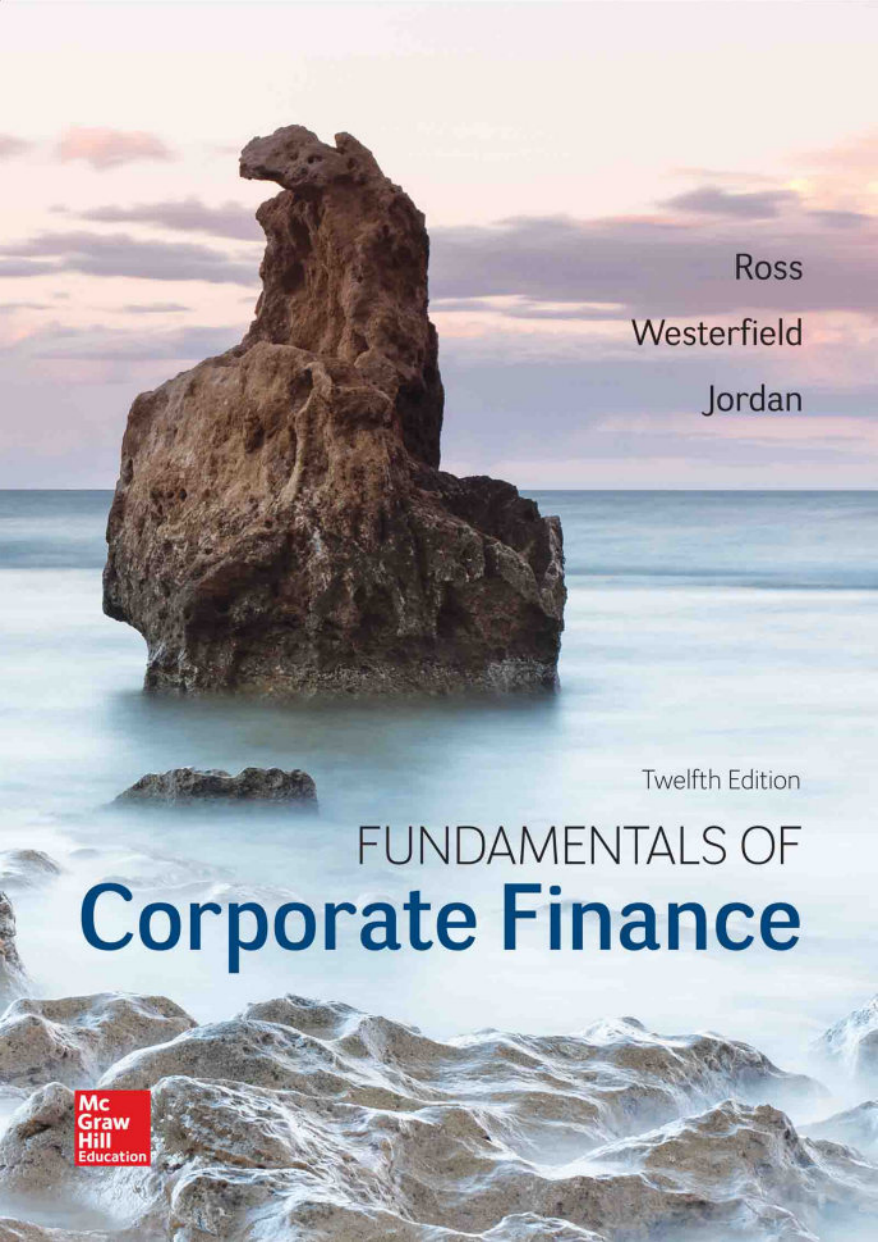
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Fundamentals of CORPORATE FINANCE

Twelfth Edition

Stephen A. Ross

Randolph W. Westerfield
University of Southern California, Emeritus

Bradford D. Jordan
University of Kentucky

Mc Graw Hill Education

FUNDAMENTALS OF CORPORATE FINANCE, TWELFTH EDITION

This book is printed on acid-free paper.

1 2 3 4 5 6 7 8 9 LWI 21 20 19 18

ISBN 978-1-259-91895-7

MHID 1-259-91895-5

Director, Finance: *Chuck Synovec*
Product Developers: *Michele Janicek, Jennifer Upton*
Senior Marketing Manager: *Trina Maurer*
Content Project Managers: *Daryl Horrocks, Jill Eccher, Karen Jocefowicz*
Buyer: *Susan K. Culbertson*
Design: *Matt Diamond*
Content Licensing Specialist: *Beth Thole*
Cover Image: ©*Jose A. Bernat Bacete/Getty Images*
Compositor: *MPS Limited*

Library of Congress Cataloging-in-Publication Data

Ross, Stephen A., author. | Westerfield, Randolph W., author. | Jordan, Bradford D., author.
Fundamentals of corporate finance/Stephen A. Ross, Massachusetts Institute of Technology, Randolph W. Westerfield, University of Southern California, Emeritus, Bradford D. Jordan, University of Kentucky.
Twelfth edition. | New York, NY : McGraw-Hill Education, [2019]
| Series: The McGraw-Hill Education series in finance, insurance, and real estate
LCCN 2017031339 | ISBN 9781259918957 (alk. paper)
LCSH: Corporations—Finance.
LCC HG4026 .R677 2019 | DDC 658.15—dc23 LC record available at https://lccn.loc.gov/2017031339

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To Stephen A. Ross and family

Our great friend, colleague, and coauthor Steve Ross passed away on March 3, 2017, while we were working on this edition of *Fundamentals of Corporate Finance*. Steve's influence on our textbook is seminal, deep, and enduring, and we will miss him greatly. We are confident that on the foundation of Steve's lasting and invaluable contributions, our textbook will continue to reach the highest level of excellence that we all aspire to.

R.W.W. B.D.J.

About the Authors

STEPHEN A. ROSS

Stephen A. Ross was the Franco Modigliani Professor of Finance and Economics at the Sloan School of Management, Massachusetts Institute of Technology. One of the most widely published authors in finance and economics, Professor Ross was widely recognized for his work in developing the Arbitrage Pricing Theory and his substantial contributions to the discipline through his research in signaling, agency theory, option pricing, and the theory of the term structure of interest rates, among other topics. A past president of the American Finance Association, he also served as an associate editor of several academic and practitioner journals. He was a trustee of CalTech. He died suddenly in March of 2017.

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Randolph W. Westerfield is Dean Emeritus and the Charles B. Thornton Professor in Finance Emeritus of the University of Southern California's Marshall School of Business. Professor Westerfield came to USC from the Wharton School, University of Pennsylvania, where he was the chairman of the finance department and a member of the finance faculty for 20 years. He is a member of the board of trustees of Oaktree Capital mutual funds. His areas of expertise include corporate financial policy, investment management, and stock market price behavior.

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Bradford D. Jordan is Professor of Finance and holder of the duPont Endowed Chair in Banking and Financial Services at the University of Kentucky. He has a long-standing interest in both applied and theoretical issues in corporate finance and has extensive experience teaching all levels of corporate finance and financial management policy. Professor Jordan has published numerous articles on issues such as cost of capital, capital structure, and the behavior of security prices. He is a past president of the Southern Finance Association, and he is coauthor of *Fundamentals of Investments: Valuation and Management,* 8e, a leading investments text, also published by McGraw-Hill.

Preface from the Authors

When the three of us decided to write a book, we were united by one strongly held principle: Corporate finance should be developed in terms of a few integrated, powerful ideas. We believed that the subject was all too often presented as a collection of loosely related topics, unified primarily by virtue of being bound together in one book, and we thought there must be a better way.

One thing we knew for certain was that we didn't want to write a "me-too" book. So, with a lot of help, we took a hard look at what was truly important and useful. In doing so, we were led to eliminate topics of dubious relevance, downplay purely theoretical issues, and minimize the use of extensive and elaborate calculations to illustrate points that are either intuitively obvious or of limited practical use.

As a result of this process, three basic themes became our central focus in writing *Fundamentals of Corporate Finance:*

AN EMPHASIS ON INTUITION

We always try to separate and explain the principles at work on a commonsense, intuitive level before launching into any specifics. The underlying ideas are discussed first in very general terms and then by way of examples that illustrate in more concrete terms how a financial manager might proceed in a given situation.

A UNIFIED VALUATION APPROACH

We treat net present value (NPV) as the basic concept underlying corporate finance. Many texts stop well short of consistently integrating this important principle. The most basic and important notion, that NPV represents the excess of market value over cost, often is lost in an overly mechanical approach that emphasizes computation at the expense of comprehension. In contrast, every subject we cover is firmly rooted in valuation, and care is taken throughout to explain how particular decisions have valuation effects.

A MANAGERIAL FOCUS

Students shouldn't lose sight of the fact that financial management concerns management. We emphasize the role of the financial manager as decision maker, and we stress the need for managerial input and judgment. We consciously avoid "black box" approaches to finance, and, where appropriate, the approximate, pragmatic nature of financial analysis is made explicit, possible pitfalls are described, and limitations are discussed.

In retrospect, looking back to our 1991 first edition IPO, we had the same hopes and fears as any entrepreneurs. How would we be received in the market? At the time, we had no idea that 26 years later, we would be working on a twelfth edition. We certainly never dreamed that in those years we would work with friends and colleagues from around the world to create country-specific Australian, Canadian, and South African editions, an International edition, Chinese, French, Polish, Portuguese, Thai, Russian, Korean, and Spanish language editions, and an entirely separate book, *Essentials of Corporate Finance,* now in its ninth edition.

Today, as we prepare to once more enter the market, our goal is to stick with the basic principles that have brought us this far. However, based on the enormous amount of feedback we have received from you and your colleagues, we have made this edition and its package even *more flexible* than previous editions. We offer flexibility in coverage, as customized editions of this text can be crafted in any combination through McGraw-Hill's *CREATE* system, and flexibility in pedagogy, by providing a wide variety

of features in the book to help students to learn about corporate finance. We also provide flexibility in package options by offering the most extensive collection of teaching, learning, and technology aids of any corporate finance text. Whether you use only the textbook, or the book in conjunction with our other products, we believe you will find a combination with this edition that will meet your current as well as your changing course needs.

Stephen A. Ross
Randolph W. Westerfield
Bradford D. Jordan

THE TAX CUTS AND JOBS ACT (TCJA) IS INCORPORATED THROUGHOUT ROSS FUNDAMENTALS OF CORPORATE FINANCE, 12E.

There are six primary areas of change and will be reflected in the 12th edition:

1. Corporate tax. The new, flat-rate 21 percent corporate rate is discussed and compared to the old progressive system. The new rate is used throughout the text in examples and problems. Entities other than C corporations still face progressive taxation, so the discussion of marginal versus average tax rates remains relevant and is retained.
2. Bonus depreciation. For a limited time, businesses can take a 100 percent depreciation charge the first year for most non-real estate, MACRS-qualified investments. This "bonus depreciation" ends in a few years and MACRS returns, so the MACRS material remains relevant and is retained. The impact of bonus depreciation is illustrated in various problems.
3. Limitations on interest deductions. The amount of interest that may be deducted for tax purposes is limited. Interest that cannot be deducted can be carried forward to future tax years (but not carried back; see next).
4. Carrybacks. Net operating loss (NOL) carrybacks have been eliminated and NOL carryforward deductions are limited in any one tax year.
5. Dividends received tax break. The tax break on dividends received by a corporation has been reduced, meaning that the portion subject to taxation has increased.
6. Repatriation. The distinction between U.S. and non-U.S. profits has been essentially eliminated. All "overseas" assets, both liquid and illiquid, are subject to a one-time "deemed" tax.

With the 12e we've also included coverage of:

- Clawbacks and deferred compensation
- Inversions
- Negative interest rates
- NYSE market operations
- Direct Listings and Cryptocurrency Initial Coin Offerings (ICOs)
- Regulation CF
- Brexit
- Repatriation
- Changes in lease accounting

Coverage

This book was designed and developed explicitly for a first course in business or corporate finance, for both finance majors and non-majors alike. In terms of background or prerequisites, the book is nearly self-contained, assuming some familiarity with basic algebra and accounting concepts, while still reviewing important accounting principles very early on. The organization of this text has been developed to give instructors the flexibility they need.

The following grid presents, for each chapter, some of the most significant features as well as a few selected chapter highlights of the 12th edition of *Fundamentals*. Of course, in every chapter, opening vignettes, boxed features, in-chapter illustrated examples using real companies, and end-of-chapter material have been thoroughly updated as well.

Chapters	Selected Topics of Interest	Benefits to You
PART 1 Overview of Corporate Finance		
CHAPTER 1 Introduction to Corporate Finance	Goal of the firm and agency problems.	Stresses value creation as the most fundamental aspect of management and describes agency issues that can arise.
	Ethics, financial management, and executive compensation.	Brings in real-world issues concerning conflicts of interest and current controversies surrounding ethical conduct and management pay.
	Sarbanes-Oxley.	Up-to-date discussion of Sarbanes-Oxley and its implications and impact.
	New: Clawbacks and deferred compensation.	Discusses new rules on bonus clawbacks and deferred compensation.
	Minicase: The McGee Cake Company.	Examines the choice of organization form for a small business.
CHAPTER 2 Financial Statements, Taxes, and Cash Flow	Cash flow vs. earnings.	Clearly defines cash flow and spells out the differences between cash flow and earnings.
	Market values vs. book values.	Emphasizes the relevance of market values over book values.
	Brief discussion of average corporate tax rates.	Highlights the variation in corporate tax rates across industries in practice.
	New: Inversions.	Discusses the controversial issue of mergers that are also tax inversions.
	Minicase: Cash Flows and Financial Statements at Sunset Boards, Inc.	Reinforces key cash flow concepts in a small business setting.

Chapters	Selected Topics of Interest	Benefits to You
PART 2 Financial Statements and Long-Term Financial Planning		
CHAPTER 3 Working with Financial Statements	Expanded DuPont analysis.	Expands the basic DuPont equation to better explore the interrelationships between operating and financial performance.
	DuPont analysis for real companies using data from S&P *Market Insight*.	Analysis shows students how to get and use real-world data, thereby applying key chapter ideas.
	Ratio and financial statement analysis using smaller firm data.	Uses firm data from *RMA* to show students how to actually get and evaluate financial statement benchmarks.
	Understanding financial statements.	Thorough coverage of standardized financial statements and key ratios.
	The enterprise value-EBITDA ratio.	Defines enterprise value (EV) and discusses the widely used EV-EBITDA ratio.
	Minicase: Ratio Analysis at S&S Air, Inc.	Illustrates the use of ratios and some pitfalls in a small business context.
CHAPTER 4 Long-Term Financial Planning and Growth	Expanded discussion of sustainable growth calculations.	Illustrates the importance of financial planning in a small firm.
	Explanation of alternative formulas for sustainable and internal growth rates.	Explanation of growth rate formulas clears up a common misunderstanding about these formulas and the circumstances under which alternative formulas are correct.
	Thorough coverage of sustainable growth as a planning tool.	Provides a vehicle for examining the interrelationships between operations, financing, and growth.
	Long-range financial planning.	Covers the percentage of sales approach to creating pro forma statements.
	Minicase: Planning for Growth at S&S Air.	Discusses the importance of a financial plan and capacity utilization for a small business.
PART 3 Valuation of Future Cash Flows		
CHAPTER 5 Introduction to Valuation: The Time Value of Money	First of two chapters on time value of money.	Relatively short chapter introduces just the basic ideas on time value of money to get students started on this traditionally difficult topic.
CHAPTER 6 Discounted Cash Flow Valuation	Growing annuities and perpetuities.	Covers more advanced time value topics with numerous examples, calculator tips, and Excel spreadsheet exhibits. Contains many real-world examples.
	Second of two chapters on time value of money.	Explores the financial pros and cons of pursuing an MBA degree.
	Minicase: The MBA Decision.	

Chapters	Selected Topics of Interest	Benefits to You
CHAPTER 7 Interest Rates and Bond Valuation	*New:* Negative interest rates.	New chapter opener explores the recent phenomenon of negative interest on government bonds.
	Bond valuation.	Complete coverage of bond valuation and bond features.
	Interest rates.	Discusses real versus nominal rates and the determinants of the term structure.
	"Clean" vs. "dirty" bond prices and accrued interest.	Clears up the pricing of bonds between coupon payment dates and also bond market quoting conventions.
	TRACE system and transparency in the corporate bond market.	Up-to-date discussion of new developments in fixed income with regard to price, volume, and transactions reporting.
	"Make-whole" call provisions.	Up-to-date discussion of a relatively new type of call provision that has become very common.
	Islamic finance.	Provides basics of some important concepts in Islamic finance.
	Minicase: Financing S&S Air's Expansion Plans with a Bond Issue.	Discusses the issues that come up in selling bonds to the public.
CHAPTER 8 Stock Valuation	Stock valuation.	Thorough coverage of constant and non-constant growth models.
	New: NYSE market operations.	Up-to-date description of major stock market operations.
	Valuation using multiples.	Illustrates using PE and price/sales ratios for equity valuation.
	Minicase: Stock Valuation at Ragan, Inc.	Illustrates the difficulties and issues surrounding small business valuation.
PART 4 Capital Budgeting		
CHAPTER 9 Net Present Value and Other Investment Criteria	First of three chapters on capital budgeting.	Relatively short chapter introduces key ideas on an intuitive level to help students with this traditionally difficult topic.
	NPV, IRR, payback, discounted payback, MIRR, and accounting rate of return.	Consistent, balanced examination of advantages and disadvantages of various criteria.
	Minicase: Bullock Gold Mining.	Explores different capital budgeting techniques with nonstandard cash flows.
CHAPTER 10 Making Capital Investment Decisions	Project cash flow.	Thorough coverage of project cash flows and the relevant numbers for a project analysis.
	Alternative cash flow definitions.	Emphasizes the equivalence of various formulas, thereby removing common misunderstandings.
	Special cases of DCF analysis.	Considers important applications of chapter tools.
	Minicase: Conch Republic Electronics, Part 1.	Analyzes capital budgeting issues and complexities.
CHAPTER 11 Project Analysis and Evaluation	Sources of value.	Stresses the need to understand the economic basis for value creation in a project.
	Scenario and sensitivity "what-if" analyses.	Illustrates how to actually apply and interpret these tools in a project analysis.
	Break-even analysis.	Covers cash, accounting, and financial break-even levels.
	Minicase: Conch Republic Electronics, Part 2.	Illustrates the use of sensitivity analysis in capital budgeting.

Chapters	Selected Topics of Interest	Benefits to You
PART 5 Risk and Return		
CHAPTER 12 Some Lessons from Capital Market History	Expanded discussion of geometric vs. arithmetic returns.	Discusses calculation and interpretation of geometric returns. Clarifies common misconceptions regarding appropriate use of arithmetic vs. geometric average returns.
	Capital market history.	Extensive coverage of historical returns, volatilities, and risk premiums.
	Market efficiency.	Efficient markets hypothesis discussed along with common misconceptions.
	The equity risk premium.	Section discusses the equity premium puzzle and latest international evidence.
	The 2008 experience.	Section on the stock market turmoil of 2008.
	Minicase: A Job at S&S Air.	Discusses selection of investments for a 401(k) plan.
CHAPTER 13 Return, Risk, and the Security Market Line	Diversification and systematic and unsystematic risk.	Illustrates basics of risk and return in a straightforward fashion.
	Beta and the security market line.	Develops the security market line with an intuitive approach that bypasses much of the usual portfolio theory and statistics.
	Minicase: The Beta for Colgate-Palmolive.	Detailed discussion of beta estimation.
PART 6 Cost of Capital and Long-Term Financial Policy		
CHAPTER 14 Cost of Capital	Cost of capital estimation.	Contains a complete, web-based illustration of cost of capital for a real company.
	Geometric vs. arithmetic growth rates.	Both approaches are used in practice. Clears up issues surrounding growth rate estimates.
	Firm valuation.	Develops the free cash flow approach to firm valuation.
	Minicase: Cost of Capital for Swan Motors.	Covers pure play approach to cost of capital estimation.
CHAPTER 15 Raising Capital	Dutch auction IPOs.	Explains uniform price auctions.
	New: Regulation CF.	Explains the new Regulation CF for crowdfunding and provides some examples.
	IPO "quiet periods."	Explains the SEC's quiet period rules.
	Rights vs. warrants.	Clarifies the optionlike nature of rights prior to their expiration dates.
	IPO valuation.	Extensive, up-to-date discussion of IPOs, including the 1999–2000 period.
	Minicase: S&S Air Goes Public.	Covers the key parts of the IPO process for a small firm.
CHAPTER 16 Financial Leverage and Capital Structure Policy	Basics of financial leverage.	Illustrates effect of leverage on risk and return.
	Optimal capital structure.	Describes the basic trade-offs leading to an optimal capital structure.
	Financial distress and bankruptcy.	Briefly surveys the bankruptcy process.
	Minicase: Stephenson Real Estate Recapitalization.	Discusses optimal capital structure for a medium-sized firm.

Chapters	Selected Topics of Interest	Benefits to You
CHAPTER 17 Dividends and Payout Policy	Very recent survey evidence on dividend policy.	New survey results show the most important (and least important) factors considered by financial managers in setting dividend policy.
	Effect of new tax laws.	Discusses implications of new, lower dividend and capital gains rates.
	Dividends and dividend policy.	Describes dividend payments and the factors favoring higher and lower payout policies.
	Optimal payout policy.	Extensive discussion of the latest research and survey evidence on dividend policy, including life-cycle theory.
	Stock repurchases.	Thorough coverage of buybacks as an alternative to cash dividends.
	Minicase: Electronic Timing, Inc.	Describes the dividend/share repurchase issue for a small company.
PART 7 Short-Term Financial Planning and Management		
CHAPTER 18 Short-Term Finance and Planning	Operating and cash cycles.	Stresses the importance of cash flow timing.
	Short-term financial planning.	Illustrates creation of cash budgets and potential need for financing.
	Purchase order financing.	Brief discussion of PO financing, which is popular with small and medium-sized firms.
	Minicase: Piepkorn Manufacturing Working Capital Management.	Illustrates the construction of a cash budget and short-term financial plan for a small company.
CHAPTER 19 Cash and Liquidity Management	Float management.	Thorough coverage of float management and potential ethical issues.
	Cash collection and disbursement.	Examination of systems used by firms to handle cash inflows and outflows.
	Minicase: Cash Management at Webb Corporation.	Evaluates alternative cash concentration systems for a small firm.
CHAPTER 20 Credit and Inventory Management	Credit management.	Analysis of credit policy and implementation.
	Inventory management.	Brief overview of important inventory concepts.
	Minicase: Credit Policy at Howlett Industries.	Evaluates working capital issues for a small firm.
PART 8 Topics in Corporate Finance		
CHAPTER 21 International Corporate Finance	Foreign exchange.	Covers essentials of exchange rates and their determination.
	International capital budgeting.	Shows how to adapt basic DCF approach to handle exchange rates.
	Exchange rate and political risk.	Discusses hedging and issues surrounding sovereign risk.
	New: Brexit.	Uses "Brexit" as an illustration of political risk.
	New: Repatriation.	New opener and in-chapter discussion of the immense overseas cash holdings by U.S. corporations.
	Minicase: S&S Air Goes International.	Discusses factors in an international expansion for a small firm.

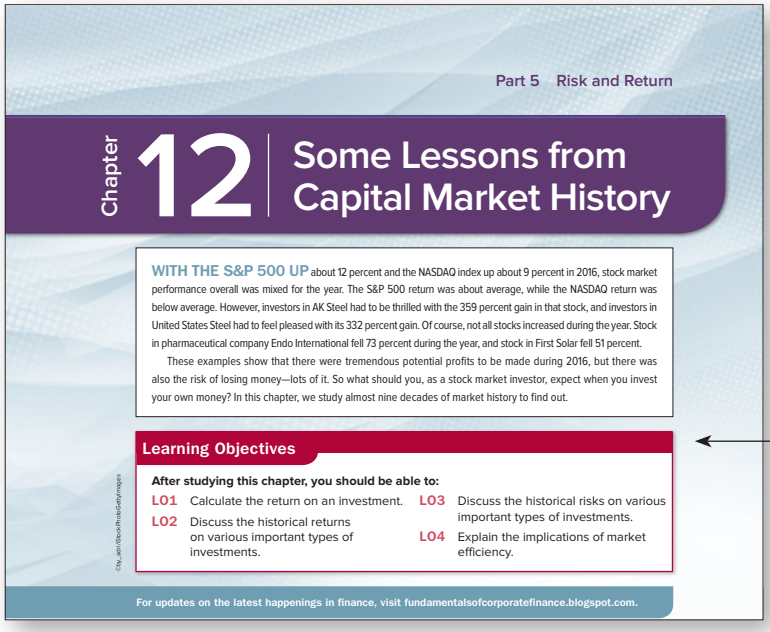
Chapters	Selected Topics of Interest	Benefits to You
CHAPTER 22 Behavioral Finance: Implications for Financial Management	Behavioral finance.	Unique and innovative coverage of the effects of biases and heuristics on financial management decisions. "In Their Own Words" box by Hersh Shefrin.
	Case against efficient markets.	Presents the behavioral case for market inefficiency and related evidence pro and con.
	Minicase: Your 401(k) Account at S&S Air.	Illustrates the considerations to be taken when selecting investment options.
CHAPTER 23 Enterprise Risk Management	Volatility and risk.	Illustrates need to manage risk and some of the most important types of risk.
	Hedging with forwards, options, and swaps.	Shows how many risks can be managed with financial derivatives.
	Minicase: Chatman Mortgage, Inc.	Analyzes hedging of interest rate risk.
CHAPTER 24 Options and Corporate Finance	Stock options, employee stock options, and real options.	Discusses the basics of these important option types.
	Option-embedded securities.	Describes the different types of options found in corporate securities.
	Minicase: S&S Air's Convertible Bond.	Examines security issuance issues for a small firm.
CHAPTER 25 Option Valuation	Put-call parity and Black-Scholes.	Develops modern option valuation and factors influencing option values.
	Options and corporate finance.	Applies option valuation to a variety of corporate issues, including mergers and capital budgeting.
	Minicase: Exotic Cuisines Employee Stock Options.	Illustrates complexities that arise in valuing employee stock options.
CHAPTER 26 Mergers and Acquisitions	Alternatives to mergers and acquisitions.	Covers strategic alliances and joint ventures and why they are important alternatives.
	Defensive tactics.	Expanded discussion of antitakeover provisions.
	Divestitures and restructurings.	Examines important actions such as equity carve-outs, spins-offs, and split-ups.
	Mergers and acquisitions.	Develops essentials of M&A analysis, including financial, tax, and accounting issues.
	Minicase: The Birdie Golf–Hybrid Golf Merger.	Covers small business valuation for acquisition purposes.
CHAPTER 27 Leasing	*New:* Changes in lease accounting.	Discusses upcoming changes in lease accounting rules and the curtailment of "off-balance-sheet" financing.
	Leases and lease valuation.	Examines essentials of leasing, good and bad reasons for leasing, and NPV of leasing.
	Minicase: The Decision to Lease or Buy at Warf Computers.	Covers lease-or-buy and related issues for a small business.

In-Text Study Features

To meet the varied needs of its intended audience, *Fundamentals of Corporate Finance* is rich in valuable learning tools and support.

CHAPTER-OPENING VIGNETTES

Vignettes drawn from real-world events introduce students to the chapter concepts.



Part 5 Risk and Return

Chapter 12 Some Lessons from Capital Market History

WITH THE S&P 500 UP about 12 percent and the NASDAQ index up about 9 percent in 2016, stock market performance overall was mixed for the year. The S&P 500 return was about average, while the NASDAQ return was below average. However, investors in AK Steel had to be thrilled with the 359 percent gain in that stock, and investors in United States Steel had to feel pleased with its 332 percent gain. Of course, not all stocks increased during the year. Stock in pharmaceutical company Endo International fell 73 percent during the year, and stock in First Solar fell 51 percent.

These examples show that there were tremendous potential profits to be made during 2016, but there was also the risk of losing money—lots of it. So what should you, as a stock market investor, expect when you invest your own money? In this chapter, we study almost nine decades of market history to find out.

Learning Objectives

After studying this chapter, you should be able to:

- **LO1** Calculate the return on an investment.
- **LO2** Discuss the historical returns on various important types of investments.
- **LO3** Discuss the historical risks on various important types of investments.
- **LO4** Explain the implications of market efficiency.

For updates on the latest happenings in finance, visit fundamentalsofcorporatefinance.blogspot.com.

CHAPTER LEARNING OBJECTIVES

This feature maps out the topics and learning goals in every chapter. Each end-of-chapter problem and test bank question is linked to a learning objective, to help you organize your assessment of knowledge and comprehension.

PEDAGOGICAL USE OF COLOR

This learning tool continues to be an important feature of *Fundamentals of Corporate Finance*. In almost every chapter, color plays an extensive, nonschematic, and largely self-evident role. A guide to the functional use of color is on pages xlv–xlvi of this front matter.

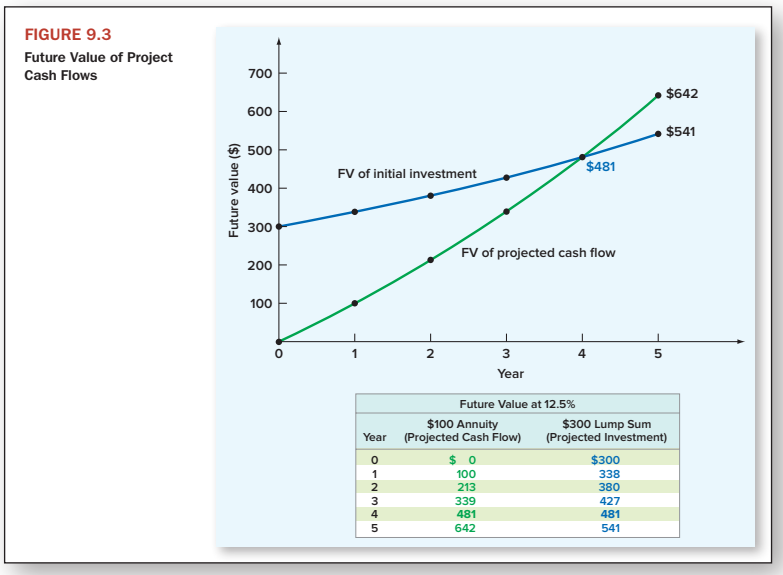


FIGURE 9.3
Future Value of Project Cash Flows

Future Value at 12.5%		
Year	$100 Annuity (Projected Cash Flow)	$300 Lump Sum (Projected Investment)
0	$ 0	$300
1	100	338
2	213	380
3	339	427
4	481	481
5	642	541

IN THEIR OWN WORDS BOXES

This series of boxes features popular articles on key topics in the text written by distinguished scholars and practitioners. Boxes include essays by Merton Miller on capital structure, Fischer Black on dividends, and Roger Ibbotson on capital market history. A complete list of "In Their Own Words" boxes appears on page xliv.

IN THEIR OWN WORDS ...

Robert C. Higgins on Sustainable Growth

Most financial officers know intuitively that it takes money to make money. Rapid sales growth requires increased assets in the form of accounts receivable, inventory, and fixed plant, which, in turn, require money to pay for assets. They also know that if their company does not have the money when needed, it can literally "grow broke." The sustainable growth equation states these intuitive truths explicitly.

Sustainable growth is often used by bankers and other external analysts to assess a company's creditworthiness. They are aided in this exercise by several sophisticated computer software packages that provide detailed analyses of the company's past financial performance, including its annual sustainable growth rate.

Bankers use this information in several ways. Quick comparison of a company's actual growth rate to its sustainable rate tells the banker what issues will be at the top of management's financial agenda. If actual growth consistently exceeds sustainable growth, management's problem will be where to get the cash to finance growth. The banker thus can anticipate interest in loan products. Conversely, if sustainable growth consistently exceeds actual, the banker had best be prepared to talk about investment products, because management's problem will be what to do with all the cash that keeps piling up in the till.

Bankers also find the sustainable growth equation useful for explaining to financially inexperienced small business owners and overly optimistic entrepreneurs that, for the long-run viability of their business, it is necessary to keep growth and profitability in proper balance.

Finally, comparison of actual to sustainable growth rates helps a banker understand why a loan applicant needs money and for how long the need might continue. In one instance, a loan applicant requested $100,000 to pay off several insistent suppliers and promised to repay in a few months when he collected some accounts receivable that were coming due. A sustainable growth analysis revealed that the firm had been growing at four to six times its sustainable growth rate and that this pattern was likely to continue in the foreseeable future. This alerted the banker to the fact that impatient suppliers were only a symptom of the much more fundamental disease of overly rapid growth, and that a $100,000 loan would likely prove to be only the down payment on a much larger, multiyear commitment.

Robert C. Higgins is the Marguerite Reimers Professor of Finance, Emeritus, at the Foster School of Business at the University of Washington. He pioneered the use of sustainable growth as a tool for financial analysis.

A NOTE ABOUT SUSTAINABLE GROWTH RATE CALCULATIONS

Very commonly, the sustainable growth rate is calculated using just the numerator in our expression, ROE × b. This causes some confusion, which we can clear up here. The issue has to do with how ROE is computed. Recall that ROE is calculated as net income divided by total equity. If total equity is taken from an ending balance sheet (as we have done consistently, and is commonly done in practice), then our formula is the right one. However, if total equity is from the beginning of the period, then the simpler formula is the correct one.

WORK THE WEB

As we discussed in this chapter, ratios are an important tool for examining a company's performance. Gathering the necessary financial statements to calculate ratios can be tedious and time-consuming. Fortunately, many sites on the web provide this information for free. One of the best is www.reuters.com. We went there, entered the ticker symbol "HD" (for Home Depot), and then went to the "Financials" page. Here is an abbreviated look at the results:

	Company	industry	sector
Quick Ratio (MRQ)	0.42	1.03	1.26
Current Ratio (MRQ)	1.34	1.91	1.58
LT Debt to Equity (MRQ)	397.33	84.80	34.40
Total Debt to Equity (MRQ)	406.99	98.04	64.39
Interest Coverage (TTM)	18.56	14.73	3.63

The website reports the company, industry, and sector ratios. As you can see, Home Depot has lower quick and current ratios than the industry.

Questions

1. *Go to www.reuters.com and find the major ratio categories listed on this website. How do the categories differ from the categories listed in this textbook?*
2. *Go to www.reuters.com and find all the ratios for Home Depot. How does the company compare to the industry for the ratios presented on this website?*

WORK THE WEB BOXES

These boxes show students how to research financial issues using the web and then how to use the information they find to make business decisions. Work the Web boxes also include interactive follow-up questions and exercises.

REAL-WORLD EXAMPLES

Actual events are integrated throughout the text, tying chapter concepts to real life through illustration and reinforcing the relevance of the material. Some examples tie into the chapter-opening vignette for added reinforcement.

SPREADSHEET STRATEGIES

How to Calculate Present Values with Multiple Future Cash Flows Using a Spreadsheet

Just as we did in our previous chapter, we can set up a basic spreadsheet to calculate the present values of the individual cash flows as follows. Notice that we have calculated the present values one at a time and added them up:

	A	B	C	D	E
1					
2	Using a spreadsheet to value multiple future cash flows				
3					
4	What is the present value of $200 in one year, $400 the next year, $600 the next year, and				
5	$800 the last year if the discount rate is 12 percent?				
6					
7	Rate:	.12			
8					
9	Year	Cash flows	Present values	Formula used	
10	1	$200	$178.57	=PV($B$7,A10,0,−B10)	
11	2	$400	$318.88	=PV($B$7,A11,0,−B11)	
12	3	$600	$427.07	=PV($B$7,A12,0,−B12)	
13	4	$800	$508.41	=PV($B$7,A13,0,−B13)	
14					
15		Total PV:	$1,432.93	=SUM(C10:C13)	
16					
17	Notice the negative signs inserted in the PV formulas. These just make the present values have				
18	positive signs. Also, the discount rate in cell B7 is entered as $B$7 (an "absolute" reference)				
19	because it is used over and over. We could have just entered ".12" instead, but our approach is				
20	more flexible.				
21					
22					

SOURCE: Microsoft Excel

SPREADSHEET STRATEGIES

This feature introduces students to Excel and shows them how to set up spreadsheets in order to analyze common financial problems—a vital part of every business student's education.

CALCULATOR HINTS

Brief calculator tutorials appear in selected chapters to help students learn or brush up on their financial calculator skills. These complement the Spreadsheet Strategies.

CALCULATOR HINTS

How to Calculate Present Values with Multiple Future Cash Flows Using a Financial Calculator

To calculate the present value of multiple cash flows with a financial calculator, we will discount the individual cash flows one at a time using the same technique we used in our previous chapter, so this is not really new. However, we can show you a shortcut. We will use the numbers in Example 6.3 to illustrate.

To begin, of course, we first remember to clear out the calculator! Next, from Example 6.3, the first cash flow is $200 to be received in one year and the discount rate is 12 percent, so we do the following:

Enter	1	12			200
	N	**I/Y**	**PMT**	**PV**	**FV**
Solve for				−178.57	

Now, you can write down this answer to save it, but that's inefficient. All calculators have a memory where you can store numbers. Why not just save it there? Doing so cuts down on mistakes because you don't have to write down and/or rekey numbers, and it's much faster.

Next, we value the second cash flow. We need to change N to 2 and FV to 400. As long as we haven't changed anything else, we don't have to reenter I/Y or clear out the calculator, so we have:

Enter	2				400
	N	**I/Y**	**PMT**	**PV**	**FV**
Solve for				−318.88	

CONCEPT BUILDING

Chapter sections are intentionally kept short to promote a step-by-step, building block approach to learning. Each section is then followed by a series of short concept questions that highlight the key ideas just presented. Students use these questions to make sure they can identify and understand the most important concepts as they read.

Concept Questions

3.3a What are the five groups of ratios? Give two or three examples of each kind.

3.3b Given the total debt ratio, what other two ratios can be computed? Explain how.

3.3c Turnover ratios all have one of two figures as the numerator. What are these two figures? What do these ratios measure? How do you interpret the results?

3.3d Profitability ratios all have the same figure in the numerator. What is it? What do these ratios measure? How do you interpret the results?

SUMMARY TABLES

These tables succinctly restate key principles, results, and equations. They appear whenever it is useful to emphasize and summarize a group of related concepts. For an example, see Chapter 3, page 68.

PV for a perpetuity = *C*/*r*

6.4

For example, an investment offers a perpetual cash flow of $500 every year. The return you require on such an investment is 8 percent. What is the value of this investment? The value of this perpetuity is:

Perpetuity PV = C/r = $500/.08 = $6,250

For future reference, Table 6.2 contains a summary of the annuity and perpetuity basic calculations we have described in this section. By now, you probably think that you'll just use online calculators to handle annuity problems. Before you do, see our nearby *Work the Web* box!

Preferred Stock **EXAMPLE 6.7**

Preferred stock (or preference stock) is an important example of a perpetuity. When a corporation sells preferred stock, the buyer is promised a fixed cash dividend every period (usually every quarter) forever. This dividend must be paid before any dividend can be paid to regular stockholders—hence the term *preferred*.

Suppose the Fellini Co. wants to sell preferred stock at $100 per share. A similar issue of preferred stock already outstanding has a price of $40 per share and offers a dividend of $1 every quarter. What dividend will Fellini have to offer if the preferred stock is going to sell?

LABELED EXAMPLES

Separate numbered and titled examples are extensively integrated into the chapters. These examples provide detailed applications and illustrations of the text material in a step-by-step format. Each example is completely self-contained so students don't have to search for additional information. Based on our classroom testing, these examples are among the most useful learning aids because they provide both detail and explanation.

KEY TERMS

Key Terms are printed in bold type and defined within the text the first time they appear. They also appear in the margins with definitions for easy location and identification by the student.

EXPLANATORY WEB LINKS

These web links are provided in the margins of the text. They are specifically selected to accompany text material and provide students and instructors with a quick way to check for additional information using the Internet.

The SEC has a good overview of the bankruptcy process in its "Online Publications" section at **www.sec.gov**.

1. A petition is filed in a federal court. Corporations may file a voluntary petition, or involuntary petitions may be filed against the corporation by several of its creditors.
2. A trustee-in-bankruptcy is elected by the creditors to take over the assets of the debtor corporation. The trustee will attempt to liquidate the assets.
3. When the assets are liquidated, after payment of the bankruptcy administration costs, the proceeds are distributed among the creditors.
4. If any proceeds remain, after expenses and payments to creditors, they are distributed to the shareholders.

KEY EQUATIONS

Called out in the text, key equations are identified by an equation number. The list in Appendix B shows the key equations by chapter, providing students with a convenient reference.

Based on our examples, we can now write the general expression for the value of a bond. If a bond has (1) a face value of F paid at maturity, (2) a coupon of C paid per period, (3) t periods to maturity, and (4) a yield of r per period, its value is:

$$\text{Bond value} = C \times [1 - 1/(1 + r)^t]/r + F/(1 + r)^t \quad (7.1)$$

$$\text{Bond value} = \begin{matrix}\text{Present value} \\ \text{of the coupons}\end{matrix} + \begin{matrix}\text{Present value} \\ \text{of the face amount}\end{matrix}$$

HIGHLIGHTED CONCEPTS

Throughout the text, important ideas are pulled out and presented in a highlighted box—signaling to students that this material is particularly relevant and critical for their understanding. For examples, Chapter 10, page 313; Chapter 13, page 434.

EXCEL MASTER

Icons in the margin identify concepts and skills covered in our unique, RWJ-created Excel Master program. For more training in Excel functions for finance, and for more practice, log on to McGraw-Hill's *Connect Finance* for *Fundamentals of Corporate Finance* to access the Excel Master files. This pedagogically superior tool will help get your students the practice they need to succeed—and to exceed expectations.

Average Returns: The First Lesson

12.3

Excel Master It! Excel Master coverage online

As you've probably begun to notice, the history of capital market returns is too complicated to be of much use in its undigested form. We need to begin summarizing all these numbers. Accordingly, we discuss how to go about condensing the detailed data. We start out by calculating average returns.

CALCULATING AVERAGE RETURNS

The obvious way to calculate the average returns on the different investments in Table 12.1 is to add up the yearly returns and divide by 91. The result is the historical average of the individual values.

For example, if you add up the returns for the large-company stocks in Figure 12.5 for the 91 years, you will get about 10.88. The average annual return is 10.88/91 = .120, or 12.0%. You interpret this 12.0 percent just like any other average. If you were to pick a year at random from the 91-year history and you had to guess what the return in that year was, the best guess would be 12.0 percent.

AVERAGE RETURNS: THE HISTORICAL RECORD

Table 12.2 shows the average returns for the investments we have discussed. As shown, in a typical year, the small-company stocks increased in value by 16.6 percent. Notice also how much larger the returns are for stocks, compared to the returns on bonds.

These averages are, of course, nominal because we haven't worried about inflation. Notice that the average inflation rate was 3.0 percent per year over this 91-year span. The nominal return on U.S. Treasury bills was 3.4 percent per year. The average real return on

CHAPTER SUMMARY AND CONCLUSIONS

Every chapter ends with a concise, but thorough, summary of the important ideas—helping students review the key points and providing closure to the chapter.

CHAPTER REVIEW AND SELF-TEST PROBLEM

2.1 Cash Flow for Mara Corporation This problem will give you some practice working with financial statements and figuring cash flow. Based on the following information for Mara Corporation, prepare an income statement for 2018 and balance sheets for 2017 and 2018. Next, following our U.S. Corporation examples in the chapter, calculate cash flow from assets, cash flow to creditors, and cash flow to stockholders for Mara for 2018. Use a 21 percent tax rate throughout. You can check your answers against ours, found in the following section.

	2017	2018
Sales	$4,203	$4,507
Cost of goods sold	2,422	2,633
Depreciation	785	952
Interest	180	196
Dividends	275	352
Current assets	2,205	2,429
Net fixed assets	7,344	7,650
Current liabilities	1,003	1,255
Long-term debt	3,106	2,085

CHAPTER REVIEW AND SELF-TEST PROBLEMS

Appearing after the Summary and Conclusions, each chapter includes a Chapter Review and Self-Test Problem section. These questions and answers allow students to test their abilities in solving key problems related to the chapter content and provide instant reinforcement.

CONCEPTS REVIEW AND CRITICAL THINKING QUESTIONS

This successful end-of-chapter section facilitates your students' knowledge of key principles, as well as their intuitive understanding of the chapter concepts. A number of the questions relate to the chapter-opening vignette—reinforcing student critical thinking skills and the learning of chapter material.

CONCEPTS REVIEW AND CRITICAL THINKING QUESTIONS

1. **Liquidity** [LO1] What does liquidity measure? Explain the trade-off a firm faces between high liquidity and low liquidity levels.
2. **Accounting and Cash Flows** [LO2] Why might the revenue and cost figures shown on a standard income statement not be representative of the actual cash inflows and outflows that occurred during a period?
3. **Book Values versus Market Values** [LO1] In preparing a balance sheet, why do you think standard accounting practice focuses on historical cost rather than market value?
4. **Operating Cash Flow** [LO2] In comparing accounting net income and operating cash flow, name two items you typically find in net income that are not in operating cash flow. Explain what each is and why it is excluded in operating cash flow.
5. **Book Values versus Market Values** [LO1] Under standard accounting rules, it is possible for a company's liabilities to exceed its assets. When this occurs, the owners' equity is negative. Can this happen with market values? Why or why not?
6. **Cash Flow from Assets** [LO4] Suppose a company's cash flow from assets is negative for a particular period. Is this necessarily a good sign or a bad sign?
7. **Operating Cash Flow** [LO4] Suppose a company's operating cash flow has been negative for several years running. Is this necessarily a good sign or a bad sign?
8. **Net Working Capital and Capital Spending** [LO4] Could a company's change in NWC be negative in a given year? (*Hint*: Yes.) Explain how this might come about. What about net capital spending?
9. **Cash Flow to Stockholders and Creditors** [LO4] Could a company's cash flow to stockholders be negative in a given year? (*Hint*: Yes.) Explain how this might come about. What about cash flow to creditors?
10. **Firm Values** [LO1] Referring back to the Boeing example used at the beginning of the chapter, note that we suggested that Boeing's stockholders probably didn't suffer as a result of the reported loss. What do you think was the basis for our conclusion?

