac{\text{EBIT}}{\text{EBIT} - I - \left(PD \times \frac{1}{1-T}\right)} \qquad (12.7)$$

EXAMPLE Substituting EBIT = \$10,000, $I = \$2{,}000$, $PD = \$2{,}400$, and the tax rate ($T = 0.40$) into Equation 12.7 yields the following result:

$$\text{DFL at \$10,000 EBIT} = \frac{\$10{,}000}{\$10{,}000 - \$2{,}000 - \left(\$2{,}400 \times \frac{1}{1-0.40}\right)}$$

$$= \frac{\$10{,}000}{\$4{,}000} = 2.5$$

Note that the formula given in Equation 12.7 provides a more direct method for calculating the degree of financial leverage than the approach illustrated using Table 12.6 and Equation 12.6.

Total Leverage

total leverage
The potential use of *fixed costs, both operating and financial,* to magnify the effect of changes in sales on the firm's earnings per share.

We also can assess the combined effect of operating and financial leverage on the firm's risk by using a framework similar to that used to develop the individual concepts of leverage. This combined effect, or **total leverage,** can be defined as the potential use of *fixed costs, both operating and financial,* to magnify the effect of changes in sales on the firm's earnings per share. Total leverage can therefore be viewed as the *total impact of the fixed costs* in the firm's operating and financial structure.

EXAMPLE Cables Inc., a computer cable manufacturer, expects sales of 20,000 units at \$5 per unit in the coming year and must meet the following obligations: variable operating costs of \$2 per unit, fixed operating costs of \$10,000, interest of \$20,000, and preferred stock dividends of \$12,000. The firm is in the 40% tax bracket and has 5,000 shares of common stock outstanding. Table 12.7 presents

10. By using the formula for DFL in Equation 12.7, it is possible to get a negative value for the DFL if the EPS for the base level of EBIT is negative. Rather than show absolute value signs in the equation, we instead assume that the base-level EPS is positive.

TABLE 12.7 The Total Leverage Effect

	(+50%)	
Sales (in units)	20,000	30,000
Sales revenue[a]	\$100,000	\$150,000
Less: Variable operating costs[b]	40,000	60,000
Less: Fixed operating costs	10,000	10,000
Earnings before interest and taxes (EBIT)	\$ 50,000	\$ 80,000
	(+60%)	
Less: Interest	20,000	20,000
Net profits before taxes	\$ 30,000	\$ 60,000
Less: Taxes ($T = 0.40$)	12,000	24,000
Net profits after taxes	\$ 18,000	\$ 36,000
Less: Preferred stock dividends	12,000	12,000
Earnings available for common	\$ 6,000	\$ 24,000
Earnings per share (EPS)	$\frac{\$6,000}{5,000} = \$1.20$	$\frac{\$24,000}{5,000} = \$4.80$
	(+300%)	

$$\text{DOL} = \frac{+60\%}{+50\%} = 1.2$$

$$\text{DFL} = \frac{+300\%}{+60\%} = 5.0$$

$$\text{DTL} = \frac{+300\%}{+50\%} = 6.0$$

[a]Sales revenue = \$5/unit × sales in units.
[b]Variable operating costs = \$2/unit × sales in units.

the levels of earnings per share associated with the expected sales of 20,000 units and with sales of 30,000 units.

The table illustrates that as a result of a 50% increase in sales (from 20,000 to 30,000 units), the firm would experience a 300% increase in earnings per share (from \$1.20 to \$4.80). Although it is not shown in the table, a 50% decrease in sales would, conversely, result in a 300% decrease in earnings per share. The linear nature of the leverage relationship accounts for the fact that sales changes of equal magnitude in opposite directions result in EPS changes of equal magnitude in the corresponding direction. At this point, it should be clear that whenever a firm has fixed costs—operating or financial—in its structure, total leverage will exist.

Measuring the Degree of Total Leverage (DTL)

degree of total leverage (DTL)
The numerical measure of the firm's total leverage.

The **degree of total leverage** (DTL) is the numerical measure of the firm's total leverage. It can be computed much as operating and financial leverage are computed. The following equation presents one approach for measuring DTL:[11]

$$\text{DTL} = \frac{\text{Percentage change in EPS}}{\text{Percentage change in sales}} \tag{12.8}$$

11. This approach is valid only when the same base level of sales is used to calculate and compare these values. In other words, *the base level of sales must be held constant if we are to compare the total leverage associated with different levels of fixed costs.*

Whenever the percentage change in EPS resulting from a given percentage change in sales is greater than the percentage change in sales, total leverage exists. This means that as long as the DTL is greater than 1, there is total leverage.

EXAMPLE Applying Equation 12.8 to the data in Table 12.7 yields

$$\text{DTL} = \frac{+300\%}{+50\%} = 6.0$$

Because this result is greater than 1, total leverage exists. The higher the value, the greater the degree of total leverage.

A more direct formula for calculating the degree of total leverage at a given base level of sales, Q, is given by Equation 12.9,[12] which uses the same notation that was presented earlier:

$$\text{DTL at base sales level } Q = \frac{Q \times (P - VC)}{Q \times (P - VC) - FC - I - \left(PD \times \frac{1}{1-T}\right)} \quad (12.9)$$

EXAMPLE Substituting $Q = 20{,}000$, $P = \$5$, $VC = \$2$, $FC = \$10{,}000$, $I = \$20{,}000$, $PD = \$12{,}000$, and the tax rate ($T = 0.40$) into Equation 12.9 yields

DTL at 20,000 units

$$= \frac{20{,}000 \times (\$5 - \$2)}{20{,}000 \times (\$5 - \$2) - \$10{,}000 - \$20{,}000 - \left(\$12{,}000 \times \frac{1}{1-0.40}\right)}$$

$$= \frac{\$60{,}000}{\$10{,}000} = 6.0$$

Clearly, the formula used in Equation 12.9 provides a more direct method for calculating the degree of total leverage than the approach illustrated using Table 12.7 and Equation 12.8.

The Relationship of Operating, Financial, and Total Leverage

Total leverage reflects the *combined impact* of operating and financial leverage on the firm. High operating leverage and high financial leverage will cause total leverage to be high. The opposite will also be true. The relationship between operating leverage and financial leverage is *multiplicative* rather than *additive*. The relationship between the degree of total leverage (DTL) and the degrees of operating leverage (DOL) and financial leverage (DFL) is given by Equation 12.10.

$$\text{DTL} = \text{DOL} \times \text{DFL} \quad (12.10)$$

12. By using the formula for DTL in Equation 12.9, it is possible to get a negative value for the DTL if the EPS for the base level of sales is negative. For our purposes, rather than show absolute value signs in the equation, we instead assume that the base-level EPS is positive.

EXAMPLE

Substituting the values calculated for DOL and DFL, shown on the right-hand side of Table 12.7, into Equation 12.10 yields

$$\text{DTL} = 1.2 \times 5.0 = 6.0$$

The resulting degree of total leverage is the same value that we calculated directly in the preceding examples.

Review Questions

12–1 What is meant by the term *leverage?* How are operating leverage, financial leverage, and total leverage related to the income statement?

12–2 What is the *operating breakeven point?* How do changes in fixed operating costs, the sale price per unit, and the variable operating cost per unit affect it?

12–3 What is *operating leverage?* What causes it? How is the *degree of operating leverage (DOL)* measured?

12–4 What is *financial leverage?* What causes it? How is the *degree of financial leverage (DFL)* measured?

12–5 What is the general relationship among operating leverage, financial leverage, and the total leverage of the firm? Do these types of leverage complement each other? Why or why not?

LG3 LG4 12.2 The Firm's Capital Structure

Capital structure is one of the most complex areas of financial decision making because of its interrelationship with other financial decision variables.[13] Poor capital structure decisions can result in a high cost of capital, thereby lowering the NPVs of projects and making more of them unacceptable. Effective capital structure decisions can lower the cost of capital, resulting in higher NPVs and more acceptable projects—and thereby increasing the value of the firm. This section links together many of the concepts presented in Chapters 4, 5, 6, 7, and 11 and the discussion of leverage in this chapter.

Types of Capital

All of the items on the right-hand side of the firm's balance sheet, excluding current liabilities, are sources of capital. The following simplified balance sheet illustrates the basic breakdown of total capital into its two components, *debt capital* and *equity capital.*

13. Of course, although capital structure is financially important, it, like many business decisions, is generally not so important as the firm's products or services. In a practical sense, a firm can probably more readily increase its value by improving quality and reducing costs than by fine-tuning its capital structure.

Balance Sheet			
Assets	Current liabilities		
	Long-term debt	**Debt capital**	**Total capital**
	Stockholders' equity Preferred stock Common stock equity Common stock Retained earnings	**Equity capital**	

The various types and characteristics of *corporate bonds,* a major source of *debt capital,* were discussed in detail in Chapter 6. The cost of debt is lower than the cost of other forms of financing. Lenders demand relatively lower returns because they take the least risk of any long-term contributors of capital: (1) They have a higher priority of claim against any earnings or assets available for payment. (2) They can exert far greater legal pressure against the company to make payment than can holders of preferred or common stock. (3) The tax deductibility of interest payments lowers the debt cost to the firm substantially.

Unlike debt capital, which must be repaid at some future date, *equity capital* is expected to remain in the firm for an indefinite period of time. The two basic sources of equity capital are (1) preferred stock and (2) common stock equity, which includes common stock and retained earnings. Common stock is typically the most expensive form of equity, followed by retained earnings and then preferred stock. Our concern here is the relationship between debt and equity capital. Key differences between these two types of capital, relative to voice in management, claims on income and assets, maturity, and tax treatment, were summarized in Chapter 7, Table 7.1. Because of its secondary position relative to debt, suppliers of equity capital take greater risk than suppliers of debt capital and therefore must be compensated with higher expected returns.

External Assessment of Capital Structure

We saw earlier that *financial leverage* results from the use of fixed-cost financing, such as debt and preferred stock, to magnify return and risk. The amount of leverage in the firm's capital structure can affect its value by affecting return and risk. Those outside the firm can make a rough assessment of capital structure by using measures found in the firm's financial statements. Some of these important debt ratios were presented in Chapter 2. For example, a direct measure of the degree of indebtedness is the *debt ratio*. The higher this ratio, the greater the relative amount of debt (or financial leverage) in the firm's capital structure. Measures of the firm's ability to meet contractual payments associated with debt include the *times interest earned ratio* and the *fixed-payment coverage ratio*. These ratios provide indirect information on financial leverage. Generally, the smaller these ratios, the greater the firm's financial leverage and the less able it is to meet payments as they come due.

TABLE 12.8 Debt Ratios for Selected Industries and Lines of Business (Fiscal Years Ended 4/1/00 Through 3/31/01)

Industry or line of business	Debt ratio	Times interest earned ratio
Manufacturing industries		
Books	65.2%	3.3
Dairy products	74.6	3.0
Electronic computers	55.4	3.4
Iron and steel forgings	62.7	2.3
Machine tools, metal cutting types	60.4	2.4
Wines & distilled alcoholic beverages	69.7	4.4
Women's, misses' & juniors' dresses	53.5	2.4
Wholesaling industries		
Furniture	69.4	3.0
General groceries	66.8	2.8
Men's and boys' clothing	60.8	2.6
Retailing industries		
Autos, new and used	76.1	1.4
Department stores	52.8	2.3
Restaurants	92.5	2.3
Service industries		
Accounting, auditing, bookkeeping	68.4	5.6
Advertising agencies	81.3	4.2
Auto repair—general	75.9	2.5
Insurance agents and brokers	94.1	4.1

Source: RMA Annual Statement Studies, 2001–2002 (fiscal years ended 4/1/00 through 3/31/01) (Philadelphia: Robert Morris Associates, 2001). Copyright © 2001 by Robert Morris Associates.

Note: Robert Morris Associates recommends that these ratios be regarded only as general guidelines and not as absolute industry norms. No claim is made as to the representativeness of these figures.

The level of debt (financial leverage) that is acceptable for one industry or line of business can be highly risky in another, because different industries and lines of business have different operating characteristics. Table 12.8 presents the debt and times interest earned ratios for selected industries and lines of business. Significant industry differences can be seen in these data. Differences in debt positions are also likely to exist *within* an industry or line of business.

Capital Structure of Non-U.S. Firms

In general, non-U.S. companies have much higher degrees of indebtedness than their U.S. counterparts. Most of the reasons for this are related to the fact that U.S. capital markets are much more developed than those elsewhere and have played a

In Practice

FOCUS ON PRACTICE Enron Plays Hide and Seek with Debt

Enron Corp.'s December 31, 2000, balance sheet showed long-term debt of $10. 2 billion and $300 million in other financial obligations. These figures gave the company a 41 percent ratio of total obligations to total capitalization. That didn't seem out of line for a company in the capital-intensive energy industry.

Yet as the company's financial condition fell apart in the fall of 2001, investors and lenders discovered that Enron's true debt load was far beyond what its balance sheet indicated. By selling assets to perfectly legal special-purpose entities (SPEs), Enron had moved billions of dollars of debt off its balance sheet into subsidiaries, trusts, partnerships, and other creative financing arrangements. Former CFO Andrew Fastow claimed that these complex arrangements were disclosed in footnotes and that Enron was not liable for repayment of the debts of these SPEs.

Enron's required filing of Form 10-Q with the SEC, on November 19, 2001, told a different story: If its debt were to fall below investment grade, Enron would have to repay those off-balance-sheet partnership obligations. Ironically, its disclosure of about $4 billion in off-balance-sheet liabilities triggered the downgrade of its debt to "junk" status and accelerated debt repayment. Enron's secrecy about its off-balance-sheet ventures led to its loss of credibility in the investment community. Its stock and bond prices slid downward; its market value plunged $35 billion in about a month; and on December 2, 2001, Enron became the largest U.S. company ever to have filed for bankruptcy.

Enron is not alone in its use of off-balance-sheet debt. Most airlines have large aircraft leases structured through off-balance-sheet vehicles, although analysts and investors are aware that the true leverage is higher. **Pacific Gas & Electric**, **Southern California Edison**, and **Xerox** have also run into problems from off-balance-sheet debt obligations. Don't expect the Enron debacle to eliminate special-purpose entities, although the SEC has been calling for tighter consolidation rules. Companies like the flexibility that off-balance-sheet financing sources provide, not to mention that such financing makes debt ratios and returns look better.

Sources: Peter Behr, "Cause of Death: Mistrust," *Washington Post* (December 13, 2001), p. E1; Ronald Fink, "What Andrew Fastow Knew," *CFO* (January 1, 2002); and David Henry, "Who Else Is Hiding Debt?" *Business Week* (January 28, 2002).

greater role in corporate financing than has been the case in other countries. In most European countries and especially in Japan and other Pacific Rim nations, large commercial banks are more actively involved in the financing of corporate activity than has been true in the United States. Furthermore, in many of these countries, banks are allowed to make large equity investments in nonfinancial corporations—a practice that is prohibited for U.S. banks. Finally, share ownership tends to be more tightly controlled among founding-family, institutional, and even public investors in Europe and Asia than it is for most large U.S. corporations. Tight ownership enables owners to understand the firm's financial condition better, resulting in their willingness to tolerate a higher degree of indebtedness.

On the other hand, similarities do exist between U.S. corporations and corporations in other countries. First, the same industry patterns of capital structure tend to be found all around the world. For example, in nearly all countries, pharmaceutical and other high-growth industrial firms tend to have lower debt ratios than do steel companies, airlines, and electric utility companies. Second, the capital structures of the largest U.S.-based multinational companies, which have access to many different capital markets around the world, typically resemble the capital structures of multinational companies from other countries more than they resemble those of smaller U.S. companies. Finally, the worldwide trend is away from reliance on banks for corporate financing and toward greater reliance on security issuance. Over time, the differences in the capital structures of U.S. and non-U.S. firms will probably lessen.

Capital Structure Theory

Scholarly research suggests that there is an optimal capital structure range. *It is not yet possible to provide financial managers with a specified methodology for use in determining a firm's optimal capital structure.* Nevertheless, financial theory does offer help in understanding how a firm's chosen financing mix affects the firm's value.

In 1958, Franco Modigliani and Merton H. Miller[14] (commonly known as "M and M") demonstrated algebraically that, assuming perfect markets,[15] the capital structure that a firm chooses does not affect its value. Many researchers, including M and M, have examined the effects of less restrictive assumptions on the relationship between capital structure and the firm's value. The result is a theoretical *optimal* capital structure based on balancing the benefits and costs of debt financing. The major benefit of debt financing is the tax shield, which allows interest payments to be deducted in calculating taxable income. The cost of debt financing results from (1) the increased probability of bankruptcy caused by debt obligations, (2) the *agency costs* of the lender's monitoring the firm's actions, and (3) the costs associated with managers having more information about the firm's prospects than do investors.

Tax Benefits

Allowing firms to deduct interest payments on debt when calculating taxable income reduces the amount of the firm's earnings paid in taxes, thereby making more earnings available for bondholders and stockholders. The deductibility of interest means the cost of debt, k_i, to the firm is subsidized by the government. Letting k_d equal the before-tax cost of debt and letting T equal the tax rate, from Chapter 11 (Equation 11.2), we have $k_i = k_d \times (1 - T)$.

Probability of Bankruptcy

The chance that a firm will become bankrupt because of an inability to meet its obligations as they come due depends largely on its level of both business risk and financial risk.

Business Risk In Chapter 11, we defined *business risk* as the risk to the firm of being unable to cover its operating costs. In general, the greater the firm's *operating leverage*—the use of fixed operating costs—the higher its business risk. Although operating leverage is an important factor affecting business risk, two

14. Franco Modigliani and Merton H. Miller, "The Cost of Capital, Corporation Finance, and the Theory of Investment," *American Economic Review* (June 1958), pp. 261–297.

15. Perfect-market assumptions include (1) no taxes, (2) no brokerage or flotation costs for securities, (3) symmetrical information—investors and managers have the same information about the firm's investment prospects, and (4) investor ability to borrow at the same rate as corporations.

other factors—revenue stability and cost stability—also affect it. *Revenue stability* reflects the relative variability of the firm's sales revenues. Firms with reasonably stable levels of demand and with products that have stable prices have stable revenues. The result is low levels of business risk. Firms with highly volatile product demand and prices have unstable revenues that result in high levels of business risk. *Cost stability* reflects the relative predictability of input prices such as those for labor and materials. The more predictable and stable these input prices are, the lower the business risk; the less predictable and stable they are, the higher the business risk.

Business risk varies among firms, regardless of their lines of business, and is not affected by capital structure decisions. The level of business risk must be taken as a "given." The higher a firm's business risk, the more cautious the firm must be in establishing its capital structure. Firms with high business risk therefore tend toward less highly leveraged capital structures, and firms with low business risk tend toward more highly leveraged capital structures. We will hold business risk constant throughout the discussions that follow.

EXAMPLE Cooke Company, a soft drink manufacturer, is preparing to make a capital structure decision. It has obtained estimates of sales and the associated levels of earnings before interest and taxes (EBIT) from its forecasting group: There is a 25% chance that sales will total \$400,000, a 50% chance that sales will total \$600,000, and a 25% chance that sales will total \$800,000. Fixed operating costs total \$200,000, and variable operating costs equal 50% of sales. These data are summarized, and the resulting EBIT calculated, in Table 12.9.

The table shows that there is a 25% chance that the EBIT will be \$0, a 50% chance that it will be \$100,000, and a 25% chance that it will be \$200,000. When developing the firm's capital structure, the financial manager must accept as given these levels of EBIT and their associated probabilities. These EBIT data effectively reflect a certain level of business risk that captures the firm's operating leverage, sales revenue variability, and cost predictability.

Hint The cash flows to investors from bonds are less risky than the dividends from preferred stock, which are less risky than dividends from common stock. Only with bonds is the issuer contractually obligated to pay the scheduled interest, and the amounts due to bondholders and preferred stockholders are usually fixed. Therefore, the required return for bonds is generally lower than that for preferred stock, which is lower than that for common stock.

Financial Risk The firm's capital structure directly affects its *financial risk*, which is the risk to the firm of being unable to cover required financial obligations. The penalty for not meeting financial obligations is bankruptcy. The more fixed-cost financing—debt (including financial leases) and preferred stock—a firm has in its capital structure, the greater its financial leverage and risk. Finan-

TABLE 12.9 Sales and Associated EBIT Calculations for Cooke Company (\$000)

Probability of sales	.25	.50	.25
Sales revenue	\$400	\$600	\$800
Less: Fixed operating costs	200	200	200
Less: Variable operating costs (50% of sales)	200	300	400
Earnings before interest and taxes (EBIT)	\$ 0	\$100	\$200

cial risk depends on the capital structure decision made by the management, and that decision is affected by the business risk the firm faces.

The *total risk* of a firm—business and financial risk combined—determines its probability of bankruptcy. Financial risk, its relationship to business risk, and their combined impact can be demonstrated by continuing the Cooke Company example.

EXAMPLE

Cooke Company's current capital structure is as follows:

Current capital structure	
Long-term debt	$ 0
Common stock equity (25,000 shares at $20)	500,000
Total capital (assets)	$500,000

Hint As you learned in Chapter 2, the debt ratio is equal to the amount of total debt divided by the total assets. The higher this ratio, the more financial leverage a firm is using.

Let us assume that the firm is considering seven alternative capital structures. If we measure these structures using the debt ratio, they are associated with ratios of 0, 10, 20, 30, 40, 50, and 60%. Assuming that (1) the firm has no current liabilities, (2) its capital structure currently contains all equity as shown, and (3) the total amount of capital remains constant[16] at $500,000, the mix of debt and equity associated with the seven debt ratios would be as shown in Table 12.10. Also

TABLE 12.10 Capital Structures Associated with Alternative Debt Ratios for Cooke Company

	Capital structure ($000)			
Debt ratio (1)	Total assets[a] (2)	Debt [(1) × (2)] (3)	Equity [(2) − (3)] (4)	Shares of common stock outstanding (000) [(4) ÷ $20][b] (5)
0%	$500	$ 0	$500	25.00
10	500	50	450	22.50
20	500	100	400	20.00
30	500	150	350	17.50
40	500	200	300	15.00
50	500	250	250	12.50
60	500	300	200	10.00

[a]Because the firm, for convenience, is assumed to have no current liabilities, its total assets equal its total capital of $500,000.