END-OF-CHAPTER QUESTIONS AND PROBLEMS

Students learn better when they have plenty of opportunity to practice; therefore, *Fundamentals*, 12e, provides extensive end-of-chapter questions and problems. The end-of-chapter support greatly exceeds typical introductory textbooks. The questions and problems are separated into three learning levels: Basic, Intermediate, and Challenge. Answers to selected end-of-chapter material appear in Appendix C. Also, most problems are available in McGraw-Hill's *Connect*—see page xxiv for details.

QUESTIONS AND PROBLEMS

connect

BASIC
(Questions 1–10)

1. **Building a Balance Sheet** [LO1] Wims, Inc., has current assets of $4,900, net fixed assets of $27,300, current liabilities of $4,100, and long-term debt of $10,200. What is the value of the shareholders' equity account for this firm? How much is net working capital?
2. **Building an Income Statement** [LO1] Griffin's Goat Farm, Inc., has sales of $796,000, costs of $327,000, depreciation expense of $42,000, interest expense of $34,000, and a tax rate of 21 percent. What is the net income for this firm?
3. **Dividends and Retained Earnings** [LO1] Suppose the firm in Problem 2 paid out $95,000 in cash dividends. What is the addition to retained earnings?
4. **Per-Share Earnings and Dividends** [LO1] Suppose the firm in Problem 3 had 80,000 shares of common stock outstanding. What is the earnings per share, or EPS, figure? What is the dividends per share figure?
5. **Calculating OCF** [LO4] Pompeii, Inc., has sales of $46,200, costs of $23,100, depreciation expense of $2,200, and interest expense of $1,700. If the tax rate is 22 percent, what is the operating cash flow, or OCF?

END-OF-CHAPTER CASES

Located at the end of the book's chapters, these minicases focus on real-life company situations that embody important corporate finance topics. Each case presents a new scenario, data, and a dilemma. Several questions at the end of each case require students to analyze and focus on all of the material they learned from each chapter.

MINICASE

Bullock Gold Mining

Seth Bullock, the owner of Bullock Gold Mining, is evaluating a new gold mine in South Dakota. Dan Dority, the company's geologist, has just finished his analysis of the mine site. He has estimated that the mine would be productive for eight years, after which the gold would be completely mined. Dan has taken an estimate of the gold deposits to Alma Garrett, the company's financial officer. Alma has been asked by Seth to perform an analysis of the new mine and present her recommendation on whether the company should open the new mine.

Alma has used the estimates provided by Dan to determine the revenues that could be expected from the mine. She has also projected the expense of opening the mine and the annual operating expenses. If the company opens the mine, it will cost $635 million today, and it will have a cash outflow of $45 million nine years from today in costs associated with closing the mine and reclaiming the area surrounding it. The expected cash flows each year from the mine are shown in the table. Bullock Mining has a required return of 12 percent on all of its gold mines.

Year	Cash Flow
0	–$635,000,000
1	89,000,000
2	105,000,000
3	130,000,000
4	173,000,000
5	205,000,000
6	155,000,000
7	145,000,000
8	122,000,000
9	– 45,000,000

QUESTIONS

1. Construct a spreadsheet to calculate the payback period, internal rate of return, modified internal rate of return, and net present value of the proposed mine.
2. Based on your analysis, should the company open the mine?
3. Bonus question: Most spreadsheets do not have a built-in formula to calculate the payback period. Write a VBA script that calculates the payback period for a project.

WEB EXERCISES (ONLINE ONLY)

For instructors interested in integrating even more online resources and problems into their course, these web activities show students how to learn from the vast amount of financial resources available on the internet. In the 12th edition of *Fundamentals*, these web exercises are available to students and instructors through *Connect*.

Comprehensive Teaching and Learning Package

This edition of *Fundamentals* has several options in terms of the textbook, instructor supplements, student supplements, and multimedia products. Mix and match to create a package that is perfect for your course!

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Keep all the supplements in one place! Your *Connect* Library contains all the necessary supplements—Teaching Resource Manual, Solutions, Test Bank, Computerized Test Bank, and PowerPoint—all in one easy-to-find, easy-to-use, integrated place: Your *Connect Finance* course.

- **Teaching Resource Manual (TRM)**
  The TRM is a full-service implementation guide designed to support you in the delivery of your curriculum and assist you in integrating Connect.
- **Solutions Manual (SM)**
  Prepared by Brad Jordan, University of Kentucky, and Joe Smolira, Belmont University
  The *Fundamentals* Solutions Manual provides detailed solutions to the extensive end-of-chapter material, including concept review questions, quantitative problems, and cases.
- **Test Bank**
  Prepared by Kay Johnson
  Over 100 questions and problems per chapter! Each chapter includes questions that test the understanding of key terms in the book; questions patterned after learning objectives, concept questions, chapter opening vignettes, boxes, and highlighted phrases; multiple-choice problems patterned after end-of-chapter questions at a variety of skill levels; and essay questions to test problem-solving skills and more advanced understanding of concepts.
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- **Excel Simulations**
  Expanded for this edition! With 180 Excel simulation questions now included in Connect, RWJ is the unparalleled leader in offering students the opportunity to practice using the Excel functions they will use throughout their careers in finance.
- **Corporate Finance Videos**
  New for this edition, brief and engaging conceptual videos (and accompanying questions) help students to master the building blocks of the Corporate Finance course.

- **PowerPoint Presentations**
  The PowerPoint slides for the 12th edition have been revised to include a wealth of instructor material, including lecture tips, real-world examples, and international notes. Each presentation also includes slides dedicated entirely to ethics notes that relate to the chapter topics.

STUDENT RESOURCES

Student resources for this edition can be found through the Library tab in your *Connect Finance* course. If you aren't using *Connect*, visit us at http://connect.mheducation.com to learn more, and ask your professor about using it in your course for access to a great group of supplement resources!

- **Excel Resources**
  For those seeking additional practice, students can access Excel template problems and Excel Master, designed by Brad Jordan and Joe Smolira.
- **Narrated Lecture Videos**
  Updated for this edition, the Narrated Lecture videos provide real-world examples accompanied by step-by-step instructions and explanations for solving problems presented in the chapter. The Concept Checks from the text are also integrated into the slides to reinforce the key topics in the chapter. Designed specifically to appeal to the different learning methods of students, the slides provide a visual and audio explanation of topics and problems.

TEACHING SUPPORT

Along with having access to all of the student resource materials through the *Connect* Library tab, you also have password-protected access to the Instructor's Manual, solutions to end-of-chapter problems and cases, Instructor's PowerPoint, Excel Template Solutions, video clips, and video projects and questions.

HOW THE MARKET WORKS

Students receive free access to this web-based portfolio simulation with a hypothetical brokerage account to buy and sell stocks and mutual funds. Students can use the real data found at this site in conjunction with the chapters on investments. They can also compete against students in their class and around the United States to run the most successful portfolio. This site is powered by Stock-Trak, the leading provider of investment simulation services to the academic community.

AVAILABLE FOR PURCHASE & PACKAGING

FinGame Online 5.0

By LeRoy Brooks, John Carroll University

(ISBN 10: 0077219880/ISBN 13: 9780077219888)

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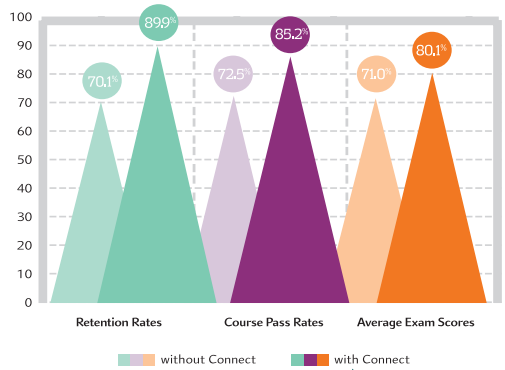

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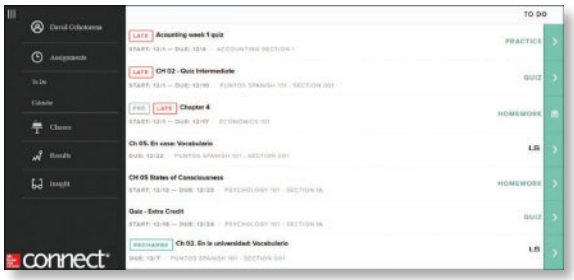

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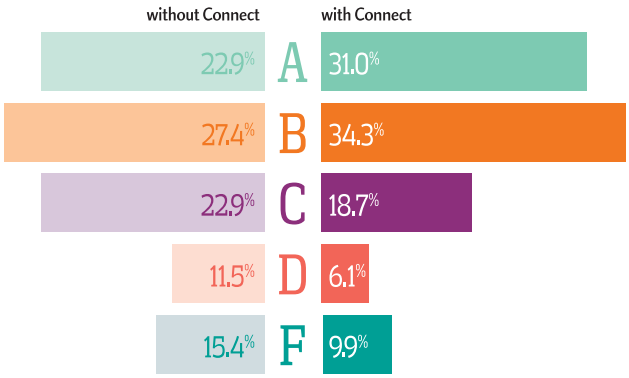

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by Mark A. White, University of Virginia, McIntire School of Commerce

(ISBN 10: 0073217093/ISBN 13: 9780073217093)

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Assurance of Learning is an important element of many accreditation standards. *Fundamentals of Corporate Finance*, 12e, is designed specifically to support your assurance of learning initiatives. Each chapter in the book begins with a list of numbered learning objectives that appear throughout the chapter, as well as in the end-of-chapter problems and exercises. Every test bank question is also linked to one of these objectives, in addition to level of difficulty, topic area, Bloom's Taxonomy level, and AACSB skill area. *Connect*, McGraw-Hill's online homework solution, and EZ Test, McGraw-Hill's easy-to-use test bank software, can search the test bank using these and other categories, providing an engine for targeted Assurance of Learning analysis and assessment.

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Acknowledgments

To borrow a phrase, writing an introductory finance textbook is easy—all you do is sit down at a word processor and open a vein. We never would have completed this book without the incredible amount of help and support we received from literally hundreds of our colleagues, students, editors, family members, and friends. We would like to thank, without implicating, all of you.

Clearly, our greatest debt is to our many colleagues (and their students) who, like us, wanted to try an alternative to what they were using and made the decision to change. Needless to say, without this support, we would not be publishing a 12th edition!

A great many of our colleagues read the drafts of our first and subsequent editions. The fact that this book has so little in common with our earliest drafts, along with the many changes and improvements we have made over the years, is a reflection of the value we placed on the many comments and suggestions that we received. To the following reviewers, then, we are grateful for their many contributions:

Ibrahim Affeneh
Jan Ambrose
Mike Anderson
Sung C. Bae
Robert Benecke
Gary Benesh
Scott Besley
Sanjai Bhaghat
Vigdis Boasson
Elizabeth Booth
Denis Boudreaux
Jim Boyd
William Brent
Ray Brooks
Charles C. Brown
Lawrence Byerly
Steve Byers
Steve Caples
Asim Celik
Christina Cella
Mary Chaffin
Fan Chen
Raju Chenna
Barbara J. Childs
Charles M. Cox
Natalya Delcoure
Michael Dorigan
David A. Dumpe
Michael Dunn
Alan Eastman
Adrian C. Edwards
Uchenna Elike
Steve Engel
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Cheri Etling
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Daniel Jubinski
Jarl G. Kallberg
Ashok Kapoor
Terry Keasler
Howard Keen
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Jim Keys
Kee Kim
Deborah King
Robert Kleinman
Ladd Kochman
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Morris A. Lamberson
Qin Lan
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Marsha Weber
Jill Wetmore
Mark White
Susan White
Annie Wong
Colbrin Wright
David J. Wright
Steve B. Wyatt
Tung-Hsiao Yang
Morris Yarmish
Michael Young
Mei Zhang
J. Kenton Zumwalt
Tom Zwirlein

Several of our most respected colleagues contributed original essays for this edition, which are entitled “In Their Own Words,” and appear in selected chapters. To these individuals we extend a special thanks:

Edward I. Altman
New York University

Robert C. Higgins
University of Washington

Roger Ibbotson
Yale University, Ibbotson Associates

Erik Lie
University of Iowa

Robert C. Merton
Harvard University, Massachusetts Institute of Technology

Jay R. Ritter
University of Florida

Richard Roll
California Institute of Technology

Fischer Black

Jeremy Siegel
University of Pennsylvania

Hersh Shefrin
Santa Clara University

Bennett Stewart
Stern Stewart & Co.

Samuel C. Weaver
Lehigh University

Merton H. Miller

We are lucky to have had skilled and experienced instructors developing the supplement material for this edition. We greatly appreciate the contributions of Joe Smolira, Belmont University, who worked closely with us to develop the Solutions Manual, the new and improved

Instructor's Guide, and to create Excel templates for many of the end-of-chapter problems. Thank you also to Kay Johnson for thorough updating, revising, and tagging of every problem in the test bank.

The following proofers did outstanding work on this edition of *Fundamentals:* Emily Bello and Steve Hailey. To them fell the unenviable task of technical proofreading, and in particular, careful checking of each calculation throughout the text and Instructor's Manual.

Finally, in every phase of this project, we have been privileged to have had the complete and unwavering support of a great organization, McGraw-Hill Education. We especially thank the sales group. The suggestions they provide, their professionalism in assisting potential adopters, and the service they provide to current users have been a major factor in our success.

We are deeply grateful to the select group of professionals who served as our development team on this edition: Chuck Synovec, Director; Jennifer Upton, Senior Product Developer; Trina Maurer, Senior Marketing Manager; Matt Diamond, Designer; Jill Eccher, Core Project Manager. Others at McGraw-Hill/Irwin, too numerous to list here, have improved the book in countless ways.

Throughout the development of this edition, we have taken great care to discover and eliminate errors. Our goal is to provide the best textbook available on the subject. To ensure that future editions are error-free, we gladly offer $10 per arithmetic error to the first individual reporting it as a modest token of our appreciation. More than this, we would like to hear from instructors and students alike. Please write and tell us how to make this a better text. Forward your comments to: Dr. Brad Jordan, c/o Editorial—Finance, McGraw-Hill Education, 1333 Burr Ridge Parkway, Burr Ridge, IL 60527.

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Randolph W. Westerfield
Bradford D. Jordan

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In Their Own Words Boxes

Pedagogical Use of Color

Throughout the 12th edition of *Fundamentals of Corporate Finance*, we make color a functional dimension of the discussion. In almost every chapter, color plays an extensive and largely self-evident role. Color in these chapters alerts students to the relationship between numbers in a discussion and an accompanying table or figure.

CHAPTER 2

Blue: Identifies net capital spending and change in net working capital
Green: Identifies cash flow numbers

CHAPTERS 3 AND 4

Throughout the chapter
Blue: Identifies income statements
Green: Identifies balance sheets (Also see all 23 ratios in Chapter 3)

CHAPTER 7

Section 7.4
Blue: Identifies the implicit interest expense
Green: Identifies the straight-line interest expense

CHAPTER 9

Section 9.5
Blue: Identifies Project A
Green: Identifies Project B

CHAPTER 13

Sections 13.1 and 13.2
Blue: Identifies Stock L
Green: Identifies Stock U

Section 13.7
Blue: Identifies Asset B
Green: Identifies Asset A

CHAPTER 14

Section 14.2
Blue: Identifies dollar and percentage changes in dividends
Green: Identifies dividends

CHAPTER 15

Section 15.9
Blue: Identifies values of shares with and without dilution
Green: Identifies original values of shares

CHAPTER 16

Section 16.2
Blue: Identifies the proposed capital structure
Green: Identifies the current capital structure

Section 16.4
Blue: Identifies Firm L
Green: Identifies Firm U

CHAPTER 18

Section 18.4
Blue: Identifies total cash collections
Green: Identifies total cash disbursements
Bold Black: Identifies the net cash inflows

CHAPTER 19

Section 19.2
Blue: Receipts and deposits
Green: Total float
End-of-chapter Appendix
Blue: Identifies contributing costs
Green: Identifies the opportunity, trading, and total costs

CHAPTER 20

Section 20.8
Blue: Identifies numbers exceeding the cost-minimizing restock quantity
Green: Identifies numbers falling below the cost-minimizing restock quantity
Bold Black: Identifies cost-minimizing quantity

CHAPTER 21

Section 21.5
Blue: Identifies cash flows
Green: Identifies expected exchange rates

CHAPTER 23

Sections 23.2, 23.3, and 23.6
Blue: Identifies the payoff profile

Green: Identifies the risk profile
Magenta: Identifies the hedge position

CHAPTER 24

Section 24.1
Blue: Identifies puts
Green: Identifies calls
Section 24.2
Blue: Identifies stock value
Green: Identifies portfolio value

CHAPTER 26

Sections 26.3 and 26.5 (See Tables 26.1 and 26.2)
Blue: Identifies Firm A and Global Resources
Green: Identifies Firm B and Regional Enterprises
Bold Black: Identifies the merged firm, Firm AB, and the merged identity of Global Resources

CHAPTER 27

Tables 27.2 and 27.3
Blue: Identifies cash flow components
Green: Identifies total cash flow

Introduction to Corporate Finance

Chapter 1

THE CONTROL of a corporation typically rests with its shareholders, who receive one vote for each share of stock they own. However, Alphabet (the parent company of Google) and Facebook are two well-known companies with unusual voting rights. Both companies originally had two classes of stock: Class A, with 1 vote per share, and Class B, with 10 votes per share. The B shares were mostly held by the founding shareholders, so the voting structure meant that Mark Zuckerberg (Facebook) and Sergey Brin and Larry Page (Alphabet) retained control of the companies they started.

In 2016, Facebook announced that it would create Class C shares, similar to what Google had done in 2014. The Class C shares would have the same economic benefit as Class A and B shares, but no voting rights. So why would these two companies create shares of stock with different voting rights, and in the case of Class C stock, no voting rights? The answer leads us to the corporate form of organization, corporate goals, and corporate control, all of which we discuss in this chapter.

Learning Objectives

After studying this chapter, you should be able to:

- **LO1** Define the basic types of financial management decisions and the role of the financial manager.
- **LO2** Explain the goal of financial management.
- **LO3** Articulate the financial implications of the different forms of business organization.
- **LO4** Explain the conflicts of interest that can arise between managers and owners.

For updates on the latest happenings in finance, visit fundamentalsofcorporatefinance.blogspot.com.

To begin our study of modern corporate finance and financial management, we need to address two central issues. First, what is corporate finance and what is the role of the financial manager in the corporation? Second, what is the goal of financial management? To describe the financial management environment, we consider the corporate form of organization and discuss some conflicts that can arise within the corporation. We also take a brief look at financial markets in the United States.

1.1 Corporate Finance and the Financial Manager

In this section, we discuss where the financial manager fits in the corporation. We start by defining *corporate finance* and the financial manager's job.

WHAT IS CORPORATE FINANCE?

Imagine that you were to start your own business. No matter what type you started, you would have to answer the following three questions in some form or another:

1. What long-term investments should you take on? That is, what lines of business will you be in and what sorts of buildings, machinery, and equipment will you need?
2. Where will you get the long-term financing to pay for your investment? Will you bring in other owners or will you borrow the money?
3. How will you manage your everyday financial activities such as collecting from customers and paying suppliers?

These are not the only questions by any means, but they are among the most important. Corporate finance, broadly speaking, is the study of ways to answer these three questions. Accordingly, we'll be looking at each of them in the chapters ahead.

THE FINANCIAL MANAGER

A striking feature of large corporations is that the owners (the stockholders) are usually not directly involved in making business decisions, particularly on a day-to-day basis. Instead, the corporation employs managers to represent the owners' interests and make decisions on their behalf. In a large corporation, the financial manager would be in charge of answering the three questions we raised in the preceding section.

For current issues facing CFOs, see **ww2.cfo.com**.

The financial management function is usually associated with a top officer of the firm, such as a vice president of finance or some other chief financial officer (CFO). Figure 1.1 is a simplified organizational chart that highlights the finance activity in a large firm. As shown, the vice president of finance coordinates the activities of the treasurer and the controller. The controller's office handles cost and financial accounting, tax payments, and management information systems. The treasurer's office is responsible for managing the firm's cash and credit, its financial planning, and its capital expenditures. These treasury activities are all related to the three general questions raised earlier, and the chapters ahead deal primarily with these issues. Our study thus bears mostly on activities usually associated with the treasurer's office.

FINANCIAL MANAGEMENT DECISIONS

As the preceding discussion suggests, the financial manager must be concerned with three basic types of questions. We consider these in greater detail next.

capital budgeting
The process of planning and managing a firm's long-term investments.

Capital Budgeting The first question concerns the firm's long-term investments. The process of planning and managing a firm's long-term investments is called **capital budgeting**. In capital budgeting, the financial manager tries to identify investment opportunities that are worth more to the firm than they cost to acquire. Loosely speaking, this means that the value of the cash flow generated by an asset exceeds the cost of that asset.

The types of investment opportunities that would typically be considered depend in part on the nature of the firm's business. For a large retailer such as Walmart, deciding whether to open another store would be an important capital budgeting decision. Similarly, for a

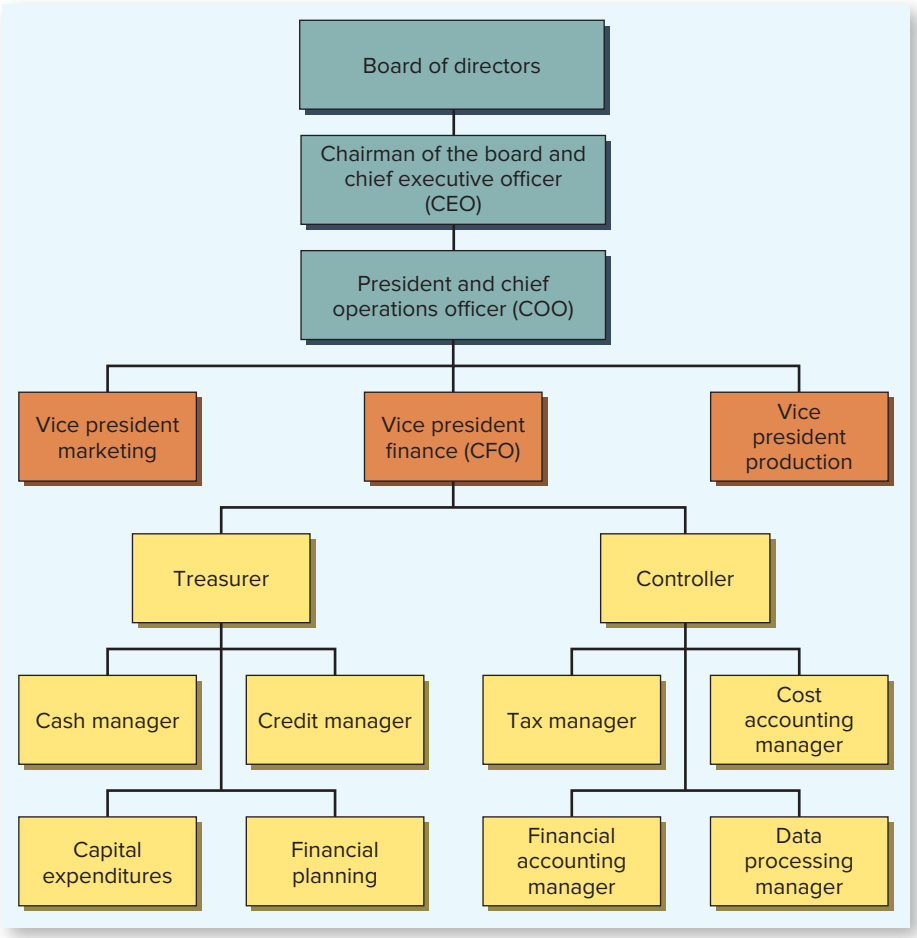


FIGURE 1.1
A Sample Simplified Organizational Chart

software company such as Oracle or Microsoft, the decision to develop and market a new spreadsheet program would be a major capital budgeting decision. Some decisions, such as what type of computer system to purchase, might not depend so much on a particular line of business.

Regardless of the specific nature of an opportunity under consideration, financial managers must be concerned not only with how much cash they expect to receive, but also with when they expect to receive it and how likely they are to receive it. Evaluating the *size, timing,* and *risk* of future cash flows is the essence of capital budgeting. In fact, as we will see in the chapters ahead, whenever we evaluate a business decision, the size, timing, and risk of the cash flows will be by far the most important things we will consider.

Capital Structure The second question for the financial manager concerns ways in which the firm obtains and manages the long-term financing it needs to support its long-term investments. A firm's **capital structure** (or financial structure) is the specific mixture of long-term debt and equity the firm uses to finance its operations. The financial manager has two concerns in this area. First, how much should the firm borrow? That is, what mixture of debt and equity is best? The mixture chosen will affect both the risk and the value of the firm. Second, what are the least expensive sources of funds for the firm?

capital structure
The mixture of debt and equity maintained by a firm.

If we picture the firm as a pie, then the firm's capital structure determines how that pie is sliced—in other words, what percentage of the firm's cash flow goes to creditors and what percentage goes to shareholders. Firms have a great deal of flexibility in choosing a financial structure. The question of whether one structure is better than any other for a particular firm is the heart of the capital structure issue.

In addition to deciding on the financing mix, the financial manager has to decide exactly how and where to raise the money. The expenses associated with raising long-term financing can be considerable, so different possibilities must be carefully evaluated. Also, corporations borrow money from a variety of lenders in a number of different, and sometimes exotic, ways. Choosing among lenders and among loan types is another job handled by the financial manager.

working capital
A firm's short-term assets and liabilities.

Working Capital Management The third question concerns **working capital** management. The term *working capital* refers to a firm's short-term assets, such as inventory, and its short-term liabilities, such as money owed to suppliers. Managing the firm's working capital is a day-to-day activity that ensures that the firm has sufficient resources to continue its operations and avoid costly interruptions. This involves a number of activities related to the firm's receipt and disbursement of cash.

Some questions about working capital that must be answered are the following: (1) How much cash and inventory should we keep on hand? (2) Should we sell on credit? If so, what terms will we offer, and to whom will we extend them? (3) How will we obtain any needed short-term financing? Will we purchase on credit, or will we borrow in the short term and pay cash? If we borrow in the short term, how and where should we do it? These are just a small sample of the issues that arise in managing a firm's working capital.

Conclusion The three areas of corporate financial management we have described—capital budgeting, capital structure, and working capital management—are very broad categories. Each includes a rich variety of topics, and we have indicated only a few questions that arise in the different areas. The chapters ahead contain greater detail.

Concept Questions

1.1a What is the capital budgeting decision?

1.1b What do you call the specific mixture of long-term debt and equity that a firm chooses to use?

1.1c Into what category of financial management does cash management fall?

1.2 Forms of Business Organization

Large firms in the United States, such as Ford and Microsoft, are almost all organized as corporations. We examine the three different legal forms of business organization—sole proprietorship, partnership, and corporation—to see why this is so. Each form has distinct advantages and disadvantages for the life of the business, the ability of the business to raise cash, and taxes. A key observation is that as a firm grows, the advantages of the corporate form may come to outweigh the disadvantages.

SOLE PROPRIETORSHIP

sole proprietorship
A business owned by a single individual.

A **sole proprietorship** is a business owned by one person. This is the simplest type of business to start and is the least regulated form of organization. Depending on where you live, you might be able to start a proprietorship by doing little more than getting a business

license and opening your doors. For this reason, there are more proprietorships than any other type of business, and many businesses that later become large corporations start out as small proprietorships.

The owner of a sole proprietorship keeps all the profits. That's the good news. The bad news is that the owner has *unlimited liability* for business debts. This means that creditors can look beyond business assets to the proprietor's personal assets for payment. Similarly, there is no distinction between personal and business income, so all business income is taxed as personal income. However, with the passage of the Tax Cuts and Jobs Act of 2017, up to 20 percent of business income may be exempt from taxation (the specific rules are too complex to cover here).

The life of a sole proprietorship is limited to the owner's life span, and the amount of equity that can be raised is limited to the amount of the proprietor's personal wealth. This limitation often means that the business is unable to exploit new opportunities because of insufficient capital. Ownership of a sole proprietorship may be difficult to transfer because this transfer requires the sale of the entire business to a new owner.

PARTNERSHIP

A **partnership** is similar to a proprietorship except that there are two or more owners (partners). In a *general partnership*, all the partners share in gains or losses, and all have unlimited liability for *all* partnership debts, not just some particular share. The way partnership gains (and losses) are divided is described in the *partnership agreement*. This agreement can be an informal oral agreement, such as "let's start a lawn mowing business," or a lengthy, formal written document.

partnership
A business formed by two or more individuals or entities.

In a *limited partnership*, one or more *general partners* will run the business and have unlimited liability, but there will be one or more *limited partners* who will not actively participate in the business. A limited partner's liability for business debts is limited to the amount that partner contributes to the partnership. This form of organization is common in real estate ventures, for example.

The advantages and disadvantages of a partnership are basically the same as those of a proprietorship. Partnerships based on a relatively informal agreement are easy and inexpensive to form. General partners have unlimited liability for partnership debts, and the partnership terminates when a general partner wishes to sell out or dies. All income is taxed as personal income to the partners, and the amount of equity that can be raised is limited to the partners' combined wealth. As with sole proprietorships, beginning in 2018, up to 20 percent of a partner's income may be exempt depending on various rules spelled out in the Tax Cuts and Jobs Act of 2017. Ownership of a general partnership is not easily transferred because a transfer requires that a new partnership be formed. A limited partner's interest can be sold without dissolving the partnership, but finding a buyer may be difficult.

Because a partner in a general partnership can be held responsible for all partnership debts, having a written agreement is very important. Failure to spell out the rights and duties of the partners frequently leads to misunderstandings later on. Also, if you are a limited partner, you must not become deeply involved in business decisions unless you are willing to assume the obligations of a general partner. The reason is that if things go badly, you may be deemed to be a general partner even though you say you are a limited partner.

Based on our discussion, the primary disadvantages of sole proprietorships and partnerships as forms of business organization are (1) unlimited liability for business debts on the part of the owners, (2) limited life of the business, and (3) difficulty of transferring ownership. These three disadvantages add up to a single, central problem: The ability of such businesses to grow can be seriously limited by an inability to raise cash for investment.

CORPORATION

The **corporation** is the most important form (in terms of size) of business organization in the United States. A corporation is a legal "person," separate and distinct from its owners,

corporation
A business created as a distinct legal entity composed of one or more individuals or entities.

and it has many of the rights, duties, and privileges of an actual person. Corporations can borrow money and own property, sue and be sued, and enter into contracts. A corporation can even be a general partner or a limited partner in a partnership, and a corporation can own stock in another corporation.

Not surprisingly, starting a corporation is somewhat more complicated than starting the other forms of business organization. Forming a corporation involves preparing *articles of incorporation* (or a charter) and a set of *bylaws*. The articles of incorporation must contain a number of things, including the corporation's name, its intended life (which can be forever), its business purpose, and the number of shares that can be issued. This information must normally be supplied to the state in which the firm will be incorporated. For most legal purposes, the corporation is a "resident" of that state.

The bylaws are rules describing how the corporation regulates its existence. For example, the bylaws describe how directors are elected. These bylaws may be a simple statement of a few rules and procedures, or they may be quite extensive for a large corporation. The bylaws may be amended or extended from time to time by the stockholders.

In a large corporation, the stockholders and the managers are usually separate groups. The stockholders elect the board of directors, who then select the managers. Managers are charged with running the corporation's affairs in the stockholders' interests. In principle, stockholders control the corporation because they elect the directors.

As a result of the separation of ownership and management, the corporate form has several advantages. Ownership (represented by shares of stock) can be readily transferred, and the life of the corporation is therefore not limited. The corporation borrows money in its own name. As a result, the stockholders in a corporation have limited liability for corporate debts. The most they can lose is what they have invested.

The relative ease of transferring ownership, the limited liability for business debts, and the unlimited life of the business are why the corporate form is superior for raising cash. If a corporation needs new equity, for example, it can sell new shares of stock and attract new investors. Apple is an example. The company was a pioneer in the personal computer business. As demand for its products exploded, it had to convert to the corporate form of organization to raise the capital needed to fund growth and new product development. The number of owners can be huge; larger corporations have many thousands or even millions of stockholders. For example, in 2017, General Electric Company (better known as GE) had about 440,000 stockholders and about 8.7 billion shares outstanding. In such cases, ownership can change continuously without affecting the continuity of the business.

The corporate form has a significant disadvantage. Because a corporation is a legal person, it must pay taxes. Moreover, money paid out to stockholders in the form of dividends is taxed again as income to those stockholders. This is *double taxation*, meaning that corporate profits are taxed twice: First at the corporate level when they are earned and again at the personal level when they are paid out.[1]

Today, all 50 states have enacted laws allowing for the creation of a relatively new form of business organization, the limited liability company (LLC). The goal of this entity is to operate and be taxed like a partnership but retain limited liability for owners, so an LLC is essentially a hybrid of partnership and corporation. Although states have differing definitions for LLCs, the more important scorekeeper is the Internal Revenue Service (IRS). The IRS will consider an LLC a corporation, thereby subjecting it to double taxation, unless it meets certain specific criteria. In essence, an LLC cannot be too corporation-like, or it will be treated as one by the IRS. LLCs have become common. For example, Goldman, Sachs and Co., one of Wall Street's last remaining partnerships, decided to convert from a private

[1]An S corporation is a special type of small corporation that is essentially taxed like a partnership and thus avoids double taxation. In 2017, the maximum number of shareholders in an S corporation was 100.

TABLE 1.1 International Corporations

		Type of Company	
Company	**Country of Origin**	**In Original Language**	**Translated**
Bayerische Motoren Werke (BMW) AG	Germany	Aktiengesellschaft	Corporation
Dornier GmbH	Germany	Gesellschaft mit Beschränkter Haftung	Limited liability company
Rolls-Royce PLC	United Kingdom	Public limited company	Public limited company
Shell UK Ltd.	United Kingdom	Limited	Corporation
Unilever NV	Netherlands	Naamloze Vennootschap	Joint stock company
Fiat SpA	Italy	Società per Azioni	Joint stock company
Volvo AB	Sweden	Aktiebolag	Joint stock company
Peugeot SA	France	Société Anonyme	Joint stock company

partnership to an LLC (it later "went public," becoming a publicly held corporation). Large accounting firms and law firms by the score have converted to LLCs.

As the discussion in this section illustrates, because of their need for outside investors and creditors, the corporate form will generally be the best choice for large firms. We focus on corporations in the chapters ahead because of the importance of the corporate form in the United States and world economies. Also, a few important financial management issues, such as dividend policy, are unique to corporations. However, businesses of all types and sizes need financial management, so the majority of the subjects we discuss bear on any form of business.

A CORPORATION BY ANOTHER NAME . . .

The corporate form of organization has many variations around the world. The exact laws and regulations differ from country to country, of course, but the essential features of public ownership and limited liability remain. These firms are often called *joint stock companies*, *public limited companies*, or *limited liability companies*, depending on the specific nature of the firm and the country of origin.

Table 1.1 gives the names of a few well-known international corporations, their countries of origin, and a translation of the abbreviation that follows the company name.

Concept Questions

1.2a What are the three forms of business organization?

1.2b What are the primary advantages and disadvantages of sole proprietorships and partnerships?

1.2c What is the difference between a general and a limited partnership?

1.2d Why is the corporate form superior when it comes to raising cash?

The Goal of Financial Management 1.3

Assuming that we restrict ourselves to for-profit businesses, the goal of financial management is to make money or add value for the owners. This goal is a little vague, of course, so we examine some different ways of formulating it to come up with a more precise definition. Such a definition is important because it leads to an objective basis for making and evaluating financial decisions.

POSSIBLE GOALS

If we were to consider possible financial goals, we might come up with some ideas like the following:

Survive.

Avoid financial distress and bankruptcy.

Beat the competition.

Maximize sales or market share.

Minimize costs.

Maximize profits.

Maintain steady earnings growth.

These are only a few of the goals we could list. Furthermore, each of these possibilities presents problems as a goal for the financial manager.

For example, it's easy to increase market share or unit sales: All we have to do is lower our prices or relax our credit terms. Similarly, we can always cut costs simply by doing away with things such as research and development. We can avoid bankruptcy by never borrowing any money or never taking any risks, and so on. It's not clear that any of these actions are in the stockholders' best interests.

Profit maximization would probably be the most commonly cited goal, but even this is not a precise objective. Do we mean profits this year? If so, we should note that actions such as deferring maintenance, letting inventories run down, and taking other short-run cost-cutting measures will tend to increase profits now, but these activities aren't necessarily desirable.

The goal of maximizing profits may refer to some sort of "long-run" or "average" profits, but it's still unclear exactly what this means. First, do we mean something like accounting net income or earnings per share? As we will see in more detail in the next chapter, these accounting numbers may have little to do with what is good or bad for the firm. Second, what do we mean by the long run? As a famous economist once remarked, in the long run, we're all dead! More to the point, this goal doesn't tell us what the appropriate trade-off is between current and future profits.

The goals we've listed here are all different, but they tend to fall into two classes. The first of these relates to profitability. The goals involving sales, market share, and cost control all relate, at least potentially, to different ways of earning or increasing profits. The goals in the second group, involving bankruptcy avoidance, stability, and safety, relate in some way to controlling risk. Unfortunately, these two types of goals are somewhat contradictory. The pursuit of profit normally involves some element of risk, so it isn't really possible to maximize both safety and profit. What we need, therefore, is a goal that encompasses both factors.

THE GOAL OF FINANCIAL MANAGEMENT

The financial manager in a corporation makes decisions for the stockholders of the firm. Given this, instead of listing possible goals for the financial manager, we really need to answer a more fundamental question: From the stockholders' point of view, what is a good financial management decision?

If we assume that stockholders buy stock because they seek to gain financially, then the answer is obvious: Good decisions increase the value of the stock, and poor decisions decrease the value of the stock.

Given our observations, it follows that the financial manager acts in the shareholders' best interests by making decisions that increase the value of the stock. The appropriate goal for the financial manager can thus be stated quite easily:

The goal of financial management is to maximize the current value per share of the existing stock.

The goal of maximizing the value of the stock avoids the problems associated with the different goals we listed earlier. There is no ambiguity in the criterion, and there is no short-run versus long-run issue. We explicitly mean that our goal is to maximize the *current* stock value.

If this goal seems a little strong or one-dimensional to you, keep in mind that the stockholders in a firm are residual owners. By this we mean that they are entitled to only what is left after employees, suppliers, and creditors (and anyone else with a legitimate claim) are paid their due. If any of these groups go unpaid, the stockholders get nothing. So, if the stockholders are winning in the sense that the leftover, residual portion is growing, it must be true that everyone else is winning also.

Because the goal of financial management is to maximize the value of the stock, we need to learn how to identify investments and financing arrangements that favorably impact the value of the stock. This is precisely what we will be studying. In fact, we could have defined *corporate finance* as the study of the relationship between business decisions and the value of the stock in the business.

A MORE GENERAL GOAL

Given our goal as stated in the preceding section (maximize the value of the stock), an obvious question comes up: What is the appropriate goal when the firm has no traded stock? Corporations are certainly not the only type of business; and the stock in many corporations rarely changes hands, so it's difficult to say what the value per share is at any given time.

As long as we are dealing with for-profit businesses, only a slight modification is needed. The total value of the stock in a corporation is simply equal to the value of the owners' equity. Therefore, a more general way of stating our goal is as follows: Maximize the market value of the existing owners' equity.

With this in mind, it doesn't matter whether the business is a proprietorship, a partnership, or a corporation. For each of these, good financial decisions increase the market value of the owners' equity and poor financial decisions decrease it. In fact, although we focus on corporations in the chapters ahead, the principles we develop apply to all forms of business. Many of them even apply to the not-for-profit sector.

Finally, our goal does not imply that the financial manager should take illegal or unethical actions in the hope of increasing the value of the equity in the firm. What we mean is that the financial manager best serves the owners of the business by identifying goods and services that add value to the firm because they are desired and valued in the free marketplace.

SARBANES-OXLEY

In response to corporate scandals at companies such as Enron, WorldCom, Tyco, and Adelphia, Congress enacted the Sarbanes-Oxley Act in 2002. The act, better known as "Sarbox," is intended to protect investors from corporate abuses. For example, one section of Sarbox prohibits personal loans from a company to its officers, such as the ones that were received by WorldCom CEO Bernie Ebbers.

One of the key sections of Sarbox took effect on November 15, 2004. Section 404 requires, among other things, that each company's annual report must have an assessment of the company's internal control structure and financial reporting. An independent auditor must then evaluate and attest to management's assessment of these issues.

Sarbox contains other key requirements. For example, the officers of the corporation must review and sign the annual reports. They must explicitly declare that the annual report does not contain any false statements or material omissions; that the financial statements fairly represent the financial results; and that they are responsible for all internal controls. Finally, the annual report must list any deficiencies in internal controls. In essence, Sarbox makes company management responsible for the accuracy of the company's financial statements.

For more about Sarbanes-Oxley, visit **www.soxlaw.com**.

Because of its extensive reporting requirements, compliance with Sarbox can be very costly, which has led to some unintended results. Since its implementation, hundreds of public firms have chosen to "go dark," meaning that their shares are no longer traded on the major stock exchanges, in which case Sarbox does not apply. Most of these companies stated that their reason was to avoid the cost of compliance. Ironically, in such cases, the law has had the effect of eliminating public disclosure instead of improving it.

Concept Questions

1.3a What is the goal of financial management?
1.3b What are some shortcomings of the goal of profit maximization?
1.3c Can you give a definition of *corporate finance*?

1.4 The Agency Problem and Control of the Corporation

We've seen that the financial manager acts in the best interests of the stockholders by taking actions that increase the value of the stock. However, we've also seen that in large corporations ownership can be spread over a huge number of stockholders. This dispersion of ownership arguably means that management effectively controls the firm. In this case, will management necessarily act in the best interests of the stockholders? Put another way, might management choose to pursue its own goals at the stockholders' expense? In the following pages, we briefly consider some of the arguments relating to this question.

AGENCY RELATIONSHIPS

The relationship between stockholders and management is called an *agency relationship*. Such a relationship exists whenever someone (the principal) hires another (the agent) to represent his or her interests. For example, you might hire someone (an agent) to sell a car you own while you are away at school. In all such relationships, there is a possibility of conflict of interest between the principal and the agent. Such a conflict is called an **agency problem**.

agency problem
The possibility of conflict of interest between the stockholders and management of a firm.

Suppose you hire someone to sell your car and agree to pay that person a flat fee when he or she sells the car. The agent's incentive in this case is to make the sale, not necessarily to get you the best price. If you offer a commission of, say, 10 percent of the sales price instead of a flat fee, then this problem might not exist. This example illustrates that the way in which an agent is compensated is one factor that affects agency problems.

MANAGEMENT GOALS

To see how management and stockholder interests might differ, imagine that the firm is considering a new investment. The new investment is expected to favorably impact the share value, but it is also a relatively risky venture. The owners of the firm will wish to

take the investment (because the stock value will rise), but management may not because there is the possibility that things will turn out badly and management jobs will be lost. If management does not take the investment, then the stockholders may lose a valuable opportunity. This is one example of an agency cost.

More generally, the term *agency costs* refers to the costs of the conflict of interest between stockholders and management. These costs can be indirect or direct. An indirect agency cost is a lost opportunity, such as the one we have just described.

Direct agency costs come in two forms. The first type is a corporate expenditure that benefits management but costs the stockholders. Perhaps the purchase of a luxurious and unneeded corporate jet would fall under this heading. The second type of direct agency cost is an expense that arises from the need to monitor management actions. Paying outside auditors to assess the accuracy of financial statement information could be one example.

It is sometimes argued that, left to themselves, managers would tend to maximize the amount of resources over which they have control or, more generally, corporate power or wealth. This goal could lead to an overemphasis on corporate size or growth. For example, cases in which management is accused of overpaying to buy another company just to increase the size of the business or to demonstrate corporate power are not uncommon. Obviously, if overpayment does take place, such a purchase does not benefit the stockholders of the purchasing company.

Our discussion indicates that management may tend to overemphasize organizational survival to protect job security. Also, management may dislike outside interference, so independence and corporate self-sufficiency may be important goals.

DO MANAGERS ACT IN THE STOCKHOLDERS' INTERESTS?

Whether managers will, in fact, act in the best interests of stockholders depends on two factors. First, how closely are management goals aligned with stockholder goals? This question relates, at least in part, to the way managers are compensated. Second, can managers be replaced if they do not pursue stockholder goals? This issue relates to control of the firm. As we will discuss, there are a number of reasons to think that even in the largest firms, management has a significant incentive to act in the interests of stockholders.

Managerial Compensation Management will frequently have a significant economic incentive to increase share value for two reasons. First, managerial compensation, particularly at the top, is usually tied to financial performance in general and often to share value in particular. For example, managers are frequently given the option to buy stock at a bargain price. The more the stock is worth, the more valuable is this option. In fact, options are often used to motivate employees of all types, not just top managers. For example, in late 2016, Alphabet's more than 72,000 employees owned enough options to buy 3.3 million shares in the company. Many other corporations, large and small, have adopted similar policies.

The second incentive managers have relates to job prospects. Better performers within the firm will tend to get promoted. More generally, managers who are successful in pursuing stockholder goals will be in greater demand in the labor market and thus command higher salaries.

In fact, managers who are successful in pursuing stockholder goals can reap enormous rewards. For example, according to Equilar, the best-paid executive in 2016 was Thomas Rutledge, the CEO of Charter Communications, who made about $98 million. By way of comparison, Rutledge made less than performer Katy Perry ($135 million) and way less than boxer Floyd Mayweather ($300 million). Information about executive compensation, along with lots of other information, can be easily found on the web for almost any public company. Our nearby *Work the Web* box shows you how to get started.

WORK THE WEB

The web is a great place to learn more about individual companies, and there are a slew of sites available to help you. Try pointing your web browser to finance.yahoo.com. Once you get there, you should see a link for a "Quote Lookup".

To look up a company, you can use its "ticker symbol" (or just ticker for short), which is a unique one- to five-letter identifier. You can even type the company name into the lookup box and Yahoo Finance will show you the ticker symbol. We typed in "PZZA", which is the ticker for pizza maker Papa John's. Here is a portion of what we found:

There's a lot of information here and many links for you to explore, so have at it. By the end of the term, we hope it all makes sense to you!

Questions

1. *Go to finance.yahoo.com and find the current stock prices for Southwest Airlines (LUV), Harley-Davidson (HOG), and Anheuser-Busch InBev (BUD).*
2. *Get a quote for American Express (AXP) and follow the "Statistics" link. What information is available on this link? What do* mrq, ttm, yoy, *and* lfy *mean?*

Business ethics are considered at **www.business-ethics.com**.

While the appropriate level of executive compensation can be debated, bonuses and other payments made to executives who receive payments due to illegal or unethical behavior are a problem. Recently, "clawbacks" and deferred compensation have been introduced to combat such questionable payments. With a clawback, a bonus can be reclaimed by the company for specific reasons, such as fraud. For example, in 2016, former Wells Fargo CEO John Stumpf was forced to forfeit $41 million and former retail banking head Carrie Tolstedt had to give up $19 million due to behavior while the two led the company. Then, in April 2017, Stumpf was forced to return another $28 million and Tolstedt was forced to return an additional $47.3 million. The use of deferred compensation has

also increased. Deferred compensation is money paid to an executive several years after it is earned. With a deferred compensation agreement, if circumstances warrant, the payment can be canceled.

Control of the Firm Control of the firm ultimately rests with stockholders. They elect the board of directors, who in turn hire and fire managers. The fact that stockholders control the corporation was made abundantly clear by Steve Jobs's experience at Apple. Even though he was a founder of the corporation and was largely responsible for its most successful products, there came a time when shareholders, through their elected directors, decided that Apple would be better off without him, so out he went. Of course, he was later rehired and helped turn Apple around with great new products such as the iPod, iPhone, and iPad. Going back to the chapter opener, why would Facebook, specifically Mark Zuckerberg, want to create new shares of stock with no voting rights? The answer is that Zuckerberg had pledged to give away 99 percent of his shares in Facebook during his lifetime. The new C shares he received with no voting rights were to be given to the Chan Zuckerberg Initiative, a philanthropic entity that he created. Therefore, even in giving away these shares, he still retained control of Facebook. In Alphabet's case, Brin and Page had seen their voting power drop to about 56 percent of votes because of the number of Class A shares issued to fund acquisitions and employee stock awards. The new Class C shares were to be used to fund these areas going forward.

An important mechanism by which unhappy stockholders can act to replace existing management is called a *proxy fight*. A proxy is the authority to vote someone else's stock. A proxy fight develops when a group solicits proxies in order to replace the existing board and thereby replace existing managers. For example, in 2016, activist investor Starboard Value LP launched a proxy battle with Yahoo!, arguing that Yahoo! should sell its core business. In response, Yahoo! agreed to a deal that granted four seats on its board of directors to Starboard's nominees—and thus a long proxy fight was defused. Several months later, Yahoo! announced that it would be purchased by Verizon for $4.8 billion, although the acquisition price was reduced by $350 million due to a 2013 e-mail hack experienced by Yahoo! that had not been made public.

Another way that managers can be replaced is by takeover. Firms that are poorly managed are more attractive as acquisitions because a greater profit potential exists. Thus, avoiding a takeover gives management another incentive to act in the stockholders' interests. For example, in 2016, Marriott completed its takeover of Starwood Hotels. Marriott expected to save $250 million per year in operating the combined companies, with much of the savings coming from job cuts in the executive ranks at Starwood. In short, Marriott bought Starwood and fired most of its top executives, eliminating those salaries and saving money.

Conclusion The available theory and evidence are consistent with the view that stockholders control the firm and that stockholder wealth maximization is the relevant goal of the corporation. Even so, there will undoubtedly be times when management goals are pursued at the expense of the stockholders, at least temporarily.

STAKEHOLDERS

Our discussion thus far implies that management and stockholders are the only parties with an interest in the firm's decisions. This is an oversimplification, of course. Employees, customers, suppliers, and even the government all have a financial interest in the firm.

Taken together, these various groups are called **stakeholders** in the firm. In general, a stakeholder is someone other than a stockholder or creditor who potentially has a claim on the cash flows of the firm. Such groups will also attempt to exert control over the firm, perhaps to the detriment of the owners.

stakeholder
Someone other than a stockholder or creditor who potentially has a claim on the cash flows of the firm.

Concept Questions

1.4a What is an agency relationship?

1.4b What are agency problems and how do they come about? What are agency costs?

1.4c What incentives do managers in large corporations have to maximize share value?

1.5 Financial Markets and the Corporation

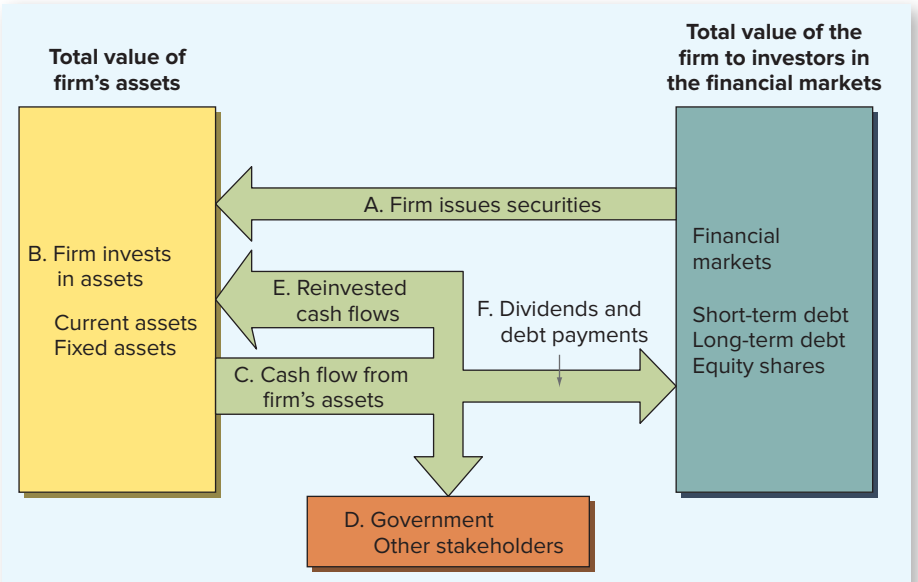
We've seen that the primary advantages of the corporate form of organization are that ownership can be transferred more quickly and easily than with other forms and that money can be raised more readily. Both of these advantages are significantly enhanced by the existence of financial markets, and financial markets play an extremely important role in corporate finance.

CASH FLOWS TO AND FROM THE FIRM

The interplay between the corporation and the financial markets is illustrated in Figure 1.2. The arrows in Figure 1.2 trace the passage of cash from the financial markets to the firm and from the firm back to the financial markets.

Suppose we start with the firm selling shares of stock and borrowing money to raise cash. Cash flows to the firm from the financial markets (A). The firm invests the cash in current and fixed assets (B). These assets generate cash (C), some of which goes to pay corporate taxes (D). After taxes are paid, some of this cash flow is reinvested in the firm (E). The rest goes back to the financial markets as cash paid to creditors and shareholders (F).

FIGURE 1.2
Cash Flows between the Firm and the Financial Markets



A. Firm issues securities to raise cash.
B. Firm invests in assets.
C. Firm's operations generate cash flow.
D. Cash is paid to government as taxes. Other stakeholders may receive cash.
E. Reinvested cash flows are plowed back into firm.
F. Cash is paid out to investors in the form of interest and dividends.

A financial market, like any market, is just a way of bringing buyers and sellers together. In financial markets, it is debt and equity securities that are bought and sold. Financial markets differ in detail, however. The most important differences concern the types of securities that are traded, how trading is conducted, and who the buyers and sellers are. Some of these differences are discussed next.

PRIMARY VERSUS SECONDARY MARKETS

Financial markets function as both primary and secondary markets for debt and equity securities. The term *primary market* refers to the original sale of securities by governments and corporations. The *secondary markets* are those in which these securities are bought and sold after the original sale. Equities are, of course, issued solely by corporations. Debt securities are issued by both governments and corporations. In the discussion that follows, we focus on corporate securities only.

Primary Markets In a primary market transaction, the corporation is the seller, and the transaction raises money for the corporation. Corporations engage in two types of primary market transactions: public offerings and private placements. A public offering, as the name suggests, involves selling securities to the general public, whereas a private placement is a negotiated sale involving a specific buyer.

By law, public offerings of debt and equity must be registered with the Securities and Exchange Commission (SEC). Registration requires the firm to disclose a great deal of information before selling any securities. The accounting, legal, and selling costs of public offerings can be considerable.

To learn more about the SEC, visit **www.sec.gov**.

Partly to avoid the various regulatory requirements and the expense of public offerings, debt and equity are often sold privately to large financial institutions such as life insurance companies or mutual funds. Such private placements do not have to be registered with the SEC and do not require the involvement of underwriters (investment banks that specialize in selling securities to the public).

Secondary Markets A secondary market transaction involves one owner or creditor selling to another. Therefore, the secondary markets provide the means for transferring ownership of corporate securities. Although a corporation is directly involved only in a primary market transaction (when it sells securities to raise cash), the secondary markets are still critical to large corporations. The reason is that investors are much more willing to purchase securities in a primary market transaction when they know that those securities can later be resold if desired.

Dealer versus Auction Markets There are two kinds of secondary markets: *auction* markets and *dealer* markets. Generally speaking, dealers buy and sell for themselves, at their own risk. A car dealer, for example, buys and sells automobiles. In contrast, brokers and agents match buyers and sellers, but they do not actually own the commodity that is bought or sold. A real estate agent, for example, does not normally buy and sell houses.

Dealer markets in stocks and long-term debt are called *over-the-counter* (OTC) markets. Most trading in debt securities takes place over the counter. The expression *over the counter* refers to days of old when securities were literally bought and sold at counters in offices around the country. Today, a significant fraction of the market for stocks and almost all of the market for long-term debt have no central location; the many dealers are connected electronically.

Auction markets differ from dealer markets in two ways. First, an auction market or exchange has a physical location (like Wall Street). Second, in a dealer market, most of the buying

and selling is done by the dealer. The primary purpose of an auction market, on the other hand, is to match those who wish to sell with those who wish to buy. Dealers play a limited role.

Trading in Corporate Securities The equity shares of most of the large firms in the United States trade in organized auction markets. The largest such market is the New York Stock Exchange (NYSE). There is also a large OTC market for stocks. In 1971, the National Association of Securities Dealers (NASD) made available to dealers and brokers an electronic quotation system called NASDAQ (which originally stood for NASD Automated Quotation system and is pronounced "naz-dak"). NASDAQ-listed companies tend to be smaller and trade less actively. There are exceptions, of course. Both Microsoft and Intel trade OTC, for example. Nonetheless, the total value of NASDAQ stocks is much less than the total value of NYSE stocks.

To learn more about the exchanges, visit **www.nyse.com** and **www.nasdaq.com**.

There are many large and important financial markets outside the United States, of course, and U.S. corporations are increasingly looking to these markets to raise cash. The Tokyo Stock Exchange and the London Stock Exchange (TSE and LSE, respectively) are two well-known examples. The fact that OTC markets have no physical location means that national borders do not present a great barrier, and there is now a huge international OTC debt market. Because of globalization, financial markets have reached the point where trading in many investments never stops; it just travels around the world.

Listing Stocks that trade on an organized exchange are said to be *listed* on that exchange. To be listed, firms must meet certain minimum criteria concerning, for example, asset size and number of shareholders. These criteria differ from one exchange to another.

The NYSE has the most stringent requirements of the exchanges in the United States. For example, to be listed on the NYSE, a company is expected to have a market value for its publicly held shares of at least $100 million. There are additional minimums on earnings, assets, and number of shares outstanding.

Concept Questions

1.5a What is a dealer market? How do dealer and auction markets differ?

1.5b What does *OTC* stand for? What is the large OTC market for stocks called?

1.5c What is the largest auction market in the United States?

1.6 Summary and Conclusions

This chapter introduced you to some of the basic ideas in corporate finance:

1. Corporate finance has three main areas of concern:
   a. Capital budgeting: What long-term investments should the firm undertake?
   b. Capital structure: Where will the firm get the long-term financing to pay for its investments? In other words, what mixture of debt and equity should the firm use to fund operations?
   c. Working capital management: How should the firm manage its everyday financial activities?

2. The goal of financial management in a for-profit business is to make decisions that increase the value of the stock or, more generally, increase the market value of the equity.

3. The corporate form of organization is superior to other forms when it comes to raising money and transferring ownership interests, but it has the significant disadvantage of double taxation.
4. There is the possibility of conflicts between stockholders and management in a large corporation. We called these conflicts *agency problems* and discussed how they might be controlled and reduced.
5. The advantages of the corporate form are enhanced by the existence of financial markets. Financial markets function as both primary and secondary markets for corporate securities and can be organized as either dealer or auction markets.

Of the topics we've discussed thus far, the most important is the goal of financial management: Maximizing the value of the stock. Throughout the text, we will be analyzing many different financial decisions, but we will always ask the same question: How does the decision under consideration affect the value of the stock?

CONNECT TO FINANCE

Connect Finance offers you plenty of opportunities to practice mastering these concepts. Log on to connect.mheducation.com to learn more. If you like what you see, ask your professor about using *Connect Finance*!

Can you answer the following *Connect* Quiz questions?

Section 1.1 Deciding which fixed assets should be purchased is an example of what type of decision?

Section 1.2 What form of ownership is easiest to transfer?

Section 1.3 What best describes the goal of financial management?

Section 1.4 In a corporation, the primary agency conflict arises between which two parties?

CONCEPTS REVIEW AND CRITICAL THINKING QUESTIONS

1. **The Financial Management Decision Process** [LO1] What are the three types of financial management decisions? For each type of decision, give an example of a business transaction that would be relevant.
2. **Sole Proprietorships and Partnerships** [LO3] What are the four primary disadvantages of the sole proprietorship and partnership forms of business organization? What benefits are there to these types of business organization as opposed to the corporate form?
3. **Corporations** [LO3] What is the primary disadvantage of the corporate form of organization? Name at least two advantages of corporate organization.
4. **Sarbanes-Oxley** [LO4] In response to the Sarbanes-Oxley Act, many small firms in the United States have opted to "go dark" and delist their stock. Why might a company choose this route? What are the costs of "going dark"?
5. **Corporate Finance Organization** [LO1] In a large corporation, what are the two distinct groups that report to the chief financial officer? Which group is the focus of corporate finance?

6. **Goal of Financial Management** [LO2] What goal should always motivate the actions of a firm's financial manager?
7. **Agency Problems** [LO4] Who owns a corporation? Describe the process whereby the owners control the firm's management. What is the main reason that an agency relationship exists in the corporate form of organization? In this context, what kinds of problems can arise?
8. **Primary versus Secondary Markets** [LO3] You've probably noticed coverage in the financial press of an initial public offering (IPO) of a company's securities. Is an IPO a primary market transaction or a secondary market transaction?
9. **Auction versus Dealer Markets** [LO3] What does it mean when we say the New York Stock Exchange is an auction market? How are auction markets different from dealer markets? What kind of market is NASDAQ?
10. **Not-for-Profit Firm Goals** [LO2] Suppose you were the financial manager of a not-for-profit business (a not-for-profit hospital, perhaps). What kinds of goals do you think would be appropriate?
11. **Goal of the Firm** [LO2] Evaluate the following statement: Managers should not focus on the current stock value because doing so will lead to an overemphasis on short-term profits at the expense of long-term profits.
12. **Ethics and Firm Goals** [LO2] Can our goal of maximizing the value of the stock conflict with other goals, such as avoiding unethical or illegal behavior? In particular, do you think subjects like customer and employee safety, the environment, and the general good of society fit in this framework, or are they essentially ignored? Think of some specific scenarios to illustrate your answer.
13. **International Firm Goal** [LO2] Would our goal of maximizing the value of the stock be different if we were thinking about financial management in a foreign country? Why or why not?
14. **Agency Problems** [LO4] Suppose you own stock in a company. The current price per share is $25. Another company has just announced that it wants to buy your company and will pay $35 per share to acquire all the outstanding stock. Your company's management immediately begins fighting off this hostile bid. Is management acting in the shareholders' best interests? Why or why not?
15. **Agency Problems and Corporate Ownership** [LO4] Corporate ownership varies around the world. Historically individuals have owned the majority of shares in public corporations in the United States. In Germany and Japan, however, banks, other large financial institutions, and other companies own most of the stock in public corporations. Do you think agency problems are likely to be more or less severe in Germany and Japan than in the United States? Why? Over the last few decades, large financial institutions such as mutual funds and pension funds have been becoming the dominant owners of stock in the United States, and these institutions are becoming more active in corporate affairs. What are the implications of this trend for agency problems and corporate control?
16. **Executive Compensation** [LO4] Critics have charged that compensation to top managers in the United States is simply too high and should be cut back. For example, focusing on large corporations, Mark Parker, CEO of Nike, earned about $47.6 million in 2016. Are such amounts excessive? In answering, it might be helpful to recognize that superstar athletes such as LeBron James, top entertainers such as Taylor Swift and Dwayne Johnson, and many others at the top of their respective fields earn at least as much, if not a great deal more.

MINICASE

The McGee Cake Company

In early 2013, Doc and Lyn McGee formed the McGee Cake Company. The company produced a full line of cakes, and its specialties included chess cake,* lemon pound cake, and double-iced, double-chocolate cake. The couple formed the company as an outside interest, and both continued to work at their current jobs. Doc did all the baking, and Lyn handled the marketing and distribution. With good product quality and a sound marketing plan, the company grew rapidly. In early 2016, the company was featured in a widely distributed entrepreneurial magazine. Later that year, the company was featured in *Gourmet Desserts*, a leading specialty food magazine. After the article appeared in *Gourmet Desserts*, sales exploded, and the company began receiving orders from all over the world.

Because of the increased sales, Doc left his other job, followed shortly by Lyn. The company hired additional workers to meet demand. Unfortunately, the fast growth experienced by the company led to cash flow and capacity problems. The company is currently producing as many cakes as possible with the assets it owns, but demand for its cakes is still growing. Further, the company has been approached by a national supermarket chain with a proposal to put four of its cakes in all of the chain's stores, and a national restaurant chain has contacted the company about selling McGee cakes in its restaurants. The restaurant would sell the cakes without a brand name.

Doc and Lyn have operated the company as a sole proprietorship. They have approached you to help manage and direct the company's growth. Specifically, they have asked you to answer the following questions.

QUESTIONS

1. What are the advantages and disadvantages of changing the company organization from a sole proprietorship to an LLC?
2. What are the advantages and disadvantages of changing the company organization from a sole proprietorship to a corporation?
3. Ultimately, what action would you recommend the company undertake? Why?

*Chess cake is quite delicious and distinct from cheesecake. The origin of the name is obscure.

Chapter 2 Financial Statements, Taxes, and Cash Flow

IN DECEMBER 2017, the Tax Cuts and Jobs Act was enacted into law beginning in 2018. The new law was a sweeping change to corporate taxes in the U.S. For example, rather than depreciating an asset over time for tax purposes, companies are allowed to depreciate the entire purchase price in the first year. Another change was a limit to the tax deductibility of interest expense. However, possibly the biggest change was the switch from a graduated corporate income tax structure, which ranged from 15 percent to 39 percent, to a flat 21 percent corporate tax rate.

While the change in the corporate tax rate affects net income, there is a more important impact. Because taxes are a key consideration in making investment decisions, the change in the tax rate could lead to a significant change in corporate behavior. Understanding why ultimately leads us to the main subject of this chapter: That all-important substance known as *cash flow*.

Learning Objectives

After studying this chapter, you should be able to:

- **LO1** Describe the difference between accounting value (or *book value*) and market value.
- **LO2** Describe the difference between accounting income and cash flow.
- **LO3** Describe the difference between average and marginal tax rates.
- **LO4** Determine a firm's cash flow from its financial statements.

For updates on the latest happenings in finance, visit fundamentalsofcorporatefinance.blogspot.com.

In this chapter, we examine financial statements, taxes, and cash flow. Our emphasis is not on preparing financial statements. Instead, we recognize that financial statements are frequently a key source of information for financial decisions, so our goal is to briefly examine such statements and point out some of their more relevant features. We pay special attention to some of the practical details of cash flow.

As you read, pay particular attention to two important differences: (1) the difference between accounting value and market value and (2) the difference between accounting income and cash flow. These distinctions will be important throughout the book.

The Balance Sheet

2.1

Excel Master It!

xlsx Excel Master coverage online

The **balance sheet** is a snapshot of the firm. It is a convenient means of organizing and summarizing what a firm owns (its assets), what a firm owes (its liabilities), and the difference between the two (the firm's equity) at a given point in time. Figure 2.1 illustrates how the balance sheet is constructed. As shown, the left side lists the assets of the firm, and the right side lists the liabilities and equity.

balance sheet
Financial statement showing a firm's accounting value on a particular date.

ASSETS: THE LEFT SIDE

Assets are classified as either *current* or *fixed* assets. A fixed asset is one that has a relatively long life. Fixed assets can be either *tangible*, such as a truck or a computer, or *intangible*, such as a trademark or patent. A current asset has a life of less than one year. This means that the asset will convert to cash within 12 months. For example, inventory would normally be purchased and sold within a year and is classified as a current asset. Obviously, cash itself is a current asset. Accounts receivable (money owed to the firm by its customers) are also current assets.

Three excellent sites for company financial information are **finance.yahoo.com**, **finance.google.com**, and **money.cnn.com**.

LIABILITIES AND OWNERS' EQUITY: THE RIGHT SIDE

The firm's liabilities are the first thing listed on the right side of the balance sheet. These are classified as either *current* or *long-term*. Current liabilities, like current assets, have a life of less than one year (meaning they must be paid within the year) and are listed before long-term liabilities. Accounts payable (money the firm owes to its suppliers) are one example of a current liability.

A debt that is not due in the coming year is classified as a long-term liability. A loan that the firm will pay off in five years is one such long-term debt. Firms borrow in the long term from a variety of sources. We will tend to use the terms *bond* and *bondholders* generically to refer to long-term debt and long-term creditors, respectively.

Finally, by definition, the difference between the total value of the assets (current and fixed) and the total value of the liabilities (current and long-term) is the *shareholders' equity*, also called *common equity* or *owners' equity*. This feature of the balance sheet is intended to reflect the fact that, if the firm were to sell all its assets and use the money to pay off its debts, then whatever residual value remained would belong to the shareholders. So, the balance sheet "balances" because the value of the left side always equals the value

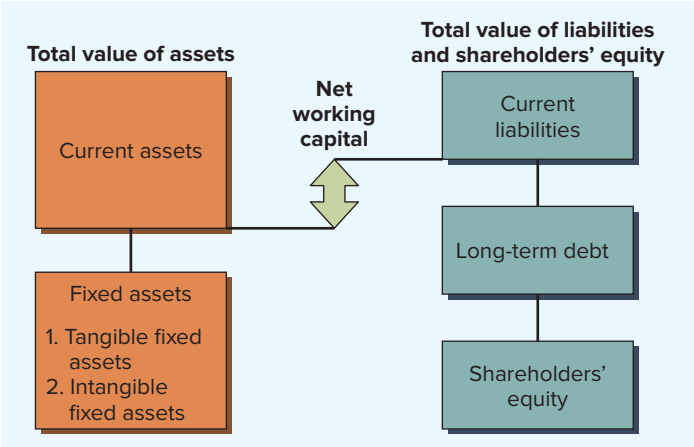


FIGURE 2.1
The Balance Sheet. Left Side: Total Value of Assets. Right Side: Total Value of Liabilities and Shareholders' Equity.

of the right side. That is, the value of the firm's assets is equal to the sum of its liabilities and shareholders' equity:[1]

Assets = Liabilities + Shareholders' equity 2.1

This is the *balance sheet identity*, or equation, and it always holds because shareholders' equity is defined as the difference between assets and liabilities.

NET WORKING CAPITAL

net working capital
Current assets less current liabilities.

As shown in Figure 2.1, the difference between a firm's current assets and its current liabilities is called **net working capital**. Net working capital is positive when current assets exceed current liabilities. Based on the definitions of current assets and current liabilities, this means the cash that will become available over the next 12 months exceeds the cash that must be paid over the same period. For this reason, net working capital is usually positive in a healthy firm.

EXAMPLE 2.1 Building the Balance Sheet

A firm has current assets of $100, net fixed assets of $500, short-term debt of $70, and long-term debt of $200. What does the balance sheet look like? What is shareholders' equity? What is net working capital?

In this case, total assets are $100 + 500 = $600 and total liabilities are $70 + 200 = $270, so shareholders' equity is the difference: $600 − 270 = $330. The balance sheet would look like this:

Assets		Liabilities and Shareholders' Equity	
Current assets	$100	Current liabilities	$ 70
Net fixed assets	500	Long-term debt	200
		Shareholders' equity	330
Total assets	$600	Total liabilities and shareholders' equity	$600

Net working capital is the difference between current assets and current liabilities, or $100 − 70 = $30.

Table 2.1 shows simplified balance sheets for the fictitious U.S. Corporation. The assets on the balance sheet are listed in order of the length of time it takes for them to convert to cash in the normal course of business. Similarly, the liabilities are listed in the order in which they would normally be paid.

The structure of the assets for a particular firm reflects the line of business the firm is in, as well as managerial decisions regarding how much cash and inventory to have on hand, the firm's credit policy, fixed-asset acquisitions, and so on.

Disney has a good investor relations site at **thewaltdisneycompany.com/investors**.

The liabilities side of the balance sheet primarily reflects managerial decisions about capital structure and the use of short-term debt. For example, in 2018, total long-term debt for U.S. Corporation was $454 and total equity was $640 + 1,690 = $2,330, so total long-term financing was $454 + 2,330 = $2,784. (Note that, throughout, all figures are in millions of dollars.) Of this amount, $454/$2,784 = 16.31 percent was long-term debt. This percentage reflects capital structure decisions made in the past by the management of U.S.

[1] The terms *owners' equity, shareholders' equity,* and *stockholders' equity* are used interchangeably to refer to the equity in a corporation. The term *net worth* is also used. Variations exist in addition to these.

TABLE 2.1
Balance Sheets

U.S. CORPORATION 2017 and 2018 Balance Sheets ($ in millions)					
Assets			**Liabilities and Owners' Equity**		
	2017	**2018**		**2017**	**2018**
Current assets			Current liabilities		
Cash	$ 104	$ 221	Accounts payable	$ 232	$ 266
Accounts receivable	455	688	Notes payable	196	123
Inventory	553	555	Total	$ 428	$ 389
Total	$1,112	$1,464			
Fixed assets					
Net plant and equipment	$1,644	$1,709	Long-term debt	$ 408	$ 454
			Owners' equity		
			Common stock and paid-in surplus	600	640
			Retained earnings	1,320	1,690
			Total	$1,920	$2,330
Total assets	$2,756	$3,173	Total liabilities and owners' equity	$2,756	$3,173

There are three particularly important things to keep in mind when examining a balance sheet: liquidity, debt versus equity, and market value versus book value.

LIQUIDITY

Liquidity refers to the speed and ease with which an asset can be converted to cash. Gold is a relatively liquid asset; a custom manufacturing facility is not. Liquidity actually has two dimensions: Ease of conversion versus loss of value. Any asset can be converted to cash quickly if we cut the price enough. A highly liquid asset is therefore one that can be quickly sold without significant loss of value. An illiquid asset is one that cannot be quickly converted to cash without a substantial price reduction.

Annual and quarterly financial statements (and lots more) for most public U.S. corporations can be found in the EDGAR database at **www.sec.gov**.

Assets are normally listed on the balance sheet in order of decreasing liquidity, meaning that the most liquid assets are listed first. Current assets are relatively liquid and include cash and assets we expect to convert to cash over the next 12 months. Accounts receivable, for example, represent amounts not yet collected from customers on sales already made. Naturally, we hope these will convert to cash in the near future. Inventory is probably the least liquid of the current assets, at least for many businesses.

Fixed assets are, for the most part, relatively illiquid. These consist of tangible things such as buildings and equipment that don't convert to cash at all in normal business activity (they are, of course, used in the business to generate cash). Intangible assets, such as a trademark, have no physical existence but can be very valuable. Like tangible fixed assets, they won't ordinarily convert to cash and are generally considered illiquid.

Liquidity is valuable. The more liquid a business is, the less likely it is to experience financial distress (that is, difficulty in paying debts or buying needed assets). Unfortunately, liquid assets are generally less profitable to hold. Cash holdings are the most liquid of all investments, but they sometimes earn no return at all—they just sit there. There is therefore a trade-off between the advantages of liquidity and forgone potential profits.

DEBT VERSUS EQUITY

To the extent that a firm borrows money, it usually gives first claim to the firm's cash flow to creditors. Equity holders are entitled to only the residual value, the portion left after creditors are paid. The value of this residual portion is the shareholders' equity in the firm, which is just the value of the firm's assets less the value of the firm's liabilities:

Shareholders' equity = Assets − Liabilities

This is true in an accounting sense because shareholders' equity is defined as this residual portion. More important, it is true in an economic sense: If the firm sells its assets and pays its debts, whatever cash is left belongs to the shareholders.

The use of debt in a firm's capital structure is called *financial leverage*. The more debt a firm has (as a percentage of assets), the greater is its degree of financial leverage. As we discuss in later chapters, debt acts like a lever in the sense that using it can greatly magnify both gains and losses. So, financial leverage increases the potential reward to shareholders, but it also increases the potential for financial distress and business failure.

MARKET VALUE VERSUS BOOK VALUE

Generally Accepted Accounting Principles (GAAP)
The common set of standards and procedures by which audited financial statements are prepared.

The values shown on the balance sheet for the firm's assets are *book values* and generally are not what the assets are actually worth. Under **Generally Accepted Accounting Principles (GAAP)**, audited financial statements in the United States mostly show assets at *historical cost*. In other words, assets are "carried on the books" at what the firm paid for them, no matter how long ago they were purchased or how much they are worth today.

The home page for the Financial Accounting Standards Board (FASB) is **www.fasb.org**.

For current assets, market value and book value might be somewhat similar because current assets are bought and converted into cash over a relatively short span of time. In other circumstances, the two values might differ quite a bit. Moreover, for fixed assets, it would be purely a coincidence if the actual market value of an asset (what the asset could be sold for) were equal to its book value. For example, a railroad might own enormous tracts of land purchased a century or more ago. What the railroad paid for that land could be hundreds or thousands of times less than what the land is worth today. The balance sheet would nonetheless show the historical cost.

The difference between market value and book value is important for understanding the impact of reported gains and losses. For example, from time to time, accounting rule changes take place that lead to reductions in the book value of certain types of assets. However, a change in accounting rules all by itself has no effect on what the assets in question are really worth. Instead, the market value of an asset depends on things like its riskiness and cash flows, neither of which have anything to do with accounting.

The balance sheet is potentially useful to many different parties. A supplier might look at the size of accounts payable to see how promptly the firm pays its bills. A potential creditor would examine the liquidity and degree of financial leverage. Managers within the firm can track things like the amount of cash and the amount of inventory the firm keeps on hand. Uses such as these are discussed in more detail in Chapter 3.

Managers and investors will frequently be interested in knowing the value of the firm. This information is not on the balance sheet. The fact that balance sheet assets are listed at cost means that there is no necessary connection between the total assets shown and the value of the firm. Indeed, many of the most valuable assets a firm might have—good management, a good reputation, talented employees—don't appear on the balance sheet at all.

Similarly, the shareholders' equity figure on the balance sheet and the true value of the stock need not be related. For example, in late 2017, the book value of IBM's equity was about $18 billion, while the market value was $142 billion. At the same time, Alphabet's book value was $139 billion, while the market value was $731 billion.

For financial managers, then, the accounting value of the stock is not an especially important concern; it is the market value that matters. Henceforth, whenever we speak of the value of an asset or the value of the firm, we will normally mean its *market value*. So, for example, when we say the goal of the financial manager is to increase the value of the stock, we mean the market value of the stock.

Market Value versus Book Value — EXAMPLE 2.2

The Klingon Corporation has net fixed assets with a book value of $700 and an appraised market value of about $1,000. Net working capital is $400 on the books, but approximately $600 would be realized if all the current accounts were liquidated. Klingon has $500 in long-term debt, both book value and market value. What is the book value of the equity? What is the market value?

We can construct two simplified balance sheets, one in accounting (book value) terms and one in economic (market value) terms:

KLINGON CORPORATION
Balance Sheets
Market Value versus Book Value

Assets			Liabilities and Shareholders' Equity		
	Book	Market		Book	Market
Net working capital	$ 400	$ 600	Long-term debt	$ 500	$ 500
Net fixed assets	700	1,000	Shareholders' equity	600	1,100
	$1,100	$1,600		$1,100	$1,600

In this example, shareholders' equity is actually worth almost twice as much as what is shown on the books. The distinction between book and market values is important precisely because book values can be so different from true economic value.

Concept Questions

2.1a What is the balance sheet identity?

2.1b What is liquidity? Why is it important?

2.1c What do we mean by financial leverage?

2.1d Explain the difference between book value and market value. Which is more important to the financial manager? Why?

income statement
Financial statement summarizing a firm's performance over a period of time.

The Income Statement

2.2

The **income statement** measures performance over some period of time, usually a quarter or a year. The income statement equation is:

Revenues − Expenses = Income

If you think of the balance sheet as a snapshot, then you can think of the income statement as a video recording covering the period between before and after pictures. Table 2.2 gives a simplified income statement for U.S. Corporation.

2.2

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TABLE 2.2
Income Statement

U.S. CORPORATION 2018 Income Statement ($ in millions)		
Net sales		$1,509
Cost of goods sold		750
Depreciation		65
Earnings before interest and taxes		$ 694
Interest paid		70
Taxable income		$ 624
Taxes (21%)		131
Net income		$ 493
Dividends	$123	
Addition to retained earnings	370	

The first thing reported on an income statement would usually be revenue and expenses from the firm's principal operations. Subsequent parts include, among other things, financing expenses such as interest paid. Taxes paid are reported separately. The last item is *net income* (the so-called bottom line). Net income is often expressed on a per-share basis and called *earnings per share* (EPS).

As indicated, U.S. Corporation paid cash dividends of $123. The difference between net income and cash dividends, $370, is the addition to retained earnings for the year. This amount is added to the cumulative retained earnings account on the balance sheet. If you look back at the two balance sheets for U.S. Corporation, you'll see that retained earnings did go up by this amount: $1,320 + 370 = $1,690.

EXAMPLE 2.3 Calculating Earnings and Dividends per Share

Suppose U.S. had 200 million shares outstanding at the end of 2018. Based on the income statement in Table 2.2, what was EPS? What were dividends per share?

From the income statement, we see that U.S. had a net income of $493 million for the year. Total dividends were $123 million. Because 200 million shares were outstanding, we can calculate earnings per share, or EPS, and dividends per share as follows:

$$\begin{aligned}\text{Earnings per share} &= \text{Net income/Total shares outstanding}\\ &= \$493/200 = \$2.46 \text{ per share}\\ \text{Dividends per share} &= \text{Total dividends/Total shares outstanding}\\ &= \$123/200 = \$.615 \text{ per share}\end{aligned}$$

When looking at an income statement, the financial manager needs to keep three things in mind: GAAP, cash versus noncash items, and time and costs.

GAAP AND THE INCOME STATEMENT

An income statement prepared using GAAP will show revenue when it accrues. This is not necessarily when the cash comes in. The general rule (the *recognition* or *realization principle*) is to recognize revenue when the earnings process is virtually complete and the value of an exchange of goods or services is known or can be reliably determined. In practice, this principle usually means that revenue is recognized at the time of sale, which need not be the same as the time of collection.

Expenses shown on the income statement are based on the *matching principle*. The basic idea here is to first determine revenues as described previously and then match those revenues with the costs associated with producing them. So, if we manufacture a product and then sell it on credit, the revenue is realized at the time of sale. The production and other costs associated with the sale of that product will likewise be recognized at that time. Once again, the actual cash outflows may have occurred at some different time.

As a result of the way revenues and expenses are realized, the figures shown on the income statement may not be at all representative of the actual cash inflows and outflows that occurred during a particular period.

NONCASH ITEMS

A primary reason that accounting income differs from cash flow is that an income statement contains **noncash items**. The most important of these is *depreciation*. Suppose a firm purchases an asset for $5,000 and pays in cash. Obviously, the firm has a $5,000 cash outflow at the time of purchase. However, instead of deducting the $5,000 as an expense, an accountant might depreciate the asset over a five-year period.

noncash items
Expenses charged against revenues that do not directly affect cash flow, such as depreciation.

If the depreciation is straight-line and the asset is written down to zero over that period, then $5,000/5 = $1,000 will be deducted each year as an expense.[2] The important thing to recognize is that this $1,000 deduction isn't cash—it's an accounting number. The actual cash outflow occurred when the asset was purchased.

The depreciation deduction is another application of the matching principle in accounting. The revenues associated with an asset generally occur over some length of time. So, the accountant seeks to match the expense of purchasing the asset with the benefits produced from owning it.

As we will see, for the financial manager, the actual timing of cash inflows and outflows is critical in coming up with a reasonable estimate of market value. For this reason, we need to learn how to separate the cash flows from the noncash accounting entries. In reality, the difference between cash flow and accounting income can be pretty dramatic. For example, consider the case of U.S. Steel, which reported a net loss of $340 million for the first quarter of 2016. Sounds bad, but U.S. Steel also reported a *positive* cash flow of $113 million, a difference of about $453 million!

TIME AND COSTS

It is often useful to think of the future as having two distinct parts: The short run and the long run. These are not precise time periods. The distinction has to do with whether costs are fixed or variable. In the long run, all business costs are variable. Given sufficient time, assets can be sold, debts can be paid, and so on.

If our time horizon is relatively short, however, some costs are effectively fixed—they must be paid no matter what (property taxes, for example). Other costs, such as wages to laborers and payments to suppliers, are still variable. As a result, even in the short run, the firm can vary its output level by varying expenditures in these areas.

The distinction between fixed and variable costs is important, at times, to the financial manager, but the way costs are reported on the income statement is not a good guide to which costs are which. The reason is that, in practice, accountants tend to classify costs as either product costs or period costs.

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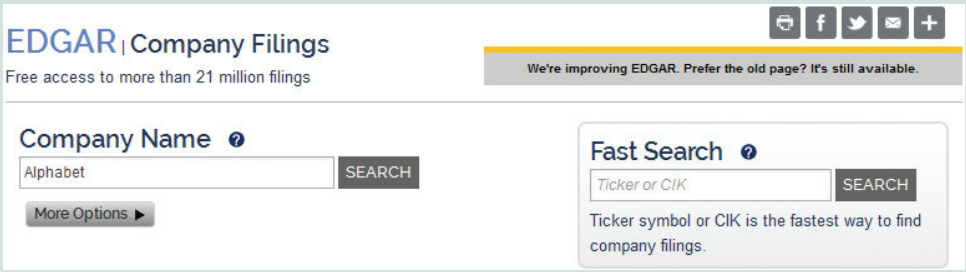
[2]By *straight-line*, we mean that the depreciation deduction is the same every year. By *written down to zero*, we mean that the asset is assumed to have no value at the end of five years. Depreciation is discussed in more detail in Chapter 10.

WORK THE WEB

The U.S. Securities and Exchange Commission (SEC) requires that most public companies file regular reports, including annual and quarterly financial statements. The SEC has a public site named EDGAR that makes these free reports available at www.sec.gov. We went to "Search EDGAR" and looked up Alphabet:



Here is a partial view of what we found:

The two reports we look at the most are the 10-K, which is the annual report filed with the SEC, and the 10-Q. The 10-K includes the list of officers and their salaries, financial statements for the previous fiscal year, and an explanation by the company of the financial results. The 10-Q is a smaller report that includes the financial statements for the quarter.

Questions

1. *As you can imagine, electronic filing of documents with the SEC has not been around for very long. Go to www.sec.gov and find the filings for General Electric. What is the date of the oldest 10-K available on the website for General Electric? Look up the 10-K forms for IBM and Apple to see if the year of the first electronic filing is the same for these companies.*
2. *Go to www.sec.gov and find out when the following forms are used: Form DEF 14A, Form 8-K, and Form 6-K.*

Product costs include such things as raw materials, direct labor expense, and manufacturing overhead. These are reported on the income statement as costs of goods sold, but they include both fixed and variable costs. Similarly, *period costs* are incurred during a particular time period and might be reported as selling, general, and administrative

expenses. Once again, some of these period costs may be fixed and others may be variable. The company president's salary, for example, is a period cost and is probably fixed, at least in the short run.

The balance sheets and income statement we have been using thus far are hypothetical. Our nearby *Work the Web* box shows how to find actual balance sheets and income statements online for almost any company. Also, with the increasing globalization of business, there is a clear need for accounting standards to become more comparable across countries. Accordingly, in recent years, U.S. accounting standards have become more closely tied to International Financial Reporting Standards (IFRS). In particular, the Financial Accounting Standards Board (FASB), which is in charge of U.S. GAAP policies, and the International Accounting Standards Board, which is in charge of IFRS policies, have been working toward a convergence of policies since 2002. Although GAAP and IFRS have become similar in important ways, as of early 2018, it appears that a full convergence of accounting policies is off the table, at least for now.

For more information about IFRS, check out the website **www.ifrs.org**.

Concept Questions

2.2a What is the income statement equation?

2.2b What are the three things to keep in mind when looking at an income statement?

2.2c Why is accounting income not the same as cash flow? Give two reasons.

2.3 Taxes

Taxes can be one of the largest cash outflows a firm experiences. For example, for the fiscal year 2016, JPMorgan Chase's earnings before taxes were about $34.54 billion. Its tax bill, including all taxes paid worldwide, was a whopping $9.8 billion, or about 28 percent of its pretax earnings. Also for fiscal year 2016, Walmart had a taxable income of $20.50 billion, and the company paid $6.2 billion in taxes—an average tax rate of 30 percent.

Excel Master It!

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The size of a company's tax bill is determined by the tax code, an often amended set of rules. In this section, we examine corporate tax rates and how taxes are calculated. If the various rules of taxation seem a little bizarre or convoluted to you, keep in mind that the tax code is the result of political, not economic, forces. As a result, there is no reason why it has to make economic sense.

CORPORATE TAX RATES

Corporate tax rates in effect for 2017 (but not 2018 and beyond) are shown in Table 2.3. As shown, corporate tax rates rise from 15 percent to 39 percent, but they drop back to 34 percent on income over $335,000. They then rise to 38 percent and subsequently fall to 35 percent.

The tax rate schedule in Table 2.3 was simplified considerably by the Tax Cuts and Jobs Act of 2017. Beginning in 2018, the corporate tax rate is 21 percent, and that rate applies regardless of the level of taxable income.

TABLE 2.3
Corporate Tax Rates for 2017

Taxable Income	Tax Rate
$ 0– 50,000	15%
50,001– 75,000	25
75,001– 100,000	34
100,001– 335,000	39
335,001–10,000,000	34
10,000,001–15,000,000	35
15,000,001–18,333,333	38
18,333,334+	35

AVERAGE VERSUS MARGINAL TAX RATES

average tax rate
Total taxes paid divided by total taxable income.

marginal tax rate
Amount of tax payable on the next dollar earned.

In making financial decisions, it is frequently important to distinguish between average and marginal tax rates. Your **average tax rate** is your tax bill divided by your taxable income—in other words, the percentage of your income that goes to pay taxes. Your **marginal tax rate** is the rate of the extra tax you would pay if you earned one more dollar. The percentage tax rates shown in Table 2.3 are all marginal rates. Put another way, the tax rates in Table 2.3 applied to the part of income in the indicated range only, not all income.

The difference between average and marginal tax rates can best be illustrated with an example. Suppose our corporation had a taxable income of $200,000 in 2017. What was the tax bill? Using Table 2.3, we can figure our tax bill:

.15($50,000)	= $	7,500
.25($75,000 – 50,000)	=	6,250
.34($100,000 – 75,000)	=	8,500
.39($200,000 – 100,000)	=	39,000
		$61,250

The IRS has a great website! Check out **www.irs.gov**.

Our total tax was $61,250.

In our example, what is the average tax rate? We had a taxable income of $200,000 and a tax bill of $61,250, so the average tax rate is $61,250/$200,000 = 30.625 percent. What is the marginal tax rate? If we made one more dollar, the tax on that dollar would be 39 cents, so our marginal rate is 39 percent.

EXAMPLE 2.4 Deep in the Heart of Taxes

Algernon, Inc., has a taxable income of $85,000 for 2017. What is its tax bill? What is its average tax rate? Its marginal tax rate? What would these be in 2018 and beyond?

From Table 2.3, we see that the tax rate applied to the first $50,000 is 15 percent; the rate applied to the next $25,000 is 25 percent; and the rate applied after that up to $100,000 is 34 percent. So Algernon must pay .15 × $50,000 + .25 × $25,000 + .34 × ($85,000 – 75,000) = $17,150. The average tax rate is thus $17,150/$85,000 = 20.18 percent. The marginal rate is 34 percent because Algernon's taxes would rise by 34 cents if it had another dollar in taxable income.

In 2018 and beyond, the average rate and the marginal rate are the same, 21 percent. There is no need to do any calculations!

Table 2.4 summarizes some different taxable incomes, marginal tax rates, and average tax rates for corporations. Notice how the average and marginal tax rates come together at 35 percent.

TABLE 2.4
Corporate Taxes and Tax Rates

(1) Taxable Income	(2) Marginal Tax Rate	(3) Total Tax	(3)/(1) Average Tax Rate
$ 45,000	15%	$ 6,750	15.00%
70,000	25	12,500	17.86
95,000	34	20,550	21.63
250,000	39	80,750	32.30
1,000,000	34	340,000	34.00
17,500,000	38	6,100,000	34.86
50,000,000	35	17,500,000	35.00
100,000,000	35	35,000,000	35.00

With a *flat-rate* tax, there is only one tax rate, so the rate is the same for all income levels. The 21 percent corporate tax created by the Tax Cuts and Jobs Act of 2017 is such a tax. In this case, as Example 2.4 illustrates, the marginal tax rate is always the same as the average tax rate. As it stands now, corporate taxation in the United States shifted in 2018 from a modified flat-rate tax, which became a true flat rate for only the highest incomes, to a true flat rate.

Normally the marginal tax rate is relevant for financial decision making. The reason is that any new cash flows will be taxed at that marginal rate. Because financial decisions usually involve new cash flows or changes in existing ones, this rate will tell us the marginal effect of a decision on our tax bill.

We should note that we have simplified the U.S. tax code in our discussions. In reality, the tax code is much more complex and riddled with various tax deductions and loopholes allowed for certain industries. As a result, the average corporate tax rate may be far from 21 percent for many companies. Table 2.5 displays average tax rates for various industries. Note that these rates pre-date the 21 percent flat tax instituted for 2018, but we still expect to see a wide range of average tax rates in 2018 and beyond due to other features of the tax code.