[b]The $20 value represents the book value per share of common stock equity noted earlier.

16. This assumption is needed so that we can assess alternative capital structures without having to consider the returns associated with the investment of additional funds raised. Attention here is given only to the *mix* of capital, not to its investment.

TABLE 12.11 Level of Debt, Interest Rate, and Dollar Amount of Annual Interest Associated with Cooke Company's Alternative Capital Structures

Capital structure debt ratio	Debt ($000) (1)	Interest rate on *all* debt (2)	Interest ($000) [(1) × (2)] (3)
0%	$ 0	0.0%	$ 0.00
10	50	9.0	4.50
20	100	9.5	9.50
30	150	10.0	15.00
40	200	11.0	22.00
50	250	13.5	33.75
60	300	16.5	49.50

shown in the table is the number of shares of common stock outstanding under each alternative.

Associated with each of the debt levels in column 3 of Table 12.10 would be an interest rate that would be expected to increase with increases in financial leverage. The level of debt, the associated interest rate (assumed to apply to *all* debt), and the dollar amount of annual interest associated with each of the alternative capital structures are summarized in Table 12.11. Because both the level of debt and the interest rate increase with increasing financial leverage (debt ratios), the annual interest increases as well.

Table 12.12 uses the levels of EBIT and associated probabilities developed in Table 12.9, the number of shares of common stock found in column 5 of Table 12.10, and the annual interest values calculated in column 3 of Table 12.11 to calculate the earnings per share (EPS) for debt ratios of 0, 30, and 60%. A 40% tax rate is assumed. Also shown are the resulting expected EPS, the standard deviation of EPS, and the coefficient of variation of EPS associated with each debt ratio.[17]

Table 12.13 summarizes the pertinent data for the seven alternative capital structures. The values shown for 0, 30, and 60% debt ratios were developed in Table 12.12, whereas calculations of similar values for the other debt ratios (10, 20, 40, and 50%) are not shown. Because the coefficient of variation measures the risk relative to the expected EPS, it is the preferred risk measure for use in comparing capital structures. As the firm's financial leverage increases, so does its coefficient of variation of EPS. As expected, an increasing level of risk is associated with increased levels of financial leverage.

The relative risks of the two extremes of the capital structures evaluated in Table 12.12 (debt ratios = 0% and 60%) can be illustrated by showing the prob-

17. For explanatory convenience, the coefficient of variation of EPS, which measures total (nondiversifiable and diversifiable) risk, is used throughout this chapter as a proxy for beta, which measures the relevant nondiversifiable risk.

TABLE 12.12 Calculation of EPS for Selected Debt Ratios ($000) for Cooke Company

Probability of EBIT	.25	.50	.25
Debt Ratio = 0%			
EBIT (Table 12.9)	$ 0.00	$100.00	$200.00
Less: Interest (Table 12.11)	0.00	0.00	0.00
Net profits before taxes	$ 0.00	$100.00	$200.00
Less: Taxes ($T = 0.40$)	0.00	40.00	80.00
Net profits after taxes	$ 0.00	$ 60.00	$120.00
EPS (25.0 shares, Table 12.10)	$ 0.00	$ 2.40	$ 4.80
Expected EPS[a]		$ 2.40	
Standard deviation of EPS[a]		$ 1.70	
Coefficient of variation of EPS[a]		0.71	
Debt Ratio = 30%			
EBIT (Table 12.9)	$ 0.00	$100.00	$200.00
Less: Interest (Table 12.11)	15.00	15.00	15.00
Net profits before taxes	($15.00)	$ 85.00	$185.00
Less: Taxes ($T = 0.40$)	(6.00)[b]	34.00	74.00
Net profits after taxes	($ 9.00)	$ 51.00	$111.00
EPS (17.50 shares, Table 12.10)	($ 0.51)	$ 2.91	$ 6.34
Expected EPS[a]		$ 2.91	
Standard deviation of EPS[a]		$ 2.42	
Coefficient of variation of EPS[a]		0.83	
Debt Ratio = 60%			
EBIT (Table 12.9)	$ 0.00	$100.00	$200.00
Less: Interest (Table 12.11)	49.50	49.50	49.50
Net profits before taxes	($49.50)	$ 50.50	$150.50
Less: Taxes ($T = 0.40$)	(19.80)[b]	20.20	60.20
Net profits after taxes	($29.70)	$ 30.30	$ 90.30
EPS (10.00 shares, Table 12.10)	($ 2.97)	$ 3.03	$ 9.03
Expected EPS[a]		$ 3.03	
Standard deviation of EPS[a]		$ 4.24	
Coefficient of variation of EPS[a]		1.40	

[a] The procedures used to calculate the expected value, standard deviation, and coefficient of variation were presented in Equations 5.2, 5.3, and 5.4, respectively, in Chapter 5.

[b] It is assumed that the firm receives the tax benefit from its loss in the current period as a result of applying the tax loss carryback procedures specified in the tax law (see Chapter 1).

TABLE 12.13 Expected EPS, Standard Deviation, and Coefficient of Variation for Alternative Capital Structures for Cooke Company

Capital structure debt ratio	Expected EPS (1)	Standard deviation of EPS (2)	Coefficient of variation of EPS [(2) ÷ (1)] (3)
0%	$2.40	$1.70	0.71
10	2.55	1.88	0.74
20	2.72	2.13	0.78
30	2.91	2.42	0.83
40	3.12	2.83	0.91
50	3.18	3.39	1.07
60	3.03	4.24	1.40

ability distribution of EPS associated with each of them. Figure 12.3 shows these two distributions. The expected level of EPS increases with increasing financial leverage, and so does risk, as reflected in the relative dispersion of each of the distributions. Clearly, the uncertainty of the expected EPS, as well as the chance of experiencing negative EPS, is greater when higher degrees of financial leverage are employed.

Further, the nature of the risk–return tradeoff associated with the seven capital structures under consideration can be clearly observed by plotting the

FIGURE 12.3

Probability Distributions
Probability distributions of EPS for debt ratios of 0% and 60% for Cooke Company

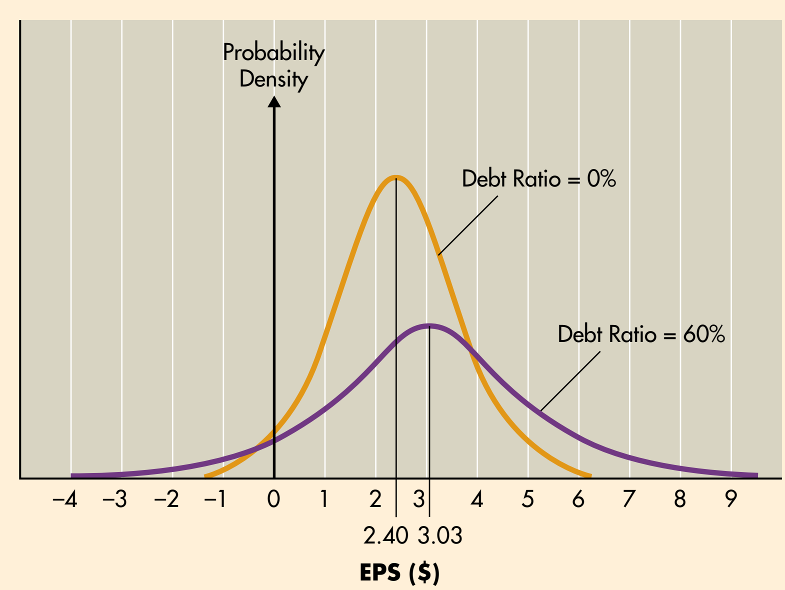
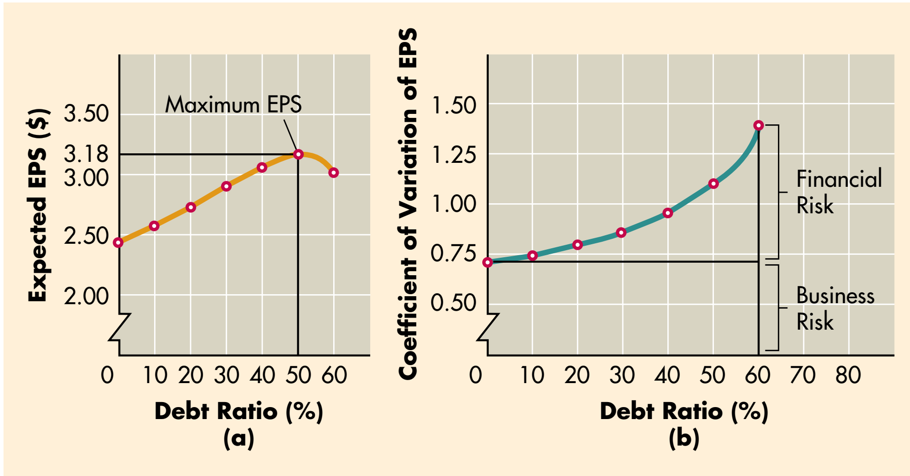


FIGURE 12.4

Expected EPS and Coefficient of Variation of EPS

Expected EPS and coefficient of variation of EPS for alternative capital structures for Cooke Company



expected EPS and coefficient of variation relative to the debt ratio. Plotting the data from Table 12.13 results in Figure 12.4. The figure shows that as debt is substituted for equity (as the debt ratio increases), the level of EPS rises and then begins to fall (graph **a**). The graph demonstrates that the peak earnings per share occurs at a debt ratio of 50%. The decline in earnings per share beyond that ratio results from the fact that the significant increases in interest are not fully offset by the reduction in the number of shares of common stock outstanding.

If we look at the risk behavior as measured by the coefficient of variation (graph **b**), we can see that risk increases with increasing leverage. A portion of the risk can be attributed to business risk, but the portion that changes in response to increasing financial leverage would be attributed to financial risk.

Clearly, a risk–return tradeoff exists relative to the use of financial leverage. How to combine these risk–return factors into a valuation framework will be addressed later in the chapter. The key point to recognize here is that as a firm introduces more leverage into its capital structure, it will experience increases in both the expected level of return and the associated risk.

Agency Costs Imposed by Lenders

As noted in Chapter 1, the managers of firms typically act as *agents* of the owners (stockholders). The owners give the managers the authority to manage the firm for the owners' benefit. The *agency problem* created by this relationship extends not only to the relationship between owners and managers but also to the relationship between owners and lenders.

When a lender provides funds to a firm, the interest rate charged is based on the lender's assessment of the firm's risk. The lender–borrower relationship, therefore, depends on the lender's expectations for the firm's subsequent behavior. The borrowing rates are, in effect, locked in when the loans are negotiated. After obtaining a loan at a certain rate, the firm could increase its risk by investing in risky projects or by incurring additional debt. Such action could weaken the lender's position in terms of its claim on the cash flow of the firm. From another point of view, if these risky investment strategies paid off, the stockholders would benefit. Because payment obligations to the lender remain unchanged, the excess cash flows generated by a positive outcome from the riskier action would enhance the value of the firm to its owners. In other words, if the risky investments pay off, the owners receive all the benefits; but if the risky investments do not pay off, the lenders share in the costs.

Clearly, an incentive exists for the managers acting on behalf of the stockholders to "take advantage" of lenders. To avoid this situation, lenders impose certain monitoring techniques on borrowers, who as a result incur *agency costs*. The most obvious strategy is to deny subsequent loan requests or to increase the cost of future loans to the firm. Because this strategy is an after-the-fact approach, other controls must be included in the loan agreement. Lenders typically protect themselves by including provisions that limit the firm's ability to alter significantly its business and financial risk. These loan provisions tend to center on issues such as the minimum level of liquidity, asset acquisitions, executive salaries, and dividend payments.

Hint Typical loan provisions included in corporate bonds are discussed in Chapter 6.

By including appropriate provisions in the loan agreement, the lender can control the firm's risk and thus protect itself against the adverse consequences of this agency problem. Of course, in exchange for incurring agency costs by agreeing to the operating and financial constraints placed on it by the loan provisions, the firm should benefit by obtaining funds at a lower cost.

Asymmetric Information

pecking order
A hierarchy of financing that begins with retained earnings, which is followed by debt financing and finally external equity financing.

Two surveys examined capital structure decisions.[18] Financial executives were asked which of two major criteria determined their financing decisions: (1) maintaining a *target capital structure* or (2) following a hierarchy of financing. This hierarchy, called a **pecking order,** begins with retained earnings, which is followed by debt financing and finally external equity financing. Respondents from 31 percent of Fortune 500 firms and from 11 percent of the (smaller) 500 largest over-the-counter firms answered target capital structure. Respondents from 69 percent of the Fortune 500 firms and 89 percent of the 500 largest OTC firms chose the pecking order.

asymmetric information
The situation in which managers of a firm have more information about operations and future prospects than do investors.

At first glance, on the basis of financial theory, this choice appears to be inconsistent with wealth maximization goals, but Stewart Myers has explained how "asymmetric information" could account for the pecking order financing preferences of financial managers.[19] **Asymmetric information** results when managers of a firm have more information about operations and future prospects than do investors. Assuming that managers make decisions with the goal of maximizing the wealth of existing stockholders, then asymmetric information can affect the capital structure decisions that managers make.

18. The results of the survey of Fortune 500 firms are reported in J. Michael Pinegar and Lisa Wilbricht, "What Managers Think of Capital Structure Theory: A Survey," *Financial Management* (Winter 1989), pp. 82–91, and the results of a similar survey of the 500 largest OTC firms are reported in Linda C. Hittle, Kamal Haddad, and Lawrence J. Gitman, "Over-the-Counter Firms, Asymmetric Information, and Financing Preferences," *Review of Financial Economics* (Fall 1992), pp. 81–92.

19. Stewart C. Myers, "The Capital Structure Puzzle," *Journal of Finance* (July 1984), pp. 575–592.

Suppose, for example, that management has found a valuable investment that will require additional financing. Management believes that the prospects for the firm's future are very good and that the market, as indicated by the firm's current stock price, does not fully appreciate the firm's value. In this case, it would be advantageous to current stockholders if management raised the required funds using debt rather than issuing new stock. Using debt to raise funds is frequently viewed as a **signal** that reflects management's view of the firm's stock value. Debt financing is a *positive signal* suggesting that management believes that the stock is "undervalued" and therefore a bargain. When the firm's positive future outlook becomes known to the market, the increased value will be fully captured by existing owners, rather than having to be shared with new stockholders.

signal
A financing action by management that is believed to reflect its view of the firm's stock value; generally, debt financing is viewed as a *positive signal* that management believes the stock is "undervalued," and a stock issue is viewed as a *negative signal* that management believes the stock is "overvalued."

If, however, the outlook for the firm is poor, management may believe that the firm's stock is "overvalued." In that case, it would be in the best interest of existing stockholders for the firm to issue new stock. Therefore, investors often interpret the announcement of a stock issue as a *negative signal*—bad news concerning the firm's prospects—and the stock price declines. This decrease in stock value, along with high underwriting costs for stock issues (compared to debt issues), make new stock financing very expensive. When the negative future outlook becomes known to the market, the decreased value is shared with new stockholders, rather than being fully captured by existing owners.

Because conditions of asymmetric information exist from time to time, firms should maintain some reserve borrowing capacity by keeping debt levels low. This reserve allows the firm to take advantage of good investment opportunities without having to sell stock at a low value and thus send signals that unduly influence the stock price.

The Optimal Capital Structure

What, then, *is* an optimal capital structure, even if it exists (so far) only in theory? To provide some insight into an answer, we will examine some basic financial relationships. It is generally believed that *the value of the firm is maximized when the cost of capital is minimized*. By using a modification of the simple zero-growth valuation model (see Equation 7.3 in Chapter 7), we can define the value of the firm, V, by Equation 12.11.

$$V = \frac{\text{EBIT} \times (1 - T)}{k_a} \tag{12.11}$$

where

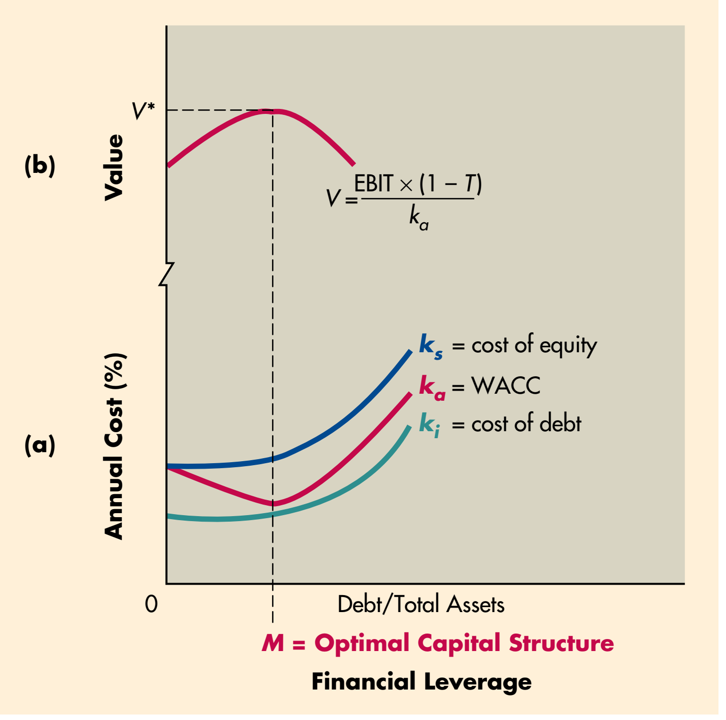
EBIT = earnings before interest and taxes
T = tax rate
EBIT $\times (1 - T)$ = the after-tax operating earnings available to the debt and equity holders
k_a = weighted average cost of capital

Clearly, if we assume that EBIT is constant, the value of the firm, V, is maximized by minimizing the weighted average cost of capital, k_a.

FIGURE 12.5

Cost Functions and Value

Capital costs and the optimal capital structure



Cost Functions

Figure 12.5(*a*) plots three cost functions—the cost of debt, the cost of equity, and the weighted average cost of capital (WACC)—as a function of financial leverage measured by the debt ratio (debt to total assets). The *cost of debt,* k_i, remains low because of the tax shield, but it slowly increases as leverage increases, to compensate lenders for increasing risk. The *cost of equity,* k_s, is above the cost of debt. It increases as financial leverage increases, but it generally increases more rapidly than the cost of debt. The cost of equity rises because the stockholders require a higher return as leverage increases, to compensate for the higher degree of financial risk.

The *weighted average cost of capital* (*WACC*) results from a weighted average of the firm's debt and equity capital costs. At a debt ratio of zero, the firm is 100 percent equity-financed. As debt is substituted for equity and as the debt ratio increases, the WACC declines because the debt cost is less than the equity cost ($k_i < k_s$). As the debt ratio continues to increase, the increased debt and equity costs eventually cause the WACC to rise (after point *M* in Figure 12.5(*a*)). This behavior results in a U-shaped, or saucer-shaped, weighted average cost-of-capital function, k_a.

A Graphical View of the Optimal Structure

optimal capital structure
The capital structure at which the weighted average cost of capital is minimized, thereby maximizing the firm's value.

Because the maximization of value, *V*, is achieved when the overall cost of capital, k_a, is at a minimum (see Equation 12.11), the **optimal capital structure** is that at which the weighted average cost of capital, k_a, is minimized. In Figure 12.5(*a*), point *M* represents the *minimum weighted average cost of capital*—the point of optimal financial leverage and hence of optimal capital structure for the firm. Figure 12.5(*b*) plots the value of the firm that results from substitution of k_a in Figure 12.5(*a*) for various levels of financial leverage into the zero-growth valuation model in Equation 12.11. As shown in Figure 12.5(*b*), at the optimal capital structure, point *M*, the value of the firm is maximized at V^*.

Generally, the lower the firm's weighted average cost of capital, the greater the difference between the return on a project and the WACC, and therefore the greater the owners' return. Simply stated, minimizing the weighted average cost of capital allows management to undertake a larger number of profitable projects, thereby further increasing the value of the firm.

As a practical matter, there is no way to calculate the optimal capital structure implied by Figure 12.5. Because it is impossible either to know or to remain at the precise optimal capital structure, firms generally try to operate in a *range* that places them near what they believe to be the optimal capital structure.

Review Questions

12–6 What is a firm's *capital structure?* What ratios assess the degree of financial leverage in a firm's capital structure?

12–7 In what ways are the capital structures of U.S. and non-U.S. firms different? How are they similar?

12–8 What is the major benefit of debt financing? How does it affect the firm's cost of debt?

12–9 What are *business risk* and *financial risk?* How does each of them influence the firm's capital structure decisions?

12–10 Briefly describe the *agency problem* that exists between owners and lenders. How do lenders cause firms to incur *agency costs* to resolve this problem?

12–11 How does *asymmetric information* affect the firm's capital structure decisions? How do the firm's financing actions give investors *signals* that reflect management's view of stock value?

12–12 How do the cost of debt, the cost of equity, and the weighted average cost of capital (WACC) behave as the firm's financial leverage increases from zero? Where is the optimal capital structure? What is its relationship to the firm's value at that point?

LG5 12.3 The EBIT–EPS Approach to Capital Structure

EBIT–EPS approach
An approach for selecting the capital structure that maximizes earnings per share (EPS) over the expected range of earnings before interest and taxes (EBIT).

One of the key variables affecting the market value of the firm's shares is its return to owners, as reflected by the firm's earnings. Therefore, earnings per share (EPS) can be conveniently used to analyze alternative capital structures. The **EBIT–EPS approach** to capital structure involves selecting the capital structure that maximizes EPS over the expected range of earnings before interest and taxes (EBIT).

Presenting a Financing Plan Graphically

To analyze the effects of a firm's capital structure on the owners' returns, we consider the relationship between earnings before interest and taxes (EBIT) and earnings per share (EPS). A constant level of EBIT—constant *business risk*—is assumed, to isolate the effect on returns of the financing costs associated with alternative capital structures. EPS is used to measure the owners' returns, which are expected to be closely related to share price.[20]

The Data Required

To graph a financing plan, we need to know at least two EBIT–EPS coordinates. The approach for obtaining coordinates can be illustrated by an example.

EXAMPLE

EBIT–EPS coordinates can be found by assuming specific EBIT values and calculating the EPS associated with them.[21] Such calculations for three capital structures—debt ratios of 0, 30, and 60%—for Cooke Company were presented in Table 12.12. For EBIT values of $100,000 and $200,000, the associated EPS values calculated there are summarized in the table within Figure 12.6.

Plotting the Data

financial breakeven point
The level of EBIT necessary to just cover all *fixed financial costs;* the level of EBIT for which EPS = $0.

The Cooke Company data can be plotted on a set of EBIT–EPS axes, as shown in Figure 12.6. The figure shows the level of EPS expected for each level of EBIT. For levels of EBIT below the *x*-axis intercept, a loss (negative EPS) results. Each of the *x*-axis intercepts is a **financial breakeven point,** the level of EBIT necessary to just cover all *fixed financial costs* (EPS = $0).

Comparing Alternative Capital Structures

We can compare alternative capital structures by graphing financing plans as shown in Figure 12.6.

EXAMPLE

Cooke Company's capital structure alternatives were plotted on the EBIT–EPS axes in Figure 12.6. This figure shows that each capital structure is superior to the others in terms of maximizing EPS over certain ranges of EBIT. The zero-leverage capital structure (debt ratio = 0%) is superior to either of the other capi-

20. The relationship that is expected to exist between EPS and owner wealth is not one of cause and effect. As indicated in Chapter 1, the maximization of profits does not necessarily ensure that owners' wealth is also being maximized. Nevertheless, it is expected that the movement of earnings per share will have some effect on owners' wealth, because EPS data constitute one of the few pieces of information investors receive, and they often bid the firm's share price up or down in response to the level of these earnings.

21. A convenient method for finding one EBIT–EPS coordinate is to calculate the *financial breakeven point,* the level of EBIT for which the firm's EPS just equals $0. It is the level of EBIT needed just to cover all fixed financial costs—annual interest (I) and preferred stock dividends (PD). The equation for the financial breakeven point is

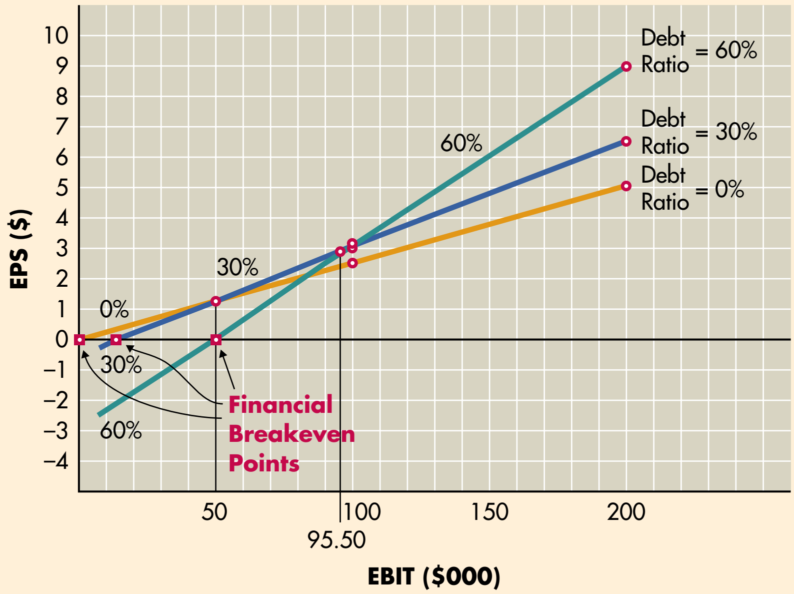
$$\text{Financial breakeven point} = I + \frac{PD}{1 - T}$$

where T is the tax rate. It can be seen that when $PD = \$0$, the financial breakeven point is equal to I, the annual interest payment.

FIGURE 12.6

EBIT–EPS Approach

A comparison of selected capital structures for Cooke Company (data from Table 12.12)



Capital structure debt ratio	EBIT $100,000	$200,000
	Earnings per share (EPS)	
0%	$2.40	$4.80
30	2.91	6.34
60	3.03	9.03

tal structures for levels of EBIT between $0 and $50,000. Between $50,000 and $95,500 of EBIT, the capital structure associated with a debt ratio of 30% is preferred. And at a level of EBIT above $95,500, the 60% debt ratio capital structure provides the highest earnings per share.[22]

22. An algebraic technique can be used to find the *indifference points* between the capital structure alternatives. This technique involves expressing each capital structure as an equation stated in terms of earnings per share, setting the equations for two capital structures equal to each other, and solving for the level of EBIT that causes the equations to be equal. When we use the notation from footnote 21 and let n equal the number of shares of common stock outstanding, the general equation for the earnings per share from a financing plan is

$$\text{EPS} = \frac{(1-T)\times(\text{EBIT}-I)-PD}{n}$$

Comparing Cooke Company's 0% and 30% capital structures, we get

$$\frac{(1-0.40)\times(\text{EBIT}-\$0)-\$0}{25.00} = \frac{(1-0.40)\times(\text{EBIT}-\$15.00)-\$0}{17.50}$$

$$\frac{0.60\times\text{EBIT}}{25.00} = \frac{0.60\times\text{EBIT}-\$9.00}{17.50}$$

$$10.50\times\text{EBIT} = 15.00\times\text{EBIT}-\$225.00$$

$$\$225.00 = 4.50\times\text{EBIT}$$

$$\text{EBIT} = \$50$$

The calculated value of the indifference point between the 0% and 30% capital structures is therefore $50,000, as can be seen in Figure 12.6.

Considering Risk in EBIT–EPS Analysis

When interpreting EBIT–EPS analysis, it is important to consider the risk of each capital structure alternative. Graphically, the risk of each capital structure can be viewed in light of two measures: (1) the *financial breakeven point* (EBIT-axis intercept) and (2) the *degree of financial leverage* reflected in the slope of the capital structure line: *The higher the financial breakeven point and the steeper the slope of the capital structure line, the greater the financial risk.*[23]

Further assessment of risk can be performed by using ratios. As financial leverage (measured by the debt ratio) increases, we expect a corresponding decline in the firm's ability to make scheduled interest payments (measured by the times interest earned ratio).

EXAMPLE Reviewing the three capital structures plotted for Cooke Company in Figure 12.6, we can see that as the debt ratio increases, so does the financial risk of each alternative. Both the financial breakeven point and the slope of the capital structure lines increase with increasing debt ratios. If we use the $100,000 EBIT value, for example, the times interest earned ratio (EBIT ÷ interest) for the zero-leverage capital structure is infinity ($100,000 ÷ $0); for the 30% debt case, it is 6.67 ($100,000 ÷ $15,000); and for the 60% debt case, it is 2.02 ($100,000 ÷ $49,500). Because lower times interest earned ratios reflect higher risk, these ratios support the conclusion that the risk of the capital structures increases with increasing financial leverage. The capital structure for a debt ratio of 60% is riskier than that for a debt ratio of 30%, which in turn is riskier than the capital structure for a debt ratio of 0%.

The Basic Shortcoming of EBIT–EPS Analysis

The most important point to recognize when using EBIT–EPS analysis is that this technique tends to concentrate on *maximizing earnings* rather than maximizing owner wealth. The use of an EPS-maximizing approach generally ignores risk. If investors did not require risk premiums (additional returns) as the firm increased the proportion of debt in its capital structure, a strategy involving maximizing EPS would also maximize owner wealth. But because risk premiums increase with increases in financial leverage, the maximization of EPS *does not* ensure owner wealth maximization. To select the best capital structure, both return (EPS) and risk (via the required return, k_s) must be integrated into a valuation framework consistent with the capital structure theory presented earlier.

Review Question

12–13 Explain the *EBIT–EPS approach* to capital structure. Include in your explanation a graph indicating the *financial breakeven point;* label the axes. Is this approach consistent with maximization of the owners' wealth?

23. The degree of financial leverage (DFL) is reflected in the slope of the EBIT–EPS function. The steeper the slope, the greater the degree of financial leverage, because the change in EPS (y axis) that results from a given change in EBIT (x axis) increases with increasing slope and decreases with decreasing slope.

LG6 12.4 Choosing the Optimal Capital Structure

A wealth maximization framework for use in making capital structure decisions should include the two key factors of return and risk. This section describes the procedures for linking to market value the return and risk associated with alternative capital structures.

Linkage

To determine the firm's value under alternative capital structures, the firm must find the level of return that must be earned to compensate owners for the risk being incurred. Such a framework is consistent with the overall valuation framework developed in Chapters 6 and 7 and applied to capital budgeting decisions in Chapters 9 and 10.

The required return associated with a given level of financial risk can be estimated in a number of ways. Theoretically, the preferred approach would be first to estimate the beta associated with each alternative capital structure and then to use the CAPM framework presented in Equation 5.8 to calculate the required return, k_s. A more operational approach involves linking the financial risk associated with each capital structure alternative directly to the required return. Such an approach is similar to the CAPM-type approach demonstrated in Chapter 10 for linking project risk and required return (RADR). Here it involves estimating the required return associated with each level of financial risk, as measured by a statistic such as the coefficient of variation of EPS. Regardless of the approach used, one would expect the required return to increase as the financial risk increases.

EXAMPLE Cooke Company, using as risk measures the coefficients of variation of EPS associated with each of the seven alternative capital structures, estimated the associated required returns. These are shown in Table 12.14. As expected, the estimated

TABLE 12.14 Required Returns for Cooke Company's Alternative Capital Structures

Capital structure debt ratio	Coefficient of variation of EPS (from column 3 of Table 12.13) (1)	Estimated required return, k_s (2)
0%	0.71	11.5%
10	0.74	11.7
20	0.78	12.1
30	0.83	12.5
40	0.91	14.0
50	1.07	16.5
60	1.40	19.0

required return of owners, k_s, increases with increasing risk, as measured by the coefficient of variation of EPS.

Estimating Value

The value of the firm associated with alternative capital structures can be estimated by using one of the standard valuation models. If, for simplicity, we assume that all earnings are paid out as dividends, we can use a zero-growth valuation model such as that developed in Chapter 7. The model, originally stated in Equation 7.3, is restated here with EPS substituted for dividends (because in each year the dividends would equal EPS):

$$P_0 = \frac{\text{EPS}}{k_s} \tag{12.12}$$

By substituting the expected level of EPS and the associated required return, k_s, into Equation 12.12, we can estimate the per-share value of the firm, P_0.

EXAMPLE We can now estimate the value of Cooke Company's stock under each of the alternative capital structures. Substituting the expected EPS (column 1 of Table 12.13) and the required returns, k_s (column 2 of Table 12.14), into Equation 12.12 for each of the capital structures, we obtain the share values given in column 3 of Table 12.15. Plotting the resulting share values against the associated debt ratios, as shown in Figure 12.7, clearly illustrates that the maximum share value occurs at the capital structure associated with a debt ratio of 30%.

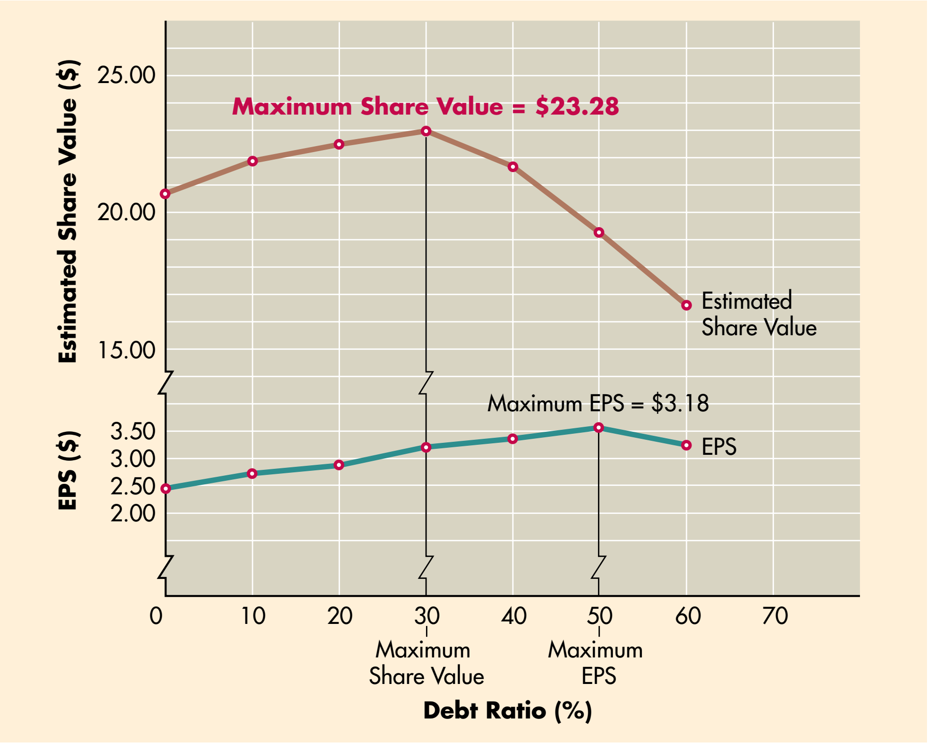
TABLE 12.15 Calculation of Share Value Estimates Associated with Alternative Capital Structures for Cooke Company

Capital structure debt ratio	Expected EPS (from column 1 of Table 12.13) (1)	Estimated required return, k_s (from column 2 of Table 12.14) (2)	Estimated share value [(1) ÷ (2)] (3)
0%	$2.40	.115	$20.87
10	2.55	.117	21.79
20	2.72	.121	22.48
30	2.91	.125	23.28
40	3.12	.140	22.29
50	3.18	.165	19.27
60	3.03	.190	15.95

FIGURE 12.7

Estimating Value

Estimated share value and EPS for alternative capital structures for Cooke Company



Maximizing Value versus Maximizing EPS

Throughout this text, the goal of the financial manager has been specified as maximizing owner wealth, not profit. Although there is some relationship between expected profit and value, there is no reason to believe that profit-maximizing strategies necessarily result in wealth maximization. It is therefore the wealth of the owners as reflected in the estimated share value that should serve as the criterion for selecting the best capital structure. A final look at Cooke Company will highlight this point.

EXAMPLE

Further analysis of Figure 12.7 clearly shows that although the firm's profits (EPS) are maximized at a debt ratio of 50%, share value is maximized at a 30% debt ratio. Therefore, the preferred capital structure would be the 30% debt ratio. The two approaches provide different conclusions because EPS maximization does not consider risk.

Some Other Important Considerations

Because there is really no practical way to calculate the optimal capital structure, any quantitative analysis of capital structure must be tempered with other important considerations. Some of the more important additional factors involved in capital structure decisions are summarized in Table 12.16.

TABLE 12.16 Important Factors to Consider in Making Capital Structure Decisions

Concern	Factor	Description
Business risk	Revenue stability	Firms that have stable and predictable revenues can more safely undertake highly leveraged capital structures than can firms with volatile patterns of sales revenue. Firms with growing sales tend to benefit from added debt because they can reap the positive benefits of financial leverage, which magnifies the effect of these increases.
	Cash flow	When considering a new capital structure, the firm must focus on its ability to generate the cash flows necessary to meet obligations. Cash forecasts reflecting an ability to service debts (and preferred stock) must support any shift in capital structure.
Agency costs	Contractual obligations	A firm may be contractually constrained with respect to the type of funds that it can raise. For example, a firm might be prohibited from selling additional debt except when the claims of holders of such debt are made subordinate to the existing debt. Contractual constraints on the sale of additional stock, as well as on the ability to distribute dividends on stock, might also exist.
	Management preferences	Occasionally, a firm will impose an internal constraint on the use of debt to limit its risk exposure to a level deemed acceptable to management. In other words, because of risk aversion, the firm's management constrains the firm's capital structure at a level that may or may not be the true optimum.
	Control	A management concerned about control may prefer to issue debt rather than (voting) common stock. Under favorable market conditions, a firm that wanted to sell equity could make a *preemptive offering* or issue *nonvoting shares* (see Chapter 7), allowing each shareholder to maintain proportionate ownership. Generally, only in closely held firms or firms threatened by takeover does control become a major concern in the capital structure decision.
Asymmetric information	External risk assessment	The firm's ability to raise funds quickly and at favorable rates depends on the external risk assessments of lenders and bond raters. The firm must therefore consider the impact of capital structure decisions both on share value and on published financial statements from which lenders and raters assess the firm's risk.
	Timing	At times when the general level of interest rates is low, debt financing might be more attractive; when interest rates are high, the sale of stock may be more appealing. Sometimes both debt and equity capital become unavailable at what would be viewed as reasonable terms. General economic conditions—especially those of the capital market—can thus significantly affect capital structure decisions.

Review Questions

12–14 Why do *maximizing EPS* and *maximizing value* not necessarily lead to the same conclusion about the optimal capital structure?

12–15 What important factors in addition to quantitative factors should a firm consider when it is making a capital structure decision?

Summary

FOCUS ON VALUE

The amount of leverage (fixed-cost assets or funds) employed by a firm directly affects its risk, return, and share value. Generally, higher leverage raises, and lower leverage reduces, risk and return. Operating leverage is concerned with the level of fixed operating costs; financial leverage focuses on fixed financial costs, particularly interest on debt and any preferred stock dividends. The firm's financial leverage is determined by its capital structure—its mix of long-term debt and equity financing. Because of its fixed interest payments, the more debt a firm employs relative to its equity, the greater its financial leverage. The value of the firm is clearly affected by its degree of operating leverage and by the composition of its capital structure. The financial manager must therefore carefully consider the types of operating and financial costs it incurs, recognizing that with greater fixed costs comes higher risk. Major decisions with regard to both operating cost structure and capital structure must therefore focus on their impact on the firm's value. Only those leverage and capital structure decisions that are consistent with the firm's goal of **maximizing its stock price** should be implemented.

REVIEW OF LEARNING GOALS

LG1 **Discuss the role of breakeven analysis, the operating breakeven point, and the effect of changing costs on it.** Breakeven analysis measures the level of sales necessary to cover total operating costs. The operating breakeven point may be calculated algebraically, by dividing fixed operating costs by the difference between the sale price per unit and variable operating cost per unit, or it may be determined graphically. The operating breakeven point increases with increased fixed and variable operating costs and decreases with an increase in sale price, and vice versa.

LG2 **Understand operating, financial, and total leverage and the relationships among them.** Operating leverage is the use of fixed operating costs by the firm to magnify the effects of changes in sales on EBIT. The higher the fixed operating costs, the greater the operating leverage. Financial leverage is the use of fixed financial costs by the firm to magnify the effects of changes in EBIT on EPS. The higher the fixed financial costs—typically, interest on debt and preferred stock dividends—the greater the financial leverage. The total leverage of the firm is the use of fixed costs—both operating and financial—to magnify the effects of changes in sales on EPS. Total leverage reflects the combined effect of operating and financial leverage.

LG3 **Describe the types of capital, external assessment of capital structure, the capital structure of non-U.S. firms, and capital structure theory.** Two basic types of capital—debt capital and equity capital—make up a firm's capital structure. They differ with respect to voice in management, claims on income and assets, maturity, and tax treatment. Capital structure can be externally assessed by using financial ratios—debt ratio, times interest earned ratio, and fixed-payment coverage ratio. Non-U.S. companies tend to have much higher degrees of indebtedness than do their U.S. counterparts, primarily because U.S. capital markets are much more developed. Similarities between U.S. corporations and those of other countries include industry patterns of capital structure, large multinational company capital structures, and the trend toward greater reliance on securities issuance and less reliance on banks for financing.

Research suggests that there is an optimal capital structure that balances the firm's benefits and costs of debt financing. The major benefit of debt financing is the tax shield. The costs of debt financing include the probability of bankruptcy, caused by business and financial risk; agency costs imposed by lenders; and asymmetric information, which typically causes firms to raise funds in a pecking order of retained earnings, then debt, and finally external equity financing, in order to send positive signals to the market and thereby enhance the wealth of shareholders.

LG4 **Explain the optimal capital structure using a graphical view of the firm's cost-of-capital functions and a zero-growth valuation model.** The zero-growth valuation model can be used to define the firm's value as its after-tax EBIT divided by its weighted average cost of capital. Assuming that EBIT is constant, the value of the firm is maximized by minimizing its weighted average cost of capital (WACC). The optimal capital structure is the one that minimizes the WACC. Graphically, although both debt and equity costs rise with increasing financial leverage, the lower cost of debt causes the WACC to decline and then rise with increasing financial leverage. As a result, the firm's WACC exhibits a U-shape, whose minimum value defines the optimal capital structure that maximizes owner wealth.

LG5 **Discuss the EBIT–EPS approach to capital structure.** The EBIT–EPS approach evaluates capital structures in light of the returns they provide the firm's owners and their degree of financial risk. Under the EBIT–EPS approach, the preferred capital structure is the one that is expected to provide maximum EPS over the firm's expected range of EBIT. Graphically, this approach reflects risk in terms of the financial breakeven point and the slope of the capital structure line. The major shortcoming of EBIT–EPS analysis is that it concentrates on maximizing earnings rather than owners' wealth.

LG6 **Review the return and risk of alternative capital structures, their linkage to market value, and other important considerations related to capital structure.** The best capital structure can be selected by using a valuation model to link return and risk factors. The preferred capital structure is the one that results in the highest estimated share value, not the highest EPS. Other important nonquantitative factors, such as revenue stability, cash flow, contractual obligations, management preferences, control, external risk assessment, and timing, must also be considered when making capital structure decisions.