Prior to 2018, with a tax rate of 35 percent for large, profitable companies, the U.S. corporate tax rate was the highest in the world among developed economies. As a result, several companies in recent years have undertaken a controversial reorganization called a *tax inversion*. In a tax inversion, a company transfers ownership of its U.S.-based operations to a corporation domiciled in a foreign country, typically by a merger. This maneuver allows the company to avoid paying taxes in the United States on earnings from outside the United

TABLE 2.5
Average Tax Rates

Industry	Number of Companies	Average Tax Rate
Electric utilities (Eastern U.S.)	24	33.8%
Trucking	33	32.7
Railroad	15	27.4
Securities brokerage	30	20.5
Banking	481	17.5
Medical supplies	264	11.2
Internet	239	5.9
Pharmaceutical	337	5.6
Biotechnology	121	4.5

States. The 2017 reduction in the corporate tax rate to 21 percent puts the United States more-or-less in the middle relative to other developed economies, and a primary reason for the reduction was to eliminate the incentive for tax inversions and other strategies to avoid the U.S. corporate tax.

Before moving on, we should note that the tax rates we have discussed in this section relate to federal taxes only. Overall tax rates can be higher if state, local, and any other taxes are considered.

Concept Questions

2.3a What is the difference between a marginal and an average tax rate?

2.3b What was the impact of the Tax Cuts and Jobs Act of 2017 on corporate tax rates?

2.4 Cash Flow

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At this point, we are ready to discuss perhaps one of the most important pieces of financial information that can be gleaned from financial statements: Cash flow. By *cash flow*, we mean the difference between the number of dollars that came in and the number of dollars that went out. For example, if you were the owner of a business, you might be very interested in how much cash you actually took out of your business in a given year. How to determine this amount is one of the things we discuss next.

No standard financial statement presents this information in the way that we wish. We will therefore discuss how to calculate cash flow for U.S. Corporation and point out how the result differs from that of standard financial statement calculations. There is a standard financial accounting statement called the *statement of cash flows*, but it is concerned with a somewhat different issue that should not be confused with what is discussed in this section. The accounting statement of cash flows is discussed in Chapter 3.

From the balance sheet identity, we know that the value of a firm's assets is equal to the value of its liabilities plus the value of its equity. Similarly, the cash flow from the firm's assets must equal the sum of the cash flow to creditors and the cash flow to stockholders (or owners):

$$\text{Cash flow from assets} = \text{Cash flow to creditors} + \text{Cash flow to stockholders} \quad (2.3)$$

This is the *cash flow identity*. It says that the cash flow from the firm's assets is equal to the cash flow paid to suppliers of capital to the firm. What it reflects is the fact that a firm generates cash through its various activities, and that cash is either used to pay creditors or paid out to the owners of the firm. We discuss the various things that make up these cash flows next.

cash flow from assets
The total of cash flow to creditors and cash flow to stockholders, consisting of the following: operating cash flow, capital spending, and change in net working capital.

operating cash flow
Cash generated from a firm's normal business activities.

CASH FLOW FROM ASSETS

Cash flow from assets involves three components: operating cash flow, capital spending, and change in net working capital. **Operating cash flow** refers to the cash flow that results from the firm's day-to-day activities of producing and selling. Expenses associated with the firm's financing of its assets are not included because they are not operating expenses.

As we discussed in Chapter 1, some portion of the firm's cash flow is reinvested in the firm. *Capital spending* refers to the net spending on fixed assets (purchases of fixed assets less sales of fixed assets). Finally, *change in net working capital* is measured as the net change in current assets relative to current liabilities for the period being examined and

represents the amount spent on net working capital. The three components of cash flow are examined in more detail next.

Operating Cash Flow To calculate operating cash flow (OCF), we want to calculate revenues minus costs, but we don't want to include depreciation because it's not a cash outflow, and we don't want to include interest because it's a financing expense. We do want to include taxes because taxes are (unfortunately) paid in cash.

If we look at U.S. Corporation's income statement (Table 2.2), we see that earnings before interest and taxes (EBIT) are $694. This is almost what we want because it doesn't include interest paid. However, we need to make two adjustments. First, recall that depreciation is a noncash expense. To get cash flow, we first add back the $65 in depreciation because it wasn't a cash deduction. The other adjustment is to subtract the $131 in taxes because these were paid in cash. The result is operating cash flow:

U.S. CORPORATION 2018 Operating Cash Flow	
Earnings before interest and taxes	$694
+ Depreciation	65
– Taxes	131
Operating cash flow	$628

U.S. Corporation had a 2018 operating cash flow of $628.

Operating cash flow is an important number because it tells us, on a very basic level, whether a firm's cash inflows from its business operations are sufficient to cover its everyday cash outflows. For this reason, a negative operating cash flow is often a sign of trouble.

There is an unpleasant possibility of confusion when we speak of operating cash flow. In accounting practice, operating cash flow is often defined as net income plus depreciation. For U.S. Corporation, this would amount to $493 + 65 = $558.

The accounting definition of operating cash flow differs from ours in one important way: Interest is deducted when net income is computed. Notice that the difference between the $628 operating cash flow we calculated and this $558 is $70, the amount of interest paid for the year. This definition of cash flow thus considers interest paid to be an operating expense. Our definition treats it properly as a financing expense. If there were no interest expense, the two definitions would be the same.

To finish our calculation of cash flow from assets for U.S. Corporation, we need to consider how much of the $628 operating cash flow was reinvested in the firm. We consider spending on fixed assets first.

Capital Spending Net capital spending is money spent on fixed assets less money received from the sale of fixed assets. At the end of 2017, net fixed assets for U.S. Corporation (Table 2.1) were $1,644. During the year, U.S. wrote off (depreciated) $65 worth of fixed assets on the income statement. So, if the firm didn't purchase any new fixed assets, net fixed assets would have been $1,644 – 65 = $1,579 at year's end. The 2018 balance sheet shows $1,709 in net fixed assets, so U.S. must have spent a total of $1,709 – 1,579 = $130 on fixed assets during the year:

This $130 is the net capital spending for 2018.

Ending net fixed assets	$1,709
– Beginning net fixed assets	1,644
+ Depreciation	65
Net capital spending	$ 130

Could net capital spending be negative? The answer is yes. This would happen if the firm sold more assets than it purchased. The *net* here refers to purchases of fixed assets net of any sales of fixed assets. You will often see capital spending called CAPEX, which is an acronym for capital expenditures. It usually means the same thing.

Change in Net Working Capital In addition to investing in fixed assets, a firm will also invest in current assets. For example, going back to the balance sheets in Table 2.1, we see that, at the end of 2018, U.S. had current assets of $1,464. At the end of 2017, current assets were $1,112; so, during the year, U.S. invested $1,464 − 1,112 = $352 in current assets.

As the firm changes its investment in current assets, its current liabilities will usually change as well. To determine the change in net working capital, the easiest approach is to take the difference between the beginning and ending net working capital (NWC) figures. Net working capital at the end of 2018 was $1,464 − 389 = $1,075. Similarly, at the end of 2017, net working capital was $1,112 − 428 = $684. Given these figures, we have the following:

Ending NWC	$1,075
– Beginning NWC	684
Change in NWC	$ 391

Net working capital thus increased by $391. Put another way, U.S. Corporation had a net investment of $391 in NWC for the year. This change in NWC is often referred to as the "addition to" NWC.

Conclusion Given the figures we've come up with, we're ready to calculate cash flow from assets. The total cash flow from assets is given by operating cash flow less the amounts invested in fixed assets and net working capital. So, for U.S. Corporation, we have:

U.S. CORPORATION 2018 Cash Flow from Assets	
Operating cash flow	$628
– Net capital spending	130
– Change in NWC	391
Cash flow from assets	$107

From the cash flow identity given earlier, we know that this $107 cash flow from assets equals the sum of the firm's cash flow to creditors and its cash flow to stockholders. We consider these next.

It wouldn't be at all unusual for a growing corporation to have a negative cash flow. As we see next, a negative cash flow means that the firm raised more money by borrowing and selling stock than it paid out to creditors and stockholders during the year.

free cash flow
Another name for cash flow from assets.

A Note about "Free" Cash Flow Cash flow from assets sometimes goes by a different name, **free cash flow**. Of course, there is no such thing as "free" cash (we wish!). Instead the name refers to cash that the firm is free to distribute to creditors and stockholders because it is not needed for working capital or fixed asset investments. We will stick with "cash flow from assets" as our label for this important concept because, in practice, there is some variation in exactly how free cash flow is computed; different users calculate it in different ways. Nonetheless, whenever you hear the phrase "free cash flow," you should understand that what is being discussed is cash flow from assets or something quite similar.

CASH FLOW TO CREDITORS AND STOCKHOLDERS

The cash flows to creditors and stockholders represent the net payments to creditors and owners during the year. Their calculation is similar to that of cash flow from assets. **Cash flow to creditors** is interest paid less net new borrowing; **cash flow to stockholders** is dividends paid less net new equity raised.

cash flow to creditors
A firm's interest payments to creditors less net new borrowing.

cash flow to stockholders
Dividends paid out by a firm less net new equity raised.

Cash Flow to Creditors

Looking at the income statement in Table 2.2, we see that U.S. Corporation paid $70 in interest to creditors. From the balance sheets in Table 2.1, we see that long-term debt rose by $454 − 408 = $46. So U.S. Corporation paid out $70 in interest, but it borrowed an additional $46. Thus, net cash flow to creditors is:

U.S. CORPORATION 2018 Cash Flow to Creditors	
Interest paid	$70
− Net new borrowing	46
Cash flow to creditors	$24

Cash flow to creditors is sometimes called *cash flow to bondholders*; we will use these terms interchangeably.

Cash Flow to Stockholders

From the income statement, we see that dividends paid to stockholders amounted to $123. To get net new equity raised, we need to look at the common stock and paid-in surplus account. This account tells us how much stock the company has sold. During the year, this account rose by $40, so $40 in net new equity was raised. Given this, we have the following:

U.S. CORPORATION 2018 Cash Flow to Stockholders	
Dividends paid	$123
− Net new equity raised	40
Cash flow to stockholders	$ 83

The cash flow to stockholders for 2018 was $83.

The last thing we need to do is to verify that the cash flow identity holds to be sure we didn't make any mistakes. From the previous section, we know that cash flow from assets is $107. Cash flow to creditors and stockholders is $24 + 83 = $107, so everything checks out. Table 2.6 contains a summary of the various cash flow calculations for future reference.

As our discussion indicates, it is essential that a firm keep an eye on its cash flow. The following serves as an excellent reminder of why doing so is a good idea, unless the firm's owners wish to end up in the "Po' " house:

QUOTH THE BANKER, "WATCH CASH FLOW"

Once upon a midnight dreary as I pondered weak and weary
Over many a quaint and curious volume of accounting lore,
Seeking gimmicks (without scruple) to squeeze through some new tax loophole,
Suddenly I heard a knock upon my door, Only this, and nothing more.

Then I felt a queasy tingling and I heard the cash a-jingling
As a fearsome banker entered whom I'd often seen before.
His face was money-green and in his eyes there could be seen
Dollar-signs that seemed to glitter as he reckoned up the score.
"Cash flow," the banker said, and nothing more.

TABLE 2.6
Cash Flow Summary

I. The cash flow identity
Cash flow from assets = Cash flow to creditors (bondholders) + Cash flow to stockholders (owners)
II. Cash flow from assets
Cash flow from assets = Operating cash flow − Net capital spending − Change in net working capital (NWC)
where:
Operating cash flow = Earnings before interest and taxes (EBIT) + Depreciation − Taxes
Net capital spending = Ending net fixed assets − Beginning net fixed assets + Depreciation
Change in NWC = Ending NWC − Beginning NWC
III. Cash flow to creditors (bondholders)
Cash flow to creditors = Interest paid − Net new borrowing
IV. Cash flow to stockholders (owners)
Cash flow to stockholders = Dividends paid − Net new equity raised

I had always thought it fine to show a jet black bottom line.
But the banker sounded a resounding, "No.
Your receivables are high, mounting upward toward the sky;
Write-offs loom. What matters is cash flow."
He repeated, "Watch cash flow."

Then I tried to tell the story of our lovely inventory
Which, though large, is full of most delightful stuff.
But the banker saw its growth, and with a mighty oath
He waved his arms and shouted, "Stop! Enough!
Pay the interest, and don't give me any guff!"

Next I looked for noncash items which could add ad infinitum
To replace the ever-outward flow of cash,
But to keep my statement black I'd held depreciation back,
And my banker said that I'd done something rash.
He quivered, and his teeth began to gnash.

When I asked him for a loan, he responded, with a groan,
That the interest rate would be just prime plus eight,
And to guarantee my purity he'd insist on some security—
All my assets plus the scalp upon my pate.
Only this, a standard rate.

Though my bottom line is black, I am flat upon my back,
My cash flows out and customers pay slow.
The growth of my receivables is almost unbelievable:
The result is certain—unremitting woe!
And I hear the banker utter an ominous low mutter,
"Watch cash flow."

Herbert S. Bailey Jr.

To which we can only add, "Amen."

AN EXAMPLE: CASH FLOWS FOR DOLE COLA

This extended example covers the various cash flow calculations discussed in the chapter. It also illustrates a few variations that may arise.

Operating Cash Flow During the year, Dole Cola, Inc., had sales and cost of goods sold of $600 and $300, respectively. Depreciation was $150 and interest paid was $30. Taxes were calculated at a straight 21 percent. Dividends were $36. (All figures are in millions of dollars.) What was operating cash flow for Dole? Why is this different from net income?

The easiest thing to do here is to create an income statement. We can then pick up the numbers we need. Dole Cola's income statement is given here:

DOLE COLA 2018 Income Statement		
Net sales		$600
Cost of goods sold		300
Depreciation		150
Earnings before interest and taxes		$150
Interest paid		30
Taxable income		$120
Taxes		25
Net income		$ 95
Dividends	$36	
Addition to retained earnings	59	

Net income for Dole was $95. We now have all the numbers we need. Referring back to the U.S. Corporation example and Table 2.6, we have this:

DOLE COLA 2018 Operating Cash Flow	
Earnings before interest and taxes	$150
+ Depreciation	150
– Taxes	25
Operating cash flow	$275

As this example illustrates, operating cash flow is not the same as net income because depreciation and interest are subtracted out when net income is calculated. If you recall our earlier discussion, we don't subtract these out in computing operating cash flow because depreciation is not a cash expense and interest paid is a financing expense, not an operating expense.

Net Capital Spending Suppose beginning net fixed assets were $500 and ending net fixed assets were $750. What was the net capital spending for the year?

From the income statement for Dole, we know that depreciation for the year was $150. Net fixed assets rose by $250. Dole thus spent $250 along with an additional $150, for a total of $400.

Change in NWC and Cash Flow from Assets Suppose Dole Cola started the year with $2,130 in current assets and $1,620 in current liabilities, and the corresponding ending figures were $2,276 and $1,710. What was the change in NWC during the year? What was cash flow from assets? How does this compare to net income?

Net working capital started out as $2,130 − 1,620 = $510 and ended up at $2,276 − 1,710 = $566. The addition to NWC was $566 − 510 = $56. Putting together all the information for Dole, we have the following:

DOLE COLA
2018 Cash Flow from Assets

Operating cash flow	$275
− Net capital spending	400
− Change in NWC	56
Cash flow from assets	−$181

Dole had a cash flow from assets of −$181. Net income was positive at $95. Is the fact that cash flow from assets was negative a cause for alarm? Not necessarily. The cash flow here is negative primarily because of a large investment in fixed assets. If these are good investments, the resulting negative cash flow is not a worry.

Cash Flow to Stockholders and Creditors We saw that Dole Cola had cash flow from assets of −$181. The fact that this is negative means that Dole raised more money in the form of new debt and equity than it paid out for the year. For example, suppose we know that Dole didn't sell any new equity for the year. What was cash flow to stockholders? To creditors?

Because it didn't raise any new equity, Dole's cash flow to stockholders is equal to the cash dividend paid:

DOLE COLA
2018 Cash Flow to Stockholders

Dividends paid	$36
− Net new equity raised	0
Cash flow to stockholders	$36

Now, from the cash flow identity, we know that the total cash paid to creditors and stockholders was −$181. Cash flow to stockholders is $36, so cash flow to creditors must be equal to −$181 − 36 = −$217:

$$\begin{aligned} &\text{Cash flow to creditors} + \text{Cash flow to stockholders} &&= -\$181 \\ &\text{Cash flow to creditors} + \$36 &&= -\$181 \\ &\text{Cash flow to creditors} &&= -\$217 \end{aligned}$$

Because we know that cash flow to creditors is −$217 and interest paid is $30 (from the income statement), we can now determine net new borrowing. Dole must have borrowed $247 during the year to help finance the fixed asset expansion:

DOLE COLA 2018 Cash Flow to Creditors	
Interest paid	$ 30
– Net new borrowing	– 247
Cash flow to creditors	–$217

Concept Questions

2.4a What is the cash flow identity? Explain what it says.
2.4b What are the components of operating cash flow?
2.4c Why is interest paid not a component of operating cash flow?

Summary and Conclusions 2.5

This chapter has introduced some of the basics of financial statements, taxes, and cash flow:

1. The book values on an accounting balance sheet can be very different from market values. The goal of financial management is to maximize the market value of the stock, not its book value.
2. Net income as it is computed on the income statement is not cash flow. A primary reason is that depreciation, a noncash expense, is deducted when net income is computed.
3. Marginal and average tax rates can be different, and it is the marginal tax rate that is relevant for most financial decisions.
4. The tax rate paid by corporations is a flat tax of 21 percent, although state and local taxes can increase this rate.
5. There is a cash flow identity much like the balance sheet identity. It says that cash flow from assets equals cash flow to creditors and stockholders.

The calculation of cash flow from financial statements isn't difficult. Care must be taken in handling noncash expenses, such as depreciation, and operating costs must not be confused with financing costs. Most of all, it is important not to confuse book values with market values, or accounting income with cash flow.

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Can you answer the following *Connect* Quiz questions?

Section 2.1 What types of accounts are the most liquid?
Section 2.2 What is an example of a noncash expense?
Section 2.3 The marginal tax rate is the tax rate that _____.
Section 2.4 Interest expense is treated as what type of cash flow?

CHAPTER REVIEW AND SELF-TEST PROBLEM

2.1 Cash Flow for Mara Corporation This problem will give you some practice working with financial statements and figuring cash flow. Based on the following information for Mara Corporation, prepare an income statement for 2018 and balance sheets for 2017 and 2018. Next, following our U.S. Corporation examples in the chapter, calculate cash flow from assets, cash flow to creditors, and cash flow to stockholders for Mara for 2018. Use a 21 percent tax rate throughout. You can check your answers against ours, found in the following section.

	2017	2018
Sales	$4,203	$4,507
Cost of goods sold	2,422	2,633
Depreciation	785	952
Interest	180	196
Dividends	275	352
Current assets	2,205	2,429
Net fixed assets	7,344	7,650
Current liabilities	1,003	1,255
Long-term debt	3,106	2,085

ANSWER TO CHAPTER REVIEW AND SELF-TEST PROBLEM

2.1 In preparing the balance sheets, remember that shareholders' equity is the residual. With this in mind, Mara's balance sheets are as follows:

MARA CORPORATION
2017 and 2018 Balance Sheets

	2017	2018		2017	2018
Current assets	$2,205	$ 2,429	Current liabilities	$1,003	$ 1,255
Net fixed assets	7,344	7,650	Long-term debt	3,106	2,085
			Equity	5,440	6,739
Total assets	$9,549	$10,079	Total liabilities and shareholders' equity	$9,549	$10,079

The income statement is straightforward:

MARA CORPORATION
2018 Income Statement

Sales		$4,507
Cost of goods sold		2,633
Depreciation		952
Earnings before interest and taxes		$ 922
Interest paid		196
Taxable income		$ 726
Taxes (21%)		152
Net income		$ 574
Dividends	$352	
Addition to retained earnings	222	

Notice that the addition to retained earnings is net income less cash dividends.

We can now pick up the figures we need to get operating cash flow:

MARA CORPORATION 2018 Operating Cash Flow	
Earnings before interest and taxes	$ 922
+ Depreciation	952
− Taxes	152
Operating cash flow	$1,722

Next, we get the net capital spending for the year by looking at the change in fixed assets, remembering to account for depreciation:

Ending net fixed assets	$7,650
− Beginning net fixed assets	7,344
+ Depreciation	952
Net capital spending	$1,258

After calculating beginning and ending NWC, we take the difference to get the change in NWC:

Ending NWC	$1,174
− Beginning NWC	1,202
Change in NWC	−$ 28

We now combine operating cash flow, net capital spending, and the change in net working capital to get the total cash flow from assets:

MARA CORPORATION Cash Flow from Assets	
Operating cash flow	$1,722
− Net capital spending	1,258
− Change in NWC	−28
Cash flow from assets	$ 492

To get cash flow to creditors, notice that long-term borrowing decreased by $1,021 during the year and that interest paid was $196:

MARA CORPORATION 2018 Cash Flow to Creditors	
Interest paid	$ 196
− Net new borrowing	−1,021
Cash flow to creditors	$ 1,217

Finally, dividends paid were $352. To get net new equity raised, we have to do some extra calculating. Total equity was up by $6,739 − 5,440 = $1,299. Of this

increase, $222 was from additions to retained earnings, so $1,077 in new equity was raised during the year. Cash flow to stockholders was thus:

MARA CORPORATION 2018 Cash Flow to Stockholders	
Dividends paid	$ 352
− Net new equity raised	1,077
Cash flow to stockholders	−$ 725

As a check, notice that cash flow from assets ($492) equals cash flow to creditors plus cash flow to stockholders ($1,217 − 725 = $492).

CONCEPTS REVIEW AND CRITICAL THINKING QUESTIONS

1. **Liquidity** [LO1] What does liquidity measure? Explain the trade-off a firm faces between high liquidity and low liquidity levels.
2. **Accounting and Cash Flows** [LO2] Why might the revenue and cost figures shown on a standard income statement not be representative of the actual cash inflows and outflows that occurred during a period?
3. **Book Values versus Market Values** [LO1] In preparing a balance sheet, why do you think standard accounting practice focuses on historical cost rather than market value?
4. **Operating Cash Flow** [LO2] In comparing accounting net income and operating cash flow, name two items you typically find in net income that are not in operating cash flow. Explain what each is and why it is excluded in operating cash flow.
5. **Book Values versus Market Values** [LO1] Under standard accounting rules, it is possible for a company's liabilities to exceed its assets. When this occurs, the owners' equity is negative. Can this happen with market values? Why or why not?
6. **Cash Flow from Assets** [LO4] Suppose a company's cash flow from assets is negative for a particular period. Is this necessarily a good sign or a bad sign?
7. **Operating Cash Flow** [LO4] Suppose a company's operating cash flow has been negative for several years running. Is this necessarily a good sign or a bad sign?
8. **Net Working Capital and Capital Spending** [LO4] Could a company's change in NWC be negative in a given year? (*Hint*: Yes.) Explain how this might come about. What about net capital spending?
9. **Cash Flow to Stockholders and Creditors** [LO4] Could a company's cash flow to stockholders be negative in a given year? (*Hint*: Yes.) Explain how this might come about. What about cash flow to creditors?
10. **Firm Values** [LO1] Referring back to the Boeing example used at the beginning of the chapter, note that we suggested that Boeing's stockholders probably didn't suffer as a result of the reported loss. What do you think was the basis for our conclusion?
11. **Enterprise Value** [LO1] A firm's *enterprise value* is equal to the market value of its debt and equity, less the firm's holdings of cash and cash equivalents. This figure is particularly relevant to potential purchasers of the firm. Why?

12. **Earnings Management** [LO2] Companies often try to keep accounting earnings growing at a relatively steady pace, thereby avoiding large swings in earnings from period to period. They also try to meet earnings targets. To do so, they use a variety of tactics. The simplest way is to control the timing of accounting revenues and costs, which all firms can do to at least some extent. For example, if earnings are looking too low this quarter, then some accounting costs can be deferred until next quarter. This practice is called *earnings management*. It is common, and it raises a lot of questions. Why do firms do it? Why are firms even allowed to do it under GAAP? Is it ethical? What are the implications for cash flow and shareholder wealth?

QUESTIONS AND PROBLEMS

BASIC
(Questions 1–10)

1. **Building a Balance Sheet** [LO1] Wims, Inc., has current assets of $4,900, net fixed assets of $27,300, current liabilities of $4,100, and long-term debt of $10,200. What is the value of the shareholders' equity account for this firm? How much is net working capital?
2. **Building an Income Statement** [LO1] Griffin's Goat Farm, Inc., has sales of $796,000, costs of $327,000, depreciation expense of $42,000, interest expense of $34,000, and a tax rate of 21 percent. What is the net income for this firm?
3. **Dividends and Retained Earnings** [LO1] Suppose the firm in Problem 2 paid out $95,000 in cash dividends. What is the addition to retained earnings?
4. **Per-Share Earnings and Dividends** [LO1] Suppose the firm in Problem 3 had 80,000 shares of common stock outstanding. What is the earnings per share, or EPS, figure? What is the dividends per share figure?
5. **Calculating OCF** [LO4] Pompeii, Inc., has sales of $46,200, costs of $23,100, depreciation expense of $2,200, and interest expense of $1,700. If the tax rate is 22 percent, what is the operating cash flow, or OCF?
6. **Calculating Net Capital Spending** [LO4] Logano Driving School's 2017 balance sheet showed net fixed assets of $2.4 million, and the 2018 balance sheet showed net fixed assets of $3.3 million. The company's 2018 income statement showed a depreciation expense of $319,000. What was net capital spending for 2018?
7. **Calculating Additions to NWC** [LO4] The 2017 balance sheet of Dream, Inc., showed current assets of $4,810 and current liabilities of $2,230. The 2018 balance sheet showed current assets of $5,360 and current liabilities of $2,970. What was the company's 2018 change in net working capital, or NWC?
8. **Cash Flow to Creditors** [LO4] The 2017 balance sheet of Kerber's Tennis Shop, Inc., showed long-term debt of $1.87 million, and the 2018 balance sheet showed long-term debt of $2.21 million. The 2018 income statement showed an interest expense of $255,000. What was the firm's cash flow to creditors during 2018?
9. **Cash Flow to Stockholders** [LO4] The 2017 balance sheet of Kerber's Tennis Shop, Inc., showed $650,000 in the common stock account and $3.98 million in the additional paid-in surplus account. The 2018 balance sheet showed $805,000 and $4.2 million in the same two accounts, respectively. If the company paid out $545,000 in cash dividends during 2018, what was the cash flow to stockholders for the year?

10. Calculating Total Cash Flows [LO4] Given the information for Kerber's Tennis Shop, Inc., in Problems 8 and 9, suppose you also know that the firm's net capital spending for 2018 was $1,250,000 and that the firm reduced its net working capital investment by $45,000. What was the firm's 2018 operating cash flow, or OCF?

INTERMEDIATE
(Questions 11–19)

11. Market Values and Book Values [LO1] Klingon Widgets, Inc., purchased new cloaking machinery three years ago for $6 million. The machinery can be sold to the Romulans today for $5.1 million. Klingon's current balance sheet shows net fixed assets of $3.4 million, current liabilities of $895,000, and net working capital of $235,000. If the current assets and current liabilities were liquidated today, the company would receive a total of $1.15 million cash. What is the book value of Klingon's total assets today? What is the sum of the market value of NWC and the market value of fixed assets?

12. Calculating Total Cash Flows [LO4] Square Hammer Corp. shows the following information on its 2018 income statement: Sales = $305,000; Costs = $176,000; Other expenses = $8,900; Depreciation expense = $18,700; Interest expense = $12,900; Taxes = $23,345; Dividends = $19,500. In addition, you're told that the firm issued $6,400 in new equity during 2018 and redeemed $4,900 in outstanding long-term debt.

a. What is the 2018 operating cash flow?

b. What is the 2018 cash flow to creditors?

c. What is the 2018 cash flow to stockholders?

d. If net fixed assets increased by $46,000 during the year, what was the addition to NWC?

13. Using Income Statements [LO1] Given the following information for Bowie Pizza Co., calculate the depreciation expense: Sales = $64,000; Costs = $30,700; Addition to retained earnings = $5,700; Dividends paid = $1,980; Interest expense = $4,400; Tax rate = 22 percent.

14. Preparing a Balance Sheet [LO1] Prepare a 2018 balance sheet for Rogers Corp. based on the following information: Cash = $127,000; Patents and copyrights = $660,000; Accounts payable = $210,000; Accounts receivable = $115,000; Tangible net fixed assets = $1,610,000; Inventory = $286,000; Notes payable = $155,000; Accumulated retained earnings = $1,368,000; Long-term debt = $830,000.

15. Residual Claims [LO1] Bishop, Inc., is obligated to pay its creditors $7,800 during the year.

a. What is the market value of the shareholders' equity if assets have a market value of $9,400?

b. What if assets equal $6,700?

16. Net Income and OCF [LO2] During 2018, Raines Umbrella Corp. had sales of $705,000. Cost of goods sold, administrative and selling expenses, and depreciation expenses were $445,000, $95,000, and $140,000, respectively. In addition, the company had an interest expense of $70,000 and a tax rate of 25 percent. (Ignore any tax loss carryforward provisions and assume interest expense is fully deductible.)

a. What is the company's net income for 2018?

b. What is its operating cash flow?

c. Explain your results in (*a*) and (*b*).

17. Accounting Values versus Cash Flows [LO2] In Problem 16, suppose Raines Umbrella Corp. paid out $102,000 in cash dividends. Is this possible? If net capital spending and net working capital were both zero, and if no new stock was issued during the year, what do you know about the firm's long-term debt account?

18. Calculating Cash Flows [LO2] Cardinal Industries had the following operating results for 2018: Sales = $33,106; Cost of goods sold = $23,624; Depreciation expense = $5,877; Interest expense = $2,650; Dividends paid = $1,888. At the beginning of the year, net fixed assets were $19,820, current assets were $6,970, and current liabilities were $3,920. At the end of the year, net fixed assets were $24,394, current assets were $8,612, and current liabilities were $4,575. The tax rate for 2018 was 22 percent.

a. What is net income for 2018?

b. What is the operating cash flow for 2018?

c. What is the cash flow from assets for 2018? Is this possible? Explain.

d. If no new debt was issued during the year, what is the cash flow to creditors? What is the cash flow to stockholders? Explain and interpret the positive and negative signs of your answers in (*a*) through (*d*).

19. Calculating Cash Flows [LO4] Consider the following abbreviated financial statements for Parrothead Enterprises:

PARROTHEAD ENTERPRISES
2017 and 2018 Partial Balance Sheets

Assets			Liabilities and Owners' Equity		
	2017	2018		2017	2018
Current assets	$1,206	$1,307	Current liabilities	$ 482	$ 541
Net fixed assets	4,973	5,988	Long-term debt	2,628	2,795

PARROTHEAD ENTERPRISES
2018 Income Statement

Sales	$15,301
Costs	7,135
Depreciation	1,363
Interest paid	388

a. What is owners' equity for 2017 and 2018?

b. What is the change in net working capital for 2018?

c. In 2018, Parrothead Enterprises purchased $2,496 in new fixed assets. How much in fixed assets did Parrothead Enterprises sell? What is the cash flow from assets for the year? The tax rate is 21 percent.

d. During 2018, Parrothead Enterprises raised $504 in new long-term debt. How much long-term debt must Parrothead Enterprises have paid off during the year? What is the cash flow to creditors?

20. Net Fixed Assets and Depreciation [LO4] On the balance sheet, the net fixed assets (NFA) account is equal to the gross fixed assets (FA) account (which records the acquisition cost of fixed assets) minus the accumulated depreciation (AD) account (which records the total depreciation taken by the firm against its fixed assets). Using the fact that NFA = FA − AD, show that the expression given in the chapter for net capital spending, $NFA_{end} - NFA_{beg} + D$ (where D is the depreciation expense during the year), is equivalent to $FA_{end} - FA_{beg}$.

CHALLENGE
(Questions 20–22)

Use the following information for Taco Swell, Inc., for Problems 21 and 22 (assume the tax rate is 21 percent):

	2017	2018
Sales	$16,549	$18,498
Depreciation	2,376	2,484
Cost of goods sold	5,690	6,731
Other expenses	1,353	1,178
Interest	1,110	1,325
Cash	8,676	9,247
Accounts receivable	11,488	13,482
Short-term notes payable	1,674	1,641
Long-term debt	29,060	35,229
Net fixed assets	72,770	77,610
Accounts payable	6,269	6,640
Inventory	20,424	21,862
Dividends	1,979	2,314

21. **Financial Statements** [LO1] Draw up an income statement and balance sheet for this company for 2017 and 2018.
22. **Calculating Cash Flow** [LO4] For 2018, calculate the cash flow from assets, cash flow to creditors, and cash flow to stockholders.

EXCEL MASTER IT! PROBLEM

Using Excel to find the marginal tax rate can be accomplished using the VLOOKUP function. However, calculating the total tax bill is a little more difficult. Below we have shown a copy of the IRS tax table for an unmarried individual for 2018. Often, tax tables are presented in this format.

If taxable income is over ...	But not over ...	The tax is:
$ 0	$ 9,525	10% of the amount over $0
9,526	38,700	$952.50 plus 15% of the amount over $9,525
38,701	93,700	$5,328.75 plus 25% of the amount over $38,700
93,701	195,450	$19,078.75 plus 28% of the amount over $93,700
195,451	424,950	$47,568.75 plus 33% of the amount over $195,450
424,951	426,700	$123,303.75 plus 35% of the amount over $424,950
426,701		$123,916.25 plus 39.6% of the amount over $426,700

In reading this table, the marginal tax rate for taxable income less than $9,525 is 10 percent. If the taxable income is between $9,525 and $38,700, the tax bill is $952.50 plus the marginal taxes. The marginal taxes are calculated as the taxable income minus $9,525 times the marginal tax rate of 15 percent.

Below, we have the corporate tax table that was applicable 2017 and as shown in Table 2.3.

Taxable income is greater than or equal to...	But less than...	Tax rate
$ 0	$ 50,000	15%
50,001	75,000	25
75,001	100,000	34
100,001	335,000	39
335,001	10,000,000	34
10,000,001	15,000,000	35
15,000,001	18,333,333	38
18,333,334		35

a. Create a tax table in Excel for corporate taxes similar to the individual tax table shown above. Your spreadsheet should then calculate the marginal tax rate, the average tax rate, and the tax bill for any level of taxable income input by a user.

b. For a taxable income of $1,350,000, what is the marginal tax rate?

c. For a taxable income of $1,350,000, what is the total tax bill?

d. For a taxable income of $1,350,000, what is the average tax rate?

MINICASE

Cash Flows and Financial Statements at Sunset Boards, Inc.

Sunset Boards is a small company that manufactures and sells surfboards in Malibu. Tad Marks, the founder of the company, is in charge of the design and sale of the surfboards, but his background is in surfing, not business. As a result, the company's financial records are not well maintained.

The initial investment in Sunset Boards was provided by Tad and his friends and family. Because the initial investment was relatively small, and the company has made surfboards only for its own store, the investors haven't required detailed financial statements from Tad. But thanks to word of mouth among professional surfers, sales have picked up recently, and Tad is considering a major expansion. His plans include opening another surfboard store in Hawaii, as well as supplying his "sticks" (surfer lingo for boards) to other sellers.

Tad's expansion plans require a significant investment, which he plans to finance with a combination of additional funds from outsiders plus some money borrowed from banks. Naturally, the new investors and creditors require more organized and detailed financial statements than Tad has previously prepared. At the urging of his investors, Tad has hired financial analyst Christina Wolfe to evaluate the performance of the company over the past year.

After rooting through old bank statements, sales receipts, tax returns, and other records, Christina has assembled the following information:

	2017	2018
Cost of goods sold	$255,605	$322,742
Cash	36,884	55,725
Depreciation	72,158	81,559
Interest expense	15,687	17,980
Selling and administrative	50,268	65,610
Accounts payable	26,186	44,318
Net fixed assets	318,345	387,855
Sales	501,441	611,224
Accounts receivable	26,136	33,901
Notes payable	29,712	32,441
Long-term debt	160,689	175,340
Inventory	50,318	67,674
New equity	0	19,500

Sunset Boards currently pays out 40 percent of net income as dividends to Tad and the other original investors, and it has a 21 percent tax rate. You are Christina's assistant, and she has asked you to prepare the following:

1. An income statement for 2017 and 2018.
2. A balance sheet for 2017 and 2018.
3. Operating cash flow for each year.
4. Cash flow from assets for 2018.
5. Cash flow to creditors for 2018.
6. Cash flow to stockholders for 2018.

QUESTIONS

1. How would you describe Sunset Boards's cash flows for 2018? Write a brief discussion.
2. In light of your discussion in the previous question, what do you think about Tad's expansion plans?

Working with Financial Statements

Chapter 3

THE PRICE OF A SHARE OF COMMON STOCK in corner pharmacy CVS Health closed at about $82 on January 6, 2017. At that price, CVS had a price-earnings (PE) ratio of 18. That is, investors were willing to pay $18 for every dollar in income earned by CVS. At the same time, investors were willing to pay $55, $34, and $6 for each dollar earned by Adobe Systems, Pfizer, and Ford, respectively. At the other extreme were Blackberry and Twitter. Both had negative earnings for the previous year, yet Blackberry was priced at about $8 per share and Twitter at about $17 per share. Because they had negative earnings, their PE ratios would have been negative, so they were not reported. At the time, the typical stock in the S&P 500 index of large company stocks was trading at a PE of about 16, or about 16 times earnings, as they say on Wall Street.

Price-to-earnings comparisons are examples of the use of financial ratios. As we will see in this chapter, there are a wide variety of financial ratios, all designed to summarize specific aspects of a firm's financial position. In addition to discussing how to analyze financial statements and compute financial ratios, we will have quite a bit to say about who uses this information and why.

Learning Objectives

After studying this chapter, you should be able to:

- **LO1** Standardize financial statements for comparison purposes.
- **LO2** Compute and, more importantly, interpret some common ratios.
- **LO3** Name the determinants of a firm's profitability.
- **LO4** Explain some of the problems and pitfalls in financial statement analysis.

For updates on the latest happenings in finance, visit fundamentalsofcorporatefinance.blogspot.com.

In Chapter 2, we discussed some of the essential concepts of financial statements and cash flow. Part 2, this chapter and the next, continues where our earlier discussion left off. Our goal here is to expand your understanding of the uses (and abuses) of financial statement information.

Financial statement information will crop up in various places in the remainder of our book. Part 2 is not essential for understanding this material, but it will help give you an overall perspective on the role of financial statement information in corporate finance.

A good working knowledge of financial statements is desirable because such statements, and numbers derived from those statements, are the primary means of communicating financial information both within the firm and outside the firm. In short, much of the language of corporate finance is rooted in the ideas we discuss in this chapter.

Furthermore, as we will see, there are many different ways of using financial statement information and many different types of users. This diversity reflects the fact that financial statement information plays an important part in many types of decisions.

In the best of all worlds, the financial manager has full market value information about all of the firm's assets. This will rarely (if ever) happen. So, the reason we rely on accounting figures for much of our financial information is that we are almost always unable to obtain all (or even part) of the market information we want. The only meaningful yardstick for evaluating business decisions is whether they create economic value (see Chapter 1). However, in many important situations, it will not be possible to make this judgment directly because we can't see the market value effects of decisions.

We recognize that accounting numbers are often pale reflections of economic reality, but they are frequently the best available information. For privately held corporations, not-for-profit businesses, and smaller firms, for example, very little direct market value information exists at all. The accountant's reporting function is crucial in these circumstances.

Clearly, one important goal of the accountant is to report financial information to the user in a form useful for decision making. Ironically, the information frequently does not come to the user in such a form. In other words, financial statements don't come with a user's guide. This chapter and the next are first steps in filling this gap.

3.1 Cash Flow and Financial Statements: A Closer Look

Excel Master It!

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At the most fundamental level, firms do two different things: They generate cash and they spend it. Cash is generated by selling a product, an asset, or a security. Selling a security involves either borrowing or selling an equity interest (shares of stock) in the firm. Cash is spent in paying for materials and labor to produce a product and in purchasing assets. Payments to creditors and owners also require the spending of cash.

In Chapter 2, we saw that the cash activities of a firm could be summarized by a simple identity:

$$\text{Cash flow from assets} = \text{Cash flow to creditors} + \text{Cash flow to owners}$$

This cash flow identity summarizes the total cash result of all transactions a firm engages in during the year. In this section, we return to the subject of cash flow by taking a closer look at the cash events during the year that led to these total figures.

SOURCES AND USES OF CASH

sources of cash
A firm's activities that generate cash.

uses of cash
A firm's activities in which cash is spent. Also called *applications of cash*.

Activities that bring in cash are called **sources of cash**. Activities that involve spending cash are called **uses** (or *applications*) **of cash**. What we need to do is to trace the changes in the firm's balance sheet to see how the firm obtained and spent its cash during some period.

To get started, consider the balance sheets for the Prufrock Corporation in Table 3.1. Notice that we have calculated the change in each of the items on the balance sheets.

Looking over the balance sheets for Prufrock, we see that quite a few things changed during the year. For example, Prufrock increased its net fixed assets by $149 and its inventory by $29. (Note that, throughout, all figures are in millions of dollars.) Where did the money come from? To answer this and related questions, we need to first identify those changes that used up cash (uses) and those that brought in cash (sources).

A little common sense is useful here. A firm uses cash by either buying assets or making payments. So, loosely speaking, an increase in an asset account means the firm, on a net basis, bought some assets—a use of cash. If an asset account went down, then on a net basis, the firm sold some assets. This would be a net source. Similarly, if a liability account goes down, then the firm has made a net payment—a use of cash.

TABLE 3.1

PRUFROCK CORPORATION 2017 and 2018 Balance Sheets ($ in millions)			
	2017	2018	Change
Assets			
Current assets			
Cash	$ 84	$ 146	+$ 62
Accounts receivable	165	188	+ 23
Inventory	393	422	+ 29
Total	$ 642	$ 756	+$114
Fixed assets			
Net plant and equipment	$2,731	$2,880	+$149
Total assets	$3,373	$3,636	+$263
Liabilities and Owners' Equity			
Current liabilities			
Accounts payable	$ 312	$ 344	+$ 32
Notes payable	231	196	– 35
Total	$ 543	$ 540	–$ 3
Long-term debt	$ 531	$ 457	–$ 74
Owners' equity			
Common stock and paid-in surplus	$ 500	$ 550	+$ 50
Retained earnings	1,799	2,089	+ 290
Total	$2,299	$2,639	+$340
Total liabilities and owners' equity	$3,373	$3,636	+$263

Given this reasoning, there is a simple, albeit mechanical, definition you may find useful. An increase in a left-side (asset) account or a decrease in a right-side (liability or equity) account is a use of cash. Likewise, a decrease in an asset account or an increase in a liability (or equity) account is a source of cash.

Looking again at Prufrock, we see that inventory rose by $29. This is a net use of cash because Prufrock effectively paid out $29 to increase inventories. Accounts payable rose by $32. This is a source of cash because Prufrock effectively has borrowed an additional $32 payable by the end of the year. Notes payable, on the other hand, went down by $35, so Prufrock effectively paid off $35 worth of short-term debt—a use of cash.

Based on our discussion, we can summarize the sources and uses of cash from the balance sheet as follows:

Sources of cash:	
Increase in accounts payable	$ 32
Increase in common stock	50
Increase in retained earnings	290
Total sources	$372
Uses of cash:	
Increase in accounts receivable	$ 23
Increase in inventory	29
Decrease in notes payable	35
Decrease in long-term debt	74
Net fixed asset acquisitions	149
Total uses	$310
Net addition to cash	$ 62

Company financial information can be found in many places on the web, including **finance.yahoo.com**, **finance.google.com**, and **money.msn.com**.

TABLE 3.2

PRUFROCK CORPORATION 2018 Income Statement ($ in millions)		
Sales		$2,311
Cost of goods sold		1,344
Depreciation		276
Earnings before interest and taxes		$ 691
Interest paid		141
Taxable income		$ 550
Taxes (21%)		116
Net income		$ 435
Dividends	$145	
Addition to retained earnings	290	

The net addition to cash is the difference between sources and uses, and our $62 result here agrees with the $62 change shown on the balance sheet.

This simple statement tells us much of what happened during the year, but it doesn't tell the whole story. For example, the increase in retained earnings is net income (a source of funds) less dividends (a use of funds). It would be more enlightening to have these reported separately so we could see the breakdown. Also, we have considered only net fixed asset acquisitions. Total or gross spending would be more interesting to know.

To further trace the flow of cash through the firm during the year, we need an income statement. For Prufrock, the results for the year are shown in Table 3.2.

Notice here that the $290 addition to retained earnings we calculated from the balance sheet is the difference between the net income of $435 and the dividends of $145.

THE STATEMENT OF CASH FLOWS

statement of cash flows
A firm's financial statement that summarizes its sources and uses of cash over a specified period.

There is some flexibility in summarizing the sources and uses of cash in the form of a financial statement. However it is presented, the result is called the **statement of cash flows**.

We present a particular format for this statement in Table 3.3. The basic idea is to group all the changes into three categories: operating activities, financing activities, and investment activities. The exact form differs in detail from one preparer to the next.

Don't be surprised if you come across different arrangements. The types of information presented will be similar; the exact order can differ. The key thing to remember in this case is that we started out with $84 in cash and ended up with $146, for a net increase of $62. We're trying to see what events led to this change.

Going back to Chapter 2, we note that there is a slight conceptual problem here. Interest paid should really go under financing activities, but unfortunately that's not the way the accounting is handled. The reason, you may recall, is that interest is deducted as an expense when net income is computed. Also, notice that the net purchase of fixed assets was $149. Because Prufrock wrote off $276 worth of assets (the depreciation), it must have actually spent a total of $149 + 276 = $425 on fixed assets.

Once we have this statement, it might seem appropriate to express the change in cash on a per-share basis, much as we did for net income. Ironically, despite the interest we might have in some measure of cash flow per share, standard accounting practice expressly prohibits reporting this information. The reason is that accountants feel that cash flow (or some component of cash flow) is not an alternative to accounting income, so only earnings per share are to be reported.

As shown in Table 3.4, it is sometimes useful to present the same information a bit differently. We will call this the "sources and uses of cash" statement. There is no such

TABLE 3.3

PRUFROCK CORPORATION 2018 Statement of Cash Flows ($ in millions)	
Cash, beginning of year	$ 84
Operating activity	
Net income	$ 435
Plus:	
Depreciation	276
Increase in accounts payable	32
Less:	
Increase in accounts receivable	– 23
Increase in inventory	– 29
Net cash from operating activity	$ 691
Investment activity	
Fixed asset acquisitions	–$ 425
Net cash from investment activity	–$ 425
Financing activity	
Decrease in notes payable	–$ 35
Decrease in long-term debt	– 74
Dividends paid	– 145
Increase in common stock	50
Net cash from financing activity	–$ 204
Net increase in cash	$ 62
Cash, end of year	$ 146

TABLE 3.4

PRUFROCK CORPORATION 2018 Sources and Uses of Cash ($ in millions)	
Cash, beginning of year	$ 84
Sources of cash	
Operations:	
Net income	$435
Depreciation	276
	$711
Working capital:	
Increase in accounts payable	$ 32
Long-term financing:	
Increase in common stock	50
Total sources of cash	$793
Uses of cash	
Working capital:	
Increase in accounts receivable	$ 23
Increase in inventory	29
Decrease in notes payable	35
Long-term financing:	
Decrease in long-term debt	74
Fixed asset acquisitions	425
Dividends paid	145
Total uses of cash	$731
Net addition to cash	$ 62
Cash, end of year	$146

statement in financial accounting, but this arrangement resembles one used many years ago. As we will discuss, this form can come in handy, but we emphasize again that it is not the way this information is normally presented.

Now that we have the various cash pieces in place, we can get a good idea of what happened during the year. Prufrock's major cash outlays were fixed asset acquisitions and cash dividends. It paid for these activities primarily with cash generated from operations.

Prufrock also retired some long-term debt and increased current assets. Finally, current liabilities were not greatly changed, and a relatively small amount of new equity was sold. Altogether, this short sketch captures Prufrock's major sources and uses of cash for the year.

Concept Questions

3.1a What is a source of cash? Give three examples.

3.1b What is a use, or application, of cash? Give three examples.

3.2 Standardized Financial Statements

Excel Master It!

Excel Master coverage online

The next thing we might want to do with Prufrock's financial statements is compare them to those of other similar companies. We would immediately have a problem, however. It's almost impossible to directly compare the financial statements for two companies because of differences in size.

For example, Ford and GM are serious rivals in the auto market, but GM is bigger (in terms of market share), so it is difficult to compare them directly. For that matter, it's difficult even to compare financial statements from different points in time for the same company if the company's size has changed. The size problem is compounded if we try to compare GM and, say, Toyota. If Toyota's financial statements are denominated in yen, then we have size *and* currency differences.

To start making comparisons, one obvious thing we might try to do is to somehow standardize the financial statements. One common and useful way of doing this is to work with percentages instead of total dollars. In this section, we describe two different ways of standardizing financial statements along these lines.

COMMON-SIZE STATEMENTS

common-size statement
A standardized financial statement presenting all items in percentage terms. Balance sheet items are shown as a percentage of assets and income statement items as a percentage of sales.

To get started, a useful way of standardizing financial statements is to express each item on the balance sheet as a percentage of assets and to express each item on the income statement as a percentage of sales. The resulting financial statements are called **common-size statements**. We consider these next.

Common-Size Balance Sheets One way, though not the only way, to construct a common-size balance sheet is to express each item as a percentage of total assets. Prufrock's 2017 and 2018 common-size balance sheets are shown in Table 3.5.

Notice that some of the totals don't check exactly because of rounding. Also notice that the total change has to be zero because the beginning and ending numbers must add up to 100 percent.

In this form, financial statements are relatively easy to read and compare. For example, looking at the two balance sheets for Prufrock, we see that current assets

TABLE 3.5

PRUFROCK CORPORATION 2017 and 2018 Common-Size Balance Sheets			
	2017	2018	Change
Assets			
Current assets			
Cash	2.5%	4.0%	+1.5%
Accounts receivable	4.9	5.2	+ .3
Inventory	11.7	11.6	+ 0
Total	19.0	20.8	+1.8
Fixed assets			
Net plant and equipment	81.0	79.2	−1.8
Total assets	100.0%	100.0%	0
Liabilities and Owners' Equity			
Current liabilities			
Accounts payable	9.2%	9.5%	+ .2%
Notes payable	6.8	5.4	−1.5
Total	16.1	14.9	−1.2
Long-term debt	15.7	12.6	−3.2
Owners' equity			
Common stock and paid-in surplus	14.8	15.1	+ .3
Retained earnings	53.3	57.5	+4.1
Total	68.2	72.6	+4.4
Total liabilities and owners' equity	100.0%	100.0%	0

were 20.8 percent of total assets in 2018, up from 19.0 percent in 2017. Current liabilities declined from 16.1 percent to 14.9 percent of total liabilities and equity over that same time. Similarly, total equity rose from 68.2 percent of total liabilities and equity to 72.6 percent.

Overall, Prufrock's liquidity, as measured by current assets compared to current liabilities, increased over the year. Simultaneously, Prufrock's indebtedness diminished as a percentage of total assets. We might be tempted to conclude that the balance sheet has grown "stronger." We will say more about this later.

Common-Size Income Statements A useful way of standardizing the income statement is to express each item as a percentage of total sales, as illustrated for Prufrock in Table 3.6.

This income statement tells us what happens to each dollar in sales. For Prufrock, interest expense eats up $.061 out of every sales dollar and taxes take another $.05. When all is said and done, $.188 of each dollar flows through to the bottom line (net income), and that amount is split into $.125 retained in the business and $.063 paid out in dividends.

These percentages are useful in comparisons. For example, a relevant figure is the cost percentage. For Prufrock, $.582 of each $1 in sales goes to pay for goods sold. It would be interesting to compute the same percentage for Prufrock's main competitors to see how Prufrock stacks up in terms of cost control.

TABLE 3.6

PRUFROCK CORPORATION 2018 Common-Size Income Statement		
Sales		100.0%
Cost of goods sold		58.2
Depreciation		11.9
Earnings before interest and taxes		29.9
Interest paid		6.1
Taxable income		23.8
Taxes (21%)		5.0
Net income		18.8%
Dividends	6.3%	
Addition to retained earnings	12.5	

Common-Size Statements of Cash Flows Although we have not presented it here, it is also possible and useful to prepare a common-size statement of cash flows. Unfortunately, with the current statement of cash flows, there is no obvious denominator such as total assets or total sales. However, if the information is arranged in a way similar to that in Table 3.4, then each item can be expressed as a percentage of total sources (or total uses). The results can then be interpreted as the percentage of total sources of cash supplied or as the percentage of total uses of cash for a particular item.

COMMON-BASE YEAR FINANCIAL STATEMENTS: TREND ANALYSIS

Imagine we were given balance sheets for the last 10 years for some company and we were trying to investigate trends in the firm's pattern of operations. Does the firm use more or less debt? Has the firm grown more or less liquid? A useful way of standardizing financial statements in this case is to choose a base year and then express each item relative to the base amount. We will call the resulting statements **common-base year statements**.

common-base year statement
A standardized financial statement presenting all items relative to a certain base year amount.

For example, from 2017 to 2018, looking at Table 3.1, Prufrock's inventory rose from $393 to $422. If we pick 2017 as our base year, then we would set inventory equal to 1.00 for that year. For the next year, we would calculate inventory relative to the base year as $422/$393 = 1.07. In this case, we could say inventory grew by about 7 percent during the year. If we had multiple years, we would divide the inventory figure for each one by $393. The resulting series is easy to plot, and it is then easy to compare companies. Table 3.7 summarizes these calculations for the asset side of the balance sheet.

COMBINED COMMON-SIZE AND BASE YEAR ANALYSIS

The trend analysis we have been discussing can be combined with the common-size analysis discussed earlier. The reason for doing this is that as total assets grow, most of the other accounts must grow as well. By first forming the common-size statements, we eliminate the effect of this overall growth.

For example, looking at Table 3.7, we see that Prufrock's accounts receivable were $165, or 4.9 percent of total assets, in 2017. In 2018, they had risen to $188, which was 5.2 percent of total assets. If we do our analysis in terms of dollars, then the 2018 figure would be $188/$165 = 1.14, representing a 14 percent increase in receivables. However, if we work with the common-size statements, then the 2018 figure would be 5.2%/4.9% = 1.06. This tells us accounts receivable, as a percentage of total assets, grew by 6 percent. Roughly speaking, what we see is that of the 14 percent total increase, about 8 percent (= 14% − 6%) is attributable to growth in total assets.

TABLE 3.7

PRUFROCK CORPORATION
Summary of Standardized Balance Sheets
(Asset Side Only)

	Assets ($ in millions)		Common-Size Assets		Common-Base Year Assets	Combined Common-Size and Base Year Assets
	2017	2018	2017	2018	2018	2018
Current assets						
Cash	$ 84	$ 146	2.5%	4.0%	1.74	1.61
Accounts receivable	165	188	4.9	5.2	1.14	1.06
Inventory	393	422	11.7	11.6	1.07	1.00
Total current assets	$ 642	$ 756	19.0	20.8	1.18	1.09
Fixed assets						
Net plant and equipment	$2,731	$2,880	81.0	79.2	1.05	.98
Total assets	$3,373	$3,636	100.0%	100.0%	1.08	1.00

NOTE: The common-size numbers are calculated by dividing each item by total assets for that year. For example, the 2017 common-size cash amount is $84/$3,373 = .025, or 2.5%. The common-base year numbers are calculated by dividing each 2018 item by the base year (2017) dollar amount. The common-base year cash is thus $146/$84 = 1.74, representing a 74 percent increase. The combined common-size and base year figures are calculated by dividing each common-size amount by the base year (2017) common-size amount. The cash figure is therefore 4.0%/2.5% = 1.61, representing a 61 percent increase in cash holdings as a percentage of total assets. Columns may not total precisely due to rounding.

Concept Questions

3.2a Why is it often necessary to standardize financial statements?

3.2b Name two types of standardized statements and describe how each is formed.

Ratio Analysis

3.3

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Another way of avoiding the problems involved in comparing companies of different sizes is to calculate and compare **financial ratios**. Such ratios are ways of comparing and investigating the relationships between different pieces of financial information. Using ratios eliminates the size problem because the size effectively divides out. We're then left with percentages, multiples, or time periods.

financial ratios
Relationships determined from a firm's financial information and used for comparison purposes.

There is a problem in discussing financial ratios. Because a ratio is one number divided by another, and because there are so many accounting numbers out there, we could examine a huge number of possible ratios. Everybody has a favorite. We will restrict ourselves to a representative sampling.

In this section, we only want to introduce you to some commonly used financial ratios. These are not necessarily the ones we think are the best. In fact, some of them may strike you as illogical or not as useful as some alternatives. If they do, don't be concerned. As a financial analyst, you can always decide how to compute your own ratios.

What you do need to worry about is the fact that different people and different sources seldom compute these ratios in exactly the same way, and this leads to much confusion. The specific definitions we use here may or may not be the same as ones you have seen or will see elsewhere. If you are ever using ratios as a tool for analysis, you should be careful to document how you calculate each one. And if you are comparing your numbers to numbers from another source, be sure you know how those numbers have been computed.

We will defer much of our discussion of how ratios are used and some problems that come up with using them until later in the chapter. For now, for each of the ratios we discuss, we consider several questions:

1. How is it computed?
2. What is it intended to measure, and why might we be interested?
3. What is the unit of measurement?
4. What might a high or low value tell us? How might such values be misleading?
5. How could this measure be improved?

Financial ratios are traditionally grouped into the following categories:

1. Short-term solvency, or liquidity, ratios.
2. Long-term solvency, or financial leverage, ratios.
3. Asset management, or turnover, ratios.
4. Profitability ratios.
5. Market value ratios.

We will consider each of these in turn. In calculating these numbers for Prufrock, we will use the ending balance sheet (2018) figures unless we say otherwise. Also notice that the various ratios are color keyed to indicate which numbers come from the income statement (blue) and which come from the balance sheet (green).

SHORT-TERM SOLVENCY, OR LIQUIDITY, MEASURES

As the name suggests, short-term solvency ratios as a group are intended to provide information about a firm's liquidity, and these ratios are sometimes called *liquidity measures*. The primary concern is the firm's ability to pay its bills over the short run without undue stress. Consequently, these ratios focus on current assets and current liabilities.

For obvious reasons, liquidity ratios are particularly interesting to short-term creditors. Because financial managers work constantly with banks and other short-term lenders, an understanding of these ratios is essential.

One advantage of looking at current assets and liabilities is that their book values and market values are likely to be similar. Often (though not always), these assets and liabilities don't live long enough for the two to get seriously out of step. On the other hand, like any type of near-cash, current assets and liabilities can and do change fairly rapidly, so today's amounts may not be a reliable guide to the future.

Go to **www.reuters.com** to examine comparative ratios for a huge number of companies.

Current Ratio

One of the best known and most widely used ratios is the *current ratio*. As you might guess, the current ratio is defined as follows:

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} \quad \text{3.1}$$

Here is Prufrock's 2018 current ratio:

$$\text{Current ratio} = \frac{\$756}{\$540} = 1.40 \text{ times}$$

Because current assets and liabilities are, in principle, converted to cash over the following 12 months, the current ratio is a measure of short-term liquidity. The unit of measurement is either dollars or times. So, we could say Prufrock has $1.40 in current assets for every $1 in current liabilities, or we could say Prufrock has its current liabilities covered 1.40 times over.

To a creditor—particularly a short-term creditor such as a supplier—the higher the current ratio, the better. To the firm, a high current ratio indicates liquidity, but it also may

indicate an inefficient use of cash and other short-term assets. Absent some extraordinary circumstances, we would expect to see a current ratio of at least 1 because a current ratio of less than 1 would mean that net working capital (current assets less current liabilities) is negative. This would be unusual in a healthy firm, at least for most types of businesses.

The current ratio, like any ratio, is affected by various types of transactions. For example, suppose the firm borrows over the long term to raise money. The short-run effect would be an increase in cash from the issue proceeds and an increase in long-term debt. Current liabilities would not be affected, so the current ratio would rise.

Finally, note that an apparently low current ratio may not be a bad sign for a company with a large reserve of untapped borrowing power.

Current Events — EXAMPLE 3.1

Suppose a firm pays off some of its suppliers and short-term creditors. What happens to the current ratio? Suppose a firm buys some inventory. What happens in this case? What happens if a firm sells some merchandise?

The first case is a trick question. What happens is that the current ratio moves away from 1. If it is greater than 1 (the usual case), it will get bigger. But if it is less than 1, it will get smaller. To see this, suppose the firm has $4 in current assets and $2 in current liabilities for a current ratio of 2. If we use $1 in cash to reduce current liabilities, then the new current ratio is ($4 − 1)/($2 − 1) = 3. If we reverse the original situation to $2 in current assets and $4 in current liabilities, then the change will cause the current ratio to fall to 1/3 from 1/2.

The second case is not quite as tricky. Nothing happens to the current ratio because cash goes down while inventory goes up—total current assets are unaffected.

In the third case, the current ratio will usually rise because inventory is normally shown at cost and the sale will normally be at something greater than cost (the difference is the markup). The increase in either cash or receivables is therefore greater than the decrease in inventory. This increases current assets, and the current ratio rises.

The Quick (or Acid-Test) Ratio Inventory is often the least liquid current asset. It's also the one for which the book values are least reliable as measures of market value because the quality of the inventory isn't considered. Some of the inventory may later turn out to be damaged, obsolete, or lost.

More to the point, relatively large inventories are often a sign of short-term trouble. The firm may have overestimated sales and overbought or overproduced as a result. In this case, the firm may have a substantial portion of its liquidity tied up in slow-moving inventory.

To further evaluate liquidity, the *quick*, or *acid-test*, *ratio* is computed just like the current ratio, except inventory is omitted:

$$\text{Quick ratio} = \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}} \quad (3.2)$$

Notice that using cash to buy inventory does not affect the current ratio, but it reduces the quick ratio. Again, the idea is that inventory is relatively illiquid compared to cash.

For Prufrock, this ratio for 2018 was:

$$\text{Quick ratio} = \frac{\$756 - 422}{\$540} = .62 \text{ times}$$

The quick ratio here tells a somewhat different story than the current ratio because inventory accounts for more than half of Prufrock's current assets. To exaggerate the point, if this inventory consisted of, say, unsold nuclear power plants, then this would be a cause for concern.

To give an example of current versus quick ratios, based on recent financial statements, Walmart and ManpowerGroup had current ratios of .85 and 1.39, respectively. However, Manpower carries no inventory to speak of, whereas Walmart's current assets are virtually all inventory. As a result, Walmart's quick ratio was only .22, whereas ManpowerGroup's was 1.39, the same as its current ratio.

Other Liquidity Ratios We briefly mention three other measures of liquidity. A very short-term creditor might be interested in the *cash ratio*:

$$\text{Cash ratio} = \frac{\text{Cash}}{\text{Current liabilities}} \tag{3.3}$$

You can verify that for 2018 this works out to be .27 times for Prufrock.

Because net working capital, or NWC, is frequently viewed as the amount of short-term liquidity a firm has, we can consider the ratio of *NWC to total assets*:

$$\text{Net working capital to total assets} = \frac{\text{Net working capital}}{\text{Total assets}} \tag{3.4}$$

A relatively low value might indicate relatively low levels of liquidity. Here, this ratio works out to be ($756 − 540)/$3,636 = .06 times.

Finally, imagine that Prufrock was facing a strike and cash inflows began to dry up. How long could the business keep running? One answer is given by the *interval measure*:

$$\text{Interval measure} = \frac{\text{Current assets}}{\text{Average daily operating costs}} \tag{3.5}$$

Total costs for the year, excluding depreciation and interest, were $1,344. The average daily cost was $1,344/365 = $3.68 per day.[1] The interval measure is thus $756/$3.68 = 205 days. Based on this, Prufrock could hang on for six months or so.[2]

The interval measure (or something similar) is also useful for newly founded or start-up companies that often have little in the way of revenues. For such companies, the interval measure indicates how long the company can operate until it needs another round of financing. The average daily operating cost for start-up companies is often called the *burn rate*, meaning the rate at which cash is burned in the race to become profitable.

LONG-TERM SOLVENCY MEASURES

Long-term solvency ratios are intended to address the firm's long-term ability to meet its obligations, or, more generally, its financial leverage. These are sometimes called *financial leverage ratios* or *leverage ratios*. We consider three commonly used measures and some variations.

Total Debt Ratio The *total debt ratio* takes into account all debts of all maturities to all creditors. It can be defined in several ways, the easiest of which is this:

$$\begin{aligned}\text{Total debt ratio} &= \frac{\text{Total assets} - \text{Total equity}}{\text{Total assets}} \\ &= \frac{\$3{,}636 - 2{,}639}{\$3{,}636} = .27 \text{ times}\end{aligned} \tag{3.6}$$

[1]For many of these ratios that involve average daily amounts, a 360-day year is often used in practice. This so-called banker's year has exactly four quarters of 90 days each and was computationally convenient in the days before pocket calculators. We'll use 365 days.

[2]Sometimes depreciation and/or interest is included in calculating average daily costs. Depreciation isn't a cash expense, so its inclusion doesn't make a lot of sense. Interest is a financing cost, so we excluded it by definition (we looked at only operating costs). We could, of course, define a different ratio that included interest expense.

In this case, an analyst might say that Prufrock uses 27 percent debt.[3] Whether this is high or low or whether it even makes any difference depends on whether capital structure matters, a subject we discuss in Part 6.

Prufrock has $.27 in debt for every $1 in assets. Therefore, there is $.73 in equity (= $1 − .27) for every $.27 in debt. With this in mind, we can define two useful variations on the total debt ratio—the *debt-equity ratio* and the *equity multiplier*:

$$\text{Debt-equity ratio} = \text{Total debt}/\text{Total equity} \quad (3.7)$$
$$= \$.27/\$.73 = .38 \text{ times}$$
$$\text{Equity multiplier} = \text{Total assets}/\text{Total equity} \quad (3.8)$$
$$= \$1/\$.73 = 1.38 \text{ times}$$

The fact that the equity multiplier is 1 plus the debt-equity ratio is not a coincidence:

$$\begin{aligned}\text{Equity multiplier} &= \text{Total assets}/\text{Total equity} = \$1/\$.73 = 1.38\\ &= (\text{Total equity} + \text{Total debt})/\text{Total equity}\\ &= 1 + \text{Debt-equity ratio} = 1.38 \text{ times}\end{aligned}$$

The thing to notice here is that given any one of these three ratios, you can immediately calculate the other two; so, they all say exactly the same thing.

Ratios used to analyze technology firms can be found at **www.chalfin.com** under the "Publications" link.

A Brief Digression: Total Capitalization versus Total Assets Frequently, financial analysts are more concerned with a firm's long-term debt than its short-term debt because the short-term debt will be constantly changing. Also, a firm's accounts payable may reflect trade practice more than debt management policy. For these reasons, the *long-term debt ratio* is often calculated as follows:

$$\text{Long-term debt ratio} = \frac{\text{Long-term debt}}{\text{Long-term debt} + \text{Total equity}} \quad (3.9)$$
$$= \frac{\$457}{\$457 + 2{,}639} = \frac{\$457}{\$3{,}096} = .15 \text{ times}$$

The $3,096 in total long-term debt and equity is sometimes called the firm's *total capitalization*, and the financial manager will frequently focus on this quantity rather than on total assets.

To complicate matters, different people (and different books) mean different things by the term *debt ratio*. Some mean a ratio of total debt, some mean a ratio of long-term debt only, and, unfortunately, a substantial number are vague about which one they mean.

This is a source of confusion, so we choose to give two separate names to the two measures. The same problem comes up in discussing the debt-equity ratio. Financial analysts frequently calculate this ratio using only long-term debt.

Times Interest Earned Another common measure of long-term solvency is the *times interest earned* (TIE) *ratio*. Once again, there are several possible (and common) definitions, but we'll stick with the most traditional:

$$\text{Times interest earned ratio} = \frac{\text{EBIT}}{\text{Interest}} \quad (3.10)$$
$$= \frac{\$691}{\$141} = 4.9 \text{ times}$$

[3]Total equity here includes preferred stock (discussed in Chapter 8 and elsewhere), if there is any. An equivalent numerator in this ratio would be Current liabilities + Long-term debt.

As the name suggests, this ratio measures how well a company has its interest obligations covered, and it is often called the *interest coverage ratio*. For Prufrock, the interest bill is covered 4.9 times over.

Cash Coverage A problem with the TIE ratio is that it is based on EBIT, which is not really a measure of cash available to pay interest. The reason is that depreciation, a noncash expense, has been deducted out. Because interest is definitely a cash outflow (to creditors), one way to define the *cash coverage ratio* is this:

$$\text{Cash coverage ratio} = \frac{\text{EBIT + Depreciation}}{\text{Interest}} \quad (3.11)$$

$$= \frac{\$691 + 276}{\$141} = \frac{\$967}{\$141} = 6.86 \text{ times}$$

The numerator here, EBIT plus depreciation, is often abbreviated EBITD (earnings before interest, taxes, and depreciation—say "ebbit-dee"). It is a basic measure of the firm's ability to generate cash from operations, and it is frequently used as a measure of cash flow available to meet financial obligations.

A common variation on EBITD is earnings before interest, taxes, depreciation, and amortization (EBITDA—say "ebbit-dah"). Here *amortization* refers to a noncash deduction similar conceptually to depreciation, except it applies to an intangible asset (such as a patent) rather than a tangible asset (such as a machine). Note that the word *amortization* here does not refer to the repayment of debt, a subject we discuss in a later chapter.

ASSET MANAGEMENT, OR TURNOVER, MEASURES

We next turn our attention to the efficiency with which Prufrock uses its assets. The measures in this section are sometimes called *asset utilization ratios*. The specific ratios we discuss can all be interpreted as measures of turnover. What they are intended to describe is how efficiently or intensively a firm uses its assets to generate sales. We first look at two important current assets: inventory and receivables.

Inventory Turnover and Days' Sales in Inventory During the year, Prufrock had a cost of goods sold of $1,344. Inventory at the end of the year was $422. With these numbers, *inventory turnover* can be calculated as follows:

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold}}{\text{Inventory}} \quad (3.12)$$

$$= \frac{\$1{,}344}{\$422} = 3.18 \text{ times}$$

In a sense, Prufrock sold off or turned over the entire inventory 3.18 times.[4] As long as we are not running out of stock and thereby forgoing sales, the higher this ratio is, the more efficiently we are managing inventory.

If we know we turned our inventory over 3.18 times during the year, we can immediately figure out how long it took us to turn it over on average. The result is the average *days' sales in inventory*:

$$\text{Days' sales in inventory} = \frac{\text{365 days}}{\text{Inventory turnover}} \quad (3.13)$$

$$= \frac{365 \text{ days}}{3.18} = 115 \text{ days}$$

[4]Notice that we used cost of goods sold in the top of this ratio. For some purposes, it might be more useful to use sales instead of costs. For example, if we wanted to know the amount of sales generated per dollar of inventory, we could just replace the cost of goods sold with sales.

This tells us that, roughly speaking, inventory sits 115 days on average before it is sold. Alternatively, assuming we have used the most recent inventory and cost figures, it will take about 115 days to work off our current inventory.

To give an example, in September 2017, the U.S. automobile industry as a whole had a 74-day supply of cars, higher than the 60-day supply considered normal. This figure means that at the then-current rate of sales, it would have taken 62 days to deplete the available supply. Of course, there was significant variation among the auto manufacturers. For example, BMW had only a 40-day supply of inventory, while Mitsubishi's days' sales in inventory was 125 days.

It might make more sense to use the average inventory in calculating turnover. Inventory turnover would then be \$1,344/[(\$393 + 422)/2] = 3.3 times.[5] It depends on the purpose of the calculation. If we are interested in how long it will take us to sell our current inventory, then using the ending figure (as we did initially) is probably better.

In many of the ratios we discuss in this chapter, average figures could just as well be used. Again, it depends on whether we are worried about the past, in which case averages are appropriate, or the future, in which case ending figures might be better. Also, using ending figures is common in reporting industry averages; so, for comparison purposes, ending figures should be used in such cases. In any event, using ending figures is definitely less work, so we'll continue to use them.

Receivables Turnover and Days' Sales in Receivables Our inventory measures give some indication of how fast we can sell product. We now look at how fast we collect on those sales. The *receivables turnover* is defined much like inventory turnover:

$$\text{Receivables turnover} = \frac{\text{Sales}}{\text{Accounts receivable}} \tag{3.14}$$

$$= \frac{\$2{,}311}{\$188} = 12.29 \text{ times}$$

Loosely speaking, Prufrock collected its outstanding credit accounts and reloaned the money 12.29 times during the year.[6]

This ratio makes more sense if we convert it to days, so here is the *days' sales in receivables*:

$$\text{Days' sales in receivables} = \frac{\text{365 days}}{\text{Receivables turnover}} \tag{3.15}$$

$$= \frac{365}{12.29} = 30 \text{ days}$$

Therefore, on average, Prufrock collects on its credit sales in 30 days. For obvious reasons, this ratio is frequently called the *average collection period* (ACP).

Note that if we are using the most recent figures, we could also say that we have 30 days' worth of sales currently uncollected. We will learn more about this subject when we study credit policy in a later chapter.

[5]Notice that we calculated the average as (Beginning value + Ending value)/2.

[6]Here we have implicitly assumed that all sales are credit sales. If they were not, we would simply use total credit sales in these calculations, not total sales.

Payables Turnover — EXAMPLE 3.2

Here is a variation on the receivables collection period. How long, on average, does it take for Prufrock Corporation to pay its bills? To answer, we need to calculate the accounts payable turnover rate using cost of goods sold. We will assume that Prufrock purchases everything on credit.

The cost of goods sold is $1,344, and accounts payable are $344. The turnover is therefore $1,344/$344 = 3.91 times. So, payables turned over about every 365/3.91 = 94 days. On average, then, Prufrock takes 94 days to pay. As a potential creditor, we might take note of this fact.

Asset Turnover Ratios Moving away from specific accounts like inventory or receivables, we can consider several "big picture" ratios. For example, *NWC turnover* is:

$$\text{NWC turnover} = \frac{\text{Sales}}{\text{NWC}} \quad (3.16)$$
$$= \frac{\$2,311}{\$756 - 540} = 10.7 \text{ times}$$

This ratio measures how much "work" we get out of our working capital. Once again, assuming we aren't missing out on sales, a high value is preferred. (Why?)

Similarly, *fixed asset turnover* is:

$$\text{Fixed asset turnover} = \frac{\text{Sales}}{\text{Net fixed assets}} \quad (3.17)$$
$$= \frac{\$2,311}{\$2,880} = .80 \text{ times}$$

With this ratio, it probably makes more sense to say that for every dollar in fixed assets, Prufrock generated $.80 in sales.

Our final asset management ratio, *total asset turnover*, comes up quite a bit. We will see it later in this chapter and in the next chapter. As the name suggests, the total asset turnover is:

$$\text{Total asset turnover} = \frac{\text{Sales}}{\text{Total assets}} \quad (3.18)$$
$$= \frac{\$2,311}{\$3,588} = .64 \text{ times}$$

In other words, for every dollar in assets, Prufrock generated $.64 in sales.

To give an example of fixed and total asset turnover, based on recent financial statements, Southwest Airlines had a total asset turnover of .85, compared to .74 for IBM. However, the much higher investment in fixed assets in an airline is reflected in Southwest's fixed asset turnover of 1.03, compared to IBM's 1.20.

EXAMPLE 3.3 More Turnover

Suppose you find that a particular company generates $.40 in sales for every dollar in total assets. How often does this company turn over its total assets?

The total asset turnover here is .40 times per year. It takes 1/.40 = 2.5 years to turn total assets over completely.

PROFITABILITY MEASURES

The three measures we discuss in this section are probably the best known and most widely used of all financial ratios. In one form or another, they are intended to measure how efficiently a firm uses its assets and manages its operations. The focus in this group is on the bottom line, net income.

Profit Margin Companies pay a great deal of attention to their *profit margins*:

$$\text{Profit margin} = \frac{\text{Net income}}{\text{Sales}} = \frac{\$435}{\$2{,}311} = .1880, \text{ or } 18.80\% \quad (3.19)$$

This tells us that Prufrock, in an accounting sense, generates a little less than 19 cents in profit for every dollar in sales.

All other things being equal, a relatively high profit margin is obviously desirable. This situation corresponds to low expense ratios relative to sales. However, we hasten to add that other things are often not equal.

For example, lowering our sales price will usually increase unit volume but will normally cause profit margins to shrink. Total profit (or, more important, operating cash flow) may go up or down; so the fact that margins are smaller isn't necessarily bad. After all, isn't it possible that, as the saying goes, "Our prices are so low that we lose money on everything we sell, but we make it up in volume"?[7]

Return on Assets *Return on assets* (ROA) is a measure of profit per dollar of assets. It can be defined several ways, but the most common is this:

$$\text{Return on assets} = \frac{\text{Net income}}{\text{Total assets}} = \frac{\$435}{\$3{,}636} = .1195, \text{ or } 11.95\% \quad (3.20)$$

Return on Equity *Return on equity* (ROE) is a measure of how the stockholders fared during the year. Because benefiting shareholders is our goal, ROE is, in an accounting sense, the true bottom-line measure of performance. ROE is usually measured as follows:

$$\text{Return on equity} = \frac{\text{Net income}}{\text{Total equity}} = \frac{\$435}{\$2{,}639} = .1646, \text{ or } 16.46\% \quad (3.21)$$

For every dollar in equity, therefore, Prufrock generated 16.46 cents in profit; but this is correct only in accounting terms.

Because ROA and ROE are such commonly cited numbers, we stress that it is important to remember they are accounting rates of return. For this reason, these measures should properly be called *return on book assets* and *return on book equity*. In fact, ROE is sometimes called *return on net worth*. Whatever it's called, it would be inappropriate to compare the result to, for example, an interest rate observed in the financial markets. We will have more to say about accounting rates of return in later chapters.

The fact that ROE exceeds ROA reflects Prufrock's use of financial leverage. We will examine the relationship between these two measures in more detail shortly.

[7] No, it's not.

ROE and ROA **EXAMPLE 3.4**

Because ROE and ROA are usually intended to measure performance over a prior period, it makes a certain amount of sense to base them on average equity and average assets, respectively. For Prufrock, how would you calculate these?

We first need to calculate average assets and average equity:

Average assets = ($3,373 + 3,636)/2 = $3,505
Average equity = ($2,299 + 2,639)/2 = $2,469

With these averages, we can recalculate ROA and ROE as follows:

$$\text{ROA} = \frac{\$435}{\$3{,}505} = .1240, \text{ or } 12.40\%$$

$$\text{ROE} = \frac{\$435}{\$2{,}469} = .1760, \text{ or } 17.60\%$$

These are slightly higher than our previous calculations because assets and equity grew during the year, so the average values are below the ending values.

MARKET VALUE MEASURES

Our final group of measures is based, in part, on information not necessarily contained in financial statements—the market price per share of stock. Obviously, these measures can be calculated directly only for publicly traded companies.

We assume that Prufrock has 33 million shares outstanding and the stock sold for $88 per share at the end of the year. If we recall that Prufrock's net income was $435 million, we can calculate its earnings per share:

$$\text{EPS} = \frac{\text{Net income}}{\text{Shares outstanding}} = \frac{\$435}{33} = \$13.17$$

Price-Earnings Ratio The first of our market value measures, the *price-earnings* (PE) *ratio* (or multiple), is defined here:

3.22

$$\text{PE ratio} = \frac{\text{Price per share}}{\text{Earnings per share}} = \frac{\$88}{\$13.17} = 6.68 \text{ times}$$

In the vernacular, we would say that Prufrock shares sell for almost seven times earnings, or we might say that Prufrock shares have or "carry" a PE multiple of 6.68.

PE ratios vary substantially across companies, but, in 2017, a typical large company in the United States had a PE in the 15–20 range. This is on the high side by historical standards, but not dramatically so. A low point for PEs was about 5 in 1974. PEs also vary across countries. For example, Japanese PEs have historically been much higher than those of their U.S. counterparts.

Because the PE ratio measures how much investors are willing to pay per dollar of current earnings, higher PEs are often taken to mean the firm has significant prospects for future growth. Of course, if a firm had no or almost no earnings, its PE would probably be quite large; so, as always, care is needed in interpreting this ratio.

Sometimes analysts divide PE ratios by expected future earnings growth rates (after multiplying the growth rate by 100). The result is the PEG ratio. Suppose Prufrock's anticipated growth rate in EPS was 6 percent. Its PEG ratio would then be 6.68/6 = 1.11. The idea behind the PEG ratio is that whether a PE ratio is high or low depends on expected future growth. High PEG ratios suggest that the PE is too high relative to growth, and vice versa.

Price-Sales Ratio In some cases, companies will have negative earnings for extended periods, so their PE ratios are not very meaningful. A good example is a recent start-up. Such companies usually do have some revenues, so analysts will often look at the *price-sales ratio*:

Price-sales ratio = Price per share/Sales per share

In Prufrock's case, sales were $2,311, so here is the price-sales ratio:

$$\text{Price-sales ratio} = \$88/(\$2{,}311/33) = \$88/\$70 = 1.26 \text{ times}$$

As with PE ratios, whether a particular price-sales ratio is high or low depends on the industry involved.

Market-to-Book Ratio A third commonly quoted market value measure is the *market-to-book ratio*:

$$\text{Market-to-book ratio} = \frac{\text{Market value per share}}{\text{Book value per share}} = \frac{\$88}{(\$2{,}639/33)} = \frac{\$88}{\$80.0} = 1.10 \text{ times} \quad (3.23)$$

Notice that book value per share is total equity (not just common stock) divided by the number of shares outstanding.

Because book value per share is an accounting number, it reflects historical costs. In a loose sense, the market-to-book ratio compares the market value of the firm's investments to their cost. A value less than 1 could mean that the firm has not been successful overall in creating value for its stockholders.

Market-to-book ratios in recent years appear high relative to past values. For example, for the 30 blue-chip companies that make up the widely followed Dow Jones Industrial Average, the historical norm is about 1.7; however, the market-to-book ratio for this group has recently been twice this size.

Another ratio, called *Tobin's Q ratio*, is much like the market-to-book ratio. Tobin's Q is the market value of a firm's assets divided by their replacement cost:

$$\begin{aligned}\text{Tobin's Q} &= \text{Market value of firm's assets/Replacement cost of firm's assets} \\ &= \text{Market value of firm's debt and equity/Replacement cost of firm's assets}\end{aligned}$$

Notice that we used two equivalent numerators here: the market value of the firm's assets and the market value of its debt and equity.

Conceptually, the Q ratio is superior to the market-to-book ratio because it focuses on what the firm is worth today relative to what it would cost to replace it today. Firms with high Q ratios tend to be those with attractive investment opportunities or significant competitive advantages (or both). In contrast, the market-to-book ratio focuses on historical costs, which are less relevant.

As a practical matter, however, Q ratios are difficult to calculate with accuracy because estimating the replacement cost of a firm's assets is not an easy task. Also, market values for a firm's debt are often unobservable. Book values can be used instead in such cases, but accuracy may suffer.

Enterprise Value-EBITDA Ratio A company's enterprise value is an estimate of the market value of the company's operating assets. By operating assets, we mean all the assets of the firm except cash. Of course, it's not practical to work with the individual assets of a firm because market values would usually not be available. Instead, we can use the right-hand side of the balance sheet and calculate the enterprise value as:

$$\begin{aligned}\text{Enterprise value} &= \text{Total market value of the stock} \\ &\quad + \text{Book value of all liabilities} - \text{Cash}\end{aligned} \quad (3.24)$$

We use the book value for liabilities because we typically can't get the market values, at least not for all of them. However, book value is usually a reasonable approximation for market value when it comes to liabilities, particularly short-term debts. Notice that the sum of the value of the market values of the stock and all liabilities equals the value of the firm's assets from the balance sheet identity. Once we have this number, we subtract the cash to get the enterprise value.

TABLE 3.8 Common Financial Ratios

I. Short-term solvency, or liquidity, ratios	II. Long-term solvency, or financial leverage, ratios
Current ratio = $\frac{\text{Current assets}}{\text{Current liabilities}}$	Total debt ratio = $\frac{\text{Total assets} - \text{Total equity}}{\text{Total assets}}$
Quick ratio = $\frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}}$	Debt-equity ratio = Total debt/Total equity
Cash ratio = $\frac{\text{Cash}}{\text{Current liabilities}}$	Equity multiplier = Total assets/Total equity
Net working capital to total assets = $\frac{\text{Net working capital}}{\text{Total assets}}$	Long-term debt ratio = $\frac{\text{Long-term debt}}{\text{Long-term debt} + \text{Total equity}}$
Interval measure = $\frac{\text{Current assets}}{\text{Average daily operating costs}}$	Times interest earned ratio = $\frac{\text{EBIT}}{\text{Interest}}$
	Cash coverage ratio = $\frac{\text{EBIT} + \text{Depreciation}}{\text{Interest}}$
III. Asset management, or turnover, ratios	**IV. Profitability ratios**
Inventory turnover = $\frac{\text{Cost of goods sold}}{\text{Inventory}}$	Profit margin = $\frac{\text{Net income}}{\text{Sales}}$
Days' sales in inventory = $\frac{\text{365 days}}{\text{Inventory turnover}}$	Return on assets (ROA) = $\frac{\text{Net income}}{\text{Total assets}}$
Receivables turnover = $\frac{\text{Sales}}{\text{Accounts receivable}}$	Return on equity (ROE) = $\frac{\text{Net income}}{\text{Total equity}}$
Days' sales in receivables = $\frac{\text{365 days}}{\text{Receivables turnover}}$	ROE = $\frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}^*}{\text{Equity}}$
NWC turnover = $\frac{\text{Sales}}{\text{NWC}}$	**V. Market value ratios**
Fixed asset turnover = $\frac{\text{Sales}}{\text{Net fixed assets}}$	Price-earnings ratio = $\frac{\text{Price per share}}{\text{Earnings per share}}$
Total asset turnover = $\frac{\text{Sales}}{\text{Total assets}}$	PEG ratio = $\frac{\text{Price-earnings ratio}}{\text{Earnings growth rate (\%)}}$
	Price-sales ratio = $\frac{\text{Price per share}}{\text{Sales per share}}$
	Market-to-book-ratio = $\frac{\text{Market value per share}}{\text{Book value per share}}$
	Tobin's Q ratio = $\frac{\text{Market value of assets}}{\text{Replacement cost of assets}}$
	Enterprise value-EBITDA ratio = $\frac{\text{Enterprise value}}{\text{EBITDA}}$

*This ROE decomposition is covered in Section 3.4.

Enterprise value is frequently used to calculate the EBITDA ratio (or enterprise multiple):

EBITDA ratio = Enterprise value/EBITDA 3.25

This ratio is similar in spirit to the PE ratio, but it relates the value of all the operating assets (the enterprise value) to a measure of the operating cash flow generated by those assets (EBITDA).

CONCLUSION

This completes our definitions of some common ratios. We could tell you about more of them, but these are enough for now. We'll go on to discuss some ways of using these ratios instead of just how to calculate them. Table 3.8 summarizes the ratios we've discussed.

Concept Questions

3.3a What are the five groups of ratios? Give two or three examples of each kind.

3.3b Given the total debt ratio, what other two ratios can be computed? Explain how.

3.3c Turnover ratios all have one of two figures as the numerator. What are these two figures? What do these ratios measure? How do you interpret the results?

3.3d Profitability ratios all have the same figure in the numerator. What is it? What do these ratios measure? How do you interpret the results?

The DuPont Identity 3.4

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As we mentioned in discussing ROA and ROE, the difference between these two profitability measures is a reflection of the use of debt financing, or financial leverage. We illustrate the relationship between these measures in this section by investigating a famous way of decomposing ROE into its component parts.

A CLOSER LOOK AT ROE

To begin, let's recall the definition of ROE:

$$\text{Return on equity} = \frac{\text{Net income}}{\text{Total equity}}$$

If we were so inclined, we could multiply this ratio by Assets/Assets without changing anything:

$$\text{Return on equity} = \frac{\text{Net income}}{\text{Total equity}} = \frac{\text{Net income}}{\text{Total equity}} \times \frac{\text{Assets}}{\text{Assets}}$$
$$= \frac{\text{Net income}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Total equity}}$$

Notice that we have expressed the ROE as the product of two other ratios—ROA and the equity multiplier:

$$\text{ROE} = \text{ROA} \times \text{Equity multiplier} = \text{ROA} \times (1 + \text{Debt-equity ratio})$$

Looking back at Prufrock, for example, we see that the debt-equity ratio was .38 and ROA was 11.95 percent. Our work here implies that Prufrock's ROE, as we previously calculated, is this:

$$\text{ROE} = .1195 \times 1.38 = .1646, \text{ or } 16.46\%$$

The difference between ROE and ROA can be substantial, particularly for certain businesses. For example, in 2016, American Express had an ROA of 3.40 percent, which is fairly typical for financial institutions. However, financial institutions tend to borrow a lot of money and, as a result, have relatively large equity multipliers. For American Express, ROE was about 26.38 percent, implying an equity multiplier of 7.75 times.

We can further decompose ROE by multiplying the top and bottom by total sales:

$$\text{ROE} = \frac{\text{Sales}}{\text{Sales}} \times \frac{\text{Net income}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Total equity}}$$

If we rearrange things a bit, ROE looks like this:

$$\text{ROE} = \underbrace{\frac{\textbf{Net income}}{\textbf{Sales}} \times \frac{\textbf{Sales}}{\textbf{Assets}}}_{\textbf{Return on assets}} \times \frac{\textbf{Assets}}{\textbf{Total equity}} \quad (3.26)$$

$$= \textbf{Profit margin} \times \textbf{Total asset turnover} \times \textbf{Equity multiplier}$$

DuPont identity
Popular expression breaking ROE into three parts: operating efficiency, asset use efficiency, and financial leverage.

What we have now done is to partition ROA into its two component parts, profit margin and total asset turnover. The last expression of the preceding equation is called the **DuPont identity**, after the DuPont Corporation, which popularized its use.

We can check this relationship for Prufrock by noting that the profit margin was 15.71 percent and the total asset turnover was .64:

$$\begin{aligned}\text{ROE} &= \text{Profit margin} \times \text{Total asset turnover} \times \text{Equity multiplier}\\ &= .1880 \times .64 \times 1.38\\ &= .1646, \text{ or } 16.46\%\end{aligned}$$

This 16.46 percent ROE is exactly what we had before.

The DuPont identity tells us that ROE is affected by three things:

1. Operating efficiency (as measured by profit margin).
2. Asset use efficiency (as measured by total asset turnover).
3. Financial leverage (as measured by the equity multiplier).

Weakness in either operating or asset use efficiency (or both) will show up in a diminished return on assets, which will translate into a lower ROE.

Considering the DuPont identity, it appears that the ROE could be leveraged up by increasing the amount of debt in the firm. However, notice that increasing debt also increases interest expense, which reduces profit margins, which acts to reduce ROE. So, ROE could go up or down, depending on other variables. More important, the use of debt financing has a number of other effects, and, as we discuss at some length in Part 6, the amount of leverage a firm uses is governed by its capital structure policy.

The decomposition of ROE we've discussed in this section is a convenient way of systematically approaching financial statement analysis. If ROE is unsatisfactory by some measure, then the DuPont identity tells you where to start looking for the reasons.

General Motors provides a good example of how DuPont analysis can be very useful and also illustrates why care must be taken in interpreting ROE values. In 1989, GM had an ROE of 12.1 percent. By 1993, its ROE had improved to 44.1 percent, a dramatic improvement. On closer inspection, however, we find that over the same period GM's profit margin had declined from 3.4 to 1.8 percent, and ROA had declined from 2.4 to 1.3 percent. The decline in ROA was moderated only slightly by an increase in total asset turnover from .71 to .73 over the period.

Given this information, how is it possible for GM's ROE to have climbed so sharply? From our understanding of the DuPont identity, it must be the case that GM's equity multiplier increased substantially. In fact, what happened was that GM's book equity value was almost wiped out overnight in 1992 by changes in the accounting treatment of pension liabilities. If a company's equity value declines sharply, its equity multiplier rises. In GM's case, the multiplier went from 4.95 in 1989 to 33.62 in 1993. In sum, the dramatic "improvement" in GM's ROE was almost entirely due to an accounting change that affected the equity multiplier and didn't really represent an improvement in financial performance at all.