SELF-TEST PROBLEMS (Solutions in Appendix B)

LG1 LG2 **ST 12–1 Breakeven point and all forms of leverage** TOR most recently sold 100,000 units at $7.50 each; its variable operating costs are $3.00 per unit, and its fixed operating costs are $250,000. Annual interest charges total $80,000, and the firm has 8,000 shares of $5 (annual dividend) preferred stock outstanding. It currently has 20,000 shares of common stock outstanding. Assume that the firm has a 40% tax rate.

a. At what level of sales (in units) would the firm break even on operations (that is, EBIT = $0)?

b. Calculate the firm's earnings per share (EPS) in tabular form at (1) the current level of sales and (2) a 120,000-unit sales level.

c. Using the current *$750,000 level of sales as a base,* calculate the firm's degree of operating leverage (DOL).

d. Using the EBIT *associated with the $750,000 level of sales as a base,* calculate the firm's degree of financial leverage (DFL).

e. Use the degree of total leverage (DTL) concept to determine the effect (in percentage terms) of a 50% increase in TOR's sales *from the $750,000 base level* on its earnings per share.

LG5 **ST 12–2** **EBIT–EPS analysis** Newlin Electronics is considering additional financing of $10,000. It currently has $50,000 of 12% (annual interest) bonds and 10,000 shares of common stock outstanding. The firm can obtain the financing through a 12% (annual interest) bond issue or through the sale of 1,000 shares of common stock. The firm has a 40% tax rate.

a. Calculate two EBIT–EPS coordinates for each plan by selecting any two EBIT values and finding their associated EPS values.

b. Plot the two financing plans on a set of EBIT–EPS axes.

c. On the basis of your graph in part **b,** at what level of EBIT does the bond plan become superior to the stock plan?

LG3 LG6 **ST 12–3** **Optimal capital structure** Hawaiian Macadamia Nut Company has collected the following data with respect to its capital structure, expected earnings per share, and required return.

Capital structure debt ratio	Expected earnings per share	Required return, k_s
0%	$3.12	13%
10	3.90	15
20	4.80	16
30	5.44	17
40	5.51	19
50	5.00	20
60	4.40	22

a. Compute the estimated share value associated with each of the capital structures, using the simplified method described in this chapter (see Equation 12.12).

b. Determine the optimal capital structure on the basis of (1) maximization of expected earnings per share and (2) maximization of share value.

c. Which capital structure do you recommend? Why?

PROBLEMS

LG1 **12–1** **Breakeven point—Algebraic** Kate Rowland wishes to estimate the number of flower arrangements she must sell at $24.95 to break even. She has estimated fixed operating costs of $12,350 per year and variable operating costs of $15.45 per arrangement. How many flower arrangements must Kate sell to break even on operating costs?

LG1 **12–2 Breakeven comparisons—Algebraic** Given the price and cost data shown in the accompanying table for each of the three firms, F, G, and H, answer the following questions.

Firm	F	G	H
Sale price per unit	$ 18.00	$ 21.00	$ 30.00
Variable operating cost per unit	6.75	13.50	12.00
Fixed operating cost	45,000	30,000	90,000

a. What is the operating breakeven point in units for each firm?
b. How would you rank these firms in terms of their risk?

LG1 **12–3 Breakeven point—Algebraic and graphical** Fine Leather Enterprises sells its single product for $129.00 per unit. The firm's fixed operating costs are $473,000 annually, and its variable operating costs are $86.00 per unit.
a. Find the firm's operating breakeven point in units.
b. Label the *x* axis "Sales (units)" and the *y* axis "Costs/Revenues ($)," and then graph the firm's sales revenue, total operating cost, and fixed operating cost functions on these axes. In addition, label the operating breakeven point and the areas of loss and profit (EBIT).

LG1 **12–4 Breakeven analysis** Barry Carter is considering opening a record store. He wants to estimate the number of CDs he must sell to break even. The CDs will be sold for $13.98 each, variable operating costs are $10.48 per CD, and annual fixed operating costs are $73,500.
a. Find the operating breakeven point in number of CDs.
b. Calculate the total operating costs at the breakeven volume found in part **a.**
c. If Barry estimates that at a minimum he can sell 2,000 CDs *per month*, should he go into the record business?
d. How much EBIT will Barry realize if he sells the minimum 2,000 CDs per month noted in part **c**?

LG1 **12–5 Breakeven point—Changing costs/revenues** JWG Company publishes *Creative Crosswords*. Last year the book of puzzles sold for $10 with variable operating cost per book of $8 and fixed operating costs of $40,000. How many books must JWG sell this year to achieve the breakeven point for the stated operating costs, given the following different circumstances?
a. All figures remain the same as last year.
b. Fixed operating costs increase to $44,000; all other figures remain the same.
c. The selling price increases to $10.50; all costs remain the same as last year.
d. Variable operating cost per book increases to $8.50; all other figures remain the same.
e. What conclusions about the operating breakeven point can be drawn from your answers?

LG1 **12–6 Breakeven analysis** Molly Jasper and her sister, Caitlin Peters, got into the novelties business almost by accident. Molly, a talented sculptor, often made little figurines as gifts for friends. Occasionally, she and Caitlin would set up a booth at a crafts fair and sell a few of the figurines along with jewelry that Caitlin made. Little by little, demand for the figurines, now called Mollycaits, grew, and the sisters began to reproduce some of the favorites in resin, using molds of the originals. The day came when a buyer for a major department store offered them a contract to produce 1,500 figurines of various designs for $10,000. Molly and Caitlin realized that it was time to get down to business. To make bookkeeping simpler, Molly had priced all of the figurines at $8.00. Variable operating costs amounted to an average of $6.00 per unit. In order to produce the order, Molly and Caitlin would have to rent industrial facilities for a month, which would cost them $4,000.

a. Calculate Mollycait's operating breakeven point.
b. Calculate Mollycait's EBIT on the department store order.
c. If Molly renegotiates the contract at a price of $10.00, what will the EBIT be?
d. If the store refuses to pay more than $8.00 per unit but is willing to negotiate quantity, what quantity of figurines will result in an EBIT of $4,000?
e. At this time, Mollycaits come in 15 different varieties. Whereas the average variable cost per unit is $6.00, the actual cost varies from unit to unit. What recommendation would you have for Molly and Caitlin with regard to pricing and/or the numbers and types of units that they offer for sale?

LG2 **12–7 EBIT sensitivity** Stewart Industries sells its finished product for $9 per unit. Its fixed operating costs are $20,000, and the variable operating cost per unit is $5.

a. Calculate the firm's earnings before interest and taxes (EBIT) for sales of 10,000 units.
b. Calculate the firm's EBIT for sales of 8,000 and 12,000 units, respectively.
c. Calculate the percentage changes in sales (from the 10,000-unit base level) and associated percentage changes in EBIT for the shifts in sales indicated in part **b.**
d. On the basis of your findings in part **c,** comment on the sensitivity of changes in EBIT in response to changes in sales.

LG2 **12–8 Degree of operating leverage** Grey Products has fixed operating costs of $380,000, variable operating costs of $16 per unit, and a selling price of $63.50 per unit.

a. Calculate the operating breakeven point in units.
b. Calculate the firm's EBIT at 9,000, 10,000, and 11,000 units, respectively.
c. With 10,000 units as a base, what are the percentage changes in units sold and EBIT as sales move from the base to the other sales levels used in part **b?**
d. Use the percentages computed in part **c** to determine the degree of operating leverage (DOL).

e. Use the formula for degree of operating leverage to determine the DOL at 10,000 units.

LG2 **12–9 Degree of operating leverage—Graphical** Levin Corporation has fixed operating costs of $72,000, variable operating costs of $6.75 per unit, and a selling price of $9.75 per unit.

a. Calculate the operating breakeven point in units.
b. Compute the degree of operating leverage (DOL) for the following unit sales levels: 25,000, 30,000, 40,000. Use the formula given in the chapter.
c. Graph the DOL figures that you computed in part **b** (on the *y* axis) against sales levels (on the *x* axis).
d. Compute the degree of operating leverage at 24,000 units; add this point to your graph.
e. What principle do your graph and figures illustrate?

LG2 **12–10 EPS calculations** Southland Industries has $60,000 of 16% (annual interest) bonds outstanding, 1,500 shares of preferred stock paying an annual dividend of $5 per share, and 4,000 shares of common stock outstanding. Assuming that the firm has a 40% tax rate, compute earnings per share (EPS) for the following levels of EBIT:

a. $24,600
b. $30,600
c. $35,000

LG2 **12–11 Degree of financial leverage** Northwestern Savings and Loan has a current capital structure consisting of $250,000 of 16% (annual interest) debt and 2,000 shares of common stock. The firm pays taxes at the rate of 40%.

a. Using EBIT values of $80,000 and $120,000, determine the associated earnings per share (EPS).
b. Using $80,000 of EBIT as a base, calculate the degree of financial leverage (DFL).
c. Rework parts **a** and **b** assuming that the firm has $100,000 of 16% (annual interest) debt and 3,000 shares of common stock.

LG2 LG5 **12–12 DFL and graphical display of financing plans** Wells and Associates has EBIT of $67,500. Interest costs are $22,500, and the firm has 15,000 shares of common stock outstanding. Assume a 40% tax rate.

a. Use the degree of financial leverage (DFL) formula to calculate the DFL for the firm.
b. Using a set of EBIT–EPS axes, plot Wells and Associates' financing plan.
c. If the firm also has 1,000 shares of preferred stock paying a $6.00 annual dividend per share, what is the DFL?
d. Plot the financing plan, including the 1,000 shares of $6.00 preferred stock, on the axes used in part **b.**
e. Briefly discuss the graph of the two financing plans.

LG1 LG2 **12–13 Integrative—Multiple leverage measures** Play-More Toys produces inflatable beach balls, selling 400,000 balls a year. Each ball produced has a variable operating cost of $0.84 and sells for $1.00. Fixed operating costs are $28,000. The firm has annual interest charges of $6,000, preferred dividends of $2,000, and a 40% tax rate.

a. Calculate the operating breakeven point in units.
b. Use the degree of operating leverage (DOL) formula to calculate DOL.
c. Use the degree of financial leverage (DFL) formula to calculate DFL.
d. Use the degree of total leverage (DTL) formula to calculate DTL. Compare this to the product of DOL and DFL calculated in parts **b** and **c.**

LG2 **12–14** **Integrative—Leverage and risk** Firm R has sales of 100,000 units at $2.00 per unit, variable operating costs of $1.70 per unit, and fixed operating costs of $6,000. Interest is $10,000 per year. Firm W has sales of 100,000 units at $2.50 per unit, variable operating costs of $1.00 per unit, and fixed operating costs of $62,500. Interest is $17,500 per year. Assume that both firms are in the 40% tax bracket.

a. Compute the degree of operating, financial, and total leverage for firm R.
b. Compute the degree of operating, financial, and total leverage for firm W.
c. Compare the relative risks of the two firms.
d. Discuss the principles of leverage that your answers illustrate.

LG1 LG2 **12–15** **Integrative—Multiple leverage measures and prediction** Carolina Fastener, Inc., makes a patented marine bulkhead latch that wholesales for $6.00. Each latch has variable operating costs of $3.50. Fixed operating costs are $50,000 per year. The firm pays $13,000 interest and preferred dividends of $7,000 per year. At this point, the firm is selling 30,000 latches a year and is taxed at 40%.

a. Calculate Carolina Fastener's operating breakeven point.
b. On the basis of the firm's current sales of 30,000 units per year and its interest and preferred dividend costs, calculate its EBIT and net profits.
c. Calculate the firm's degree of operating leverage (DOL).
d. Calculate the firm's degree of financial leverage (DFL).
e. Calculate the firm's degree of total leverage (DTL).
f. Carolina Fastener has entered into a contract to produce and sell an additional 15,000 latches in the coming year. Use the DOL, DFL, and DTL to predict and calculate the changes in EBIT and net profit. Check your work by a simple calculation of Carolina Fastener's EBIT and net profit, using the basic information given.

LG3 **12–16** **Various capital structures** Charter Enterprises currently has $1 million in total assets and is totally equity-financed. It is contemplating a change in capital structure. Compute the amount of debt and equity that would be outstanding if the firm were to shift to each of the following debt ratios: 10, 20, 30, 40, 50, 60, and 90%. (*Note:* The amount of total assets would not change.) Is there a limit to the debt ratio's value?

LG3 **12–17** **Debt and financial risk** Tower Interiors has made the forecast of sales shown in the following table. Also given is the probability of each level of sales.

Sales	Probability
$200,000	.20
300,000	.60
400,000	.20

The firm has fixed operating costs of $75,000 and variable operating costs equal to 70% of the sales level. The company pays $12,000 in interest per period. The tax rate is 40%.

a. Compute the earnings before interest and taxes (EBIT) for each level of sales.

b. Compute the earnings per share (EPS) for each level of sales, the expected EPS, the standard deviation of the EPS, and the coefficient of variation of EPS, assuming that there are 10,000 shares of common stock outstanding.

c. Tower has the opportunity to reduce leverage to zero and pay no interest. This will require that the number of shares outstanding be increased to 15,000. Repeat part **b** under this assumption.

d. Compare your findings in parts **b** and **c,** and comment on the effect of the reduction of debt to zero on the firm's financial risk.

LG4 **12–18 EPS and optimal debt ratio** Williams Glassware has estimated, at various debt ratios, the expected earnings per share and the standard deviation of the earnings per share as shown in the following table.

Debt ratio	Earnings per share (EPS)	Standard deviation of EPS
0%	$2.30	$1.15
20	3.00	1.80
40	3.50	2.80
60	3.95	3.95
80	3.80	5.53

a. Estimate the optimal debt ratio on the basis of the relationship between earnings per share and the debt ratio. You will probably find it helpful to graph the relationship.

b. Graph the relationship between the coefficient of variation and the debt ratio. Label the areas associated with business risk and financial risk.

LG5 **12–19 EBIT–EPS and capital structure** Data-Check is considering two capital structures. The key information is shown in the following table. Assume a 40% tax rate.

Source of capital	Structure A	Structure B
Long-term debt	$100,000 at 16% coupon rate	$200,000 at 17% coupon rate
Common stock	4,000 shares	2,000 shares

a. Calculate two EBIT–EPS coordinates for each of the structures by selecting any two EBIT values and finding their associated EPS values.
b. Plot the two capital structures on a set of EBIT–EPS axes.
c. Indicate over what EBIT range, if any, each structure is preferred.
d. Discuss the leverage and risk aspects of each structure.
e. If the firm is fairly certain that its EBIT will exceed $75,000, which structure would you recommend? Why?

LG5 12–20 **EBIT–EPS and preferred stock** Litho-Print is considering two possible capital structures, A and B, shown in the following table. Assume a 40% tax rate.

Source of capital	Structure A	Structure B
Long-term debt	$75,000 at 16% coupon rate	$50,000 at 15% coupon rate
Preferred stock	$10,000 with an 18% annual dividend	$15,000 with an 18% annual dividend
Common stock	8,000 shares	10,000 shares

a. Calculate two EBIT–EPS coordinates for each of the structures by selecting any two EBIT values and finding their associated EPS values.
b. Graph the two capital structures on the same set of EBIT–EPS axes.
c. Discuss the leverage and risk associated with each of the structures.
d. Over what range of EBIT is each structure preferred?
e. Which structure do you recommend if the firm expects its EBIT to be $35,000? Explain.

LG3 LG4 LG6 12–21 **Integrative—Optimal capital structure** Medallion Cooling Systems, Inc., has total assets of $10,000,000, EBIT of $2,000,000, and preferred dividends of $200,000 and is taxed at a rate of 40%. In an effort to determine the optimal capital structure, the firm has assembled data on the cost of debt, the number of common shares for various levels of indebtedness, and the overall required return on investment:

Capital structure debt ratio	Cost of debt, k_d	Number of common shares	Required return, k_s
0%	0%	200,000	12%
15	8	170,000	13
30	9	140,000	14
45	12	110,000	16
60	15	80,000	20

a. Calculate earnings per share for each level of indebtedness.
b. Use Equation 12.12 and the earnings per share calculated in part **a** to calculate a price per share for each level of indebtedness.
c. Choose the optimal capital structure. Justify your choice.

LG3 LG4 LG6 **12–22** **Integrative—Optimal capital structure** Nelson Corporation has made the following forecast of sales, with the associated probabilities of occurrence noted.

Sales	Probability
$200,000	.20
300,000	.60
400,000	.20

The company has fixed operating costs of $100,000 per year, and variable operating costs represent 40% of sales. The existing capital structure consists of 25,000 shares of common stock that have a $10 per share book value. No other capital items are outstanding. The marketplace has assigned the following required returns to risky earnings per share.

Coefficient of variation of EPS	Estimated required return, k_s
0.43	15%
0.47	16
0.51	17
0.56	18
0.60	22
0.64	24

The company is contemplating *shifting its capital structure* by substituting debt in the capital structure for common stock. The three different debt ratios under consideration are shown in the following table, along with an estimate, for each ratio, of the corresponding required interest rate on *all* debt.

Debt ratio	Interest rate on *all* debt
20%	10%
40	12
60	14

The tax rate is 40%. The market value of the equity for a leveraged firm can be found by using the simplified method (see Equation 12.12).

a. Calculate the expected earnings per share (EPS), the standard deviation of EPS, and the coefficient of variation of EPS for the three proposed capital structures.

b. Determine the optimal capital structure, assuming (1) maximization of earnings per share and (2) maximization of share value.

c. Construct a graph (similar to Figure 12.7) showing the relationships in part **b.** (*Note:* You will probably have to sketch the lines, because you have only three data points.)

LG3 LG4 LG5 LG6

12–23 Integrative—Optimal capital structure The board of directors of Morales Publishing, Inc., has commissioned a capital structure study. The company has total assets of $40,000,000. It has earnings before interest and taxes of $8,000,000 and is taxed at 40%.

a. Create a spreadsheet like the one in Table 12.10 showing values of debt and equity as well as the total number of shares, assuming a book value of $25 per share.

% Debt	Total assets	$ Debt	$ Equity	No. of shares @ $25
0%	$40,000,000	$______	$______	______
10	40,000,000	______	______	______
20	40,000,000	______	______	______
30	40,000,000	______	______	______
40	40,000,000	______	______	______
50	40,000,000	______	______	______
60	40,000,000	______	______	______

b. Given the before-tax cost of debt at various levels of indebtedness, calculate the yearly interest expenses.

% Debt	$ Total debt	Before-tax cost of debt, k_d	$ Interest expense
0%	$______	0.0%	$______
10	______	7.5	______
20	______	8.0	______
30	______	9.0	______
40	______	11.0	______
50	______	12.5	______
60	______	15.5	______

c. Using EBIT of $8,000,000, a 40% tax rate, and the information developed in parts **a** and **b,** calculate the most likely earnings per share for the firm at various levels of indebtedness. Mark the level of indebtedness that maximizes EPS.

% Debt	EBIT	Interest expense	EBT	Taxes	Net income	No. of shares	EPS
0%	$8,000,000	______	______	______	______	______	______
10	8,000,000	______	______	______	______	______	______
20	8,000,000	______	______	______	______	______	______
30	8,000,000	______	______	______	______	______	______
40	8,000,000	______	______	______	______	______	______
50	8,000,000	______	______	______	______	______	______
60	8,000,000	______	______	______	______	______	______

d. Using the EPS developed in part **c,** the estimates of required return, k_s, and Equation 12.12, estimate the value per share at various levels of indebtedness. Mark the level of indebtedness that results in the maximum price per share, P_0.

Debt	EPS	k_s	P_0
0%	________	10.0%	________
10	________	10.3	________
20	________	10.9	________
30	________	11.4	________
40	________	12.6	________
50	________	14.8	________
60	________	17.5	________

e. Prepare a recommendation to the board of directors of Morales Publishing, Inc., that specifies the degree of indebtedness that will accomplish the firm's goal of optimizing shareholder wealth. Use your findings in parts **a** through **d** to justify your recommendation.

LG3 LG4 LG5 LG6

12–24 Integrative—Optimal capital structure Country Textiles, which has fixed operating costs of $300,000 and variable operating costs equal to 40% of sales, has made the following three sales estimates, with their probabilities noted.

Sales	Probability
$ 600,000	.30
900,000	.40
1,200,000	.30

The firm wishes to analyze five possible capital structures—0, 15, 30, 45, and 60% debt ratios. The firm's total assets of $1 million are assumed to be constant. Its common stock has a book value of $25 per share, and the firm is in the 40% tax bracket. The following additional data have been gathered for use in analyzing the five capital structures under consideration.

Capital structure debt ratio	Before-tax cost of debt, k_d	Required return, k_s
0%	0.0%	10.0%
15	8.0	10.5
30	10.0	11.6
45	13.0	14.0
60	17.0	20.0

a. Calculate the level of EBIT associated with each of the three levels of sales.

b. Calculate the amount of debt, the amount of equity, and the number of shares of common stock outstanding for each of the capital structures being considered.

c. Calculate the annual interest on the debt under each of the capital structures being considered. (*Note:* The before-tax cost of debt, k_d, is the interest rate applicable to *all* debt associated with the corresponding debt ratio.)

d. Calculate the EPS associated with each of the three levels of EBIT calculated in part **a** for each of the five capital structures being considered.

e. Calculate (1) the expected EPS, (2) the standard deviation of EPS, and (3) the coefficient of variation of EPS for each of the capital structures, using your findings in part **d.**

f. Plot the expected EPS and coefficient of variation of EPS against the capital structures (x axis) on separate sets of axes, and comment on the return and risk relative to capital structure.

g. Using the EBIT–EPS data developed in part **d,** plot the 0, 30, and 60% capital structures on the same set of EBIT–EPS axes, and discuss the ranges over which each is preferred. What is the major problem with the use of this approach?

h. Using the valuation model given in Equation 12.12 and your findings in part **e,** estimate the share value for each of the capital structures being considered.

i. Compare and contrast your findings in parts **f** and **h.** Which structure is preferred if the goal is to maximize EPS? Which structure is preferred if the goal is to maximize share value? Which capital structure do you recommend? Explain.