DuPont analysis (and ratio analysis in general) can be used to compare two companies as well. Yahoo! and Alphabet are among the most important Internet companies in the world. We will use them to illustrate how DuPont analysis can be useful in helping to ask the right questions about a firm's financial performance. The DuPont breakdowns for Yahoo! and Alphabet are summarized in Table 3.9.

As shown, in 2015, Yahoo! had an ROE of –15.0 percent, well down from its ROE in 2013 of 10.4 percent. In contrast, in 2015, Alphabet had an ROE of 13.6 percent, about the same as its ROE in 2013 of 14.8 percent. Given this information, how is it possible that

TABLE 3.9

	ROE		Profit margin		Total asset turnover		Equity multiplier
Yahoo!							
2015	–15.0%	=	–87.5%	×	.110	×	1.56
2014	.4	=	3.1	×	.075	×	1.59
2013	10.4	=	29.2	×	.279	×	1.29
Alphabet							
2015	13.6%	=	21.8%	×	.509	×	1.23
2014	13.6	=	21.4	×	.511	×	1.24
2013	14.8	=	21.6	×	.539	×	1.27

Alphabet's ROE could be so much higher during this period of time, and what accounts for the decrease in Yahoo!'s ROE?

On closer inspection of the DuPont breakdown, we see that Yahoo!'s profit margin in 2015 was –87.5 percent, really poor performance. Meanwhile, Alphabet's profit margin was 21.8 percent. While much of the difference in ROE can be explained by the difference in the profit margin, Yahoo! and Alphabet have similar financial leverage. However, it is also important to note that Alphabet has another advantage over Yahoo! in ROE—namely, the much higher asset utilization.

AN EXPANDED DUPONT ANALYSIS

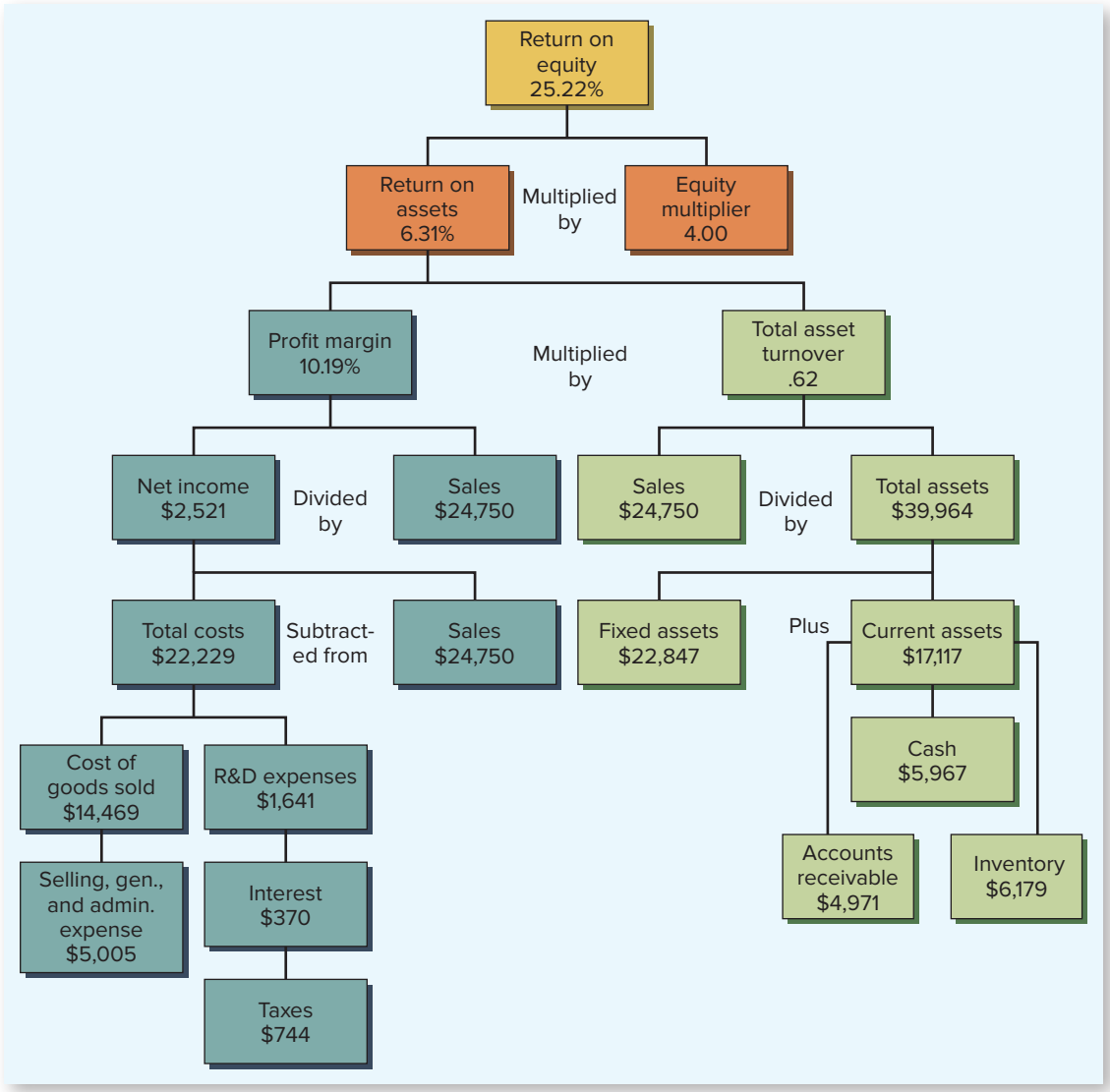
So far, we've seen how the DuPont equation lets us break down ROE into its basic three components: profit margin, total asset turnover, and financial leverage. We now extend this analysis to take a closer look at how key parts of a firm's operations feed into ROE. To get going, we went to finance.yahoo.com and found financial statements for science and technology giant DuPont. What we found is summarized in Table 3.10.

Using the information in Table 3.10, Figure 3.1 shows how we can construct an expanded DuPont analysis for DuPont and present that analysis in chart form. The advantage of the extended DuPont chart is that it lets us examine several ratios at once, thereby getting a better overall picture of a company's performance and also allowing us to determine possible items to improve.

TABLE 3.10

FINANCIAL STATEMENTS FOR DUPONT 12 months ending December 31, 2016 (All numbers are in millions)					
Income Statement		**Balance Sheet**			
Sales	$24,750	Current assets		Current liabilities	
CoGS	14,469	Cash	$ 5,967	Accounts payable	$ 8,468
Gross profit	$10,281	Accounts receivable	4,971	Other	429
SG&A expenses	5,005	Inventory	6,179	Total	$ 8,897
R&D expenses	1,641	Total	$17,117		
EBIT	$ 3,635				
Interest	370	Fixed assets	$22,847	Total long-term debt	$21,069
EBT	$ 3,265				
Taxes	744			Total equity	$ 9,998
Net income	$ 2,521	Total assets	$39,964	Total liabilities and equity	$39,964

FIGURE 3.1 Extended DuPont Chart for DuPont



Looking at the left side of our DuPont chart in Figure 3.1, we see items related to profitability. As always, profit margin is calculated as net income divided by sales. But as our chart emphasizes, net income depends on sales and a variety of costs, such as cost of goods sold (CoGS) and selling, general, and administrative expenses (SG&A expense). DuPont can increase its ROE by increasing sales and also by reducing one or more of these costs. In other words, if we want to improve profitability, our chart clearly shows us the areas on which we should focus.

Turning to the right side of Figure 3.1, we have an analysis of the key factors underlying total asset turnover. Thus, for example, we see that reducing inventory holdings through more efficient management reduces current assets, which reduces total assets, which then improves total asset turnover.

Concept Questions

3.4a Return on assets, or ROA, can be expressed as the product of two ratios. Which two?

3.4b Return on equity, or ROE, can be expressed as the product of three ratios. Which three?

Using Financial Statement Information 3.5

Our last task in this chapter is to discuss in more detail some practical aspects of financial statement analysis. In particular, we will look at reasons for analyzing financial statements, how to get benchmark information, and some problems that come up in the process.

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WHY EVALUATE FINANCIAL STATEMENTS?

As we have discussed, the primary reason for looking at accounting information is that we don't have, and can't reasonably expect to get, market value information. We stress that whenever we have market information, we will use it instead of accounting data. Also, if there is a conflict between accounting and market data, market data should be given precedence.

Financial statement analysis is essentially an application of "management by exception." In many cases, such analysis will boil down to comparing ratios for one business with average or representative ratios. Those ratios that seem to differ the most from the averages are tagged for further study.

Internal Uses Financial statement information has a variety of uses within a firm. Among the most important of these is performance evaluation. For example, managers are frequently evaluated and compensated on the basis of accounting measures of performance such as profit margin and return on equity. Also, firms with multiple divisions frequently compare the performance of those divisions using financial statement information.

Another important internal use we will explore in the next chapter is planning for the future. As we will see, historical financial statement information is useful for generating projections about the future and for checking the realism of assumptions made in those projections.

External Uses Financial statements are useful to parties outside the firm, including short-term and long-term creditors and potential investors. For example, we would find such information quite useful in deciding whether to grant credit to a new customer.

We would also use this information to evaluate suppliers, and suppliers would review our statements before deciding to extend credit to us. Large customers use this information to decide if we are likely to be around in the future. Credit-rating agencies rely on financial statements in assessing a firm's overall creditworthiness. The common theme here is that financial statements are a prime source of information about a firm's financial health.

We would also find such information useful in evaluating our main competitors. We might be thinking of launching a new product. A prime concern would be whether the competition would jump in shortly thereafter. In this case, we would be interested in learning about our competitors' financial strength to see if they could afford the necessary development.

Finally, we might be thinking of acquiring another firm. Financial statement information would be essential in identifying potential targets and deciding what to offer.

CHOOSING A BENCHMARK

Given that we want to evaluate a division or a firm based on its financial statements, a basic problem immediately comes up. How do we choose a benchmark, or a standard of comparison? We describe some ways of getting started in this section.

Time Trend Analysis One standard we could use is history. Suppose we found that the current ratio for a particular firm is 2.4 based on the most recent financial statement information. Looking back over the last 10 years, we might find that this ratio had declined fairly steadily over that period.

Based on this, we might wonder if the liquidity position of the firm has deteriorated. It could be, of course, that the firm has made changes that allow it to more efficiently use its current assets, the nature of the firm's business has changed, or business practices have changed. If we investigate, we might find any of these possible explanations behind the decline. This is an example of what we mean by management by exception—a deteriorating time trend may not be bad, but it does merit investigation.

Peer Group Analysis The second means of establishing a benchmark is to identify firms similar in the sense that they compete in the same markets, have similar assets, and operate in similar ways. In other words, we need to identify a *peer group*. There are obvious problems with doing this because no two companies are identical. Ultimately, the choice of which companies to use as a basis for comparison is subjective.

Standard Industrial Classification (SIC) code
A U.S. government code used to classify a firm by its type of business operations.

One common way of identifying potential peers is based on **Standard Industrial Classification (SIC) codes**. These are four-digit codes established by the U.S. government for statistical reporting. Firms with the same SIC code are frequently assumed to be similar.

The first digit in an SIC code establishes the general type of business. For example, firms engaged in finance, insurance, and real estate have SIC codes beginning with 6. Each additional digit narrows down the industry. So, companies with SIC codes beginning with 60 are mostly banks and banklike businesses; those with codes beginning with 602 are mostly commercial banks; and SIC code 6025 is assigned to national banks that are members of the Federal Reserve system. Table 3.11 lists selected two-digit codes (the first two digits of the four-digit SIC codes) and the industries they represent.

TABLE 3.11
Selected Two-Digit SIC Codes

Agriculture, Forestry, and Fishing	Transportation, Communication, Electric, Gas, and Sanitary Service
01 Agriculture production—crops	40 Railroad transportation
08 Forestry	45 Transportation by air
09 Fishing, hunting, and trapping	49 Electric, gas, and sanitary services
Mining	**Retail Trade**
10 Metal mining	54 Food stores
12 Bituminous coal and lignite mining	55 Automobile dealers and gas stations
13 Oil and gas extraction	58 Eating and drinking places
Construction	**Finance, Insurance, and Real Estate**
15 Building construction	60 Banking
16 Construction other than building	63 Insurance
17 Construction—special trade contractors	65 Real estate
Manufacturing	**Services**
28 Chemicals and allied products	78 Motion pictures
29 Petroleum refining and related industries	80 Health services
37 Transportation equipment	82 Educational services

SIC codes are far from perfect. For example, suppose you were examining financial statements for Walmart, the largest retailer in the United States. The relevant two-digit SIC code is 53, General Merchandise Stores. In a quick scan of the nearest financial database, you would find about 20 large, publicly owned corporations with a similar SIC code, but you might not be comfortable with some of them. Target would seem to be a reasonable peer, but Neiman Marcus also carries the same industry code. Are Walmart and Neiman Marcus really comparable?

As this example illustrates, it is probably not appropriate to blindly use SIC code-based averages. Instead, analysts often identify a set of primary competitors and then compute a set of averages based on just this group. Also, we may be more concerned with a group of the top firms in an industry, not the average firm. Such a group is called an *aspirant group* because we aspire to be like its members. In this case, a financial statement analysis reveals how far we have to go.

Beginning in 1997, a new industry classification system was initiated. Specifically, the North American Industry Classification System (NAICS, pronounced "nakes") is intended to replace the older SIC codes, and it will eventually. Currently, however, SIC codes are still widely used.

With these caveats about industry codes in mind, we can now take a look at a specific industry. Suppose we are in the wine making business. Table 3.12 contains some condensed common-size financial statements for this industry from the Risk Management Association (RMA, formerly known as Robert Morris Associates), one of many sources of such information. Table 3.13 contains selected ratios from the same source.

Learn more about NAICS at **www.naics.com**.

There is a large amount of information here, most of which is self-explanatory. On the right in Table 3.12, we have current information reported for different groups based on sales. Within each sales group, common-size information is reported. For example, firms with sales in the $10 million to $25 million range have cash and equivalents equal to 2.0 percent of total assets. There are 48 companies in this group, out of 258 in all.

On the left, we have three years' worth of summary historical information for the entire group. For example, operating profit decreased slightly from 11.7 percent of sales to 11.4 percent over that time.

Table 3.13 contains some selected ratios, again reported by sales groups on the right and time period on the left. To see how we might use this information, suppose our firm has a current ratio of 2. Based on these ratios, is this value unusual?

Looking at the current ratio for the overall group for the most recent year (third column from the left in Table 3.13), we see that three numbers are reported. The one in the middle, 2.1, is the median, meaning that half of the 258 firms had current ratios that were lower and half had higher current ratios. The other two numbers are the upper and lower quartiles. So, 25 percent of the firms had a current ratio larger than 4.0 and 25 percent had a current ratio smaller than 1.4. Our value of 2 falls comfortably within these bounds, so it doesn't appear too unusual. This comparison illustrates how knowledge of the range of ratios is important in addition to knowledge of the average. Notice how stable the current ratio has been for the last three years.

More Ratios — EXAMPLE 3.5

Take a look at the most recent numbers reported for Cost of Sales/Inventory and EBIT/Interest in Table 3.13. What are the overall median values? What are these ratios?

If you look back at our discussion, you will see that these are the inventory turnover and the times interest earned, or TIE, ratios. The median value for inventory turnover for the entire group is .7 times. So, the days' sales in inventory would be 365/.7 = 521 days, which is the boldfaced number reported. While this is long compared to other industries, this doesn't seem like very long for fine wines. The median for the TIE is 3.7 times. The number in parentheses indicates that the calculation is meaningful for, and therefore based on, only 235 of the 258 companies. In this case, the reason is that only 235 companies paid any significant amount of interest.

TABLE 3.12 Selected Financial Statement Information

Manufacturing—Wineries (NAICS 312130)									
COMPARATIVE HISTORICAL DATA				CURRENT DATA SORTED BY SALES					
			Type of Statement						
38	33	29	Unqualified	1			2	4	22
40	53	41	Reviewed		2		15	15	9
17	15	12	Compiled	1	2	3	3	2	1
24	25	26	Tax Returns	11	6	4	4	1	
100	150	150	Other	24	35	20	18	26	27
4/1/13–3/31/14 ALL 219	4/1/14–3/31/15 ALL 276	4/1/15–3/31/16 ALL 258	NUMBER OF STATEMENTS	31 (4/1–9/30/15)		227 (10/1/15–3/31/16)			
				0–1MM 37	1–3MM 45	3–5MM 27	5–10MM 42	10–25MM 48	25MM & OVER 59
%	%	%	**Assets**	%	%	%	%	%	%
5.2	5.3	5.0	Cash & Equivalents	6.8	5.0	8.7	5.2	2.0	4.4
8.4	8.1	9.2	Trade Receivables (net)	5.6	7.3	7.5	9.0	11.0	12.3
44.4	47.4	47.3	Inventory	52.0	50.1	49.4	42.6	47.0	44.9
2.4	1.9	1.7	All Other Current	.6	1.6	.7	1.8	1.6	2.8
60.5	62.7	63.1	Total Current	65.0	64.0	66.3	58.6	61.6	64.3
32.0	29.2	29.8	Fixed Assets (net)	28.4	32.6	22.9	36.3	29.4	27.6
3.5	4.0	3.7	Intangibles (net)	4.5	1.5	3.7	3.1	5.0	4.1
4.0	4.1	3.4	All Other Non-current	2.0	2.0	7.1	2.0	3.9	4.0
100.0	100.0	100.0	Total	100.0	100.0	100.0	100.0	100.0	100.0
			Liabilities						
14.1	16.8	15.7	Notes Payable-Short term	17.7	14.3	10.0	12.3	18.8	18.1
2.1	1.8	1.3	Cur. Mat.-L.T.D	.9	1.0	.9	2.0	1.4	1.6
8.8	8.9	8.8	Trade Payables	5.9	9.0	7.2	7.8	12.2	9.3
.2	.2	.2	Income Taxes Payable	.4	.3	.0	.3	.0	.1
6.0	6.0	6.5	All Other Current	7.6	4.8	6.0	4.1	8.7	7.4
31.2	33.8	32.6	Total Current	32.5	29.3	24.1	26.5	41.2	36.5
19.8	17.4	18.5	Long-Term Debt	20.5	17.5	17.8	22.5	17.4	16.6
.4	.3	.4	Deferred Taxes	.0	.0	.2	.7	.7	.4
6.3	6.7	6.6	All Other Non-current	13.5	5.6	7.8	7.5	4.4	3.6
42.2	41.8	41.9	Net Worth	33.5	47.6	50.1	42.8	36.3	42.9
100.0	100.0	100.0	Total Liabilities & Net Worth	100.0	100.0	100.0	100.0	100.0	100.0
			Income Data						
100.0	100.0	100.0	Net Sales	100.0	100.0	100.0	100.0	100.0	100.0
48.9	50.0	49.3	Gross Profit	57.1	54.1	55.8	49.5	45.0	41.0
37.2	37.9	37.9	Operating Expenses	51.4	44.5	39.4	38.2	32.5	27.8
11.7	12.0	11.4	Operating Profit	5.7	9.7	16.4	11.3	12.5	13.3
2.7	2.6	2.6	All Other Expenses (net)	3.4	1.9	1.1	4.3	2.9	2.1
9.0	9.5	8.8	Profit Before Taxes	2.3	7.8	15.3	7.1	9.6	11.2

M = $ thousand; MM = $ million.

Interpretation of Statement Studies Figures: RMA cautions that the studies be regarded only as a general guideline and not as an absolute industry norm. This is due to limited samples within categories, the categorization of companies by their primary Standard Industrial Classification (SIC) number only, and different methods of operations by companies within the same industry. For these reasons, RMA recommends that the figures be used only as general guidelines in addition to other methods of financial analysis.

TABLE 3.13 Selected Ratios

Manufacturing—Wineries (NAICS 312130)									
COMPARATIVE HISTORICAL DATA				CURRENT DATA SORTED BY SALES					
			Type of Statement						
38	33	29	Unqualified	1			2	4	22
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17	15	12	Compiled	1	2	3	3	2	1
24	25	26	Tax Returns	11	6	4	4	1	
100	150	150	Other	24	35	20	18	26	27
4/1/13–3/31/14 ALL 219	4/1/14–3/31/15 ALL 276	4/1/15–3/31/16 ALL 258	NUMBER OF STATEMENTS	31 (4/1–9/30/15) 0–1MM 37		1–3MM 45	3–5MM 27	227 (10/1/15–3/31/16) 5–10MM 42	10–25MM 48	25MM & OVER 59	
			Ratios								
4.0	4.5	4.0	Current	4.1		5.8	5.9	3.8	2.4	3.4	
2.1	2.0	2.1		2.7		2.3	3.3	2.3	1.5	1.9	
1.4	1.4	1.4		1.4		1.5	1.8	1.8	1.2	1.3	
.9	.9	.9	Quick	1.2		1.1	1.9	1.2	.6	.7	
.3	.3	.3		.3		.3	.5	.4	.3	.4	
.2	.2	.2		.1		.2	.2	.2	.1	.2	
16 23.0	**15** 24.8	**15** 23.7	Sales/Receivables	**0** UND		**7** 49.3	**11** 32.8	**16** 22.4	**21** 17.2	**28** 13.1	
30 12.2	**34** 10.6	**31** 11.8		**10** 35.6		**28** 12.9	**20** 18.3	**29** 12.6	**37** 9.8	**41** 8.9	
51 7.1	**52** 7.0	**52** 7.0		**46** 7.9		**50** 7.3	**39** 9.4	**57** 6.4	**56** 6.5	**59** 6.2	
261 1.4	**332** 1.1	**304** 1.2	Cost of Sales/Inventory	**192** 1.9		**304** 1.2	**261** 1.4	**304** 1.2	**365** 1.0	**261** 1.4	
456 .8	**521** .7	**521** .7		**608** .6		**608** .6	**608** .6	**608** .6	**521** .7	**365** 1.0	
730 .5	**912** .4	**730** .5		**912** .4		**912** .4	**730** .5	**730** .5	**730** .5	**608** .6	
25 14.4	**26** 14.0	**21** 17.3	Cost of Sales/Payables	**0** UND		**10** 36.2	**21** 17.2	**23** 16.0	**36** 10.1	**23** 16.1	
55 6.6	**59** 6.2	**51** 7.2		**48** 7.6		**53** 6.9	**35** 10.3	**47** 7.8	**69** 5.3	**51** 7.2	
101 3.6	**122** 3.0	**107** 3.4		**166** 2.2		**146** 2.5	**70** 5.2	**122** 3.0	**122** 3.0	**76** 4.8	
1.4	1.3	1.3	Sales/Working Capital	1.2		1.2	1.1	1.3	2.0	1.9	
2.7	2.4	2.6		2.0		2.8	2.3	2.1	3.7	2.9	
6.6	5.1	5.2		7.8		5.8	4.0	2.8	6.7	6.0	
9.7	11.4	14.3	EBIT/Interest	4.5		7.9	31.5	12.3	13.0	19.9	
(200) 3.9	(252) 4.7	(235) 3.7		(31) 1.0		(36) 3.6	(25) 9.0	(40) 2.3	(46) 4.1	(57) 5.7	
1.4	1.7	1.3		−2.1		1.2	2.1	1.1	1.2	2.8	
8.0	9.1	9.5	Net Profit + Depr., Dep,. Amort./Cur. Mat. L/T/D						6.9	17.3	
(42) 4.8	(55) 5.0	(45) 5.9							(10) 3.5	(24) 7.7	
1.9	2.6	2.6							1.8	4.3	
.3	.2	.2	Fixed/Worth	.2		.2	.1	.4	.2	.3	
.8	.7	.7		.6		.7	.4	1.0	.8	.8	
1.6	1.4	1.5		4.5		1.5	1.1	1.5	1.9	1.3	
.6	.6	.6	Debt/Worth	.5		.5	.4	.6	1.2	.8	
1.5	1.4	1.4		2.6		1.0	1.2	1.4	2.1	1.1	
4.1	3.0	3.9		24.2		2.7	4.3	2.8	4.3	3.2	
32.8	33.9	32.7	% Profit Before Taxes/Tangible Net Worth	34.2		25.0	47.0	20.0	42.2	27.9	
(194) 14.8	(253) 15.6	(230) 13.6		(29) 5.5		(41) 11.8	(25) 20.5	(38) 7.4	(43) 19.6	(54) 18.3	
2.7	3.3	2.7		−8.9		4.6	3.3	.4	3.7	10.2	

(continued)

TABLE 3.13 (*continued*)

4/1/13–3/31/14 ALL 219	4/1/14–3/31/15 ALL 276	4/1/15–3/31/16 ALL 258	NUMBER OF STATEMENTS	31 (4/1–9/30/15) 0–1MM 37	1–3MM 45	3–5MM 27	227 (10/1/15–3/31/16) 5–10MM 42	10–25MM 48	25MM & OVER 59
12.0	12.8	12.1	% Profit Before Taxes/Total Assets	13.6	9.1	23.9	8.7	13.4	13.1
5.1	5.6	4.8		1.4	5.2	7.2	2.7	4.4	7.0
.7	.9	.6		–5.0	.8	1.5	.2	.8	3.0
7.4	9.5	8.6	Sales/Net Fixed Assets	7.3	6.8	13.9	3.9	33.5	9.0
2.5	3.0	2.9		5.0	2.3	5.1	1.4	2.1	3.3
1.1	1.1	1.2		2.4	1.5	1.7	.9	1.0	1.4
1.1	1.0	1.1	Sales/Total Assets	1.1	1.1	1.2	1.0	1.1	1.1
.7	.7	.7		.7	.7	.8	.6	.7	.7
.5	.5	.5		.5	.5	.5	.4	.4	.5
2.4	2.4	2.1	% Depr., Dep., Amort./Sales	3.4	1.6	1.1	2.7	2.3	1.4
(171) 5.2	(214) 5.1	(199) 5.3		(22) 5.9	(31) 5.8	(18) 3.9	(35) 7.1	(37) 6.1	(56) 4.0
8.3	8.1	8.4		14.3	8.7	9.6	9.1	9.3	7.1
3.1	2.7	2.6	% Officers', Directors', Owners' Comp/Sales						
(27) 4.3	(35) 4.1	(33) 4.1							
7.7	9.5	7.3							
4892971M	**8360552M**	**5519014M**	**Net Sales ($)**	**19825M**	**82307M**	**103312M**	**287163M**	**774866M**	**4251541M**
6963108M	**8811913M**	**8435750M**	**Total Assets ($)**	**49293M**	**161278M**	**147637M**	**602723M**	**1722233M**	**5752586M**

M = $ thousand; MM = $ million.

There are many sources of ratio information in addition to the one we examine here. Our nearby *Work the Web* box shows how to get this information for just about any company, along with some useful benchmarking information. Be sure to look it over and then benchmark your favorite company.

PROBLEMS WITH FINANCIAL STATEMENT ANALYSIS

Other websites provide different information about a company's ratios. For example, check out **www.marketwatch.com** and **www.morningstar.com**.

We close our chapter on financial statements by discussing some additional problems that can arise in using financial statements. In one way or another, the basic problem with financial statement analysis is that there is no underlying theory to help us identify which quantities to look at and to use in establishing benchmarks.

As we discuss in other chapters, there are many cases in which financial theory and economic logic provide guidance in making judgments about value and risk. Little such help exists with financial statements. This is why we can't say which ratios matter the most and what may be considered a high or low value.

One particularly severe problem is that many firms are conglomerates, owning more or less unrelated lines of business. The consolidated financial statements for such firms don't fit any neat industry category. Well-known companies like General Electric (GE) and 3M fall into this category. More generally, the kind of peer group analysis we have been describing works best when the firms are strictly in the same line of business, the industry is competitive, and there is only one way of operating.

Another problem that is becoming increasingly common is that major competitors and natural peer group members in an industry may be scattered around the globe. The automobile industry is an obvious example. The problem here is that financial statements from outside the United States do not necessarily conform at all to generally accepted accounting

WORK THE WEB

As we discussed in this chapter, ratios are an important tool for examining a company's performance. Gathering the necessary financial statements to calculate ratios can be tedious and time-consuming. Fortunately, many sites on the web provide this information for free. One of the best is www.reuters.com. We went there, entered the ticker symbol "HD" (for Home Depot), and then went to the "Financials" page. Here is an abbreviated look at the results:

	Company	industry	sector
Quick Ratio (MRQ)	0.42	1.03	1.26
Current Ratio (MRQ)	1.34	1.91	1.58
LT Debt to Equity (MRQ)	397.33	84.80	34.40
Total Debt to Equity (MRQ)	406.99	98.04	64.39
Interest Coverage (TTM)	18.56	14.73	3.63

The website reports the company, industry, and sector ratios. As you can see, Home Depot has lower quick and current ratios than the industry.

Questions

1. *Go to www.reuters.com and find the major ratio categories listed on this website. How do the categories differ from the categories listed in this textbook?*
2. *Go to www.reuters.com and find all the ratios for Home Depot. How does the company compare to the industry for the ratios presented on this website?*

principles (GAAP). The existence of different standards and procedures makes it difficult to compare financial statements across national borders.

Even companies that are clearly in the same line of business may not be comparable. For example, electric utilities engaged primarily in power generation are all classified in the same group (SIC 4911). This group is often thought to be relatively homogeneous. However, most utilities operate as regulated monopolies, so they don't compete much with each other, at least not historically. Many have stockholders, and many are organized as cooperatives with no stockholders. There are several different ways of generating power, ranging from hydroelectric to nuclear, so the operating activities of these utilities can differ quite a bit. Finally, profitability is strongly affected by the regulatory environment, so utilities in different locations can be similar but show different profits.

Several other general problems frequently crop up. First, different firms use different accounting procedures—for inventory, for example. This makes it difficult to compare statements. Second, different firms end their fiscal years at different times. For firms in seasonal businesses (such as a retailer with a large Christmas season), this can lead to difficulties in comparing balance sheets because of fluctuations in accounts during the year. Finally, for any particular firm, unusual or transient events, such as a one-time profit from an asset sale, may affect financial performance. In comparing firms, such events can give misleading signals.

Concept Questions

3.5a What are some uses for financial statement analysis?
3.5b Why do we say that financial statement analysis is management by exception?
3.5c What are SIC codes and how might they be useful?
3.5d What are some problems that can arise with financial statement analysis?

3.6 Summary and Conclusions

This chapter has discussed aspects of financial statement analysis:

1. *Sources and uses of cash*: We discussed how to identify the ways in which businesses obtain and use cash, and we described how to trace the flow of cash through a business over the course of the year. We briefly looked at the statement of cash flows.
2. *Standardized financial statements*: We explained that differences in size make it difficult to compare financial statements, and we discussed how to form common-size and common-base period statements to make comparisons easier.
3. *Ratio analysis*: Evaluating ratios of accounting numbers is another way of comparing financial statement information. We defined and discussed a number of the most commonly reported and used financial ratios. We also discussed the famous DuPont identity as a way of analyzing financial performance.
4. *Using financial statements*: We described how to establish benchmarks for comparison and discussed some types of information that are available. We then examined potential problems that can arise.

After you have studied this chapter, we hope that you have some perspective on the uses and abuses of financial statements. You should also find that your vocabulary of business and financial terms has grown substantially.

CONNECT TO FINANCE

For more practice, you should be in Connect Finance. Log on to connect.mheducation.com to get started!

Can you answer the following *Connect* Quiz questions?

Section 3.1 What is an example of a source of cash?

Section 3.2 Pioneer Aviation has total liabilities of $23,800 and total equity of $46,200. Current assets are $8,600. What is the common-size percentage for the current assets?

Section 3.3 What ratio measures the number of days that a firm can operate based on its current assets?

Section 3.4 What is the correct formula for computing the return on equity?

Section 3.5 If you want to identify other firms that have assets and operations that are similar to those of your firm, what should you refer to?

CHAPTER REVIEW AND SELF-TEST PROBLEMS

3.1 Sources and Uses of Cash Consider the following balance sheets for the Philippe Corporation. Calculate the changes in the various accounts and, where applicable, identify the change as a source or use of cash. What were the major sources and uses of cash? Did the company become more or less liquid during the year? What happened to cash during the year?

PHILIPPE CORPORATION 2017 and 2018 Balance Sheets ($ in millions)		
	2017	2018
Assets		
Current assets		
Cash	$ 210	$ 215
Accounts receivable	355	310
Inventory	507	328
Total	$1,072	$ 853
Fixed assets		
Net plant and equipment	$6,085	$6,527
Total assets	$7,157	$7,380
Liabilities and Owners' Equity		
Current liabilities		
Accounts payable	$ 207	$ 298
Notes payable	1,715	1,427
Total	$1,922	$1,725
Long-term debt	$1,987	$2,308
Owners' equity		
Common stock and paid-in surplus	$1,000	$1,000
Retained earnings	2,248	2,347
Total	$3,248	$3,347
Total liabilities and owners' equity	$7,157	$7,380

3.2 Common-Size Statements Here is the most recent income statement for Philippe. Prepare a common-size income statement based on this information. How do you interpret the standardized net income? What percentage of sales goes to cost of goods sold?

PHILIPPE CORPORATION 2018 Income Statement ($ in millions)		
Sales		$4,053
Cost of goods sold		2,816
Depreciation		550
Earnings before interest and taxes		$ 687
Interest paid		502
Taxable income		$ 185
Taxes (21%)		39
Net income		$ 146
Dividends	$47	
Addition to retained earnings	99	

3.3 Financial Ratios Based on the balance sheets and income statement in the previous two problems, calculate the following ratios for 2018:

Current ratio _____
Quick ratio _____
Cash ratio _____
Inventory turnover _____
Receivables turnover _____
Days' sales in inventory _____
Days' sales in receivables _____
Total debt ratio _____
Long-term debt ratio _____
Times interest earned ratio _____
Cash coverage ratio _____

3.4 ROE and the DuPont Identity Calculate the 2018 ROE for the Philippe Corporation and then break down your answer into its component parts using the DuPont identity.

ANSWERS TO CHAPTER REVIEW AND SELF-TEST PROBLEMS

3.1 We've filled in the answers in the following table. Remember, increases in assets and decreases in liabilities indicate that we spent some cash. Decreases in assets and increases in liabilities are ways of getting cash.

Philippe used its cash primarily to purchase fixed assets and to pay off short-term debt. The major sources of cash to do this were additional long-term borrowing, reductions in current assets, and additions to retained earnings.

PHILIPPE CORPORATION
2017 and 2018 Balance Sheets
($ in millions)

	2017	2018	Change	Source or Use of Cash
Assets				
Current assets				
Cash	$ 210	$ 215	+$ 5	
Accounts receivable	355	310	– 45	Source
Inventory	507	328	– 179	Source
Total	$1,072	$ 853	–$219	
Fixed assets				
Net plant and equipment	$6,085	$6,527	+$442	Use
Total assets	$7,157	$7,380	+$223	
Liabilities and Owners' Equity				
Current liabilities				
Accounts payable	$ 207	$ 298	+$ 91	Source
Notes payable	1,715	1,427	– 288	Use
Total	$1,922	$1,725	–$197	
Long-term debt	$1,987	$2,308	+$321	Source
Owners' equity				
Common stock and paid-in surplus	$1,000	$1,000	+$ 0	—
Retained earnings	2,248	2,347	+ 99	Source
Total	$3,248	$3,347	+$ 99	
Total liabilities and owners' equity	$7,157	$7,380	+$223	

The current ratio went from \$1,072/\$1,922 = .56 to \$853/\$1,725 = .49, so the firm's liquidity appears to have declined somewhat. Overall, however, the amount of cash on hand increased by \$5.

3.2 We've calculated the common-size income statement here. Remember that we simply divide each item by total sales.

PHILIPPE CORPORATION 2018 Common-Size Income Statement		
Sales		100.0%
Cost of goods sold		69.5
Depreciation		13.6
Earnings before interest and taxes		17.0
Interest paid		12.4
Taxable income		4.6
Taxes (21%)		1.0
Net income		3.6
Dividends	1.2%	
Addition to retained earnings	2.4	

Net income is 3.6 percent of sales. Because this is the percentage of each sales dollar that makes its way to the bottom line, the standardized net income is the firm's profit margin. Cost of goods sold is 69.5 percent of sales.

3.3 We've calculated the following ratios based on the ending figures. If you don't remember a definition, refer back to Table 3.8.

Current ratio	\$853/\$1,725	= .49 times
Quick ratio	\$525/\$1,725	= .30 times
Cash ratio	\$215/\$1,725	= .12 times
Inventory turnover	\$2,816/\$328	= 8.59 times
Receivables turnover	\$4,053/\$310	= 13.07 times
Days' sales in inventory	365/8.59	= 42.51 days
Days' sales in receivables	365/13.07	= 27.92 days
Total debt ratio	\$4,033/\$7,380	= .546, or 54.6%
Long-term debt ratio	\$2,308/\$5,655	= .408, or 40.8%
Times interest earned ratio	\$687/\$502	= 1.37 times
Cash coverage ratio	\$1,237/\$502	= 2.46 times

3.4 The return on equity is the ratio of net income to total equity. For Philippe, this is \$146/\$3,347 = 4.4 percent, which is not outstanding.

Given the DuPont identity, ROE can be written as follows:

$$\begin{aligned}\textbf{ROE} &= \textbf{Profit margin} \times \textbf{Total asset turnover} \times \textbf{Equity multiplier}\\ &= \textbf{\$146/\$4,053} \times \textbf{\$4,053/\$7,380} \times \textbf{\$7,380/\$3,347}\\ &= \textbf{.036\%} \times \textbf{.549} \times \textbf{2.20}\\ &= \textbf{.044, or 4.4\%}\end{aligned}$$

Notice that return on assets, ROA, is .036% × .549 = 1.98 percent.

CONCEPTS REVIEW AND CRITICAL THINKING QUESTIONS

1. **Current Ratio** [LO2] What effect would the following actions have on a firm's current ratio? Assume that net working capital is positive.
   a. Inventory is purchased.
   b. A supplier is paid.
   c. A short-term bank loan is repaid.
   d. A long-term debt is paid off early.
   e. A customer pays off a credit account.
   f. Inventory is sold at cost.
   g. Inventory is sold for a profit.
2. **Current Ratio and Quick Ratio** [LO2] In recent years, Dixie Co. has greatly increased its current ratio. At the same time, the quick ratio has fallen. What has happened? Has the liquidity of the company improved?
3. **Current Ratio** [LO2] Explain what it means for a firm to have a current ratio equal to .50. Would the firm be better off if the current ratio were 1.50? What if it were 15.0? Explain your answers.
4. **Financial Ratios** [LO2] Fully explain the kind of information the following financial ratios provide about a firm:
   a. Quick ratio.
   b. Cash ratio.
   c. Total asset turnover.
   d. Equity multiplier.
   e. Long-term debt ratio.
   f. Times interest earned ratio.
   g. Profit margin.
   h. Return on assets.
   i. Return on equity.
   j. Price–earnings ratio.
5. **Standardized Financial Statements** [LO1] What types of information do common-size financial statements reveal about the firm? What is the best use for these common-size statements? What purpose do common-base year statements have? When would you use them?
6. **Peer Group Analysis** [LO2] Explain what peer group analysis is. As a financial manager, how could you use the results of peer group analysis to evaluate the performance of your firm? How is a peer group different from an aspirant group?
7. **DuPont Identity** [LO3] Why is the DuPont identity a valuable tool for analyzing the performance of a firm? Discuss the types of information it reveals compared to ROE considered by itself.
8. **Industry-Specific Ratios** [LO2] Specialized ratios are sometimes used in specific industries. For example, the so-called book-to-bill ratio is closely watched for semiconductor manufacturers. A ratio of .93 indicates that for every $100 worth of chips shipped over some period, only $93 worth of new orders were received. In November 2016, the semiconductor equipment industry's book-to-bill ratio was .96, compared to .91 during the month of October 2016. The book-to-bill ratio reached a recent low of .47 during January 2009 and a recent high of 1.23 during July 2010. What is this ratio intended to measure? Why do you think it is so closely followed?
9. **Industry-Specific Ratios** [LO2] So-called same-store sales are a very important measure for companies as diverse as McDonald's and Sears. As the name suggests, examining same-store sales means comparing revenues from the same stores or restaurants at two different points in time. Why might companies focus on same-store sales rather than total sales?
10. **Industry-Specific Ratios** [LO2] There are many ways of using standardized financial information beyond those discussed in this chapter. The usual goal is to put firms

on an equal footing for comparison purposes. For example, for auto manufacturers, it is common to express sales, costs, and profits on a per-car basis. For each of the following industries, give an example of an actual company and discuss one or more potentially useful means of standardizing financial information:

a. Public utilities.
b. Large retailers.
c. Airlines.
d. Online services.
e. Hospitals.
f. College textbook publishers.

11. **Statement of Cash Flows** [LO4] In recent years, several manufacturing companies have reported the cash flow from the sale of Treasury securities in the cash from operations section of the statement of cash flows. What is the problem with this practice? Is there any situation in which this practice would be acceptable?
12. **Statement of Cash Flows** [LO4] Suppose a company lengthens the time it takes to pay suppliers. How would this affect the statement of cash flows? How sustainable is the change in cash flows from this practice?

QUESTIONS AND PROBLEMS

BASIC
(Questions 1–17)

1. **Calculating Liquidity Ratios** [LO2] SDJ, Inc., has net working capital of $2,170, current liabilities of $4,590, and inventory of $3,860. What is the current ratio? What is the quick ratio?
2. **Calculating Profitability Ratios** [LO2] DTO, Inc., has sales of $16.7 million, total assets of $12.9 million, and total debt of $5.7 million. If the profit margin is 5 percent, what is net income? What is ROA? What is ROE?
3. **Calculating the Average Collection Period** [LO2] Twist Corp. has a current accounts receivable balance of $537,810. Credit sales for the year just ended were $5,473,640. What is the receivables turnover? The days' sales in receivables? How long did it take on average for credit customers to pay off their accounts during the past year?
4. **Calculating Inventory Turnover** [LO2] The King Corporation has ending inventory of $386,735, and cost of goods sold for the year just ended was $4,981,315. What is the inventory turnover? The days' sales in inventory? How long on average did a unit of inventory sit on the shelf before it was sold?
5. **Calculating Leverage Ratios** [LO2] Queen, Inc., has a total debt ratio of .46. What is its debt-equity ratio? What is its equity multiplier?
6. **Calculating Market Value Ratios** [LO2] Makers Corp. had additions to retained earnings for the year just ended of $415,000. The firm paid out $220,000 in cash dividends, and it has ending total equity of $5.6 million. If the company currently has 170,000 shares of common stock outstanding, what are earnings per share? Dividends per share? Book value per share? If the stock currently sells for $65 per share, what is the market-to-book ratio? The price-earnings ratio? If the company had sales of $7.45 million, what is the price-sales ratio?
7. **DuPont Identity** [LO3] If Roten Rooters, Inc., has an equity multiplier of 1.27, total asset turnover of 2.10, and a profit margin of 6.1 percent, what is its ROE?
8. **DuPont Identity** [LO3] Jack Corp. has a profit margin of 6.4 percent, total asset turnover of 1.77, and ROE of 15.84 percent. What is this firm's debt-equity ratio?

9. **Sources and Uses of Cash** [LO1] Based only on the following information for Thrice Corp., did cash go up or down? By how much? Classify each event as a source or use of cash.

Decrease in inventory	$375
Decrease in accounts payable	220
Increase in notes payable	290
Increase in accounts receivable	270

10. **Calculating Average Payables Period** [LO2] Heritage, Inc., had a cost of goods sold of $68,314. At the end of the year, the accounts payable balance was $15,486. How long on average did it take the company to pay off its suppliers during the year? What might a large value for this ratio imply?

11. **Enterprise Value-EBITDA Multiple** [LO2] The market value of the equity of Hudgins, Inc., is $645,000. The balance sheet shows $53,000 in cash and $215,000 in debt, while the income statement has EBIT of $91,000 and a total of $157,000 in depreciation and amortization. What is the enterprise value-EBITDA multiple for this company?

12. **Equity Multiplier and Return on Equity** [LO3] SME Company has a debt-equity ratio of .57. Return on assets is 7.9 percent, and total equity is $620,000. What is the equity multiplier? Return on equity? Net income?

Just Dew It Corporation reports the following balance sheet information for 2017 and 2018. Use this information to work Problems 13 through 17.

JUST DEW IT CORPORATION
2017 and 2018 Balance Sheets

Assets	2017	2018	Liabilities and Owners' Equity	2017	2018
Current assets			Current liabilities		
Cash	$ 12,157	$ 14,105	Accounts payable	$ 46,382	$ 49,276
Accounts receivable	29,382	32,815	Notes payable	18,246	19,784
Inventory	54,632	57,204	Total	$ 64,628	$ 69,060
Total	$ 96,171	$104,124			
			Long-term debt	$ 49,000	$ 45,000
			Owners' equity		
			Common stock and paid-in surplus	$ 50,000	$ 50,000
			Retained earnings	299,784	315,894
Net plant and equipment	$367,241	$375,830	Total	$349,784	$365,894
			Total liabilities and		
Total assets	$463,412	$479,954	owners' equity	$463,412	$479,954

13. **Preparing Standardized Financial Statements** [LO1] Prepare the 2017 and 2018 common-size balance sheets for Just Dew It.

14. **Preparing Standardized Financial Statements** [LO1] Prepare the 2018 common-base year balance sheet for Just Dew It.

15. **Preparing Standardized Financial Statements** [LO1] Prepare the 2018 combined common-size, common-base year balance sheet for Just Dew It.

16. **Sources and Uses of Cash** [LO1] For each account on this company's balance sheet, show the change in the account during 2018 and note whether this change was a

source or use of cash. Do your numbers add up and make sense? Explain your answer for total assets as compared to your answer for total liabilities and owners' equity.

17. **Calculating Financial Ratios [LO2]** Based on the balance sheets given for Just Dew It, calculate the following financial ratios for each year:
    a Current ratio.
    b Quick ratio.
    c Cash ratio.
    d NWC to total assets ratio
    e Debt-equity ratio and equity multiplier.
    f Total debt ratio and long-term debt ratio.

INTERMEDIATE
(Questions 18–30)

18. **Using the DuPont Identity [LO3]** Y3K, Inc., has sales of $6,183, total assets of $2,974, and a debt-equity ratio of .57. If its return on equity is 11 percent, what is its net income?