CHAPTER 12 CASE Evaluating Tampa Manufacturing's Capital Structure

Tampa Manufacturing, an established producer of printing equipment, expects its sales to remain flat for the next 3 to 5 years because of both a weak economic outlook and an expectation of little new printing technology development over that period. On the basis of this scenario, the firm's management has been instructed by its board to institute programs that will allow it to operate more efficiently, earn higher profits, and, most important, maximize share value. In this regard, the firm's chief financial officer (CFO), Jon Lawson, has been charged with evaluating the firm's capital structure. Lawson believes that the current capital structure, which contains 10% debt and 90% equity, may lack adequate financial leverage. To evaluate the firm's capital structure, Lawson has gathered the data summarized in the following table on the current capital structure (10% debt ratio) and two alternative capital structures—A (30% debt ratio) and B (50% debt ratio)—that he would like to consider.

	Capital structure[a]		
Source of capital	Current (10% debt)	A (30% debt)	B (50% debt)
Long-term debt	\$1,000,000	\$3,000,000	\$5,000,000
Coupon interest rate[b]	9%	10%	12%
Common stock	100,000 shares	70,000 shares	40,000 shares
Required return on equity, k_s[c]	12%	13%	18%

[a]These structures are based on maintaining the firm's current level of \$10,000,000 of total financing.
[b]Interest rate applicable to *all* debt.
[c]Market-based return for the given level of risk.

Lawson expects the firm's earnings before interest and taxes (EBIT) to remain at its current level of $1,200,000. The firm has a 40% tax rate.

Required

a. Use the current level of EBIT to calculate the times interest earned ratio for each capital structure. Evaluate the current and two alternative capital structures using the times interest earned and debt ratios.
b. Prepare a single EBIT–EPS graph showing the current and two alternative capital structures.
c. On the basis of the graph in part **b,** which capital structure will maximize Tampa's earnings per share (EPS) at its expected level of EBIT of $1,200,000? Why might this *not* be the best capital structure?
d. Using the zero-growth valuation model given in Equation 12.12, find the market value of Tampa's equity under each of the three capital structures at the $1,200,000 level of expected EBIT.
e. On the basis of your findings in parts **c** and **d,** which capital structure would you recommend? Why?

WEB EXERCISE

Go to the Web site *www.smartmoney.com*. In the column on the right under **Quotes & Research** enter the symbol **DIS**; click on **Stock Snapshot**; and then click on **Go**.

1. What is the name of the company? Click on **Financials**.
2. What are the 5-year high and the 5-year low for the company's debt/equity ratio (the ratio of long-term debt to stockholders' equity)?

At the bottom of this page under **Stock Search**, enter the next stock symbol from the list below and then click on **Submit**. Enter the name of the company in the matrix below and then click on **Financials**. Enter the 5-year high and low for the debt/equity ratio in the matrix for each of the stock symbols.

		Debt/equity ratio	
Symbol	**Company name**	**5-yr. low**	**5-yr. high**
DIS			
AIT			
MRK			
LG			
LUV			
IBM			
GE			
BUD			
PFE			
INTC			

3. Which of the companies have high debt/equity ratios?
4. Which of the companies have low debt/equity ratios?
5. Why do the companies that have a low debt/equity ratio use more equity even though it is more expensive than debt?

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

CHAPTER

15

Current Liabilities Management

LEARNING GOALS

- **LG1** Review the key components of a firm's credit terms and the procedures for analyzing them.
- **LG2** Understand the effects of stretching accounts payable on their cost, and the use of accruals.
- **LG3** Describe the interest rates and basic types of unsecured bank sources of short-term loans.
- **LG4** Discuss the basic features of commercial paper and the key aspects of international short-term loans.
- **LG5** Explain the characteristics of secured short-term loans and the use of accounts receivable as short-term-loan collateral.
- **LG6** Describe the various ways in which inventory can be used as short-term-loan collateral.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand how to analyze supplier credit terms in order to decide whether the firm should take or give up cash discounts; you also need to understand the various types of short-term loans, both unsecured and secured, that you will be required to record and report.

Information systems: You need to understand what data the firm will need in order to process accounts payable, track accruals, and meet bank loans and other short-term debt obligations in a timely manner.

Management: You need to know the sources of short-term loans so that if short-term financing is needed, you will understand its costs, both financial and ethical.

Marketing: You need to understand how accounts receivable and inventory can be used as loan collateral; the procedures used by the firm to secure short-term loans with such collateral could affect customer relationships.

Operations: You need to understand the use of accounts payable as a form of short-term financing and the effect on one's suppliers of stretching payables; you also need to understand the process by which a firm uses inventory as collateral.

Bennett Footwear Group

Bennett Steps Toward Growth

You won't see "**Bennett Footwear Group**" on any shoeboxes in your closet, but you may own some of its shoe brands, which include Franco Sarto and Danelle. Bennett designs, imports, and distributes women and children's footwear and also markets its footwear through private-label programs with many key customers. Founded in 1961 as Bennett Importing, the company merged in 1998 with two other footwear companies, positioning the combined enterprise to serve a wide range of footwear markets. The company imports shoes from Italy, Brazil, China, and Portugal. Today Bennett's customers include value-oriented retailers such as Payless ShoeSource and Wal-Mart, as well as major department stores such as Nordstrom, Filene's, and Macy.

Although the merger created economies of scale and better market penetration, it also brought Bennett a complex financial structure with much debt. Bennett also needed funds to "grow its business" quickly in three areas: to take advantage of the increasing popularity of the Franco Sarto brand, to branch out into men's shoes and accessories, and to expand its private-label products for mass merchandisers.

Bennett and **CIT Commercial Services**, a leading lender to apparel and footwear companies, worked together to develop a sound program to restructure the company's debt, provide growth capital, and improve liquidity. CIT's industry knowledge and its experience lending to similar companies helped it arrive at a fair value for the inventory and accounts receivable that would serve as loan collateral (security). CIT provided Bennett with a $20-million secured revolving line of credit and a $6-million, 3-year term loan. With these short- and intermediate-term credit facilities, Bennett Footwear was able to refinance a portion of its outstanding debt and pay off most of its subordinated notes while continuing to expand its Franco Sarto lines.

Short-term bank financing is just one current liabilities management strategy that firms use to fund the buildup of inventory and accounts receivable until they can turn them back into cash. Other methods include spontaneous sources of short-term financing—accounts payable and accruals—and commercial paper. In this chapter, we'll explain how to use these strategies to the firm's advantage.

LG1 LG2 15.1 Spontaneous Liabilities

spontaneous liabilities
Financing that arises from the normal course of business; the two major short-term sources of such liabilities are accounts payable and accruals.

unsecured short-term financing
Short-term financing obtained without pledging specific assets as collateral.

Spontaneous liabilities arise from the normal course of business. The two major spontaneous sources of short-term financing are accounts payable and accruals. As the firm's sales increase, accounts payable increase in response to the increased purchases necessary to produce at higher levels. Also in response to increasing sales, the firm's accruals increase as wages and taxes rise because of greater labor requirements and the increased taxes on the firm's increased earnings. There is normally no explicit cost attached to either of these current liabilities, although they do have certain implicit costs. In addition, both are forms of **unsecured short-term financing**—short-term financing obtained without pledging specific assets as collateral. The firm should take advantage of these "interest-free" sources of unsecured short-term financing whenever possible.

Accounts Payable Management

Hint An account payable of a purchaser is an account receivable on the supplier's books. Chapter 14 highlighted the key strategies and considerations involved in extending credit to customers.

Accounts payable are the major source of unsecured short-term financing for business firms. They result from transactions in which merchandise is purchased but no formal note is signed to show the purchaser's liability to the seller. The purchaser in effect agrees to pay the supplier the amount required in accordance with credit terms normally stated on the supplier's invoice. The discussion of accounts payable here is presented from the viewpoint of the purchaser.

Role in the Cash Conversion Cycle

accounts payable management
Management by the firm of the time that elapses between its purchase of raw materials and its mailing payment to the supplier.

The average payment period is the final component of the *cash conversion cycle* introduced in Chapter 14. The average payment period has two parts: (1) the time from the purchase of raw materials until the firm mails the payment and (2) payment float time (the time it takes after the firm mails its payment until the supplier has withdrawn spendable funds from the firm's account). In the preceding chapter, we discussed issues related to payment float time. Here we discuss the management by the firm of the time that elapses between its purchase of raw materials and its mailing payment to the supplier. This activity is **accounts payable management.**

The firm's goal is to pay as slowly as possible without damaging its credit rating. This means that accounts should be paid on the last day possible, given the supplier's stated credit terms. For example, if the terms are net 30, then the account should be paid 30 days from the *beginning of the credit period,* which is typically either the *date of invoice* or the *end of the month* (*EOM*) in which the purchase was made. This allows for the maximum use of an interest-free loan from the supplier and will not damage the firm's credit rating (because the account is paid within the stated credit terms).

EXAMPLE

In the demonstration of the cash conversion cycle in Chapter 14 (see pages 601–602), MAX Company had an average payment period of 35 days (consisting of 30 days until payment was mailed and 5 days of payment float), which resulted in average accounts payable of $473,958. Thus the daily accounts payable generated by MAX was $13,542 ($473,958/35). If MAX were to mail its payments in 35 days instead of 30, its accounts payable would increase by $67,710 ($13,542 × 5). As a result, MAX's cash conversion cycle would decrease by 5 days, and the firm would reduce its investment in operations by $67,710. Clearly, if this action did not damage MAX's credit rating, it would be in the company's best interest.

Analyzing Credit Terms

The credit terms that a firm is offered by its suppliers enable it to delay payments for its purchases. Because the supplier's cost of having its money tied up in merchandise after it is sold is probably reflected in the purchase price, the purchaser is already indirectly paying for this benefit. The purchaser should therefore carefully analyze credit terms to determine the best trade credit strategy. If a firm is extended credit terms that include a cash discount, it has two options—to take the cash discount or to give it up.

Taking the Cash Discount If a firm intends to take a cash discount, it should pay on the last day of the discount period. There is no cost associated with taking a cash discount.

EXAMPLE

Lawrence Industries, operator of a small chain of video stores, purchased $1,000 worth of merchandise on February 27 from a supplier extending terms of 2/10 net 30 EOM. If the firm takes the cash discount, it must pay $980 [$1,000 − (0.02 × $1,000)] by March 10, thereby saving $20.

cost of giving up a cash discount
The implied rate of interest paid to delay payment of an account payable for an additional number of days.

Giving Up the Cash Discount If the firm chooses to give up the cash discount, it should pay on the final day of the credit period. There is an implicit cost associated with giving up a cash discount. The **cost of giving up a cash discount** is the implied rate of interest paid to delay payment of an account payable for an additional number of days. In other words, the amount is the interest being paid by the firm to keep its money for a number of days. This cost can be illustrated by a simple example. The example assumes that payment will be made on the last possible day (either the final day of the cash discount period or the final day of the credit period).

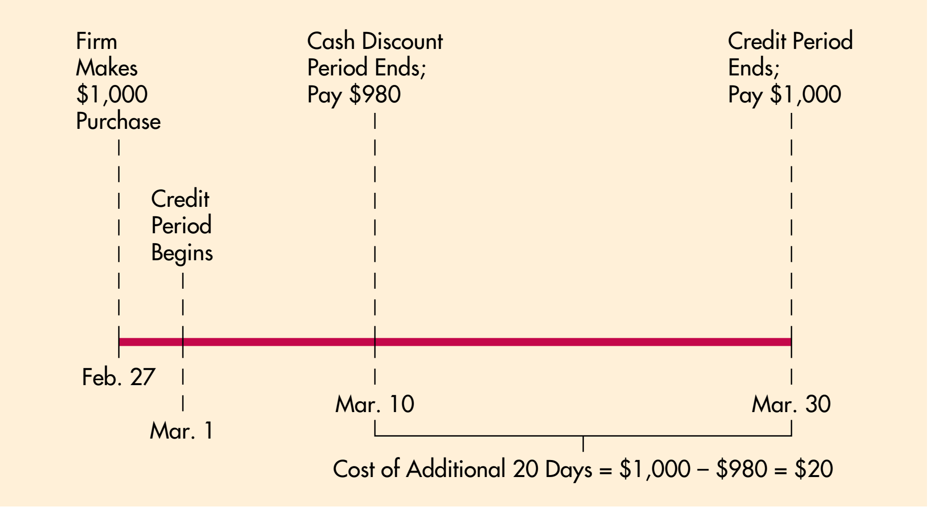
EXAMPLE

In the preceding example, we saw that Lawrence Industries could take the cash discount on its February 27 purchase by paying $980 on March 10. If Lawrence gives up the cash discount, payment can be made on March 30. To keep its money for an extra 20 days, the firm must give up an opportunity to pay $980 for its $1,000 purchase. In other words, it will cost the firm $20 to delay payment for 20 days. Figure 15.1 shows the payment options that are open to the company.

To calculate the cost of giving up the cash discount, the *true purchase price* must be viewed as the *discounted cost of the merchandise,* which is $980 for

FIGURE 15.1

Payment Options
Payment options for Lawrence Industries



Lawrence Industries. The annual percentage cost of giving up the cash discount can be calculated using Equation 15.1:[1]

$$\text{Cost of giving up cash discount} = \frac{CD}{100\% - CD} \times \frac{360}{N} \qquad (15.1)$$

where

CD = stated cash discount in percentage terms
N = number of days that payment can be delayed by giving up the cash discount

Substituting the values for CD (2%) and N (20 days) into Equation 15.1 results in an annualized cost of giving up the cash discount of 36.73% $[(2\% \div 98\%) \times (360 \div 20)]$. A 360-day year is assumed.[2]

A simple way to *approximate* the cost of giving up a cash discount is to use the stated cash discount percentage, CD, in place of the first term of Equation 15.1:

$$\text{Approximate cost of giving up cash discount} = CD \times \frac{360}{N} \qquad (15.2)$$

1. Equation 15.1 and the related discussions are based on the assumption that only one discount is offered. In the event that multiple discounts are offered, calculation of the cost of giving up the discount must be made for each alternative.

2. This example assumes that Lawrence Industries gives up only one discount during the year, which costs it 2.04% for 20 days (that is, 2% ÷ 98%) or 36.73% when annualized. However, if Lawrence Industries *continually* gives up the 2% cash discounts, the effect of compounding will cause the annualized cost to rise to 43.84%:

$$\text{Annualized cost when discounts are } \textit{continually} \text{ given up} = \left(1 + \frac{CD}{100\% - CD}\right)^{360/N} - 1 \qquad (15.1a)$$

$$= \left(1 + \frac{2\%}{100\% - 2\%}\right)^{360/20} - 1 = \underline{\underline{43.84}}\%$$

The smaller the cash discount, the closer the approximation to the actual cost of giving it up. Using this approximation, the cost of giving up the cash discount for Lawrence Industries is 36% [2% × (360 ÷ 20)].

Using the Cost of Giving Up a Cash Discount in Decision Making The financial manager must determine whether it is advisable to take a cash discount. Financial managers must remember that taking cash discounts may represent an important source of additional profitability.

EXAMPLE Mason Products, a large building-supply company, has four possible suppliers, each offering different credit terms. Otherwise, their products and services are identical. Table 15.1 presents the credit terms offered by suppliers A, B, C, and D and the cost of giving up the cash discounts in each transaction. The approximation method of calculating the cost of giving up a cash discount (Equation 15.2) has been used. The cost of giving up the cash discount from supplier A is 36%; from supplier B, 8%; from supplier C, 21.6%; and from supplier D, 28.8%.

If the firm needs short-term funds, which it can borrow from its bank at an interest rate of 13%, and if each of the suppliers is viewed *separately,* which (if any) of the suppliers' cash discounts will the firm give up? In dealing with supplier A, the firm takes the cash discount, because the cost of giving it up is 36%, and then borrows the funds it requires from its bank at 13% interest. With supplier B, the firm would do better to give up the cash discount, because the cost of this action is less than the cost of borrowing money from the bank (8% versus 13%). With either supplier C or supplier D, the firm should take the cash discount, because in both cases the cost of giving up the discount is greater than the 13% cost of borrowing from the bank.

The example shows that the cost of giving up a cash discount is relevant when one is evaluating a single supplier's credit terms in light of certain *bank borrowing costs*. However, other factors relative to payment strategies may also need to be considered. For example, some firms, particularly small firms and poorly managed firms, routinely give up *all* discounts because they either lack alternative sources of unsecured short-term financing or fail to recognize the implicit costs of their actions.

TABLE 15.1 Cash Discounts and Associated Costs for Mason Products

Supplier	Credit terms	Approximate cost of giving up a cash discount
A	2/10 net 30 EOM	36.0%
B	1/10 net 55 EOM	8.0
C	3/20 net 70 EOM	21.6
D	4/10 net 60 EOM	28.8

Effects of Stretching Accounts Payable

stretching accounts payable
Paying bills as late as possible without damaging the firm's credit rating.

A strategy that is often employed by a firm is **stretching accounts payable—**that is, paying bills as late as possible without damaging its credit rating. Such a strategy can reduce the cost of giving up a cash discount.

EXAMPLE

Lawrence Industries was extended credit terms of 2/10 net 30 EOM. The cost of giving up the cash discount, assuming payment on the last day of the credit period, was found to be approximately 36% [2% × (360 ÷ 20)]. If the firm were able to stretch its account payable to 70 days without damaging its credit rating, the cost of giving up the cash discount would be only 12% [2% × (360 ÷ 60)]. Stretching accounts payable reduces the implicit cost of giving up a cash discount.

Although stretching accounts payable may be financially attractive, it raises an important ethical issue: It may cause the firm to violate the agreement it entered into with its supplier when it purchased merchandise. Clearly, a supplier would not look kindly on a customer who regularly and purposely postponed paying for purchases.

Accruals

accruals
Liabilities for services received for which payment has yet to be made.

The second spontaneous source of short-term business financing is accruals. **Accruals** are liabilities for services received for which payment has yet to be made. The most common items accrued by a firm are wages and taxes. Because taxes are payments to the government, their accrual cannot be manipulated by the firm. However, the accrual of wages can be manipulated to some extent. This is accomplished by delaying payment of wages, thereby receiving an interest-free loan from employees who are paid sometime after they have performed the work. The pay period for employees who earn an hourly rate is often governed by union regulations or by state or federal law. However, in other cases, the frequency of payment is at the discretion of the company's management.

EXAMPLE

Tenney Company, a large janitorial service company, currently pays its employees at the end of each work week. The weekly payroll totals $400,000. If the firm were to extend the pay period so as to pay its employees 1 week later throughout an entire year, the employees would in effect be lending the firm $400,000 for a year. If the firm could earn 10% annually on invested funds, such a strategy would be worth $40,000 per year (0.10 × $400,000).

Review Questions

15–1 What are the two major sources of spontaneous short-term financing for a firm? How do their balances behave relative to the firm's sales?

15–2 Is there a cost associated with *taking a cash discount?* Is there any cost associated with *giving up a cash discount?* How do short-term borrowing costs affect the cash discount decision?

15–3 What is "stretching accounts payable"? What effect does this action have on the cost of giving up a cash discount?

In Practice

FOCUS ON ETHICS Amazon Stays Ethical to Avoid Biting the Hands That Feed It

Top managers in a tiny central Ohio company fret but say nothing publicly as a giant retailer routinely waits 120 days to pay its invoices marked "due in 30 days." The credit manager is quiet, partly because the company depends on this key account for survival and partly because "stretching payables" is the most widespread unethical practice in corporate America.

Unlike the retailer above, e-tailer **Amazon**, despite its size and marketing success, pays its suppliers on time amidst intense pressures on it to become profitable. Amazon has changed strategy, emphasizing profitability over growth. In fact, during 2001 it reported its first profit—1¢ per share. CFO Warren Jensen, describing the critical role management of working capital plays in the quest for profits, was quoted in *CFO* magazine as saying, "This isn't about trying to string our vendors out." Amazon has negative net working capital (that is, its current liabilities exceed current assets) but has chosen to employ just-in-time inventory delivery from book publishers—not delayed payments—to reduce the need for short-term bank loans. One advantage of Amazon's payables policy is that suppliers would be likely to work with Amazon should its cash position temporarily drop below that needed to cover payables.

In economic downturns, companies face even greater temptation to delay payments, and many do so. Stephen Payne, of REL Consultancy Group, warns that this unethical practice "can bite you in the rear end" as suppliers detect it and simply jack up prices to counter the effect. The buyer's average payment period represents its suppliers' average collection periods, after all.

Stretching payables is unethical for two reasons. First, the buyer is violating the terms of its trade credit agreement. Second, the buyer is in effect doing additional borrowing from its suppliers without their knowledge or authorization. "Everybody's doing it" is never a valid excuse for trying to add to shareholder wealth through such blatantly unethical behavior. Shareholder wealth maximization is once again seen to be subject to ethical constraints.

LG3 LG4 15.2 Unsecured Sources of Short-Term Loans

Businesses obtain unsecured short-term loans from two major sources, banks and commercial paper. Unlike the spontaneous sources of unsecured short-term financing, bank loans and commercial paper are negotiated and result from actions taken by the firm's financial manager. Bank loans are more popular, because they are available to firms of all sizes; commercial paper tends to be available only to large firms. In addition, international loans can be used to finance international transactions.

Bank Loans

short-term, self-liquidating loan
An unsecured short-term loan in which the use to which the borrowed money is put provides the mechanism through which the loan is repaid.

Banks are a major source of unsecured short-term loans to businesses. The major type of loan made by banks to businesses is the **short-term, self-liquidating loan.** These loans are intended merely to carry the firm through seasonal peaks in financing needs that are due primarily to buildups of inventory and accounts receivable. As inventories and receivables are converted into cash, the funds needed to retire these loans are generated. In other words, the use to which the borrowed money is put provides the mechanism through which the loan is repaid—hence the term *self-liquidating*. Banks lend unsecured, short-term funds in three basic ways: through single-payment notes, lines of credit, and revolving credit agreements. Before we look at these types of loans, we consider loan interest rates.

Loan Interest Rates

prime rate of interest (prime rate)
The lowest rate of interest charged by leading banks on business loans to their most important business borrowers.

The interest rate on a bank loan can be a fixed or a floating rate, typically based on the prime rate of interest. The **prime rate of interest (prime rate)** is the lowest rate of interest charged by leading banks on business loans to their most important business borrowers.[3] The prime rate fluctuates with changing supply-and-demand relationships for short-term funds.[4] Banks generally determine the rate to be charged to various borrowers by adding a premium to the prime rate to adjust it for the borrower's "riskiness." The premium may amount to 4 percent or more, although most unsecured short-term loans carry premiums of less than 2 percent.[5]

fixed-rate loan
A loan with a rate of interest that is determined at a set increment above the prime rate and at which it remains fixed until maturity.

floating-rate loan
A loan with a rate of interest initially set at an increment above the prime rate and allowed to "float," or vary, above prime *as the prime rate varies* until maturity.

Fixed- and Floating-Rate Loans Loans can have either fixed or floating interest rates. On a **fixed-rate loan,** the rate of interest is determined at a set increment above the prime rate on the date of the loan and remains unvarying at that fixed rate until maturity. On a **floating-rate loan,** the increment above the prime rate is initially established, and the rate of interest is allowed to "float," or vary, above prime *as the prime rate varies* until maturity. Generally, the increment above the prime rate will be *lower* on a floating-rate loan than on a fixed-rate loan of equivalent risk, because the lender bears less risk with a floating-rate loan. As a result of the volatile nature of the prime rate during recent years, today *most short-term business loans are floating-rate loans.*

Method of Computing Interest Once the *nominal (or stated) annual rate* is established, the method of computing interest is determined. Interest can be paid either when a loan matures or in advance. If interest is paid *at maturity,* the *effective (or true) annual rate*—the actual rate of interest paid—for an assumed 1-year period[6] is equal to

$$\frac{\text{Interest}}{\text{Amount borrowed}} \tag{15.3}$$

Most bank loans to businesses require the interest payment at maturity.

3. A trend away from using the prime rate as a benchmark has begun in the United States in response to various borrower lawsuits against banks. Some banks now use the term *base rate* or *reference rate* rather than *prime rate* for pricing corporate and other loans. In fact, the use of the *London Interbank Offered Rate* (*LIBOR*) is gaining momentum as a base lending rate in the United States.

4. During the past 25 years, the prime rate has varied from a record high of 21.5% (December 1980) to a low of 4.75% (December 2001 through the middle of 2002). Since 1995, it has fluctuated in the range from a high of about 9.50% to a low of about 4.75%.

5. Some, generally very large, firms can borrow from their banks at an interest rate slightly below the prime rate. This typically occurs when the borrowing firm either maintains high deposit balances at the bank over time or agrees to pay an upfront fee to "buy down" the interest rate. Below-prime-rate loans are clearly the exception rather than the rule.

6. Effective annual rates (EARs) for loans with maturities of less than 1 year can be found by using the technique presented in Chapter 4 for finding EARs when interest is compounded more frequently than annually. See Equation 4.23.

discount loans
Loans on which interest is paid in advance by being deducted from the amount borrowed.

When interest is paid *in advance,* it is deducted from the loan so that the borrower actually receives less money than is requested. Loans on which interest is paid in advance are called **discount loans.** The *effective annual rate for a discount loan,* assuming a 1-year period, is calculated as

$$\frac{\text{Interest}}{\text{Amount borrowed} - \text{Interest}} \tag{15.4}$$

Paying interest in advance raises the effective annual rate above the stated annual rate.

EXAMPLE

Wooster Company, a manufacturer of athletic apparel, wants to borrow \$10,000 at a stated annual rate of 10% interest for 1 year. If the interest on the loan is paid at maturity, the firm will pay \$1,000 ($0.10 \times$ \$10,000) for the use of the \$10,000 for the year. Substituting into Equation 15.3 reveals that the effective annual rate is therefore

$$\frac{\$1{,}000}{\$10{,}000} = 10.0\%$$

If the money is borrowed at the same *stated* annual rate for 1 year but interest is paid in advance, the firm still pays \$1,000 in interest, but it receives only \$9,000 (\$10,000 − \$1,000). The effective annual rate in this case is

$$\frac{\$1{,}000}{\$10{,}000 - \$1{,}000} = \frac{\$1{,}000}{\$9{,}000} = 11.1\%$$

Paying interest in advance thus makes the effective annual rate (11.1%) greater than the stated annual rate (10.0%).

Single-Payment Notes

single-payment note
A short-term, one-time loan made to a borrower who needs funds for a specific purpose for a short period.

A **single-payment note** can be obtained from a commercial bank by a creditworthy business borrower. This type of loan is usually a one-time loan made to a borrower who needs funds for a specific purpose for a short period. The resulting instrument is a *note,* signed by the borrower, that states the terms of the loan, including the length of the loan and the interest rate. This type of short-term note generally has a maturity of 30 days to 9 months or more. The interest charged is usually tied in some way to the prime rate of interest.

EXAMPLE

Gordon Manufacturing, a producer of rotary mower blades, recently borrowed \$100,000 from each of two banks—bank A and bank B. The loans were incurred on the same day, when the prime rate of interest was 9%. Each loan involved a 90-day note with interest to be paid at the end of 90 days. The interest rate was set at 1½% above the prime rate on bank A's *fixed-rate note.* Over the 90-day period, the rate of interest on this note will remain at 10½% (9% prime rate + 1½% increment) regardless of fluctuations in the prime rate. The total interest cost on this loan is \$2,625 [\$100,000 × (10½% × 90/360)]. The effective 90-day rate on this loan is 2.625% (\$2,625/\$100,000).

Assuming that the loan from bank A is rolled over each 90 days throughout the year under the same terms and circumstances, its effective *annual* interest rate is found by using Equation 4.23. Because the loan costs 2.625% for 90 days, it is necessary to compound (1 + 0.02625) for four periods in the year (that is, 360/90) and then subtract 1:

$$\text{Effective annual rate} = (1 + 0.02625)^4 - 1$$
$$= 1.1092 - 1 = 0.1092 = \underline{\underline{10.92}}\%$$

The effective annual rate of interest on the fixed-rate, 90-day note is 10.92%.

Bank B set the interest rate at 1% above the prime rate on its *floating-rate note*. The rate charged over the 90 days will vary directly with the prime rate. Initially, the rate will be 10% (9% + 1%), but when the prime rate changes, so will the rate of interest on the note. For instance, if after 30 days the prime rate rises to 9.5%, and after another 30 days it drops to 9.25%, the firm will be paying 0.833% for the first 30 days (10% × 30/360), 0.875% for the next 30 days (10.5% × 30/360), and 0.854% for the last 30 days (10.25% × 30/360). Its total interest cost will be $2,562 [$100,000 × (0.833% + 0.875% + 0.854%)], resulting in an effective 90-day rate of 2.562% ($2,562/$100,000).

Again, assuming the loan is rolled over each 90 days throughout the year under the same terms and circumstances, its effective *annual* rate is 10.65%:

$$\text{Effective annual rate} = (1 + 0.02562)^4 - 1$$
$$= 1.1065 - 1 = 0.1065 = \underline{\underline{10.65}}\%$$

Clearly, in this case the floating-rate loan would have been less expensive than the fixed-rate loan because of its generally lower effective annual rate.

Lines of Credit

line of credit
An agreement between a commercial bank and a business specifying the amount of unsecured short-term borrowing the bank will make available to the firm over a given period of time.

A **line of credit** is an agreement between a commercial bank and a business specifying the amount of unsecured short-term borrowing the bank will make available to the firm over a given period of time. It is similar to the agreement under which issuers of bank credit cards, such as MasterCard, Visa, and Discover, extend preapproved credit to cardholders. A line-of-credit agreement is typically made for a period of 1 year and often places certain constraints on the borrower. It is *not a guaranteed loan* but indicates that if the bank has sufficient funds available, it will allow the borrower to owe it *up to* a certain amount of money. The amount of a line of credit is the *maximum amount the firm can owe the bank* at any point in time.

When applying for a line of credit, the borrower may be required to submit such documents as its cash budget, its pro forma income statement, its pro forma balance sheet, and its recent financial statements. If the bank finds the customer acceptable, the line of credit will be extended. The major attraction of a line of credit from the bank's point of view is that it eliminates the need to examine the creditworthiness of a customer each time it borrows money.

Interest Rates The interest rate on a line of credit is normally stated as a floating rate—the *prime rate plus a premium*. If the prime rate changes, the interest rate charged on new *as well as outstanding* borrowing automatically changes.

The amount a borrower is charged in excess of the prime rate depends on its creditworthiness. The more creditworthy the borrower, the lower the premium (interest increment) above prime, and vice versa.

operating-change restrictions
Contractual restrictions that a bank may impose on a firm's financial condition or operations as part of a line-of-credit agreement.

Operating-Change Restrictions In a line-of-credit agreement, a bank may impose **operating-change restrictions,** which give it the right to revoke the line if any major changes occur in the firm's financial condition or operations. The firm is usually required to submit up-to-date, and preferably audited, financial statements for periodic review. In addition, the bank typically needs to be informed of shifts in key managerial personnel or in the firm's operations before changes take place. Such changes may affect the future success and debt-paying ability of the firm and thus could alter its credit status. If the bank does not agree with the proposed changes and the firm makes them anyway, the bank has the right to revoke the line of credit.

compensating balance
A required checking account balance equal to a certain percentage of the amount borrowed from a bank under a line-of-credit or revolving credit agreement.

Compensating Balances To ensure that the borrower will be a good customer, many short-term unsecured bank loans—single-payment notes and lines of credit—require the borrower to maintain, in a checking account, a **compensating balance** equal to a certain percentage of the amount borrowed. Compensating balances of 10 to 20 percent are frequently required. A compensating balance not only forces the borrower to be a good customer of the bank but may also raise the interest cost to the borrower.

EXAMPLE

Hint Sometimes the compensating balance is stated as a percentage of the amount of the line of credit. In other cases, it is linked to both the amount borrowed and the amount of the line of credit.

Estrada Graphics, a graphic design firm, has borrowed $1 million under a line-of-credit agreement. It must pay a stated interest rate of 10% and maintain, in its checking account, a compensating balance equal to 20% of the amount borrowed, or $200,000. Thus it actually receives the use of only $800,000. To use that amount for a year, the firm pays interest of $100,000 ($0.10 \times \$1{,}000{,}000$). The effective annual rate on the funds is therefore 12.5% ($\$100{,}000 \div \$800{,}000$), 2.5% more than the stated rate of 10%.

If the firm normally maintains a balance of $200,000 or more in its checking account, the effective annual rate equals the stated annual rate of 10% because none of the $1 million borrowed is needed to satisfy the compensating-balance requirement. If the firm normally maintains a $100,000 balance in its checking account, only an additional $100,000 will have to be tied up, leaving it with $900,000 of usable funds. The effective annual rate in this case would be 11.1% ($\$100{,}000 \div \$900{,}000$). Thus a compensating balance raises the cost of borrowing *only if* it is larger than the firm's normal cash balance.

annual cleanup
The requirement that for a certain number of days during the year borrowers under a line of credit carry a zero loan balance (that is, owe the bank nothing).

Annual Cleanups To ensure that money lent under a line-of-credit agreement is actually being used to finance seasonal needs, many banks require an **annual cleanup.** This means that the borrower must have a loan balance of zero—that is, owe the bank nothing—for a certain number of days during the year. Insisting that the borrower carry a zero loan balance for a certain period ensures that short-term loans do not turn into long-term loans.

All the characteristics of a line-of-credit agreement are negotiable to some extent. Today, banks bid competitively to attract large, well-known firms. A prospective borrower should attempt to negotiate a line of credit with the most favorable interest rate, for an optimal amount of funds, and with a minimum of restrictions. Borrowers today frequently pay fees to lenders instead of maintaining deposit balances as compensation for loans and other services. The lender attempts to get a good return with maximum safety. Negotiations should produce a line of credit that is suitable to both borrower and lender.

Revolving Credit Agreements

revolving credit agreement
A line of credit *guaranteed* to a borrower by a commercial bank regardless of the scarcity of money.

commitment fee
The fee that is normally charged on a *revolving credit agreement;* it often applies to the average unused balance of the borrower's credit line.

A **revolving credit agreement** is nothing more than a *guaranteed line of credit*. It is guaranteed in the sense that the commercial bank assures the borrower that a specified amount of funds will be made available regardless of the scarcity of money. The interest rate and other requirements are similar to those for a line of credit. It is not uncommon for a revolving credit agreement to be for a period greater than 1 year.[7] Because the bank guarantees the availability of funds, a **commitment fee** is normally charged on a revolving credit agreement.[8] This fee often applies to the average unused balance of the borrower's credit line. It is normally about 0.5 percent of the *average unused portion* of the line.

EXAMPLE

REH Company, a major real estate developer, has a \$2 million revolving credit agreement with its bank. Its average borrowing under the agreement for the past year was \$1.5 million. The bank charges a commitment fee of 0.5%. Because the average unused portion of the committed funds was \$500,000 (\$2 million − \$1.5 million), the commitment fee for the year was \$2,500 (0.005 × \$500,000). Of course, REH also had to pay interest on the actual \$1.5 million borrowed under the agreement. Assuming that \$160,000 interest was paid on the \$1.5 million borrowed, the effective cost of the agreement was 10.83% [(\$160,000 + \$2,500)/\$1,500,000]. Although more expensive than a line of credit, a revolving credit agreement can be less risky from the borrower's viewpoint, because the availability of funds is guaranteed.

Commercial Paper

commercial paper
A form of financing consisting of short-term, unsecured promissory notes issued by firms with a high credit standing.

Commercial paper is a form of financing that consists of short-term, unsecured promissory notes issued by firms with a high credit standing. Generally, only quite large firms of unquestionable financial soundness are able to issue commercial paper. Most commercial paper has maturities ranging from 3 to 270 days. Although there is no set denomination, it is generally issued in multiples of \$100,000 or more. A large portion of the commercial paper today is issued by finance companies; manufacturing firms account for a smaller portion of this type of financing. Businesses often purchase commercial paper, which they hold as marketable securities, to provide an interest-earning reserve of liquidity.

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7. Many authors classify the revolving credit agreement as a form of *intermediate-term financing,* defined as having a maturity of 1 to 7 years. In this text, we do not use the intermediate-term financing classification; only short-term and long-term classifications are made. Because many revolving credit agreements are for more than 1 year, they can be classified as a form of long-term financing; however, they are discussed here because of their similarity to line-of-credit agreements.

8. Some banks not only require payment of the commitment fee but also require the borrower to maintain, in addition to a compensating balance against actual borrowings, a compensating balance of 10% or so against the unused portion of the commitment.

In Practice

FOCUS ON PRACTICE GM Keeps America Rolling

After the attacks of September 11, 2001, further stalled consumer spending, which was already down during the recession, **General Motors (GM)** decided to jump-start auto sales. On September 19, America's largest auto manufacturer offered car buyers 0 percent financing for up to 5 years on all 2002-model passenger cars, pickups, and sport utility vehicles. Its "Keep America Rolling" campaign launched a major effort to gain significant market share, and it worked. Consumers flocked to GM dealer showrooms and gave the car manufacturer its third-best sales year ever—and its first increase in market share since 1988. Higher demand also kept GM's plants operating and its workers employed. The promotion was so successful that GM extended it through January 2, 2002, although it kept 0 percent only for 3-year loans, which were less popular, raised interest rates for the more popular 4- and 5-year loans, and excluded Chevy Corvettes and Cadillacs from the extended plan.

But the increased sales came at a cost to GM and to the other car manufacturers that were forced to follow its lead. GM's more lenient credit-per-car-basis receivables dropped without the financing charges. The free financing amounted to incentives averaging \$2,600 per vehicle—hundreds of millions of dollars that GM needed to cover the difference between what its finance company paid to borrow (about 5 percent) and the 0 percent that consumers received. Profits also dropped, because GM earned only about \$360 for each vehicle it sold in North America. Auto industry analysts also questioned the long-term effect on GM, concerned that consumers simply moved up their new-car purchases by a few months so that the program merely cannibalized future sales rather than representing any real gain.

The increased risk and cloudy profit picture were among the factors that, in mid-October, led Standard & Poor's to downgrade senior unsecured debt and short-term debt for both GM and its GMAC financing arm. This increased GM's cost of issuing commercial paper for its short-term financing requirements and also pushed up its longer-term financing costs at a time when its overall financing needs were on the rise.

Sources: Adapted from Sholnn Freeman and Gregory White, "GM to Extend 0% Financing Deal to Jan. 2," *Wall Street Journal* (November 13, 2001), p. A2; Micheline Maynard, "Auto Sales Dip Slightly from 2000 Record," *San Diego Union-Tribune* (January 4, 2002), pp. C1, C3; Jonathan Stempel, "S&P Cuts Ford, General Motors Ratings," *Reuters Business Report* (October 15, 2001); and Gregory White, "GM's 0% Finance Plan Is Good for Economy, Risky for the Company," *Wall Street Journal* (October 30, 2001), pp. A1, A8.

Interest on Commercial Paper

Commercial paper is sold at a discount from its *par,* or *face, value.* The interest paid by the issuer of commercial paper is determined by the size of the discount and the length of time to maturity. The actual interest earned by the purchaser is determined by certain calculations, illustrated by the following example.

EXAMPLE

Bertram Corporation, a large shipbuilder, has just issued \$1 million worth of commercial paper that has a 90-day maturity and sells for \$980,000. At the end of 90 days, the purchaser of this paper will receive \$1 million for its \$980,000 investment. The interest paid on the financing is therefore \$20,000 on a principal of \$980,000. The effective 90-day rate on the paper is 2.04% (\$20,000/\$980,000). Assuming that the paper is rolled over each 90 days throughout the year, the effective annual rate for Bertram's commercial paper, found by using Equation 4.23, is 8.41% $[(1 + 0.0204)^4 - 1]$.

An interesting characteristic of commercial paper is that its interest cost is *normally* 2 to 4 percent below the prime rate. In other words, firms are able to raise funds more cheaply by selling commercial paper than by borrowing from a commercial bank. The reason is that many suppliers of short-term funds do not have the option, as banks do, of making low-risk business loans at the prime rate.[9] They can invest safely only in marketable securities such as Treasury bills and commercial paper. The yields on these marketable securities on May 1, 2002, when the prime rate of interest was 4.75 percent, were about 1.73 percent for 3-month Treasury bills and about 1.80 percent for 3-month commercial paper.

Although the stated interest cost of borrowing through the sale of commercial paper is normally lower than the prime rate, the *overall cost* of commercial paper may not be less than that of a bank loan. Additional costs include the fees paid by most issuers to obtain the bank line of credit used to back the paper, fees paid to obtain third-party ratings used to make the paper more salable, and flotation costs. In addition, even if it is slightly more expensive to borrow from a commercial bank, it may at times be advisable to do so to establish a good working relationship with a bank. This strategy ensures that when money is tight, funds can be obtained promptly and at a reasonable interest rate.

Hint Commercial paper is directly placed with investors by the issuer or is sold by dealers in commercial paper. Most of it is purchased by other businesses and financial institutions.

International Loans

In some ways, arranging short-term financing for international trade is no different from financing purely domestic operations. In both cases, producers must finance production and inventory and then continue to finance accounts receivable before collecting any cash payments from sales. In other ways, however, the short-term financing of international sales and purchases is fundamentally different from that of strictly domestic trade.

International Transactions

The important difference between international and domestic transactions is that payments are often made or received in a foreign currency. Not only must a U.S. company pay the costs of doing business in the foreign exchange market, but it also is exposed to *exchange rate risk*. A U.S.-based company that exports goods and has accounts receivable denominated in a foreign currency faces the risk that the U.S. dollar will appreciate in value relative to the foreign currency. The risk to a U.S. importer with foreign-currency-denominated accounts payable is that the dollar will depreciate. Although *exchange rate risk* can often be *hedged* by using currency forward, futures, or options markets, doing so is costly and is not possible for all foreign currencies.

Typical international transactions are large in size and have long maturity dates. Therefore, companies that are involved in international trade generally have to finance larger dollar amounts for longer time periods than companies that operate domestically. Furthermore, because foreign companies are rarely

9. Commercial banks are legally prohibited from lending amounts in excess of 15% (plus an additional 10% for loans secured by readily marketable collateral) of the bank's unimpaired capital and surplus to any one borrower. This restriction is intended to protect depositors by forcing the commercial bank to spread its risk across a number of borrowers. In addition, smaller commercial banks do not have many opportunities to lend to large, high-quality business borrowers.

well known in the United States, some financial institutions are reluctant to lend to U.S. exporters or importers, particularly smaller firms.

Financing International Trade

letter of credit
A letter written by a company's bank to the company's foreign supplier, stating that the bank guarantees payment of an invoiced amount if all the underlying agreements are met.

Several specialized techniques have evolved for financing international trade. Perhaps the most important financing vehicle is the **letter of credit,** a letter written by a company's bank to the company's foreign supplier, stating that the bank guarantees payment of an invoiced amount if all the underlying agreements are met. The letter of credit essentially substitutes the bank's reputation and creditworthiness for that of its commercial customer. A U.S. exporter is more willing to sell goods to a foreign buyer if the transaction is covered by a letter of credit issued by a well-known bank in the buyer's home country.

Firms that do business in foreign countries on an ongoing basis often finance their operations, at least in part, in the local market. A company that has an assembly plant in Mexico, for example, might choose to finance its purchases of Mexican goods and services with peso funds borrowed from a Mexican bank. This not only minimizes exchange rate risk but also improves the company's business ties to the host community. Multinational companies, however, sometimes finance their international transactions through dollar-denominated loans from international banks. The *Eurocurrency loan markets* allow creditworthy borrowers to obtain financing on very attractive terms.