19. **Days' Sales in Receivables [LO2]** A company has net income of $196,500, a profit margin of 6.8 percent, and an accounts receivable balance of $119,630. Assuming 65 percent of sales are on credit, what is the company's days' sales in receivables?

20. **Ratios and Fixed Assets [LO2]** The Maurer Company has a long-term debt ratio of .35 and a current ratio of 1.30. Current liabilities are $955, sales are $7,210, profit margin is 8.3 percent, and ROE is 17.5 percent. What is the amount of the firm's net fixed assets?

21. **Profit Margin [LO4]** In response to complaints about high prices, a grocery chain runs the following advertising campaign: "If you pay your child $1.50 to go buy $50 worth of groceries, then your child makes twice as much on the trip as we do." You've collected the following information from the grocery chain's financial statements:

($ in millions)	
Sales	$680
Net income	10.2
Total assets	380
Total debt	270

Evaluate the grocery chain's claim. What is the basis for the statement? Is this claim misleading? Why or why not?

22. **Return on Equity [LO2]** Firm A and Firm B have debt-total asset ratios of 65 percent and 45 percent, respectively, and returns on total assets of 5 percent and 9 percent, respectively. Which firm has a greater return on equity?

23. **Calculating the Cash Coverage Ratio [LO2]** Pop Evil Inc.'s net income for the most recent year was $16,481. The tax rate was 34 percent. The firm paid $3,681 in total interest expense and deducted $4,385 in depreciation expense. What was the cash coverage ratio for the year?

24. **Cost of Goods Sold [LO2]** Highly Suspect Corp. has current liabilities of $415,000, a quick ratio of .79, inventory turnover of 9.5, and a current ratio of 1.25. What is the cost of goods sold for the company?

25. **Ratios and Foreign Companies [LO2]** Prince Albert Canning PLC had a net loss of £29,157 on sales of £315,650. What was the company's profit margin? Does the fact that these figures are quoted in a foreign currency make any difference? Why? In dollars, sales were $395,183. What was the net loss in dollars?

Some recent financial statements for Smolira Golf Corp. follow. Use this information to work Problems 26 through 30.

SMOLIRA GOLF CORP.
2017 and 2018 Balance Sheets

Assets	2017	2018	Liabilities and Owners' Equity	2017	2018
Current assets			Current liabilities		
Cash	$ 34,385	$ 37,837	Accounts payable	$ 36,722	$ 42,582
Accounts receivable	17,801	27,766	Notes payable	19,008	16,200
Inventory	36,310	42,632	Other	19,864	24,634
Total	$ 88,496	$108,235	Total	$ 75,594	$ 83,416
			Long-term debt	$115,000	$145,000
			Owners' equity		
			Common stock and paid-in surplus	$ 55,000	$ 55,000
Fixed assets			Accumulated retained earnings	307,217	344,452
Net plant and equipment	464,315	519,633	Total	$362,217	$399,452
Total assets	$552,811	$627,868	Total liabilities and owners' equity	$552,811	$627,868

SMOLIRA GOLF CORP.
2018 Income Statement

Sales		$506,454
Cost of goods sold		359,328
Depreciation		44,463
Earnings before interest and taxes		$102,663
Interest paid		19,683
Taxable income		$ 82,980
Taxes (25%)		20,745
Net income		$ 62,235
Dividends	$25,000	
Retained earnings	37,235	

26. Calculating Financial Ratios [LO2] Find the following financial ratios for Smolira Golf Corp. (use year-end figures rather than average values where appropriate):

Short-term solvency ratios:

a. Current ratio. _____

b. Quick ratio. _____

c. Cash ratio. _____

Asset utilization ratios:

d. Total asset turnover. _____

e. Inventory turnover. _____

f. Receivables turnover. _____

Long-term solvency ratios:

g. Total debt ratio. _____

h. Debt-equity ratio. _____

i. Equity multiplier. _____
j. Times interest earned ratio. _____
k. Cash coverage ratio. _____

Profitability ratios:

l. Profit margin. _____
m. Return on assets. _____
n. Return on equity. _____

27. **DuPont Identity** [LO3] Construct the DuPont identity for Smolira Golf Corp.
28. **Statement of Cash Flows** [LO1] Prepare the 2018 statement of cash flows for Smolira Golf Corp.
29. **Market Value Ratios** [LO2] Smolira Golf Corp. has 20,000 shares of common stock outstanding, and the market price for a share of stock at the end of 2018 was $58. What is the price-earnings ratio? What are the dividends per share? What is the market-to-book ratio at the end of 2018? If the company's growth rate is 9 percent, what is the PEG ratio?
30. **Tobin's Q** [LO2] What is Tobin's Q for Smolira Golf? What assumptions are you making about the book value of debt and the market value of debt? What about the book value of assets and the market value of assets? Are these assumptions realistic? Why or why not?

EXCEL MASTER IT! PROBLEM

The eXtensible Business Reporting Language (XBRL) is the future of financial reporting. XBRL is a computer language that "tags" each item and specifies what that item is. XBRL reporting has also been adopted for use in Australia, Japan, and the United Kingdom. The Securities and Exchange Commission (SEC) requires that U.S. companies submit financial reports to the SEC in XBRL format. XBRL reporting allows investors to quickly download financial statements for analysis.

For this assignment, go to the SEC website at www.sec.gov. Once there, look up the financials for a company. Next to the 10-Q (quarterly) and 10-K (annual) reports, you should notice a link that says "InteractiveData." Click on this link, follow the "Financial Statements" link, and select "View Excel Document." This link will allow you to download all of the financial statements in one Excel document. Download the Excel document and copy into the next worksheet. Use these statements to calculate the ratios on that worksheet. Do you notice any changes in these ratios that might indicate further investigation?

MINICASE

Ratio Analysis at S&S Air, Inc.

Chris Guthrie was recently hired by S&S Air, Inc., to assist the company with its financial planning and to evaluate the company's performance. Chris graduated from college five years ago with a finance degree. He has been employed in the finance department of a *Fortune* 500 company since then.

S&S Air was founded 10 years ago by friends Mark Sexton and Todd Story. The company has manufactured and sold light airplanes over this period, and the company's products have received high reviews for safety and reliability. The company has a niche market in that it sells primarily to individuals who

own and fly their own airplanes. The company has two models: the Birdie, which sells for $103,000, and the Eagle, which sells for $178,000.

Although the company manufactures aircraft, its operations are different from commercial aircraft companies. S&S Air builds aircraft to order. By using prefabricated parts, the company can complete the manufacture of an airplane in only five weeks. The company also receives a deposit on each order, as well as another partial payment before the order is complete. In contrast, a commercial airplane may take one and one-half to two years to manufacture once the order is placed.

Mark and Todd have provided the following financial statements. Chris has gathered the industry ratios for the light airplane manufacturing industry.

S&S AIR, INC.
2018 Income Statement

Sales		$46,298,115
Cost of goods sold		34,536,913
Other expenses		5,870,865
Depreciation		2,074,853
EBIT		$ 3,815,484
Interest		725,098
Taxable income		$ 3,090,386
Taxes (25%)		772,597
Net income		$ 2,317,789
Dividends	$ 705,000	
Add to retained earnings	1,612,789	

S&S AIR, INC.
2018 Balance Sheet

Assets		Liabilities and Equity	
Current assets		Current liabilities	
Cash	$ 524,963	Accounts payable	$ 1,068,356
Accounts receivable	843,094	Notes payable	2,439,553
Inventory	1,235,161	Total current liabilities	$ 3,507,909
Total current assets	$ 2,603,218		
		Long-term debt	$ 6,300,000
Fixed assets			
Net plant and equipment	$20,381,945	Shareholder equity	
		Common stock	$ 460,000
		Retained earnings	12,717,254
		Total equity	$13,177,254
Total assets	$22,985,163	Total liabilities and equity	$22,985,163

Light Airplane Industry Ratios

	Lower Quartile	Median	Upper Quartile
Current ratio	.50	1.43	1.89
Quick ratio	.21	.35	.62
Cash ratio	.08	.21	.39
Total asset turnover	.68	.85	1.38
Inventory turnover	4.89	6.15	10.89
Receivables turnover	6.27	9.82	14.11
Total debt ratio	.41	.52	.61
Debt-equity ratio	.68	1.08	1.56
Equity multiplier	1.68	2.08	2.56
Times interest earned	5.18	8.06	9.83
Cash coverage ratio	5.84	9.41	10.27
Profit margin	4.05%	5.10%	7.15%
Return on assets	6.05%	9.53%	13.21%
Return on equity	9.93%	15.14%	19.15%

QUESTIONS

1. Using the financial statements provided for S&S Air, calculate each of the ratios listed in the table for the light aircraft industry.
2. Mark and Todd agree that a ratio analysis can provide a measure of the company's performance. They have chosen Boeing as an aspirant company. Would you choose Boeing as an aspirant company? Why or why not? There are other aircraft manufacturers S&S Air could use as aspirant companies. Discuss whether it is appropriate to use any of the following companies: Bombardier, Embraer, Cirrus Aircraft Corporation, and Cessna Aircraft Company.
3. Compare the performance of S&S Air to the industry. For each ratio, comment on why it might be viewed as positive or negative relative to the industry. Suppose you create an inventory ratio calculated as inventory divided by current liabilities. How do you think S&S Air's ratio would compare to the industry average?

Long-Term Financial Planning and Growth

Chapter 4

GROWTH RATES ARE IMPORTANT TOOLS for evaluating a company and, as we will see later, for valuing a company's stock. When thinking about (and calculating) growth rates, a little common sense goes a long way. For example, in 2017, retailing giant Walmart had about 1.156 billion square feet of stores, distribution centers, and so forth. The company expected to increase its square footage by about 4 percent over the next year. This doesn't sound too outrageous, but can Walmart grow its square footage at 4 percent indefinitely?

We'll get into the calculation in our next chapter, but if you assume that Walmart grows at 4 percent per year over the next 291 years, the company will have about 105 trillion square feet of property, which is about the total land mass of the entire United States! In other words, if Walmart keeps growing at 4 percent, the entire country will eventually be one big Walmart. Scary.

Sirius XM Satellite Radio is another example in which common sense comes in handy. The company had total revenues of about $805,000 in 2002 and $4.9 billion in 2016. This represents an annual increase of about 86 percent! How likely do you think it is that the company can continue this growth rate? If this growth continued, the company would have revenues of about $16.01 trillion in just 13 years, which is about the same as the gross domestic product (GDP) of the United States. Obviously, Sirius XM Radio's growth rate will slow substantially in the next several years. So, long-term growth rate estimates must be chosen very carefully. As a rule of thumb, for really long-term growth estimates, you should probably assume that a company will not grow much faster than the economy as a whole, which is about 1 to 3 percent (inflation-adjusted).

Proper management of growth is vital. Thus, this chapter emphasizes the importance of planning for the future and discusses some tools firms use to think about, and manage, growth.

Learning Objectives

After studying this chapter, you should be able to:

- **LO1** Apply the percentage of sales method.
- **LO2** Compute the external financing needed to fund a firm's growth.
- **LO3** Name the determinants of a firm's growth.
- **LO4** Anticipate some of the problems in planning for growth.

For updates on the latest happenings in finance, visit fundamentalsofcorporatefinance.blogspot.com.

A lack of effective long-range planning is a commonly cited reason for financial distress and failure. As we discuss in this chapter, long-range planning is a means of systematically thinking about the future and anticipating possible problems before they arrive. There are no magic mirrors, of course, so the best we can hope for is a logical and organized procedure for exploring the unknown. As one member of GM's board was heard to say, "Planning is a process that at best helps the firm avoid stumbling into the future backward."

Financial planning establishes guidelines for change and growth in a firm. It normally focuses on the big picture. This means it is concerned with the major elements of a firm's financial and investment policies without examining the individual components of those policies in detail.

Our primary goals in this chapter are to discuss financial planning and to illustrate the interrelatedness of the various investment and financing decisions a firm makes. In the chapters ahead, we will examine in much more detail how these decisions are made.

We first describe what is usually meant by *financial planning*. For the most part, we talk about long-term planning. Short-term financial planning is discussed in a later chapter. We examine what the firm can accomplish by developing a long-term financial plan. To do this, we develop a simple but useful long-range planning technique: The percentage of sales approach. We describe how to apply this approach in some simple cases, and we discuss some extensions.

To develop an explicit financial plan, managers must establish certain basic elements of the firm's financial policy:

1. *The firm's needed investment in new assets*: This will arise from the investment opportunities the firm chooses to undertake, and it is the result of the firm's capital budgeting decisions.
2. *The degree of financial leverage the firm chooses to employ*: This will determine the amount of borrowing the firm will use to finance its investments in real assets. This is the firm's capital structure policy.
3. *The amount of cash the firm thinks is necessary and appropriate to pay shareholders*: This is the firm's dividend policy.
4. *The amount of liquidity and working capital the firm needs on an ongoing basis*: This is the firm's net working capital decision.

As we will see, the decisions a firm makes in these four areas will directly affect its future profitability, its need for external financing, and its opportunities for growth.

A key lesson to be learned from this chapter is that a firm's investment and financing policies interact and thus cannot truly be considered in isolation from one another. The types and amounts of assets a firm plans on purchasing must be considered along with the firm's ability to raise the capital necessary to fund those investments. Many business students are aware of the classic three *P*s (or even four *P*s) of marketing. Not to be outdone, financial planners have no fewer than six *P*s: *P*roper *P*rior *P*lanning *P*revents *P*oor *P*erformance.

Financial planning forces the corporation to think about goals. A goal frequently espoused by corporations is growth, and almost all firms use an explicit, companywide growth rate as a major component of their long-term financial planning. For example, in September 2007, Toyota Motor announced that it planned to sell about 9.8 million vehicles in 2008 and 10.4 million vehicles in 2009, becoming the first auto manufacturer to sell more than 10 million vehicles in a year. Of course, Toyota's plans didn't come to fruition. In 2009, the company sold only 7.2 million cars, and it sold 8.6 million in 2010. In 2013, the company sold 9.98 million cars, almost reaching the goal set four years prior, before selling 10.14 million vehicles in 2014 and 10.15 million vehicles in 2015.

There are direct connections between the growth a company can achieve and its financial policy. In the following sections, we show how financial planning models can be used to better understand how growth is achieved. We also show how such models can be used to establish the limits on possible growth.

What Is Financial Planning? 4.1

Financial planning formulates the way in which financial goals are to be achieved. A financial plan is thus a statement of what is to be done in the future. Many decisions have long lead times, which means they take a long time to implement. In an uncertain world, this requires that decisions be made far in advance of their implementation. If a firm wants to build a factory in 2020, for example, it might have to begin lining up contractors and financing in 2018 or even earlier.

GROWTH AS A FINANCIAL MANAGEMENT GOAL

Because the subject of growth will be discussed in various places in this chapter, we need to start out with an important warning: Growth, by itself, is not an appropriate goal for the financial manager. Clothing retailer J. Peterman Co., whose quirky catalogs were made famous on the TV show *Seinfeld*, learned this lesson the hard way. Despite its strong brand name and years of explosive revenue growth, the company was ultimately forced to file for bankruptcy—the victim of an overly ambitious, growth-oriented expansion plan.

Amazon.com, the big online retailer, is another example. At one time, Amazon's motto seemed to be "growth at any cost." Unfortunately, what really grew rapidly for the company were losses. As a result, Amazon refocused its business, explicitly sacrificing growth in the hope of achieving profitability. The plan seems to be working, as Amazon has become a profitable retailing giant.

As we discussed in Chapter 1, the appropriate goal for a firm is increasing the market value of the owners' equity. Of course, if a firm is successful in doing this, then growth will usually result. Growth may thus be a desirable consequence of good decision making, but it is not an end unto itself. We discuss growth because growth rates are so commonly used in the planning process. As we will see, growth is a convenient means of summarizing various aspects of a firm's financial and investment policies. Also, if we think of growth as growth in the market value of the equity in the firm, then goals of growth and increasing the market value of the equity in the firm are not all that different.

You can find growth rates at **www.reuters.com** and **finance.yahoo.com**.

DIMENSIONS OF FINANCIAL PLANNING

It is often useful for planning purposes to think of the future as having a short run and a long run. The short run, in practice, is usually the coming 12 months. We focus our attention on financial planning over the long run, which is usually taken to be the coming two to five years. This time period is called the **planning horizon**, and it is the first dimension of the planning process that must be established.

planning horizon
The long-range time period on which the financial planning process focuses (usually the next two to five years).

In drawing up a financial plan, all of the individual projects and investments the firm will undertake are combined to determine the total needed investment. In effect, the smaller investment proposals of each operational unit are added up, and the sum is treated as one big project. This process is called **aggregation**. The level of aggregation is the second dimension of the planning process that needs to be determined.

aggregation
The process by which smaller investment proposals of each of a firm's operational units are added up and treated as one big project.

Once the planning horizon and level of aggregation are established, a financial plan requires inputs in the form of alternative sets of assumptions about important variables. For example, suppose a company has two separate divisions: One for consumer products and

one for gas turbine engines. The financial planning process might require each division to prepare three alternative business plans for the next three years:

1. *A worst case*: This plan would require making relatively pessimistic assumptions about the company's products and the state of the economy. This kind of disaster planning would emphasize a division's ability to withstand significant economic adversity, and it would require details concerning cost cutting and even divestiture and liquidation. For example, in 2016, Lenovo announced that it had written off $173 million in smartphone inventory. The company had evidently overestimated the demand for its products.
2. *A normal case*: This plan would require making the most likely assumptions about the company and the economy.
3. *A best case*: Each division would be required to work out a case based on optimistic assumptions. It could involve new products and expansion and then detail the financing needed to fund the expansion. For example, in 2016, Amazon ran out of its Echo hands-free speaker on December 9. The company didn't expect to get any back in stock until at least December 30th, missing much of the Christmas shopping season. The smaller Echo Dot was also sold out and not expected to be back in stock until December 27th. In fact, because of the shortage, Echos were selling on eBay for $399, almost triple the Amazon retail price of $139. Evidently, Amazon underestimated the best case.

In this discussion, business activities are aggregated along divisional lines, and the planning horizon is three years. This type of planning, which considers all possible events, is particularly important for cyclical businesses (businesses with sales that are strongly affected by the overall state of the economy or business cycles).

WHAT CAN PLANNING ACCOMPLISH?

Because a company is likely to spend a lot of time examining the different scenarios that will become the basis for its financial plan, it seems reasonable to ask what the planning process will accomplish.

Examining Interactions As we discuss in greater detail in the following pages, the financial plan must make explicit the linkages between investment proposals for the different operating activities of the firm and its available financing choices. In other words, if the firm is planning on expanding and undertaking new investments and projects, where will the financing be obtained to pay for this activity?

Exploring Options The financial plan allows the firm to develop, analyze, and compare many different scenarios in a consistent way. Various investment and financing options can be explored, and their impact on the firm's shareholders can be evaluated. Questions concerning the firm's future lines of business and optimal financing arrangements are addressed. Options such as marketing new products or closing plants might be evaluated.

Avoiding Surprises Financial planning should identify what may happen to the firm if different events take place. In particular, it should address what actions the firm will take if things go seriously wrong or, more generally, if assumptions made today about the future are seriously in error. As physicist Niels Bohr once observed, "Prediction is very difficult, particularly when it concerns the future."* Thus, one purpose of financial planning is to avoid surprises and develop contingency plans.

*Source: Niels Bohr (1885–1962)

For example, when Tesla Motors announced its new Model X in February 2012, the company promised that production would begin in 2013. In 2013, when production had yet to start, Tesla pushed back production until late 2014. A company spokesperson stated that production was being delayed "to allow ourselves to focus on production and enhancements in Model S." Of course, even though production of the Model S had begun on time several years earlier, production of that model was below expectations for at least a year. And Tesla didn't meet its revised goal; the first Model X didn't hit the market until September 2015. Thus, a lack of proper planning can be a problem for even the most high-tech companies.

Ensuring Feasibility and Internal Consistency Beyond a general goal of creating value, a firm will normally have many specific goals. Such goals might be couched in terms of market share, return on equity, financial leverage, and so on. At times, the linkages between different goals and different aspects of a firm's business are difficult to see. A financial plan makes these linkages explicit, while also imposing a unified structure for reconciling goals and objectives. In other words, financial planning is a way of verifying that the goals and plans made for specific areas of a firm's operations are feasible and internally consistent. Conflicting goals will often exist. To generate a coherent plan, goals and objectives will have to be modified, and priorities will have to be established.

For example, one goal a firm might have is 12 percent growth in unit sales per year. Another goal might be to reduce the firm's total debt ratio from 40 to 20 percent. Are these two goals compatible? Can they be accomplished simultaneously? Maybe yes, maybe no. As we will discuss, financial planning is a way of finding out what is possible—and, by implication, what is not.

Conclusion Probably the most important result of the planning process is that it forces managers to think about goals and establish priorities. In fact, conventional business wisdom holds that financial plans don't work, but financial planning does. The future is inherently unknown. What we can do is establish the direction in which we want to travel and make some educated guesses about what we will find along the way. If we do a good job, we won't be caught off guard when the future rolls around.

Concept Questions

4.1a What are the two dimensions of the financial planning process?

4.1b Why should firms draw up financial plans?

Financial Planning Models: A First Look 4.2

Just as companies differ in size and products, the financial planning process will differ from firm to firm. In this section, we discuss some common elements in financial plans and develop a basic model to illustrate these elements. What follows is a quick overview; later sections will take up the various topics in more detail.

Excel Master It!

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A FINANCIAL PLANNING MODEL: THE INGREDIENTS

Most financial planning models require the user to specify some assumptions about the future. Based on those assumptions, the model generates predicted values for many other variables. Models can vary quite a bit in complexity, but almost all have the elements we discuss next.

Sales Forecast Almost all financial plans require an externally supplied sales forecast. In our models that follow, for example, the sales forecast will be the "driver," meaning that the user of the planning model will supply this value, and most other values will be calculated based on it. This arrangement is common for many types of business; planning will focus on projected future sales and the assets and financing needed to support those sales.

Frequently, the sales forecast will be given as the growth rate in sales rather than as an explicit sales figure. These two approaches are essentially the same because we can calculate projected sales once we know the growth rate. Perfect sales forecasts are not possible, of course, because sales depend on the uncertain future state of the economy. To help a firm come up with its projections, some businesses specialize in macroeconomic and industry projections.

As we discussed previously, we frequently will be interested in evaluating alternative scenarios, so it isn't necessarily crucial that the sales forecast be accurate. In such cases, our goal is to examine the interplay between investment and financing needs at different possible sales levels, not to pinpoint what we expect to happen.

Pro Forma Statements A financial plan will have a forecast balance sheet, income statement, and statement of cash flows. These are called *pro forma statements*, or *pro formas* for short. The phrase *pro forma* literally means "as a matter of form." In our case, this means the financial statements are the form we use to summarize the different events projected for the future. At a minimum, a financial planning model will generate these statements based on projections of key items such as sales.

In the planning models we will describe, the pro formas are the output from the financial planning model. The user will supply a sales figure, and the model will generate the resulting income statement and balance sheet.

Asset Requirements The plan will describe projected capital spending. At a minimum, the projected balance sheet will contain changes in total fixed assets and net working capital. These changes are effectively the firm's total capital budget. Proposed capital spending in different areas must be reconciled with the overall increases contained in the long-range plan.

Financial Requirements The plan will include a section about the necessary financing arrangements. This part of the plan should discuss dividend policy and debt policy. Sometimes firms will expect to raise cash by selling new shares of stock or by borrowing. In this case, the plan will have to consider what kinds of securities have to be sold and what methods of issuance are most appropriate. These are subjects we consider in Part 6 of our book, where we discuss long-term financing, capital structure, and dividend policy.

The Plug After the firm has a sales forecast and an estimate of the required spending on assets, some amount of new financing will often be necessary because projected total assets will exceed projected total liabilities and equity. In other words, the balance sheet will no longer balance.

Because new financing may be necessary to cover all of the projected capital spending, a financial "plug" variable must be selected. The plug is the designated source or sources of external financing needed to deal with any shortfall (or surplus) in financing and thereby bring the balance sheet into balance.

For example, a firm with a great number of investment opportunities and limited cash flow may have to raise new equity. Other firms with few growth opportunities and ample cash flow will have a surplus and thus might pay an extra dividend. In the first case, external equity is the plug variable. In the second, the dividend is used.

Economic Assumptions The plan will have to state explicitly the economic environment in which the firm expects to reside over the life of the plan. Among the more important economic assumptions that will have to be made are the level of interest rates and the firm's tax rate.

A SIMPLE FINANCIAL PLANNING MODEL

We can begin our discussion of long-term planning models with a relatively simple example. The Computerfield Corporation's financial statements from the most recent year are as follows:

COMPUTERFIELD CORPORATION
Financial Statements

Income Statement		Balance Sheet			
Sales	$1,000	Assets	$500	Debt	$250
Costs	800			Equity	250
Net income	$ 200	Total	$500	Total	$500

Unless otherwise stated, the financial planners at Computerfield assume that all variables are tied directly to sales and current relationships are optimal. This means that all items will grow at exactly the same rate as sales. This is obviously oversimplified; we use this assumption only to make a point.

Suppose sales increase by 20 percent, rising from $1,000 to $1,200. Planners would then also forecast a 20 percent increase in costs, from $800 to $800 × 1.2 = $960. The pro forma income statement would be:

Pro Forma
Income Statement

Sales	$1,200
Costs	960
Net income	$ 240

The assumption that all variables will grow by 20 percent lets us easily construct the pro forma balance sheet as well:

Pro Forma Balance Sheet

Assets	$600 (+100)	Debt	$300 (+ 50)
		Equity	300 (+ 50)
Total	$600 (+100)	Total	$600 (+100)

Notice that we have increased every item by 20 percent. The numbers in parentheses are the dollar changes for the different items.

Now we have to reconcile these two pro formas. How, for example, can net income be equal to $240 and equity increase by only $50? The answer is that Computerfield must have paid out the difference of $240 − 50 = $190, possibly as a cash dividend. In this case, dividends are the plug variable.

Suppose Computerfield does not pay out the $190. In this case, the addition to retained earnings is the full $240. Computerfield's equity will grow to $250 (the starting amount) plus $240 (net income), or $490, and debt must be retired to keep total assets equal to $600.

Planware provides insight into cash flow forecasting (**www.planware.org**).

With $600 in total assets and $490 in equity, debt will have to be $600 − 490 = $110. Because we started with $250 in debt, Computerfield will have to retire $250 − 110 = $140 in debt. The resulting pro forma balance sheet would look like this:

Pro Forma Balance Sheet			
Assets	$600 (+100)	Debt	$110 (−140)
		Equity	490 (+240)
Total	$600 (+100)	Total	$600 (+100)

In this case, debt is the plug variable used to balance projected total assets and liabilities.

This example shows the interaction between sales growth and financial policy. As sales increase, so do total assets. This occurs because the firm must invest in net working capital and fixed assets to support higher sales levels. Because assets are growing, total liabilities and equity (the right side of the balance sheet) will grow as well.

The thing to notice from our simple example is that the way the liabilities and owners' equity change depends on the firm's financing policy and its dividend policy. The growth in assets requires that the firm decide on how to finance that growth. This is strictly a managerial decision. Note that in our example, the firm needed no outside funds. This won't usually be the case, so we explore a more detailed situation in the next section.

Concept Questions

4.2a What are the basic components of a financial plan?

4.2b Why is it necessary to designate a plug in a financial planning model?

4.3 The Percentage of Sales Approach

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In the previous section, we described a simple planning model in which every item increased at the same rate as sales. This may be a reasonable assumption for some elements. For others, such as long-term borrowing, it probably is not: The amount of long-term borrowing is something set by management, and it does not necessarily relate directly to the level of sales.

In this section, we describe an extended version of our simple model. The basic idea is to separate the income statement and balance sheet accounts into two groups—those that vary directly with sales and those that do not. Given a sales forecast, we will then be able to calculate how much financing the firm will need to support the predicted sales level.

percentage of sales approach
A financial planning method in which accounts are varied depending on a firm's predicted sales level.

The financial planning model we describe next is based on the **percentage of sales approach**. Our goal here is to develop a quick and practical way of generating pro forma statements. We defer discussion of some "bells and whistles" to a later section.

THE INCOME STATEMENT

We start out with the most recent income statement for the Rosengarten Corporation, as shown in Table 4.1. Notice we have still simplified things by including costs, depreciation, and interest in a single cost figure.

Rosengarten has projected a 25 percent increase in sales for the coming year, so we are anticipating sales of $1,000 × 1.25 = $1,250. To generate a pro forma income statement, we assume that total costs will continue to run at $833/$1,000 = .833, or 83.3% of sales. With this assumption, Rosengarten's pro forma income statement is shown in Table 4.2. The effect

TABLE 4.1
Rosengarten Corporation Income Statement

ROSENGARTEN CORPORATION Income Statement		
Sales		$1,000
Costs		833
Taxable income		$ 167
Taxes (21%)		35
Net income		$ 132
Dividends	$44	
Addition to retained earnings	88	

TABLE 4.2
Rosengarten Corporation Pro Forma Income Statement

ROSENGARTEN CORPORATION Pro Forma Income Statement	
Sales (projected)	$1,250
Costs (83.3% of sales)	1,041
Taxable income	$ 209
Taxes (21%)	44
Net income	$ 165

here of assuming that costs are a constant percentage of sales is to assume that the profit margin is constant. To check this, notice that the profit margin was $132/$1,000 = .132, or 13.2%. In our pro forma, the profit margin is $165/$1,250 = .132, or 13.2%, so it is unchanged.

Next, we need to project the dividend payment. This amount is up to Rosengarten's management. We will assume Rosengarten has a policy of paying out a constant fraction of net income in the form of a cash dividend. For the most recent year, the **dividend payout ratio** was this:

dividend payout ratio
The amount of cash paid out to shareholders divided by net income.

$$\text{Dividend payout ratio} = \text{Cash dividends/Net income} = \$44/\$132 = 1/3 \quad (4.1)$$

We can also calculate the ratio of the addition to retained earnings to net income:

$$\text{Addition to retained earnings/Net income} = \$88/\$132 = 2/3$$

This ratio is called the **retention ratio** or **plowback ratio**, and it is equal to 1 minus the dividend payout ratio because everything not paid out is retained. Assuming that the payout ratio is constant, here are the projected dividends and addition to retained earnings:

retention ratio
The addition to retained earnings divided by net income. Also called the *plowback ratio*.

$$\begin{aligned} \text{Projected dividends paid to shareholders} &= \$165 \times 1/3 = \$\ 55 \\ \text{Projected addition to retained earnings} &= \$165 \times 2/3 = \ 110 \\ &\quad\ \$165 \end{aligned}$$

THE BALANCE SHEET

To generate a pro forma balance sheet, we start with the most recent statement, as shown in Table 4.3.

On our balance sheet, we assume that some items vary directly with sales and others do not. For items that vary with sales, we express each as a percentage of sales for the year just completed. When an item does not vary directly with sales, we write "n/a" for "not applicable."

TABLE 4.3 Rosengarten Corporation Balance Sheet

ROSENGARTEN CORPORATION Balance Sheet					
Assets			**Liabilities and Owners' Equity**		
	$	**Percentage of Sales**		**$**	**Percentage of Sales**
Current assets			Current liabilities		
Cash	$ 160	16%	Accounts payable	$ 300	30%
Accounts receivable	440	44	Notes payable	100	n/a
Inventory	600	60	Total	$ 400	n/a
Total	$1,200	120	Long-term debt	$ 800	n/a
Fixed assets			Owners' equity		
Net plant and equipment	$1,800	180	Common stock and paid-in surplus	$ 800	n/a
			Retained earnings	1,000	n/a
			Total	$1,800	n/a
Total assets	$3,000	300%	Total liabilities and owners' equity	$3,000	n/a

For example, on the asset side, inventory is equal to 60 percent of sales (= $600/$1,000) for the year just ended. We assume this percentage applies to the coming year, so for each $1 increase in sales, inventory will rise by $.60. More generally, the ratio of total assets to sales for the year just ended is $3,000/$1,000 = 3, or 300%.

capital intensity ratio
A firm's total assets divided by its sales, or the amount of assets needed to generate $1 in sales.

This ratio of total assets to sales is sometimes called the **capital intensity ratio**. It tells us the amount of assets needed to generate $1 in sales; so the higher the ratio is, the more capital-intensive is the firm. Notice also that this ratio is the reciprocal of the total asset turnover ratio we defined in the last chapter.

For Rosengarten, assuming that this ratio is constant, it takes $3 in total assets to generate $1 in sales (apparently Rosengarten is in a relatively capital-intensive business). Therefore, if sales are to increase by $100, Rosengarten will have to increase total assets by three times this amount, or $300.

On the liability side of the balance sheet, we show accounts payable varying with sales. The reason is that we expect to place more orders with our suppliers as sales volume increases, so payables will change "spontaneously" with sales. Notes payable, on the other hand, represent short-term debt such as bank borrowing. This item will not vary unless we take specific actions to change the amount, so we mark it as "n/a."

Similarly, we use "n/a" for long-term debt because it won't automatically change with sales. The same is true for common stock and paid-in surplus. The last item on the right side, retained earnings, will vary with sales, but it won't be a simple percentage of sales. Instead, we will explicitly calculate the change in retained earnings based on our projected net income and dividends.

We can now construct a partial pro forma balance sheet for Rosengarten. We do this by using the percentages we have just calculated wherever possible to calculate the projected amounts. For example, net fixed assets are 180 percent of sales; so, with a new sales level of $1,250, the net fixed asset amount will be $1.80 \times \$1{,}250 = \$2{,}250$, representing an increase of $\$2{,}250 - 1{,}800 = \$450$ in plant and equipment. It is important to note that for items that don't vary directly with sales, we initially assume no change and write in the

TABLE 4.4

ROSENGARTEN CORPORATION
Partial Pro Forma Balance Sheet

Assets			Liabilities and Owners' Equity		
	Projected	Change from Previous Year		Projected	Change from Previous Year
Current assets			Current liabilities		
Cash	$ 200	$ 40	Accounts payable	$ 375	$ 75
Accounts receivable	550	110	Notes payable	100	0
Inventory	750	150	Total	$ 475	$ 75
Total	$1,500	$300	Long-term debt	$ 800	$ 0
Fixed assets					
Net plant and equipment	$2,250	$450	Owners' equity		
			Common stock and paid-in surplus	$ 800	$ 0
			Retained earnings	1,110	110
			Total	$1,910	$110
Total assets	$3,750	$750	Total liabilities and owners' equity	$3,185	$185
			External financing needed	$ 565	$565

original amounts. The result is shown in Table 4.4. Notice that the change in retained earnings is equal to the $110 addition to retained earnings we calculated earlier.

Inspecting our pro forma balance sheet, we notice that assets are projected to increase by $750. However, without additional financing, liabilities and equity will increase by only $185, leaving a shortfall of $750 − 185 = $565. We label this amount *external financing needed* (EFN).

A PARTICULAR SCENARIO

Our financial planning model now reminds us of one of those good news–bad news jokes. The good news is we're projecting a 25 percent increase in sales. The bad news is that this isn't going to happen unless Rosengarten can somehow raise $565 in new financing.

This is a good example of how the planning process can point out problems and potential conflicts. If, for example, Rosengarten has a goal of not borrowing any additional funds and not selling any new equity, then a 25 percent increase in sales is probably not feasible.

If we take the need for $565 in new financing as given, we know that Rosengarten has three possible sources: short-term borrowing, long-term borrowing, and new equity. The choice of some combination among these three is up to management; we will illustrate only one of the many possibilities.

Suppose Rosengarten decides to borrow the needed funds. In this case, the firm might choose to borrow some over the short term and some over the long term. For example, current assets increased by $300, whereas current liabilities rose by only $75. Rosengarten could borrow $300 − 75 = $225 in short-term notes payable and leave total net working capital unchanged. With $565 needed, the remaining $565 − 225 = $340 would have to come from long-term debt. Table 4.5 shows the completed pro forma balance sheet for Rosengarten.

TABLE 4.5

ROSENGARTEN CORPORATION
Pro Forma Balance Sheet

Assets			Liabilities and Owners' Equity		
	Projected	Change from Previous Year		Projected	Change from Previous Year
Current assets			Current liabilities		
Cash	$ 200	$ 40	Accounts payable	$ 375	$ 75
Accounts receivable	550	110	Notes payable	325	225
Inventory	750	150	Total	$ 700	$300
Total	$1,500	$300	Long-term debt	$1,140	$340
Fixed assets					
Net plant and equipment	$2,250	$450	Owners' equity		
			Common stock and paid-in surplus	$ 800	$ 0
			Retained earnings	1,110	110
			Total	$1,910	$110
Total assets	$3,750	$750	Total liabilities and owners' equity	$3,750	$750

We have used a combination of short- and long-term debt as the plug here, but we emphasize that this is just one possible strategy; it is not necessarily the best one by any means. There are many other scenarios we could (and should) investigate. The various ratios we discussed in Chapter 3 come in handy here. For example, with the scenario we have just examined, we would surely want to examine the current ratio and the total debt ratio to see if we were comfortable with the new projected debt levels.

Now that we have finished our balance sheet, we have all of the projected sources and uses of cash. We could finish off our pro formas by drawing up the projected statement of cash flows along the lines discussed in Chapter 3. We will leave this as an exercise and instead investigate an important alternative scenario.

AN ALTERNATIVE SCENARIO

The assumption that assets are a fixed percentage of sales is convenient, but it may not be suitable in many cases. In particular, note that we effectively assumed that Rosengarten was using its fixed assets at 100 percent of capacity because any increase in sales led to an increase in fixed assets. For most businesses, there would be some slack or excess capacity, and production could be increased by perhaps running an extra shift.

For example, in July 2016, Fiat Chrysler announced that it would spend $1.05 billion in assembly plants in Ohio and Illinois to expand production of its Jeep product line. Later that year, Ford announced plans to close two Mexican plants. Ford also announced that it would idle four of its plants for a week, or longer. Evidently Ford had excess capacity, whereas Fiat Chrysler did not.

In another example, in November 2016, automotive replacement parts manufacturer Standard Motor Products announced that it was closing a plant in Texas. The company stated that it would increase production at other plants to compensate for the closings. Apparently, Standard Motor had significant excess capacity at its production facilities. Overall, according to the Federal Reserve, capacity utilization for U.S. manufacturing companies in September 2017 was 76.2 percent, up slightly from the 76.1 percent in the previous month.

If we assume that Rosengarten is operating at only 70 percent of capacity, then the need for external funds will be quite different. When we say "70 percent of capacity," we mean that the current sales level is 70 percent of the full-capacity sales level:

Current sales = \$1,000 = .70 × Full-capacity sales

Full-capacity sales = \$1,000/.70 = \$1,429

This tells us that sales could increase by almost 43 percent—from \$1,000 to \$1,429—before any new fixed assets would be needed.

In our previous scenario, we assumed it would be necessary to add \$450 in net fixed assets. In the current scenario, no spending on net fixed assets is needed because sales are projected to rise only to \$1,250, which is substantially less than the \$1,429 full-capacity level.

As a result, our original estimate of \$565 in external funds needed is too high. We estimated that \$450 in new net fixed assets would be needed. Instead, no spending on new net fixed assets is necessary. Thus, if we are currently operating at 70 percent capacity, we need only \$565 − 450 = \$115 in external funds. The excess capacity thus makes a considerable difference in our projections.

EFN and Capacity Usage — EXAMPLE 4.1

Suppose Rosengarten is operating at 90 percent capacity. What would sales be at full capacity? What is the capital intensity ratio at full capacity? What is EFN in this case?

Full-capacity sales would be \$1,000/.90 = \$1,111. From Table 4.3, we know that fixed assets are \$1,800. At full capacity, the ratio of fixed assets to sales is this:

Fixed assets/Full-capacity sales = \$1,800/\$1,111 = 1.62

So, Rosengarten needs \$1.62 in fixed assets for every \$1 in sales once it reaches full capacity. At the projected sales level of \$1,250, then, it needs \$1,250 × 1.62 = \$2,025 in fixed assets. Compared to the \$2,250 we originally projected, this is \$225 less, so EFN is \$565 − 225 = \$340.

Current assets would still be \$1,500, so total assets would be \$1,500 + 2,025 = \$3,525. The capital intensity ratio would thus be \$3,525/\$1,250 = 2.82, which is less than our original value of 3 because of the excess capacity.

These alternative scenarios illustrate that it is inappropriate to blindly manipulate financial statement information in the planning process. The results depend critically on the assumptions made about the relationships between sales and asset needs. We return to this point a little later.

One thing should be clear by now. Projected growth rates play an important role in the planning process. They are also important to outside analysts and potential investors. Our nearby *Work the Web* box shows you how to obtain growth rate estimates for real companies.

Concept Questions

4.3a What is the basic idea behind the percentage of sales approach?

4.3b Unless it is modified, what does the percentage of sales approach assume about fixed asset capacity usage?

WORK THE WEB

Calculating company growth rates can involve detailed research, and a major part of a stock analyst's job is to estimate them. One place to find earnings and sales growth rates on the web is Yahoo! Finance at finance.yahoo.com. We pulled up a quote for 3M Company and followed the "Analysts" link. Here is an abbreviated look at the results:

Revenue Estimate	Current Qtr. (Mar 2017)	Next Qtr. (Jun 2017)	Current Year	Next Year
No. of Analysts	12	12	16	15
Avg. Estimate	7.47B	7.71B	30.44B	31.44B
Low Estimate	7.33B	7.58B	30.14B	31.1B
High Estimate	7.57B	7.85B	30.91B	31.89B
Year Ago Sales	7.41B	7.66B	30.11B	30.44B
Sales Growth (year/est)	0.90%	0.70%	1.10%	3.30%

As shown, analysts expect, on average, revenue (sales) of $30.44 billion in 2017, growing to $31.44 billion in 2018, an increase of 3.3 percent. We also have the following table showing estimates for estimated growth in 3M's EPS:

Earnings Estimate	Current Qtr. (Mar 2017)	Next Qtr. (Jun 2017)	Current Year	Next Year
No. of Analysts	16	15	18	17
Avg. Estimate	2.06	2.23	8.62	9.38
Low Estimate	2.02	2.14	8.4	9
High Estimate	2.14	2.29	8.8	10.2
Year Ago EPS	2.05	2.08	8.16	8.62

As you can see, the average EPS estimate for 3M in 2017 is $8.62, while the average EPS estimate for 2018 is $9.38, an increase of 8.8 percent. What does this mean for 3M stock? We'll get to that in a later chapter.

Questions

1. *One of the things shown here is the projected sales growth for 3M during 2017 at the time this was captured from* finance.yahoo.com. *How does the current sales projection or the actual sales number differ from this projection? Can you think of any reasons for the difference?*
2. *On the same web page, you can find the earnings history for 3M. How close have analysts been to estimating 3M's earnings? In other words, what has the "surprise" been in 3M's earnings?*

External Financing and Growth

4.4

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External financing needed and growth are obviously related. All other things staying the same, the higher the rate of growth in sales or assets, the greater will be the need for external financing. In the previous section, we took a growth rate as given, and then we determined the amount of external financing needed to support that growth. In this section, we turn things around a bit. We will take the firm's financial policy as given and then examine the relationship between that financial policy and the firm's ability to finance new investments and thereby grow.

Once again, we emphasize that we are focusing on growth but not because growth is an appropriate goal; instead, for our purposes, growth is a convenient means of examining the interactions between investment and financing decisions. In effect, we assume that the use of growth as a basis for planning is a reflection of the very high level of aggregation used in the planning process.

EFN AND GROWTH

The first thing we need to do is establish the relationship between EFN and growth. To do this, we introduce the simplified income statement and balance sheet for the Hoffman Company in Table 4.6. Notice that we have simplified the balance sheet by combining short-term and long-term debt into a single total debt figure. Effectively, we are assuming that none of the current liabilities varies spontaneously with sales. This assumption isn't as restrictive as it sounds. If any current liabilities (such as accounts payable) vary with sales, we can assume that any such accounts have been netted out in current assets. Also, we continue to combine depreciation, interest, and costs on the income statement.

Suppose the Hoffman Company is forecasting next year's sales level at $600, a $100 increase. Notice that the percentage increase in sales is $100/$500 = .20, or 20%. Using the percentage of sales approach and the figures in Table 4.6, we can prepare a pro forma income statement and balance sheet as in Table 4.7. As Table 4.7 illustrates, at a 20 percent growth

TABLE 4.6

HOFFMAN COMPANY
Income Statement and Balance Sheet

Income Statement

Sales		$500.0
Costs		416.5
Taxable income		$ 83.5
Taxes (21%)		17.5
Net income		$ 66.0
Dividends	$22	
Addition to retained earnings	44	

Balance Sheet

Assets			Liabilities and Owners' Equity		
	$	Percentage of Sales		$	Percentage of Sales
Current assets	$200	40%	Total debt	$250	n/a
Net fixed assets	300	60	Owners' equity	250	n/a
Total assets	$500	100%	Total liabilities and owners' equity	$500	n/a

TABLE 4.7

HOFFMAN COMPANY
Pro Forma Income Statement and Balance Sheet

Income Statement

Sales (projected)		$600.0
Costs (83.3% of sales)		499.8
Taxable income		$100.2
Taxes (21%)		21.0
Net income		$ 79.2
Dividends	$26.4	
Addition to retained earnings	52.8	

Balance Sheet

Assets	$	Percentage of Sales	Liabilities and Owners' Equity	$	Percentage of Sales
Current assets	$240.0	40%	Total debt	$250.0	n/a
Net fixed assets	360.0	60	Owners' equity	302.8	n/a
Total assets	$600.0	100%	Total liabilities and owners' equity	$552.8	n/a
			External financing needed	$ 47.2	n/a

rate, Hoffman needs $100 in new assets (assuming full capacity). The projected addition to retained earnings is $52.8, so the external financing needed (EFN) is $100 − 52.8 = $47.2.

Notice that the debt-equity ratio for Hoffman was originally (from Table 4.6) equal to $250/$250 = 1.0. We will assume that the Hoffman Company does not wish to sell new equity. In this case, the $47.2 in EFN will have to be borrowed. What will the new debt-equity ratio be? From Table 4.7, we know that total owners' equity is projected at $302.8. The new total debt will be the original $250 plus $47.2 in new borrowing, or $297.2 total. The debt-equity ratio thus falls from 1.0 to $297.2/$302.8 = .98.