Transactions Between Subsidiaries

Much international trade involves transactions between corporate subsidiaries. A U.S. company might, for example, manufacture one part in an Asian plant and another part in the United States, assemble the product in Brazil, and sell it in Europe. The shipment of goods back and forth between subsidiaries creates accounts receivable and accounts payable, but the parent company has considerable discretion about how and when payments are made. In particular, the parent can minimize foreign exchange fees and other transaction costs by "netting" what affiliates owe each other and paying only the net amount due, rather than having both subsidiaries pay each other the gross amounts due.

Review Questions

15–4 How is the *prime rate of interest* relevant to the cost of short-term bank borrowing? What is a *floating-rate loan?*

15–5 How does the *effective annual rate* differ between a loan requiring interest payments *at maturity* and another, similar loan requiring interest *in advance?*

15–6 What are the basic terms and characteristics of a *single-payment note?* How is the *effective annual rate* on such a note found?

15–7 What is a *line of credit?* Describe each of the following features that are often included in these agreements: (**a**) operating-change restrictions; (**b**) compensating balance; and (**c**) annual cleanup.

15–8 What is a *revolving credit agreement?* How does this arrangement differ from the line-of-credit agreement? What is a *commitment fee?*

15–9 How is *commercial paper* used to raise short-term funds? Who can issue commercial paper? Who buys commercial paper?

15–10 What is the important difference between international and domestic transactions? How is a *letter of credit* used in financing international trade transactions? How is "netting" used in transactions between subsidiaries?

LG5 LG6 15.3 Secured Sources of Short-Term Loans

secured short-term financing
Short-term financing (loan) that has specific assets pledged as collateral.

security agreement
The agreement between the borrower and the lender that specifies the collateral held against a secured loan.

When a firm has exhausted its sources of unsecured short-term financing, it may be able to obtain additional short-term loans on a secured basis. **Secured short-term financing** has specific assets pledged as collateral. The *collateral* commonly takes the form of an asset, such as accounts receivable or inventory. The lender obtains a security interest in the collateral through the execution of a **security agreement** with the borrower that specifies the collateral held against the loan. In addition, the terms of the loan against which the security is held form part of the security agreement. They specify the conditions required for the security interest to be removed, along with the interest rate on the loan, repayment dates, and other loan provisions. A copy of the security agreement is filed in a public office within the state—typically, a county or state court. Filing provides subsequent lenders with information about which assets of a prospective borrower are unavailable for use as collateral. The filing requirement protects the lender by legally establishing the lender's security interest.

Characteristics of Secured Short-Term Loans

Although many people believe that holding collateral as security reduces the risk of a loan, lenders do not usually view loans in this way. Lenders recognize that holding collateral can reduce losses if the borrower defaults, but *the presence of collateral has no impact on the risk of default.* A lender requires collateral to ensure recovery of some portion of the loan in the event of default. What the lender wants above all, however, is to be repaid as scheduled. In general, lenders prefer to make less risky loans at lower rates of interest than to be in a position in which they must liquidate collateral.

Collateral and Terms

Lenders of secured short-term funds prefer collateral that has a duration closely matched to the term of the loan. Current assets—accounts receivable and inventory—are the most desirable short-term-loan collateral, because they can normally be converted into cash much sooner than fixed assets. Thus the short-term lender of secured funds generally accepts only liquid current assets as collateral.

percentage advance
The percent of the book value of the collateral that constitutes the principal of a secured loan.

Typically, the lender determines the desirable **percentage advance** to make against the collateral. This percentage advance constitutes the principal of the secured loan and is normally between 30 and 100 percent of the book value of the collateral. It varies according to the type and liquidity of collateral.

Hint Remember that firms typically borrow on a secured basis only after exhausting less costly, unsecured sources of short-term funds.

The interest rate that is charged on secured short-term loans is typically *higher* than the rate on unsecured short-term loans. Lenders do not normally consider secured loans less risky than unsecured loans. In addition, negotiating and administering secured loans is more troublesome for the lender than negotiating and administering unsecured loans. The lender therefore normally requires added compensation in the form of a service charge, a higher interest rate, or both.

Institutions Extending Secured Short-Term Loans

commercial finance companies
Lending institutions that make *only* secured loans—both short-term and long-term—to businesses.

The primary sources of secured short-term loans to businesses are commercial banks and finance companies. Both institutions deal in short-term loans secured primarily by accounts receivable and inventory. The operations of commercial banks have already been described. **Commercial finance companies** are lending institutions that make *only* secured loans—both short-term and long-term—to businesses. Unlike banks, finance companies are not permitted to hold deposits.

Only when its unsecured and secured short-term borrowing power from the commercial bank is exhausted will a borrower turn to the commercial finance company for additional secured borrowing. Because the finance company generally ends up with higher-risk borrowers, its interest charges on secured short-term loans are usually higher than those of commercial banks. The leading U.S. commercial finance companies include the CIT Group and GE Capital.

The Use of Accounts Receivable as Collateral

Two commonly used means of obtaining short-term financing with accounts receivable are *pledging accounts receivable* and *factoring accounts receivable*. Actually, only a pledge of accounts receivable creates a secured short-term loan; factoring really entails the *sale* of accounts receivable at a discount. Although factoring is not actually a form of secured short-term borrowing, it does involve the use of accounts receivable to obtain needed short-term funds.

Pledging Accounts Receivable

pledge of accounts receivable
The use of a firm's accounts receivable as security, or collateral, to obtain a short-term loan.

A **pledge of accounts receivable** is often used to secure a short-term loan. Because accounts receivable are normally quite liquid, they are an attractive form of short-term-loan collateral.

The Pledging Process When a firm requests a loan against accounts receivable, the lender first evaluates the firm's accounts receivable to determine their desirability as collateral. The lender makes a list of the acceptable accounts, along with the billing dates and amounts. If the borrowing firm requests a loan for a fixed amount, the lender needs to select only enough accounts to secure the funds requested. If the borrower wants the maximum loan available, the lender evaluates all the accounts to select the maximum amount of acceptable collateral.

After selecting the acceptable accounts, the lender normally adjusts the dollar value of these accounts for expected returns on sales and other allowances. If a customer whose account has been pledged returns merchandise or receives some type of allowance, such as a cash discount for early payment, the amount of the collateral is automatically reduced. For protection from such occurrences, the lender normally reduces the value of the acceptable collateral by a fixed percentage.

lien
A publicly disclosed legal claim on collateral.

Next, the percentage to be advanced against the collateral must be determined. The lender evaluates the quality of the acceptable receivables and the expected cost of their liquidation. This percentage represents the principal of the loan and typically ranges between 50 and 90 percent of the face value of acceptable accounts receivable. To protect its interest in the collateral, the lender files a **lien,** which is a publicly disclosed legal claim on the collateral. For an example of the complete pledging process, see the book's Web site at www.aw.com/gitman.

nonnotification basis
The basis on which a borrower, having pledged an account receivable, continues to collect the account payments without notifying the account customer.

notification basis
The basis on which an account customer whose account has been pledged (or factored) is notified to remit payment directly to the lender (or factor).

Notification Pledges of accounts receivable are normally made on a **nonnotification basis,** meaning that a customer whose account has been pledged as collateral is not notified. Under the nonnotification arrangement, the borrower still collects the pledged account receivable, and the lender trusts the borrower to remit these payments as they are received. If a pledge of accounts receivable is made on a **notification basis,** the customer is notified to remit payment directly to the lender.

Pledging Cost The stated cost of a pledge of accounts receivable is normally 2 to 5 percent above the prime rate. In addition to the stated interest rate, a service charge of up to 3 percent may be levied by the lender to cover its administrative costs. Clearly, pledges of accounts receivable are a high-cost source of short-term financing.

Factoring Accounts Receivable

factoring accounts receivable
The outright sale of accounts receivable at a discount to a *factor* or other financial institution.

factor
A financial institution that specializes in purchasing accounts receivable from businesses.

Factoring accounts receivable involves selling them outright, at a discount, to a financial institution. A **factor** is a financial institution that specializes in purchasing accounts receivable from businesses. Some commercial banks and commercial finance companies also factor accounts receivable. Although it is not the same as obtaining a short-term loan, factoring accounts receivable is similar to borrowing with accounts receivable as collateral.

nonrecourse basis
The basis on which accounts receivable are sold to a factor with the understanding that the factor accepts all credit risks on the purchased accounts.

Factoring Agreement A factoring agreement normally states the exact conditions and procedures for the purchase of an account. The factor, like a lender against a pledge of accounts receivable, chooses accounts for purchase, selecting only those that appear to be acceptable credit risks. Where factoring is to be on a continuing basis, the factor will actually make the firm's credit decisions, because this will guarantee the acceptability of accounts.[10] Factoring is normally done on a *notification basis,* and the factor receives payment of the account directly from the customer. In addition, most sales of accounts receivable to a factor are made on a **nonrecourse basis.** This means that the factor agrees to accept all credit risks. Thus, if a purchased account turns out to be uncollectible, the factor must absorb the loss.

Typically, the factor is not required to pay the firm until the account is collected or until the last day of the credit period, whichever occurs first. The factor

10. The use of credit cards such as MasterCard, Visa, and Discover by consumers has some similarity to factoring, because the vendor that accepts the card is reimbursed at a discount for purchases made with the card. The difference between factoring and credit cards is that cards are nothing more than a line of credit extended by the issuer, which charges the vendors a fee for accepting the cards. In factoring, the factor does not analyze credit until after the sale has been made; in many cases (except when factoring is done on a continuing basis), the initial credit decision is the responsibility of the vendor, not the factor that purchases the account.

sets up an account similar to a bank deposit account for each customer. As payment is received or as due dates arrive, the factor deposits money into the seller's account, from which the seller is free to make withdrawals as needed.

In many cases, if the firm leaves the money in the account, a *surplus* will exist on which the factor will pay interest. In other instances, the factor may make *advances* to the firm against uncollected accounts that are not yet due. These advances represent a negative balance in the firm's account, on which interest is charged.

Factoring Cost Factoring costs include commissions, interest levied on advances, and interest earned on surpluses. The factor deposits in the firm's account the book value of the collected or due accounts purchased by the factor, less the commissions. The commissions are typically stated as a 1 to 3 percent discount from the book value of factored accounts receivable. The *interest levied on advances* is generally 2 to 4 percent above the prime rate. It is levied on the actual amount advanced. The *interest paid on surpluses* is generally between 0.2 and 0.5 percent per month. An example of the factoring process is included on the book's Web site at *www.aw.com/gitman*.

Although its costs may seem high, factoring has certain advantages that make it attractive to many firms. One is the ability it gives the firm to *turn accounts receivable immediately into cash* without having to worry about repayment. Another advantage of factoring is that it ensures a *known pattern of cash flows*. In addition, if factoring is undertaken on a continuing basis, the firm *can eliminate its credit and collection departments*.

The Use of Inventory as Collateral

Inventory is generally second to accounts receivable in desirability as short-term loan collateral. Inventory normally has a market value that is greater than its book value, which is used to establish its value as collateral. A lender whose loan is secured with inventory will probably be able to sell that inventory for at least book value if the borrower defaults on its obligations.

The most important characteristic of inventory being evaluated as loan collateral is *marketability,* which must be considered in light of its physical properties. A warehouse of *perishable* items, such as fresh peaches, may be quite marketable, but if the cost of storing and selling the peaches is high, they may not be desirable collateral. *Specialized items,* such as moon-roving vehicles, are not desirable collateral either, because finding a buyer for them could be difficult. When evaluating inventory as possible loan collateral, the lender looks for items with very stable market prices that have ready markets and that lack undesirable physical properties.

Floating Inventory Liens

floating inventory lien
A secured short-term loan against inventory under which the lender's claim is on the borrower's inventory in general.

A lender may be willing to secure a loan under a **floating inventory lien,** which is a claim on inventory in general. This arrangement is most attractive when the firm has a stable level of inventory that consists of a diversified group of relatively inexpensive merchandise. Inventories of items such as auto tires, screws and bolts, and shoes are candidates for floating-lien loans. Because it is difficult for a lender to verify the presence of the inventory, the lender generally advances less than 50 percent of the book value of the average inventory. The interest charge on a floating lien is 3 to 5 percent above the prime rate. Commercial banks often require floating liens as extra security on what would otherwise be an unsecured loan. Floating-lien inventory loans may also be available from commercial finance companies. An example of a floating lien is included on the book's Web site at *www.aw.com/gitman*.

Trust Receipt Inventory Loans

trust receipt inventory loan
A secured short-term loan against inventory under which the lender advances 80 to 100 percent of the cost of the borrower's relatively expensive inventory items in exchange for the borrower's promise to repay the lender, with accrued interest, immediately after the sale of each item of collateral.

A **trust receipt inventory loan** often can be made against relatively expensive automotive, consumer durable, and industrial goods that can be identified by serial number. Under this agreement, the borrower keeps the inventory, and the lender may advance 80 to 100 percent of its cost. The lender files a *lien* on all the items financed. The borrower is free to sell the merchandise but is trusted to remit the amount lent, along with accrued interest, to the lender immediately after the sale. The lender then releases the lien on the item. The lender makes periodic checks of the borrower's inventory to make sure that the required amount of collateral remains in the hands of the borrower. The interest charge to the borrower is normally 2 percent or more above the prime rate.

Trust receipt loans are often made by manufacturers' wholly owned financing subsidiaries, known as *captive finance companies,* to their customers. Captive finance companies are especially popular in industries that manufacture consumer durable goods, because they provide the manufacturer with a useful sales tool. For example, General Motors Acceptance Corporation (GMAC), the financing subsidiary of General Motors, grants these types of loans to its dealers. Trust receipt loans are also available through commercial banks and commercial finance companies.

Warehouse Receipt Loans

warehouse receipt loan
A secured short-term loan against inventory under which the lender receives control of the pledged inventory collateral, which is stored by a designated warehousing company on the lender's behalf.

A **warehouse receipt loan** is an arrangement whereby the lender, who may be a commercial bank or commercial finance company, receives control of the pledged inventory collateral, which is stored by a designated agent on the lender's behalf. After selecting acceptable collateral, the lender hires a warehousing company to act as its agent and take possession of the inventory.

Two types of warehousing arrangements are possible. A *terminal warehouse* is a central warehouse that is used to store the merchandise of various customers. The lender normally uses such a warehouse when the inventory is easily transported and can be delivered to the warehouse relatively inexpensively. Under a *field warehouse* arrangement, the lender hires a field warehousing company to set up a warehouse on the borrower's premises or to lease part of the borrower's warehouse to store the pledged collateral. Regardless of which type of warehouse is used, the warehousing company places a guard over the inventory. Only on written approval of the lender can any portion of the secured inventory be released by the warehousing company.

The actual lending agreement specifically states the requirements for the release of inventory. As in the case of other secured loans, the lender accepts only collateral that is believed to be readily marketable and advances only a portion—generally 75 to 90 percent—of the collateral's value. The specific costs of warehouse receipt loans are generally higher than those of any other secured lending arrangements because of the need to hire and pay a warehousing company to guard and supervise the collateral. The basic interest charged on warehouse receipt loans is higher than that charged on unsecured loans, generally ranging from 3 to 5 percent above the prime rate. In addition to the interest charge, the borrower must absorb the costs of warehousing by paying the warehouse fee, which is generally between 1 and 3 percent of the amount of the loan. The borrower is normally also required to pay the insurance costs on the warehoused merchandise. An example of the procedures and costs of a warehouse receipt loan is included on the book's web site at *www.aw.com/gitman*.

Review Questions

15–11 Are secured short-term loans viewed as more risky or less risky than unsecured short-term loans? Why?

15–12 In general, what interest rates and fees are levied on secured short-term loans? Why are these rates generally *higher* than the rates on unsecured short-term loans?

15–13 Describe and compare the basic features of the following methods of using *accounts receivable* to obtain short-term financing: (**a**) pledging accounts receivable, and (**b**) factoring accounts receivable. Be sure to mention the institutions that offer each of them.

15–14 For the following methods of using *inventory* as short-term loan collateral, describe the basic features of each, and compare their use: (**a**) floating lien; (**b**) trust receipt loan; and (**c**) warehouse receipt loan.

SUMMARY

FOCUS ON VALUE

Current liabilities represent an important and generally inexpensive source of financing for a firm. The level of short-term (current liabilities) financing employed by a firm affects its profitability and risk. Accounts payable are an inexpensive spontaneous source of short-term financing. They should be paid as late as possible without damaging the firm's credit rating. This strategy will shorten the firm's cash conversion cycle and reduce its required investment in operating assets. If vendors offer cash discounts, the firm must consider the economics of giving up versus taking the discount. Accruals, another spontaneous liability, should be maximized because they represent free financing. Notes payable, which represent negotiated short-term financing, can be obtained from banks on an unsecured basis. They should be obtained at the lowest cost under the best possible terms. Large, well-known firms can obtain unsecured short-term financing through the sale of commercial paper. On a secured basis, the firm can obtain loans from banks or commercial finance companies, using either accounts receivable or inventory as collateral.

The financial manager must obtain the right quantity and form of current liabilities financing in order to provide the lowest-cost funds with the least risk. Such a strategy should positively contribute to the firm's goal of **maximizing the stock price.**

REVIEW OF LEARNING GOALS

LG1 **Review the key components of a firm's credit terms and the procedures for analyzing them.** The major spontaneous source of short-term financing is accounts payable, which are the primary source of short-term funds. Accounts payable result from credit purchases of merchandise. The key features of this form of financing are summarized in part I of Table 15.2. Credit terms may differ with respect to the credit period, cash discount, cash discount period, and beginning of the credit period. The cost of giving up cash discounts is a factor in deciding whether to take or give up a cash discount. Cash discounts should be given up only when a firm in need of short-term funds must pay an interest rate on borrowing that is greater than the cost of giving up the cash discount.

LG2 **Understand the effects of stretching accounts payable on their cost, and the use of accruals.** Stretching accounts payable can lower the cost of giving up a cash discount. This is because the firm can keep its money longer if it gives up the discount. Accruals, which result primarily from wage and tax obligations, are virtually free. The key features of this spontaneous liability are summarized in part I of Table 15.2.

LG3 **Describe the interest rates and basic types of unsecured bank sources of short-term loans.** Banks are the major source of unsecured short-term loans to businesses. The interest rate on these loans is tied to the prime rate of interest by a risk premium and may be fixed or floating. It should be evaluated by using the effective annual rate. This rate is calculated differently, depending on whether interest is paid when the loan matures or in advance. Bank loans may take the form of a single-payment note, a line of credit, or a revolving credit agreement. The key features of the various types of bank loans are summarized in part II of Table 15.2.

LG4 **Discuss the basic features of commercial paper and the key aspects of international short-term loans.** Commercial paper is an unsecured IOU issued by firms with a high credit standing. The key features of commercial paper are summarized in part II of Table 15.2. International sales and purchases expose firms to exchange rate risk. They are larger and of longer maturity than typical transactions, and they can be financed by using a letter of credit, by borrowing in the local market, or through dollar-denominated loans from international banks. On transactions between subsidiaries, "netting" can be used to minimize foreign exchange fees and other transaction costs.

LG5 **Explain the characteristics of secured short-term loans and the use of accounts receivable as short-term-loan collateral.** Secured short-term loans are those for which the lender requires collateral—typically, current assets such as accounts receivable or inventory. Only a percentage of the book value of acceptable collateral is advanced by the lender. These loans are more expensive than unsecured loans; collateral does not lower the risk of default, and increased administrative costs result. Both commercial banks and commercial finance companies make secured short-term loans. Both pledging, which is the use of accounts receivable as loan collateral, and factoring, which is the outright sale of accounts receivable at a discount, involve the use of accounts receivable to obtain needed short-term funds. The key features of loans using accounts receivable as collateral are summarized in part III of Table 15.2.

LG6 **Describe the various ways in which inventory can be used as short-term-loan collateral.** Inventory can be used as short-term-loan collateral under a floating lien, a trust receipt arrangement, or a warehouse receipt loan. The key features of loans using inventory as collateral are summarized in part III of Table 15.2.

TABLE 15.2 Summary of Key Features of Common Sources of Short-Term Financing

Type of short-term financing	Source	Cost or conditions	Characteristics
I. Spontaneous liabilities			
Accounts payable	Suppliers of merchandise	No stated cost except when a cash discount is offered for early payment.	Credit extended on open account for 0 to 120 days. The largest source of short-term financing.
Accruals	Employees and government	Free.	Result because wages (employees) and taxes (government) are paid at discrete points in time after the service has been rendered. Hard to manipulate this source of financing.
II. Unsecured sources of short-term loans			
Bank sources			
(1) Single-payment notes	Commercial banks	Prime plus 0% to 4% risk premium—fixed or floating rate.	A single-payment loan used to meet a funds shortage expected to last only a short period of time.
(2) Lines of credit	Commercial banks	Prime plus 0% to 4% risk premium—fixed or floating rate. Often must maintain 10% to 20% compensating balance and clean up the line annually.	A prearranged borrowing limit under which funds, if available, will be lent to allow the borrower to meet seasonal needs.
(3) Revolving credit agreements	Commercial banks	Prime plus 0% to 4% risk premium—fixed or floating rate. Often must maintain 10% to 20% compensating balance and pay a commitment fee of approximately 0.5% of the average unused balance.	A line-of-credit agreement under which the availability of funds is guaranteed. Often for a period greater than 1 year.
Commercial paper	Business firms—both nonfinancial and financial	Generally 2% to 4% below the prime rate of interest.	An unsecured short-term promissory note issued by the most financially sound firms.

(*continued*)

TABLE 15.2 Summary of Key Features of Common Sources of Short-Term Financing (continued)

Type of short-term financing	Source	Cost or conditions	Characteristics
III. Secured sources of short-term loans			
Accounts receivable collateral			
(1) Pledging	Commercial banks and commercial finance companies	2% to 5% above prime plus up to 3% in fees. Advance 50% to 90% of collateral value.	Selected accounts receivable are used as collateral. The borrower is trusted to remit to the lender on collection of pledged accounts. Done on a non-notification basis.
(2) Factoring	Factors, commercial banks, and commercial finance companies	1% to 3% discount from face value of factored accounts. Interest of 2% to 4% above prime levied on advances. Interest between 0.2% and 0.5% per month earned on surplus balances left with factor.	Selected accounts are sold—generally without recourse—at a discount. All credit risks go with the accounts. Factor will lend (make advances) against uncollected accounts that are not yet due. Factor will also pay interest on surplus balances. Typically done on a notification basis.
Inventory collateral			
(1) Floating liens	Commercial banks and commercial finance companies	3% to 5% above prime. Advance less than 50% of collateral value.	A loan against inventory in general. Made when firm has stable inventory of a variety of inexpensive items.
(2) Trust receipts	Manufacturers' captive financing subsidiaries, commercial banks, and commercial finance companies	2% or more above prime. Advance 80% to 100% of cost of collateral.	Loan against relatively expensive automotive, consumer durable, and industrial goods that can be identified by serial number. Collateral remains in possession of borrower, who is trusted to remit proceeds to lender upon its sale.
(3) Warehouse receipts	Commercial banks and commercial finance companies	3% to 5% above prime plus a 1% to 3% warehouse fee. Advance 75% to 90% of collateral value.	Inventory used as collateral is placed under control of the lender either through a terminal warehouse or through a field warehouse. A third party—a warehousing company—guards the inventory for the lender. Inventory is released only on written approval of the lender.

SELF-TEST PROBLEM (Solution in Appendix B)

LG1 LG2 **ST 15–1** **Cash discount decisions** The credit terms for each of three suppliers are shown in the following table.

Supplier	Credit terms
X	1/10 net 55 EOM
Y	2/10 net 30 EOM
Z	2/20 net 60 EOM

a. Determine the *approximate* cost of giving up the cash discount from each supplier.
b. Assuming that the firm needs short-term financing, indicate whether it would be better to give up the cash discount or take the discount and borrow from a bank at 15% annual interest. Evaluate each supplier *separately* using your findings in part **a.**
c. What impact, if any, would the fact that the firm could stretch its accounts payable (net period only) by 20 days from supplier Z have on your answer in part **b** relative to this supplier?

PROBLEMS

LG1 **15–1** **Payment dates** Determine when a firm must pay for purchases made and invoices dated on November 25 under each of the following credit terms.
a. net 30 date of invoice
b. net 30 EOM
c. net 45 date of invoice
d. net 60 EOM

LG1 **15–2** **Cost of giving up cash discounts** Determine the cost of giving up cash discounts under each of the following terms of sale.
a. 2/10 net 30
b. 1/10 net 30
c. 2/10 net 45
d. 3/10 net 45
e. 1/10 net 60
f. 3/10 net 30
g. 4/10 net 180

LG1 **15–3** **Credit terms** Purchases made on credit are due in full by the end of the billing period. Many firms extend a discount for payment made in the first part of the billing period. The original invoice contains a type of "short-hand" notation that explains the credit terms that apply.
a. Write the short-hand expression of credit terms for each of the following.

Cash discount	Cash discount period	Credit period	Beginning of credit period
1%	15 days	45 days	date of invoice
2	10	30	end of month
2	7	28	date of invoice
1	10	60	end of month

b. For each of the sets of credit terms in part **a,** calculate the number of days until full payment is due for invoices dated March 12.

c. For each of the sets of credit terms, calculate the cost of giving up the cash discount.

d. If the firm's cost of short-term financing is 8%, what would you recommend in regard to taking the discount or giving it up in each case?

LG1 **15–4 Cash discount versus loan** Erica Stone works in an accounts payable department. She has attempted to convince her boss to take the discount on the 3/10 net 45 credit terms most suppliers offer, but her boss argues that giving up the 3% discount is less costly than a short-term loan at 14%. Prove to whoever is wrong that the other is correct.

LG1 LG2 **15–5 Cash discount decisions** Prairie Manufacturing has four possible suppliers, all of whom offer different credit terms. Except for the differences in credit terms, their products and services are virtually identical. The credit terms offered by these suppliers are shown in the following table.

Supplier	Credit terms
J	1/10 net 30 EOM
K	2/20 net 80 EOM
L	1/20 net 60 EOM
M	3/10 net 55 EOM

a. Calculate the *approximate* cost of giving up the cash discount from each supplier.

b. If the firm needs short-term funds, which are currently available from its commercial bank at 16%, and if each of the suppliers is viewed *separately,* which, if any, of the suppliers' cash discounts should the firm give up? Explain why.

c. What impact, if any, would the fact that the firm could stretch its accounts payable (net period only) by 30 days from supplier M have on your answer in part **b** relative to this supplier?

LG2 **15–6 Changing payment cycle** Upon accepting the position of chief executive officer and chairman of Reeves Machinery, Frank Cheney changed the firm's weekly payday from Monday afternoon to the following Friday afternoon. The firm's weekly payroll was $10 million, and the cost of short-term funds was 13%. If the effect of this change was to delay check clearing by 1 week, what *annual* savings, if any, were realized?

LG2 **15–7 Spontaneous sources of funds, accruals** When Tallman Haberdashery, Inc., merged with Meyers Men's Suits, Inc., Tallman's employees were switched from a weekly to a bi-weekly pay period. Tallman's weekly payroll amounted to

$750,000. The cost of funds for the combined firms is 11%. What annual savings, if any, are realized by this change of pay period?

LG3 **15–8** **Cost of bank loan** Data Back-Up Systems has obtained a $10,000, 90-day bank loan at an annual interest rate of 15%, payable at maturity. (*Note:* Assume a 360-day year.)

a. How much interest (in dollars) will the firm pay on the 90-day loan?
b. Find the effective 90-day rate on the loan.
c. Annualize your result in part **b** to find the effective annual rate for this loan, assuming that it is rolled over every 90 days throughout the year under the same terms and circumstances.

LG3 **15–9** **Effective annual rate** A financial institution made a $10,000, 1-year discount loan at 10% interest, requiring a compensating balance equal to 20% of the face value of the loan. Determine the effective annual rate associated with this loan.

LG3 **15–10** **Compensating balances and effective annual rates** Lincoln Industries has a line of credit at Bank Two that requires it to pay 11% interest on its borrowing and to maintain a compensating balance equal to 15% of the amount borrowed. The firm has borrowed $800,000 during the year under the agreement. Calculate the effective annual rate on the firm's borrowing in each of the following circumstances:

a. The firm normally maintains no deposit balances at Bank Two.
b. The firm normally maintains $70,000 in deposit balances at Bank Two.
c. The firm normally maintains $150,000 in deposit balances at Bank Two.
d. Compare, contrast, and discuss your findings in parts **a, b,** and **c.**

LG3 **15–11** **Compensating balance vs. discount loan** Weathers Catering Supply, Inc., needs to borrow $150,000 for 6 months. State Bank has offered to lend the funds at a 9% annual rate subject to a 10% compensating balance. Frost Finance Co. has offered to lend the funds at a 9% annual rate with discount-loan terms. The principal of both loans would be payable at maturity as a single sum.

a. Calculate the effective annual rate of interest on each loan.
b. What could Weathers do that would reduce the effective annual rate on the State Bank loan?

LG3 **15–12** **Integrative—Comparison of loan terms** Cumberland Furniture wishes to establish a prearranged borrowing agreement with its local commercial bank. The bank's terms for a line of credit are 3.30% over the prime rate, and each year the borrowing must be reduced to zero for a 30-day period. For an equivalent revolving credit agreement, the rate is 2.80% over prime with a commitment fee of 0.50% on the average unused balance. With both loans, the required compensating balance is equal to 20% of the amount borrowed. The prime rate is currently 8%. Both agreements have $4 million borrowing limits. The firm expects on average to borrow $2 million during the year no matter which loan agreement it decides to use.

a. What is the effective annual rate under the line of credit?
b. What is the effective annual rate under the revolving credit agreement? (*Hint:* Compute the ratio of the dollars that the firm will pay in interest and commitment fees to the dollars that the firm will effectively have use of.)
c. If the firm does expect to borrow an average of half the amount available, which arrangement would you recommend for the borrower? Explain why.

LG4 **15–13** **Cost of commercial paper** Commercial paper is usually sold at a discount. Fan Corporation has just sold an issue of 90-day commercial paper with a face value of $1 million. The firm has received initial proceeds of $978,000.
a. What effective annual rate will the firm pay for financing with commercial paper, assuming that it is rolled over every 90 days throughout the year?
b. If a brokerage fee of $9,612 was paid from the initial proceeds to an investment banker for selling the issue, what effective annual rate will the firm pay, assuming that the paper is rolled over every 90 days throughout the year?

LG5 **15–14** **Accounts receivable as collateral** Kansas City Castings (KCC) is attempting to obtain the maximum loan possible using accounts receivable as collateral. The firm extends net-30-day credit. The amounts that are owed KCC by its 12 credit customers, the average age of each account, and customer's average payment period are as shown in the following table.

Customer	Account receivable	Average age of account	Average payment period of customer
A	$37,000	40 days	30 days
B	42,000	25	50
C	15,000	40	60
D	8,000	30	35
E	50,000	31	40
F	12,000	28	30
G	24,000	30	70
H	46,000	29	40
I	3,000	30	65
J	22,000	25	35
K	62,000	35	40
L	80,000	60	70

a. If the bank will accept all accounts that can be collected in 45 days or less as long as the customer has a history of paying within 45 days, which accounts will be acceptable? What is the total dollar amount of accounts receivable collateral? (*Note:* Accounts receivable that have an average age greater than the customer's average payment period are also excluded.)
b. In addition to the conditions in part **a,** the bank recognizes that 5% of credit sales will be lost to returns and allowances. Also, the bank will lend only

80% of the acceptable collateral (after adjusting for returns and allowances). What level of funds would be made available through this lending source?

LG5 **15–15 Accounts receivable as collateral** Springer Products wishes to borrow $80,000 from a local bank using its accounts receivable to secure the loan. The bank's policy is to accept as collateral any accounts that are normally paid within 30 days of the end of the credit period, as long as the average age of the account is not greater than the customer's average payment period. Springer's accounts receivable, their average ages, and the average payment period for each customer are shown in the following table. The company extends terms of net 30 days.

Customer	Account receivable	Average age of account	Average payment period of customer
A	$20,000	10 days	40 days
B	6,000	40	35
C	22,000	62	50
D	11,000	68	65
E	2,000	14	30
F	12,000	38	50
G	27,000	55	60
H	19,000	20	35

a. Calculate the dollar amount of acceptable accounts receivable collateral held by Springer Products.
b. The bank reduces collateral by 10% for returns and allowances. What is the level of acceptable collateral under this condition?
c. The bank will advance 75% against the firm's acceptable collateral (after adjusting for returns and allowances). What amount can Springer borrow against these accounts?

LG3 LG5 **15–16 Accounts receivable as collateral, cost of borrowing** Maximum Bank has analyzed the accounts receivable of Scientific Software, Inc. The bank has chosen eight accounts totaling $134,000 that it will accept as collateral. The bank's terms include a lending rate set at prime + 3% and a 2% commission charge. The prime rate currently is 8.5%.
a. The bank will adjust the accounts by 10% for returns and allowances. It then will lend up to 85% of the adjusted acceptable collateral. What is the maximum amount that the bank will lend to Scientific Software?
b. What is Scientific Software's effective annual rate of interest if it borrows $100,000 for 12 months? For 6 months? For 3 months? (Assume that the prime rate remains at 8.5% during the life of the loan.)

LG5 **15–17 Factoring** Blair Finance factors the accounts of the Holder Company. All eight factored accounts are shown in the following table, with the amount factored, the date due, and the status on May 30. Indicate the amounts that Blair should have remitted to Holder as of May 30 and the dates of those remittances. Assume that the factor's commission of 2% is deducted as part of determining the amount of the remittance.

Account	Amount	Date due	Status on May 30
A	$200,000	May 30	Collected May 15
B	90,000	May 30	Uncollected
C	110,000	May 30	Uncollected
D	85,000	June 15	Collected May 30
E	120,000	May 30	Collected May 27
F	180,000	June 15	Collected May 30
G	90,000	May 15	Uncollected
H	30,000	June 30	Collected May 30

LG1 LG6 15–18 **Inventory financing** Raymond Manufacturing faces a liquidity crisis—it needs a loan of $100,000 for 30 days. Having no source of additional unsecured borrowing, the firm must find a secured short-term lender. The firm's accounts receivable are quite low, but its inventory is considered liquid and reasonably good collateral. The book value of the inventory is $300,000, of which $120,000 is finished goods.

(1) City-Wide Bank will make a $100,000 *trust receipt* loan against the finished goods inventory. The annual interest rate on the loan is 12% on the outstanding loan balance plus a 0.25% administration fee levied against the $100,000 initial loan amount. Because it will be liquidated as inventory is sold, the average amount owed over the month is expected to be $75,000.

(2) Sun State Bank will lend $100,000 against a *floating lien* on the book value of inventory for the 30-day period at an annual interest rate of 13%.

(3) Citizens' Bank and Trust will lend $100,000 against a *warehouse receipt* on the finished goods inventory and charge 15% annual interest on the outstanding loan balance. A 0.5% warehousing fee will be levied against the average amount borrowed. Because the loan will be liquidated as inventory is sold, the average loan balance is expected to be $60,000.

a. Calculate the dollar cost of each of the proposed plans for obtaining an initial loan amount of $100,000.

b. Which plan do you recommend? Why?

c. If the firm had made a purchase of $100,000 for which it had been given terms of 2/10 net 30, would it increase the firm's profitability to give up the discount and not borrow as recommended in part **b?** Why or why not?

CHAPTER 15 CASE

Selecting Kanton Company's Financing Strategy and Unsecured Short-Term Borrowing Arrangement

Morton Mercado, the CFO of Kanton Company, carefully developed the estimates of the firm's total funds requirements for the coming year. These are shown in the following table.

Month	Total funds	Month	Total funds
January	$1,000,000	July	$6,000,000
February	1,000,000	August	5,000,000
March	2,000,000	September	5,000,000
April	3,000,000	October	4,000,000
May	5,000,000	November	2,000,000
June	7,000,000	December	1,000,000

In addition, Morton expects short-term financing costs of about 10% and long-term financing costs of about 14% during that period. He developed the three possible financing strategies that follow:

Strategy 1—Aggressive: Finance seasonal needs with short-term funds and permanent needs with long-term funds.

Strategy 2—Conservative: Finance an amount equal to the peak need with long-term funds and use short-term funds only in an emergency.

Strategy 3—Tradeoff: Finance $3,000,000 with long-term funds and finance the remaining funds requirements with short-term funds.

Using the data on the firm's total funds requirements, Morton estimated the average annual short-term and long-term financing requirements for each strategy in the coming year, as shown in the following table.

	Average annual financing		
Type of financing	Strategy 1 (aggressive)	Strategy 2 (conservative)	Strategy 3 (tradeoff)
Short-term	$2,500,000	$ 0	$1,666,667
Long-term	1,000,000	7,000,000	3,000,000

To ensure that, along with spontaneous financing from accounts payable and accruals, adequate short-term financing will be available, Morton plans to establish an unsecured short-term borrowing arrangement with its local bank, Third National. The bank has offered either a line-of-credit agreement or a revolving credit agreement. Third National's terms for a line of credit are an interest rate of 2.50% above the prime rate, and the borrowing must be reduced to zero for a 30-day period during the year. On an equivalent revolving credit agreement, the interest rate would be 3.00% above prime with a commitment fee of 0.50% on the average unused balance. Under both loans, a compensating balance equal to 20% of the amount borrowed would be required. The prime rate is currently 7%. Both the line-of-credit agreement and the revolving credit agreement would have borrowing limits of $1,000,000. For purposes of his analysis, Morton estimates that Kanton will borrow $600,000 on the average during the year, regardless which financing strategy and loan arrangement it chooses.

Required

a. Determine the total annual cost of each of the three possible financing strategies.

b. Assuming that the firm expects its current assets to total $4 million throughout the year, determine the average amount of net working capital under each financing strategy. (*Hint:* Current liabilities equal average short-term financing.)

c. Using the net working capital found in part **b** as a measure of risk, discuss the profitability–risk tradeoff associated with each financing strategy. Which strategy would you recommend to Morton Mercado for Kanton Company? Why?

d. Find the effective annual rate under:
(1) The line-of-credit agreement.
(2) The revolving credit agreement. (*Hint:* Find the ratio of the dollars that the firm will pay in interest and commitment fees to the dollars that the firm will effectively have use of.)

e. If the firm does expect to borrow an average of $600,000, which borrowing arrangement would you recommend to Kanton? Explain why.

WEB EXERCISE

Go to the Web site *www.21stfinancialsolutions.com*.

1. Click on **What Is Factoring**? What are factoring's advantages?
2. In the left-hand navigation bar, click on **Is factoring for You**? What are the additional benefits, and what types of companies can use factoring to their advantage?
3. Using the information in **How factoring works**, summarize the factoring process.

Next, go to the Web site *www.wellsfargo.com*.

4. On the top navigation bar, click on **commercial services**. Under **Business Lending and Leasing**, click on **commercial loans**.
   a. What types of loans does the bank offer businesses?
   b. Click on each of the four categories and summarize the type of loan and its uses.
5. At the top of the page, click on the link for **factoring services**.
   a. Describe the two types of factoring services.
   b. Click on **Wells Fargo Business Credit**. What features does Wells Fargo offer its factoring customers?

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.

INTEGRATIVE CASE 5

Case de Diseño

In January 2004, Teresa Leal was named treasurer of Casa de Diseño. She decided that she could best orient herself by systematically examining each area of the company's financial operations. She began by studying the firm's short-term financial activities.

Casa de Diseño is located in southern California and specializes in a furniture line called "Ligne Moderna." Of high quality and contemporary design, the furniture appeals to the customer who wants something unique for his or her home or apartment. Most Ligne Moderna furniture is built by special order, because a wide variety of upholstery, accent trimming, and colors are available. The product line is distributed through exclusive dealership arrangements with well-established retail stores. Casa de Diseño's manufacturing process virtually eliminates the use of wood. Plastic and metal provide the basic framework, and wood is used only for decorative purposes.

Casa de Diseño entered the plastic-furniture market in late 1998. The company markets its plastic-furniture products as indoor–outdoor items under the brand name "Futuro." Futuro plastic furniture emphasizes comfort, durability, and practicality and is distributed through wholesalers. The Futuro line has been very successful, accounting for nearly 40 percent of the firm's sales and profits in 2003. Casa de Diseño anticipates some additions to the Futuro line and also some limited change of direction in its promotion in an effort to expand the applications of the plastic furniture.

Ms. Leal has decided to study the firm's cash management practices. To determine the effects of these practices, she must first determine the current operating and cash conversion cycles. In her investigations, she found that Casa de Diseño purchases all of its raw materials and production supplies on open account. The company is operating at production levels that preclude volume discounts. Most suppliers do not offer cash discounts, and Casa de Diseño usually receives credit terms of net 30. An analysis of Casa de Diseño's accounts payable showed that its average payment period is 30 days. Leal consulted industry data and found that the industry average payment period was 39 days. Investigation of six California furniture manufacturers revealed that their average payment period was also 39 days.

Next, Leal studied the production cycle and inventory policies. Casa de Diseño tries not to hold any more inventory than necessary in either raw materials or finished goods. The average inventory age was 110 days. Leal determined that the industry standard, as reported in a survey done by *Furniture Age,* the trade association journal, was 83 days.

Casa de Diseño sells to all of its customers on a net-60 basis, in line with the industry trend to grant such credit terms on specialty furniture. Leal discovered, by aging the accounts receivable, that the average collection period for the firm was 75 days. Investigation of the trade association's and California manufacturers' averages showed that the same collection period existed where net-60 credit terms were given. Where cash discounts were offered, the collection period was significantly shortened. Leal believed that if Casa de Diseño were to offer credit terms of 3/10 net 60, the average collection period could be reduced by 40 percent.

Casa de Diseño was spending an estimated $26,500,000 per year on operating-cycle investments. Leal considered this expenditure level to be the minimum she could expect the firm to disburse during 2004. Her concern was whether the firm's cash management was as efficient as it could be. She knew that the company paid 15 percent annual interest for its resource investment. For this reason, she was concerned about the financing cost resulting from any inefficiencies in the management of Casa de Diseño's cash conversion cycle.

Required

a. Assuming a constant rate for purchases, production, and sales throughout the year, what are Casa de Diseño's existing operating cycle (OC), cash conversion cycle (CCC), and resource investment needs?

b. If Leal can optimize Casa de Diseño's operations according to industry standards, what will Casa de Diseño's operating cycle (OC), cash conversion cycle (CCC), and resource investment need be under these more efficient conditions?

c. In terms of resource investment requirements, what is the cost of Casa de Diseño's operational inefficiency?

d. (1) If in addition to achieving industry standards for payables and inventory, the firm can reduce the average collection period by offering credit terms of 3/10 net 60, what additional savings in resource investment costs will result from the shortened cash conversion cycle, assuming that the level of sales remains constant?

(2) If the firm's sales (all on credit) are $40,000,000 and 45% of the customers are expected to take the cash discount, by how much will the firm's annual revenues be reduced as a result of the discount?

(3) If the firm's variable cost of the $40,000,000 in sales is 80%, determine the reduction in the average investment in accounts receivable and the

annual savings that will result from this reduced investment, assuming that sales remain constant. (Assume a 360-day year.)

(4) If the firm's bad-debt expenses decline from 2% to 1.5% of sales, what annual savings will result, assuming that sales remain constant?

(5) Use your findings in parts (2) through (4) to assess whether offering the cash discount can be justified financially. Explain why or why not.

e. On the basis of your analysis in parts **a** through **d,** what recommendations would you offer Teresa Leal?

f. Review for Teresa Leal the key sources of short-term financing, other than accounts payable, that she may consider in order to finance Casa de Diseño's resource investment need calculated in part **b.** Be sure to mention both unsecured and secured sources.