Table 4.8 shows EFN for several different growth rates. The projected addition to retained earnings and the projected debt-equity ratio for each scenario are also given (you should probably calculate a few of these for practice). In determining the debt-equity ratios, we assumed that any needed funds were borrowed, and we also assumed any surplus funds were used to pay off debt. Thus, for the zero growth case, debt falls by $44, from $250 to $206. In Table 4.8, notice that the increase in assets required is equal to the original assets

TABLE 4.8

Growth and Projected EFN for the Hoffman Company

Projected Sales Growth	Increase in Assets Required	Addition to Retained Earnings	External Financing Needed, EFN	Projected Debt-Equity Ratio
0%	$ 0	$44.0	−$44.0	.70
5	25	46.2	−21.2	.77
10	50	48.4	1.6	.84
15	75	50.6	24.4	.91
20	100	52.8	47.2	.98
25	125	55.0	70.0	1.05

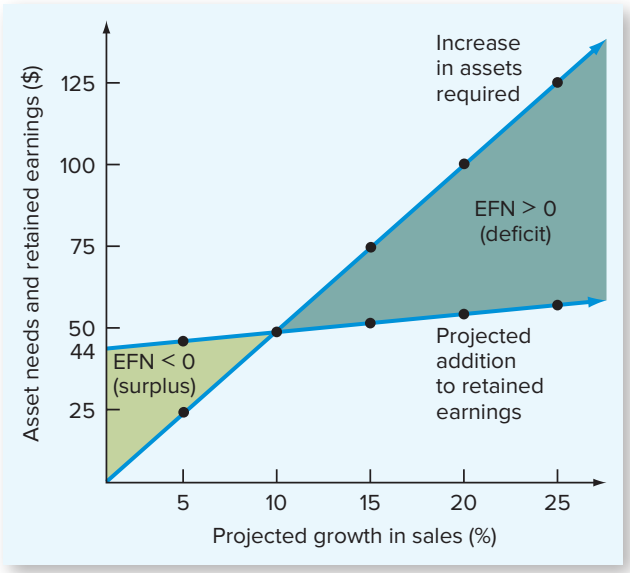

FIGURE 4.1

Growth and Related Financing Needed for the Hoffman Company

of $500 multiplied by the growth rate. Similarly, the addition to retained earnings is equal to the original $44 plus $44 times the growth rate.

Table 4.8 shows that for relatively low growth rates, Hoffman will run a surplus, and its debt-equity ratio will decline. Once the growth rate increases to about 10 percent, however, the surplus becomes a deficit. Furthermore, as the growth rate exceeds approximately 20 percent, the debt-equity ratio surpasses its original value of 1.0.

Figure 4.1 illustrates the connection between growth in sales and external financing needed in more detail by plotting asset needs and additions to retained earnings from Table 4.8 against the growth rates. As shown, the need for new assets grows at a much faster rate than the addition to retained earnings, so the internal financing provided by the addition to retained earnings rapidly disappears.

As this discussion shows, whether a firm runs a cash surplus or deficit depends on growth. Microsoft is a good example. Its revenue growth in the 1990s was amazing, averaging well over 30 percent per year for the decade. Growth slowed down noticeably over the 2000–2010 period; nonetheless, Microsoft's combination of growth and substantial profit margins led to enormous cash surpluses. In part because Microsoft pays a relatively small dividend, the cash really piled up; in 2017, Microsoft's cash horde exceeded $137 billion.

FINANCIAL POLICY AND GROWTH

Based on our preceding discussion, we see that there is a direct link between growth and external financing. In this section, we discuss two growth rates that are particularly useful in long-range planning.

The Internal Growth Rate

The first growth rate of interest is the maximum growth rate that can be achieved with no external financing of any kind. We will call this the **internal growth rate** because this is the rate the firm can maintain with internal financing only. In Figure 4.1, this internal growth rate is represented by the point where the two lines cross. At this point, the required increase in assets is exactly equal to the addition

internal growth rate
The maximum growth rate a firm can achieve without external financing of any kind.

to retained earnings, and EFN is therefore zero. We have seen that this happens when the growth rate is slightly less than 10 percent. With a little algebra (see Problem 31 at the end of the chapter), we can define this growth rate more precisely:

$$\textbf{Internal growth rate} = \frac{\textbf{ROA} \times \boldsymbol{b}}{\textbf{1} - \textbf{ROA} \times \boldsymbol{b}} \quad \textbf{4.2}$$

Here, ROA is the return on assets we discussed in Chapter 3, and b is the plowback, or retention, ratio defined earlier in this chapter.

For the Hoffman Company, net income was $66 and total assets were $500. ROA is thus $66/$500 = .132, or 13.2%. Of the $66 net income, $44 was retained, so the plowback ratio, b, is $44/$66 = 2/3. With these numbers, we can calculate the internal growth rate:

$$\begin{aligned}\text{Internal growth rate} &= \frac{\text{ROA} \times b}{1 - \text{ROA} \times b} \\ &= \frac{.132 \times (2/3)}{1 - .132 \times (2/3)} \\ &= .0964, \text{ or } 9.64\%\end{aligned}$$

Thus, the Hoffman Company can expand at a maximum rate of 9.64 percent per year without external financing.

The Sustainable Growth Rate We have seen that if the Hoffman Company wishes to grow more rapidly than at a rate of 9.64 percent per year, external financing must be arranged. The second growth rate of interest is the maximum growth rate a firm can achieve with no external *equity* financing while it maintains a constant debt-equity ratio. This rate is commonly called the **sustainable growth rate** because it is the maximum rate of growth a firm can maintain without increasing its financial leverage.

sustainable growth rate
The maximum growth rate a firm can achieve without external equity financing while maintaining a constant debt-equity ratio.

There are various reasons why a firm might wish to avoid equity sales. For example, as we discuss in Chapter 15, new equity sales can be expensive. Alternatively, the current owners may not wish to bring in new owners or contribute additional equity. Why a firm might view a particular debt-equity ratio as optimal is discussed in Chapters 14 and 16; for now, we will take it as given.

Based on Table 4.8, the sustainable growth rate for Hoffman is approximately 20 percent because the debt-equity ratio is near 1.0 at that growth rate. The precise value can be calculated (see Problem 31 at the end of the chapter):

$$\textbf{Sustainable growth rate} = \frac{\textbf{ROE} \times \boldsymbol{b}}{\textbf{1} - \textbf{ROE} \times \boldsymbol{b}} \quad \textbf{4.3}$$

This is identical to the internal growth rate except that ROE, return on equity, is used instead of ROA.

For the Hoffman Company, net income was $66 and total equity was $250; ROE is thus $66/$250 = .264, or 26.4%. The plowback ratio, b, is still 2/3, so we can calculate the sustainable growth rate as follows:

$$\begin{aligned}\text{Sustainable growth rate} &= \frac{\text{ROE} \times b}{1 - \text{ROE} \times b} \\ &= \frac{.264 \times (2/3)}{1 - .264 \times (2/3)} \\ &= .2135, \text{ or } 21.35\%\end{aligned}$$

Thus, the Hoffman Company can expand at a maximum rate of 21.35 percent per year without external equity financing.

Sustainable Growth — EXAMPLE 4.2

Suppose Hoffman grows at exactly the sustainable growth rate of 21.35 percent. What will the pro forma statements look like?

At a 21.35 percent growth rate, sales will rise from $500 to $606.7. The pro forma income statement will look like this:

HOFFMAN COMPANY
Pro Forma Income Statement

Sales (projected)		$606.7
Costs (83.3% of sales)		505.4
Taxable income		$101.3
Taxes (21%)		21.3
Net income		$ 80.0
Dividends	$26.7	
Addition to retained earnings	53.4	

We construct the balance sheet as we did before. Notice, in this case, that owners' equity will rise from $250 to $303.4 because the addition to retained earnings is $53.4.

HOFFMAN COMPANY
Pro Forma Balance Sheet

Assets			Liabilities and Owners' Equity		
	$	Percentage of Sales		$	Percentage of Sales
Current assets	$242.7	40%	Total debt	$250.0	n/a
Net fixed assets	364.0	60	Owners' equity	303.4	n/a
Total assets	$606.7	100%	Total liabilities and owners' equity	$553.4	n/a
			External financing needed	$ 53.4	n/a

As illustrated, EFN is $53.4. If Hoffman borrows this amount, then total debt will rise to $303.4, and the debt-equity ratio will be exactly 1.0, which verifies our earlier calculation. At any other growth rate, something would have to change.

Determinants of Growth In the last chapter, we saw that the return on equity, ROE, could be decomposed into its various components using the DuPont identity. Because ROE appears so prominently in the determination of the sustainable growth rate, it is obvious that the factors important in determining ROE are also important determinants of growth.

From Chapter 3, we know that ROE can be written as the product of three factors:

$$\text{ROE} = \text{Profit margin} \times \text{Total asset turnover} \times \text{Equity multiplier}$$

If we examine our expression for the sustainable growth rate, we see that anything that increases ROE will increase the sustainable growth rate by making the top bigger and the bottom smaller. Increasing the plowback ratio will have the same effect.

Putting it all together, what we have is that a firm's ability to sustain growth depends explicitly on the following four factors:

1. *Profit margin*: An increase in profit margin will increase the firm's ability to generate funds internally and thereby increase its sustainable growth.

2. *Dividend policy*: A decrease in the percentage of net income paid out as dividends will increase the retention ratio. This increases internally generated equity and thus increases sustainable growth.
3. *Financial policy*: An increase in the debt-equity ratio increases the firm's financial leverage. Because this makes additional debt financing available, it increases the sustainable growth rate.
4. *Total asset turnover*: An increase in the firm's total asset turnover increases the sales generated for each dollar in assets. This decreases the firm's need for new assets as sales grow and thereby increases the sustainable growth rate. Notice that increasing total asset turnover is the same thing as decreasing capital intensity.

The sustainable growth rate is a very useful planning number. What it illustrates is the explicit relationship between the firm's four major areas of concern: Its operating efficiency as measured by profit margin, its asset use efficiency as measured by total asset turnover, its dividend policy as measured by the retention ratio, and its financial policy as measured by the debt-equity ratio.

Given values for all four of these, there is only one growth rate that can be achieved. This is an important point, so it bears restating:

If a firm does not wish to sell new equity and its profit margin, dividend policy, financial policy, and total asset turnover (or capital intensity) are all fixed, then there is only one possible growth rate.

As we described early in this chapter, one of the primary benefits of financial planning is that it ensures internal consistency among the firm's various goals. The concept of the sustainable growth rate captures this element nicely. Also, we now see how a financial planning model can be used to test the feasibility of a planned growth rate. If sales are to grow at a rate higher than the sustainable growth rate, the firm must increase profit margins, increase total asset turnover, increase financial leverage, increase earnings retention, or sell new shares.

The two growth rates, internal and sustainable, are summarized in Table 4.9.

TABLE 4.9
Summary of Internal and Sustainable Growth Rates

I.	Internal Growth Rate
	$\text{Internal growth rate} = \frac{\text{ROA} \times b}{1 - \text{ROA} \times b}$ where ROA = Return on assets = Net income/Total assets b = Plowback (retention) ratio = Addition to retained earnings/Net income The internal growth rate is the maximum growth rate that can be achieved with no external financing of any kind.
II.	**Sustainable Growth Rate**
	$\text{Sustainable growth rate} = \frac{\text{ROE} \times b}{1 - \text{ROE} \times b}$ where ROE = Return on equity = Net income/Total equity b = Plowback (retention) ratio = Addition to retained earnings/Net income The sustainable growth rate is the maximum growth rate that can be achieved with no external equity financing while maintaining a constant debt-equity ratio.

IN THEIR OWN WORDS ...

Robert C. Higgins on Sustainable Growth

Most financial officers know intuitively that it takes money to make money. Rapid sales growth requires increased assets in the form of accounts receivable, inventory, and fixed plant, which, in turn, require money to pay for assets. They also know that if their company does not have the money when needed, it can literally "grow broke." The sustainable growth equation states these intuitive truths explicitly.

Sustainable growth is often used by bankers and other external analysts to assess a company's creditworthiness. They are aided in this exercise by several sophisticated computer software packages that provide detailed analyses of the company's past financial performance, including its annual sustainable growth rate.

Bankers use this information in several ways. Quick comparison of a company's actual growth rate to its sustainable rate tells the banker what issues will be at the top of management's financial agenda. If actual growth consistently exceeds sustainable growth, management's problem will be where to get the cash to finance growth. The banker thus can anticipate interest in loan products. Conversely, if sustainable growth consistently exceeds actual, the banker had best be prepared to talk about investment products, because management's problem will be what to do with all the cash that keeps piling up in the till.

Bankers also find the sustainable growth equation useful for explaining to financially inexperienced small business owners and overly optimistic entrepreneurs that, for the long-run viability of their business, it is necessary to keep growth and profitability in proper balance.

Finally, comparison of actual to sustainable growth rates helps a banker understand why a loan applicant needs money and for how long the need might continue. In one instance, a loan applicant requested $100,000 to pay off several insistent suppliers and promised to repay in a few months when he collected some accounts receivable that were coming due. A sustainable growth analysis revealed that the firm had been growing at four to six times its sustainable growth rate and that this pattern was likely to continue in the foreseeable future. This alerted the banker to the fact that impatient suppliers were only a symptom of the much more fundamental disease of overly rapid growth, and that a $100,000 loan would likely prove to be only the down payment on a much larger, multiyear commitment.

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A NOTE ABOUT SUSTAINABLE GROWTH RATE CALCULATIONS

Very commonly, the sustainable growth rate is calculated using just the numerator in our expression, ROE $\times$ b. This causes some confusion, which we can clear up here. The issue has to do with how ROE is computed. Recall that ROE is calculated as net income divided by total equity. If total equity is taken from an ending balance sheet (as we have done consistently, and is commonly done in practice), then our formula is the right one. However, if total equity is from the beginning of the period, then the simpler formula is the correct one.

In principle, you'll get exactly the same sustainable growth rate regardless of which way you calculate it (as long as you match up the ROE calculation with the right formula). In reality, you may see some differences because of accounting-related complications. By the way, if you use the average of beginning and ending equity (as some advocate), yet another formula is needed. Also, all of our comments here apply to the internal growth rate as well.

A simple example is useful to illustrate these points. Suppose a firm has a net income of $20 and a retention ratio of .60. Beginning assets are $100. The debt-equity ratio is .25, so beginning equity is $80.

If we use beginning numbers, we get the following:

ROE = $20/$80 = .25, or 25%

Sustainable growth = .60 $\times$ .25 = .15, or 15%

For the same firm, ending equity is $80 + .60 $\times$ $20 = $92. So, we can calculate this:

ROE = $20/$92 = .2174, or 21.74%

Sustainable growth = .60 $\times$ .2174/(1 $-$ .60 $\times$ .2174) = .15, or 15%

These growth rates are exactly the same (after accounting for a small rounding error in the second calculation). See if you don't agree that the internal growth rate is 12 percent.

EXAMPLE 4.3 Profit Margins and Sustainable Growth

The Sandar Co. has a debt-equity ratio of .5, a profit margin of 3 percent, a dividend payout ratio of 40 percent, and a capital intensity ratio of 1. What is its sustainable growth rate? If Sandar desired a 10 percent sustainable growth rate and planned to achieve this goal by improving profit margins, what would you think?

ROE is .03 × 1 × 1.5 = .045, or 4.5%. The retention ratio is 1 – .40 = .60. Sustainable growth is thus .045(.60)/[1 – .045(.60)] = .0277, or 2.77%.

For the company to achieve a 10 percent growth rate, the profit margin will have to rise. To see this, assume that sustainable growth is equal to 10 percent and then solve for profit margin, PM:

.10 = PM(1.5)(.6)/[1 – PM(1.5)(.6)]

PM = .1/.99 = .101, or 10.1%

For the plan to succeed, the necessary increase in profit margin is substantial, from 3 percent to about 10 percent. This may not be feasible.

Concept Questions

4.4a How is a firm's sustainable growth related to its accounting return on equity (ROE)?

4.4b What are the determinants of growth?

4.5 Some Caveats Regarding Financial Planning Models

Financial planning models do not always ask the right questions. A primary reason is that they tend to rely on accounting relationships and not financial relationships. In particular, the three basic elements of firm value tend to get left out—namely, cash flow size, risk, and timing.

Because of this, financial planning models sometimes do not produce meaningful clues about what strategies will lead to increases in value. Instead, they divert the user's attention to questions concerning the association of, say, the debt-equity ratio and firm growth.

The financial model we used for the Hoffman Company was simple—in fact, too simple. Our model, like many in use today, is really an accounting statement generator at heart. Such models are useful for pointing out inconsistencies and reminding us of financial needs, but they offer little guidance concerning what to do about these problems.

In closing our discussion, we should add that financial planning is an iterative process. Plans are created, examined, and modified over and over. The final plan will be a result negotiated between all the different parties to the process. In fact, long-term financial planning in most corporations relies on what might be called the Procrustes approach.[1] Upper-level managers have a goal in mind, and it is up to the planning staff to rework and ultimately deliver a feasible plan that meets that goal.

[1] In Greek mythology, Procrustes is a giant who seizes travelers and ties them to an iron bed. He stretches them or cuts off their legs as needed to make them fit the bed.

The final plan will therefore implicitly contain different goals in different areas and also satisfy many constraints. For this reason, such a plan need not be a dispassionate assessment of what we think the future will bring; it may instead be a means of reconciling the planned activities of different groups and a way of setting common goals for the future.

Concept Questions

4.5a What are some important elements that are often missing in financial planning models?

4.5b Why do we say planning is an iterative process?

Summary and Conclusions 4.6

Financial planning forces the firm to think about the future. We have examined a number of features of the planning process. We described what financial planning can accomplish and the components of a financial model. We went on to develop the relationship between growth and financing needs, and we discussed how a financial planning model is useful in exploring that relationship.

Corporate financial planning should not become a purely mechanical activity. If it does, it will probably focus on the wrong things. In particular, plans all too often are formulated in terms of a growth target with no explicit linkage to value creation, and they frequently are overly concerned with accounting statements. Nevertheless, the alternative to financial planning is stumbling into the future. Perhaps the immortal Yogi Berra (the baseball catcher, not the cartoon character) put it best when he said, "Ya gotta watch out if you don't know where you're goin'. You just might not get there."[2]

CONNECT TO FINANCE

If you are using *Connect* Finance in your course, get online to take a Practice Test, check out study tools, and find out where you need additional practice.

Can you answer the following *Connect* Quiz questions?

Section 4.1 Murphy's, Inc., is in the process of preparing a financial plan for the firm for the next five years. This five-year period is referred to as the _____.

Section 4.2 What is generally the first step in the financial planning process?

Section 4.3 A firm has current sales of $272,600 with total assets of $311,000. What is the full-capacity capital intensity ratio if the firm is currently operating at 68 percent capacity?

Section 4.4 What growth rate assumes that the debt-equity ratio is held constant?

Section 4.5 What is generally considered when compiling a financial plan?

[2] We're not *exactly* sure what this means either, but we like the sound of it.

CHAPTER REVIEW AND SELF-TEST PROBLEMS

4.1 Calculating EFN Based on the following information for the Skandia Mining Company, what is EFN if sales are predicted to grow by 10 percent? Use the percentage of sales approach and assume the company is operating at full capacity. The payout ratio is constant.

SKANDIA MINING COMPANY
Financial Statements

Income Statement		Balance Sheet			
		Assets		Liabilities and Owners' Equity	
Sales	$4,250.0	Current assets	$ 900.0	Current liabilities	$ 500.0
Costs	3,936.7	Net fixed assets	2,200.0	Long-term debt	1,800.0
Taxable income	$ 313.3			Owners' equity	800.0
Taxes (21%)	65.8			Total liabilities and owners' equity	
Net income	$ 247.5	Total assets	$3,100.0		$3,100.0
Dividends	$ 82.6				
Addition to retained earnings	164.9				

4.2 EFN and Capacity Use Based on the information in Problem 4.1, what is EFN, assuming 60 percent capacity usage for net fixed assets? Assuming 95 percent capacity?

4.3 Sustainable Growth Based on the information in Problem 4.1, what growth rate can Skandia maintain if no external financing is used? What is the sustainable growth rate?

ANSWERS TO CHAPTER REVIEW AND SELF-TEST PROBLEMS

4.1 We can calculate EFN by preparing the pro forma statements using the percentage of sales approach. Note that sales are forecast to be $\$4{,}250 \times 1.10 = \$4{,}675$.

SKANDIA MINING COMPANY
Pro Forma Financial Statements

Income Statement		
Sales	$4,675.0	Forecast
Costs	4,330.4	92.63% of sales
Taxable income	$ 344.6	
Taxes (21%)	72.4	
Net income	$ 272.3	
Dividends	$ 90.9	33.37% of net income
Addition to retained earnings	181.4	

Balance Sheet					
Assets			Liabilities and Owners' Equity		
Current assets	$ 990.0	21.18%	Current liabilities	$ 550.0	11.76%
Net fixed assets	2,420.0	51.76%	Long-term debt	1,800.0	n/a
			Owners' equity	981.4	n/a
Total assets	$3,410.0	72.94%	Total liabilities and owners' equity	$3,331.4	n/a
			EFN	$ 78.6	n/a

4.2 Full-capacity sales are equal to current sales divided by the capacity utilization. At 60 percent of capacity:

$\$4{,}250 = .60 \times \text{Full-capacity sales}$

$\$7{,}083 = \text{Full-capacity sales}$

With a sales level of $4,675, no net new fixed assets will be needed, so our earlier estimate is too high. We estimated an increase in fixed assets of $2,420 − 2,200 = $220. The new EFN will thus be $78.6 − 220 = −$141.4, a surplus. No external financing is needed in this case.

At 95 percent capacity, full-capacity sales are $4,474. The ratio of fixed assets to full-capacity sales is thus $2,200/$4,474 = .4918, or 49.18%. At a sales level of $4,675, we will thus need $4,675 × .4918 = $2,299.0 in net fixed assets, an increase of $99.0. This is $220 − 99 = $121 less than we originally predicted, so the EFN is now $78.6 − 121 = −$42.4, a surplus. No additional financing is needed.

4.3 Skandia retains $b = 1 - .3337 = .6663$, or 66.63% of net income. Return on assets is $247.5/$3,100 = .0798, or 7.98%. The internal growth rate is thus:

$$\frac{\text{ROA} \times b}{1 - \text{ROA} \times b} = \frac{.0798 \times .6663}{1 - .0798 \times .6663}$$

$$= .0562, \text{ or } 5.62\%$$

Return on equity for Skandia is $247.5/$800 = .3094, or 30.94%, so we can calculate the sustainable growth rate as follows:

$$\frac{\text{ROE} \times b}{1 - \text{ROE} \times b} = \frac{.3094 \times .6663}{1 - .3094 \times .6663}$$

$$= .2597, \text{ or } 25.97\%$$

CONCEPTS REVIEW AND CRITICAL THINKING QUESTIONS

1. **Sales Forecast [LO1]** Why do you think most long-term financial planning begins with sales forecasts? Put differently, why are future sales the key input?
2. **Sustainable Growth [LO3]** In the chapter, we used Rosengarten Corporation to demonstrate how to calculate EFN. The ROE for Rosengarten is about 7.3 percent, and the plowback ratio is about 67 percent. If you calculate the sustainable growth rate for Rosengarten, you will find it is only 5.14 percent. In our calculation for EFN, we used a growth rate of 25 percent. Is this possible? (*Hint*: Yes. How?)
3. **External Financing Needed [LO2]** Testaburger, Inc., uses no external financing and maintains a positive retention ratio. When sales grow by 15 percent, the firm has a negative projected EFN. What does this tell you about the firm's internal growth rate? How about the sustainable growth rate? At this same level of sales growth, what will happen to the projected EFN if the retention ratio is increased? What if the retention ratio is decreased? What happens to the projected EFN if the firm pays out all of its earnings in the form of dividends?
4. **EFN and Growth Rates [LO2, 3]** Broslofski Co. maintains a positive retention ratio and keeps its debt-equity ratio constant every year. When sales grow by 20 percent, the firm has a negative projected EFN. What does this tell you about the firm's sustainable growth rate? Do you know, with certainty, if the internal growth rate is greater than or less than 20 percent? Why? What happens to the projected EFN if the retention ratio is increased? What if the retention ratio is decreased? What if the retention ratio is zero?

Use the following information to answer Questions 5–10: A small business called The Grandmother Calendar Company began selling personalized photo calendar kits. The kits were a hit, and sales soon sharply exceeded forecasts. The rush of orders created a huge backlog, so the company leased more space and expanded capacity; but it still could not keep up with demand. Equipment failed from overuse and quality suffered. Working capital was drained to expand production, and, at the same time, payments from customers were often delayed until the product was shipped. Unable to deliver on orders, the company became so strapped for cash that employee paychecks began to bounce. Finally, out of cash, the company ceased operations entirely three years later.

5. **Product Sales** [LO4] Do you think the company would have suffered the same fate if its product had been less popular? Why or why not?
6. **Cash Flow** [LO4] The Grandmother Calendar Company clearly had a cash flow problem. In the context of the cash flow analysis we developed in Chapter 2, what was the impact of customers not paying until orders were shipped?
7. **Product Pricing** [LO4] The firm actually priced its product to be about 20 percent less than that of competitors, even though the Grandmother calendar was more detailed. In retrospect, was this a wise choice?
8. **Corporate Borrowing** [LO4] If the firm was so successful at selling, why wouldn't a bank or some other lender step in and provide it with the cash it needed to continue?
9. **Cash Flow** [LO4] Which was the biggest culprit here: Too many orders, too little cash, or too little production capacity?
10. **Cash Flow** [LO4] What are some of the actions that a small company like The Grandmother Calendar Company can take if it finds itself in a situation in which growth in sales outstrips production capacity and available financial resources? What other options (besides expansion of capacity) are available to a company when orders exceed capacity?

QUESTIONS AND PROBLEMS

BASIC
(Questions 1–15)

1. **Forma Statements** [LO1] Consider the following simplified financial statements for the Wims Corporation (assuming no income taxes):

Income Statement		Balance Sheet			
Sales	$38,000	Assets	$27,300	Debt	$ 6,700
Costs	32,600			Equity	20,600
Net income	$ 5,400	Total	$27,300	Total	$27,300

The company has predicted a sales increase of 15 percent. It has predicted that every item on the balance sheet will increase by 15 percent as well. Create the pro forma statements and reconcile them. What is the plug variable here?

2. **Pro Forma Statements and EFN** [LO1, 2] In Question 1, assume the company pays out half of net income in the form of a cash dividend. Costs and assets vary with sales, but debt and equity do not. Prepare the pro forma statements and determine the external financing needed.

3. **Calculating EFN** [LO2] The most recent financial statements for Kerch, Inc., are shown here (assuming no income taxes):

Income Statement		Balance Sheet			
Sales	$7,200	Assets	$21,700	Debt	$ 9,100
Costs	4,730			Equity	12,600
Net income	$2,470	Total	$21,700	Total	$21,700

Assets and costs are proportional to sales. Debt and equity are not. No dividends are paid. Next year's sales are projected to be $8,424. What is the external financing needed?

4. **EFN** [LO2] The most recent financial statements for Cardinal, Inc., are shown here:

Income Statement		Balance Sheet			
Sales	$25,400	Assets	$61,000	Debt	$26,900
Costs	17,300			Equity	34,100
Taxable income	$ 8,100	Total	$61,000	Total	$61,000
Taxes (21%)	1,701				
Net income	$ 6,399				

Assets and costs are proportional to sales. Debt and equity are not. A dividend of $2,100 was paid, and the company wishes to maintain a constant payout ratio. Next year's sales are projected to be $29,210. What is the external financing needed?

5. **EFN** [LO2] The most recent financial statements for Assouad, Inc., are shown here:

Income Statement		Balance Sheet			
Sales	$7,900	Current assets	$ 3,900	Current liabilities	$ 2,100
Costs	5,500	Fixed assets	8,600	Long-term debt	3,700
Taxable income	$2,400			Equity	6,700
Taxes (25%)	600	Total	$12,500	Total	$12,500
Net income	$1,800				

Assets, costs, and current liabilities are proportional to sales. Long-term debt and equity are not. The company maintains a constant 40 percent dividend payout ratio. As with every other firm in its industry, next year's sales are projected to increase by exactly 15 percent. What is the external financing needed?

6. **Calculating Internal Growth** [LO3] The most recent financial statements for Bello Co. are shown here:

Income Statement		Balance Sheet			
Sales	$18,900	Current assets	$11,700	Debt	$15,700
Costs	12,800	Fixed assets	26,500	Equity	22,500
Taxable income	$ 6,100	Total	$38,200	Total	$38,200
Taxes (21%)	1,281				
Net income	$ 4,819				

Assets and costs are proportional to sales. Debt and equity are not. The company maintains a constant 30 percent dividend payout ratio. What is the internal growth rate?

7. **Calculating Sustainable Growth** [LO3] For the company in Problem 6, what is the sustainable growth rate?

8. **Sales and Growth** [LO2] The most recent financial statements for Alexander Co. are shown here:

Income Statement		Balance Sheet			
Sales	$42,800	Current assets	$17,500	Long-term debt	$37,000
Costs	35,500	Fixed assets	68,300	Equity	48,800
Taxable income	$ 7,300	Total	$85,800	Total	$85,800
Taxes (23%)	1,679				
Net income	$ 5,621				

Assets and costs are proportional to sales. The company maintains a constant 40 percent dividend payout ratio and a constant debt-equity ratio. What is the maximum increase in sales that can be sustained assuming no new equity is issued?

9. **Calculating Retained Earnings from Pro Forma Income** [LO1] Consider the following income statement for the Heir Jordan Corporation:

HEIR JORDAN CORPORATION Income Statement		
Sales		$49,000
Costs		40,300
Taxable income		$ 8,700
Taxes (22%)		1,914
Net income		$ 6,786
Dividends	$2,400	
Addition to retained earnings	4,386	

A 20 percent growth rate in sales is projected. Prepare a pro forma income statement assuming costs vary with sales and the dividend payout ratio is constant. What is the projected addition to retained earnings?

10. **Applying Percentage of Sales** [LO1] The balance sheet for the Heir Jordan Corporation follows. Based on this information and the income statement in the previous problem, supply the missing information using the percentage of sales approach. Assume that accounts payable vary with sales, whereas notes payable do not. Put "n/a" where needed.

HEIR JORDAN CORPORATION Balance Sheet					
Assets			Liabilities and Owners' Equity		
	$	Percentage of Sales		$	Percentage of Sales
Current assets			Current liabilities		
Cash	$ 2,950	—	Accounts payable	$ 2,400	—
Accounts receivable	4,100	—	Notes payable	5,400	—
Inventory	6,400	—	Total	$ 7,800	—
Total	$13,450	—	Long-term debt	$28,000	—
Fixed assets					
Net plant and equipment	$41,300	—	Owners' equity		
			Common stock and paid-in surplus	$15,000	—
			Retained earnings	3,950	—
			Total	$18,950	—
Total assets	$54,750	—	Total liabilities and owners' equity	$54,750	—

11. EFN and Sales [LO2] From the previous two questions, prepare a pro forma balance sheet showing EFN, assuming an increase in sales of 15 percent, no new external debt or equity financing, and a constant payout ratio.

12. Internal Growth [LO3] If A7X Co. has an ROA of 7.6 percent and a payout ratio of 25 percent, what is its internal growth rate?

13. Sustainable Growth [LO3] If Synyster Corp. has an ROE of 14.7 percent and a payout ratio of 30 percent, what is its sustainable growth rate?

14. Sustainable Growth [LO3] Based on the following information, calculate the sustainable growth rate for Kaleb's Heavy Equipment:

Profit margin	= 7.3%
Capital intensity ratio	= .80
Debt–equity ratio	= .95
Net income	= $73,000
Dividends	= $24,000

15. Sustainable Growth [LO3] Assuming the following ratios are constant, what is the sustainable growth rate?

Total asset turnover	= 2.90
Profit margin	= 5.2%
Equity multiplier	= 1.10
Payout ratio	= 35%

INTERMEDIATE
(Questions 16–26)

16. Full-Capacity Sales [LO1] Hodgkiss Mfg., Inc., is currently operating at only 91 percent of fixed asset capacity. Current sales are $715,000. How fast can sales grow before any new fixed assets are needed?

17. Fixed Assets and Capacity Usage [LO1] For the company in Problem 16, suppose fixed assets are $520,000 and sales are projected to grow to $790,000. How much in new fixed assets are required to support this growth in sales? Assume the company wants to operate at full capacity.

18. Growth and Profit Margin [LO3] Ramble On Co. wishes to maintain a growth rate of 12 percent per year, a debt-equity ratio of .90, and a dividend payout ratio of 25 percent. The ratio of total assets to sales is constant at .85. What profit margin must the firm achieve?

19. Growth and Assets [LO3] A firm wishes to maintain an internal growth rate of 7.1 percent and a dividend payout ratio of 25 percent. The current profit margin is 6.5 percent, and the firm uses no external financing sources. What must total asset turnover be?

20. Sustainable Growth [LO3] Based on the following information, calculate the sustainable growth rate for Hendrix Guitars, Inc.:

Profit margin	= 6.3%
Total asset turnover	= 1.75
Total debt ratio	= .35
Payout ratio	= 30%

21. Sustainable Growth and Outside Financing [LO3] You've collected the following information about Molino, Inc.:

Sales	= $215,000
Net income	= $17,300
Dividends	= $9,400
Total debt	= $77,000
Total equity	= $59,000

What is the sustainable growth rate for the company? If it does grow at this rate, how much new borrowing will take place in the coming year, assuming a constant debt-equity ratio? What growth rate could be supported with no outside financing at all?

22. **Sustainable Growth Rate** [LO3] Gilmore, Inc., had equity of $145,000 at the beginning of the year. At the end of the year, the company had total assets of $210,000. During the year, the company sold no new equity. Net income for the year was $27,000 and dividends were $5,800. What is the sustainable growth rate for the company? What is the sustainable growth rate if you use the formula ROE × *b* and beginning of period equity? What is the sustainable growth rate if you use end of period equity in this formula? Is this number too high or too low? Why?

23. **Internal Growth Rates** [LO3] Calculate the internal growth rate for the company in Problem 22. Now calculate the internal growth rate using ROA × *b* for both beginning of period and end of period total assets. What do you observe?

24. **Calculating EFN** [LO2] The most recent financial statements for Crosby, Inc., follow. Sales for 2018 are projected to grow by 20 percent. Interest expense will remain constant; the tax rate and the dividend payout rate will also remain constant. Costs, other expenses, current assets, fixed assets, and accounts payable increase spontaneously with sales. If the firm is operating at full capacity and no new debt or equity is issued, what external financing is needed to support the 20 percent growth rate in sales?

CROSBY, INC.
2017 Income Statement

Sales		$980,760
Costs		792,960
Other expenses		20,060
Earnings before interest and taxes		$167,740
Interest paid		14,740
Taxable income		$153,000
Taxes (21%)		32,130
Net income		$120,870
Dividends	$39,250	
Addition to retained earnings	81,620	

CROSBY, INC.
Balance Sheet as of December 31, 2017

Assets		Liabilities and Owners' Equity	
Current assets		Current liabilities	
Cash	$ 27,920	Accounts payable	$ 71,720
Accounts receivable	42,630	Notes payable	17,620
Inventory	95,910	Total	$ 89,340
Total	$166,460	Long-term debt	$170,000
Fixed assets		Owners' equity	
Net plant and equipment	$455,980	Common stock and paid-in surplus	$140,000
		Retained earnings	223,100
		Total	$363,100
Total assets	$622,440	Total liabilities and owners' equity	$622,440

25. Capacity Usage and Growth [LO2] In the previous problem, suppose the firm was operating at only 80 percent capacity in 2017. What is EFN now?

26. Calculating EFN [LO2] In Problem 24, suppose the firm wishes to keep its debt-equity ratio constant. What is EFN now?

CHALLENGE (Questions 27–32)

27. EFN and Internal Growth [LO2, 3] Redo Problem 24 using sales growth rates of 15 and 25 percent in addition to 20 percent. Illustrate graphically the relationship between EFN and the growth rate, and use this graph to determine the relationship between them. At what growth rate is the EFN equal to zero? Why is this internal growth rate different from that found by using the equation in the text?

28. EFN and Sustainable Growth [LO2, 3] Redo Problem 26 using sales growth rates of 30 and 35 percent in addition to 20 percent. Assume the firm wishes to maintain its debt-equity ratio. Illustrate graphically the relationship between EFN and the growth rate, and use this graph to determine the relationship between them. At what growth rate is the EFN equal to zero? Why is this sustainable growth rate different from that found by using the equation in the text?

29. Constraints on Growth [LO3] Sig, Inc., wishes to maintain a growth rate of 12 percent per year and a debt-equity ratio of .43. The profit margin is 5.9 percent, and the ratio of total assets to sales is constant at 1.80. Is this growth rate possible? To answer, determine what the dividend payout ratio must be. How do you interpret the result?

30. EFN [LO2] Define the following:

S = Previous year's sales
A = Total assets
E = Total equity
g = Projected growth in sales
PM = Profit margin
b = Retention (plowback) ratio

Assuming all debt is constant, show that EFN can be written as follows:

$$EFN = -PM(S)b + (A - PM(S)b) \times g$$

Hint: Asset needs will equal $A \times g$. The addition to retained earnings will equal $PM(S)b \times (1 + g)$.

31. Growth Rates [LO3] Based on the result in Problem 30, show that the internal and sustainable growth rates are as given in the chapter. *Hint*: For the internal growth rate, set EFN equal to zero and solve for g.

32. Sustainable Growth Rate [LO3] In the chapter, we discussed the two versions of the sustainable growth rate formula. Derive the formula ROE $\times$ b from the formula given in the chapter, where ROE is based on beginning of period equity. Also, derive the formula ROA $\times$ b from the internal growth rate formula.

EXCEL MASTER IT! PROBLEM

Financial planning can be more complex than the percentage of sales approach indicates. Often, the assumptions behind the percentage of sales approach may be too simple. A more sophisticated model allows important items to vary without being a strict percentage of sales.

Consider a new model in which depreciation is calculated as a percentage of beginning fixed assets and interest expense depends directly on the amount of debt. Debt is still the

plug variable. Note that since depreciation and interest now do not necessarily vary directly with sales, the profit margin is no longer constant. Also, for the same reason, taxes and dividends will no longer be a fixed percentage of sales. The parameter estimates used in the new model are:

Cost percentage	= Costs / Sales
Depreciation rate	= Depreciation / Beginning fixed assets
Interest rate	= Interest paid / Total debt
Tax rate	= Taxes / Net income
Payout ratio	= Dividends / Net income
Capital intensity ratio	= Fixed assets / Sales
Fixed assets ratio	= Fixed assets / Total assets

The model parameters can be determined by whatever methods the company deems appropriate. For example, they might be based on average values for the last several years, industry standards, subjective estimates, or even company targets. Alternatively, sophisticated statistical techniques can be used to estimate them.

The Moore Company is preparing its pro forma financial statements for the next year using this model. The abbreviated financial statements are presented below.

Sales growth	20%
Tax rate	21%
Income Statement	
Sales	$780,000
Costs	415,000
Depreciation	135,000
Interest	68,000
Taxable income	$162,000
Taxes	34,020
Net income	$127,980
Dividends	$ 30,000
Additions to retained earnings	$ 97,980

Balance Sheet

Assets		Liabilities and Equity	
Current assets	$ 240,000	Total debt	$ 880,000
Net fixed assets	1,350,000	Owners' equity	710,000
Total assets	$1,590,000	Total debt and equity	$1,590,000

a. Calculate each of the parameters necessary to construct the pro forma balance sheet.

b. Construct the pro forma balance sheet. What is the total debt necessary to balance the pro forma balance sheet?

c. In this financial planning model, show that it is possible to solve algebraically for the amount of new borrowing.

MINICASE

Planning for Growth at S&S Air

After Chris completed the ratio analysis for S&S Air (see Chapter 3), Mark and Todd approached him about planning for next year's sales. The company had historically used little planning for investment needs. As a result, the company experienced some challenging times because of cash flow problems. The lack of planning resulted in missed sales, as well as periods when Mark and Todd were unable to draw salaries. To this end, they would like Chris to prepare a financial plan for the next year so the company can begin to address any outside investment requirements. The income statement and balance sheet are shown here:

S&S AIR, INC.
2018 Income Statement

Sales		$46,298,115
Cost of goods sold		34,536,913
Other expenses		5,870,865
Depreciation		2,074,853
EBIT		$ 3,815,484
Interest		725,098
Taxable income		$ 3,090,386
Taxes (21%)		772,597
Net income		$ 2,317,789
Dividends	$ 705,000	
Add to retained earnings	1,612,789	

S&S AIR, INC.
2018 Balance Sheet

Assets		Liabilities and Equity	
Current assets		Current liabilities	
Cash	$ 524,963	Accounts payable	$ 1,068,356
Accounts receivable	843,094	Notes payable	2,439,553
Inventory	1,235,161	Total current liabilities	$ 3,507,909
Total current assets	$ 2,603,218	Long-term debt	$ 6,300,000
Fixed assets			
Net plant and equipment	$20,381,945	Shareholder equity	
		Common stock	$ 460,000
		Retained earnings	12,717,254
		Total equity	$13,177,254
Total assets	$22,985,163	Total liabilities and equity	$22,985,163

QUESTIONS

1. Calculate the internal growth rate and sustainable growth rate for S&S Air. What do these numbers mean?
2. S&S Air is planning for a growth rate of 12 percent next year. Calculate the EFN for the company assuming the company is operating at full capacity. Can the company's sales increase at this growth rate?
3. Most assets can be increased as a percentage of sales. For instance, cash can be increased by any amount. However, fixed assets must be increased in specific amounts because it is impossible, as a practical matter, to buy part of a new plant or machine. In this case, a company has a "staircase" or "lumpy" fixed cost structure. Assume S&S Air is currently producing at 100 percent capacity. As a result, to increase production, the company must set up an entirely new line at a cost of $5,000,000. Calculate the new EFN with this assumption. What does this imply about capacity utilization for the company next year?

Chapter 5 Introduction to Valuation: The Time Value of Money

AS YOU ARE PROBABLY AWARE, the United States government has a significant amount of debt. That debt, which is widely owned by investors, comes in different varieties, including Series EE U.S. Treasury savings bonds. With a Series EE bond, you pay a particular amount today of, say, $25, and the bond accrues interest over the time you hold it. In early 2017, the U.S. Treasury promised to pay .10 percent per year on EE savings bonds. In an interesting (and important) wrinkle, if you hold the bond for 20 years, the Treasury promises to "step up" the value to double your cost. That is, if the $25 bond you purchased and all the accumulated interest earned are worth less than $50, the Treasury will automatically increase the value of the bond to $50.

Is giving up $25 in exchange for $50 in 20 years a good deal? On the plus side, you get back $2 for every $1 you put up. That probably sounds good, but, on the downside, you have to wait 20 years to get it. What you need to know is how to analyze this trade-off. This chapter gives you the tools you need.

Learning Objectives

After studying this chapter, you should be able to:

- **LO1** Determine the future value of an investment made today.
- **LO2** Determine the present value of cash to be received at a future date.
- **LO3** Find the return on an investment.
- **LO4** Calculate how long it takes for an investment to reach a desired value.

For updates on the latest happenings in finance, visit fundamentalsofcorporatefinance.blogspot.com.

One of the basic problems faced by the financial manager is how to determine the value today of cash flows expected in the future. For example, the jackpot in a Powerball™ lottery drawing was $110 million. Does this mean the winning ticket was worth $110 million? The answer is no because the jackpot was actually going to pay out over a 20-year period at a rate of $5.5 million per year. How much was the ticket worth then? The answer depends on the time value of money, the subject of this chapter.

In the most general sense, the phrase *time value of money* refers to the fact that a dollar in hand today is worth more than a dollar promised at some time in the future. On a practical level, one reason for this is that you could earn interest while you waited; so, a dollar today would grow to more than a dollar later. The trade-off between money now and money

later thus depends on, among other things, the rate you can earn by investing. Our goal in this chapter is to explicitly evaluate this trade-off between dollars today and dollars at some future time.

A thorough understanding of the material in this chapter is critical to understanding material in subsequent chapters, so you should study it with particular care. We will present a number of examples in this chapter. In many problems, your answer may differ from ours slightly. This can happen because of rounding and is not a cause for concern.

5.1 Future Value and Compounding

Excel Master It!


Excel Master coverage online

The first thing we will study is future value. **Future value (FV)** refers to the amount of money an investment will grow to over some period of time at some given interest rate. Put another way, future value is the cash value of an investment at some time in the future. We start out by considering the simplest case: A single-period investment.

future value (FV)
The amount an investment is worth after one or more periods.

INVESTING FOR A SINGLE PERIOD

Suppose you invest $100 in a savings account that pays 10 percent interest per year. How much will you have in one year? You will have $110. This $110 is equal to your original *principal* of $100 plus $10 in interest that you earn. We say that $110 is the future value of $100 invested for one year at 10 percent, and we mean that $100 today is worth $110 in one year, given that 10 percent is the interest rate.

In general, if you invest for one period at an interest rate of r, your investment will grow to $(1 + r)$ per dollar invested. In our example, r is 10 percent, so your investment grows to $1 + .10 = 1.1$ dollars per dollar invested. You invested $100 in this case, so you ended up with $\$100 \times 1.10 = \$110$.

INVESTING FOR MORE THAN ONE PERIOD

Going back to our $100 investment, what will you have after two years, assuming the interest rate doesn't change? If you leave the entire $110 in the bank, you will earn $\$110 \times .10 = \$11$ in interest during the second year, so you will have a total of $\$110 + 11 = \$121$. This $121 is the future value of $100 in two years at 10 percent. Another way of looking at it is that one year from now you are effectively investing $110 at 10 percent for a year. This is a single-period problem, so you'll end up with $1.10 for every dollar invested, or $\$110 \times 1.1 = \$121$ total.

This $121 has four parts. The first part is the $100 original principal. The second part is the $10 in interest you earned in the first year, and the third part is another $10 you earned in the second year, for a total of $120. The last $1 you end up with (the fourth part) is interest you earned in the second year on the interest paid in the first year: $\$10 \times .10 = \$1$.

This process of leaving your money and any accumulated interest in an investment for more than one period, thereby *reinvesting* the interest, is called **compounding**. Compounding the interest means earning **interest on interest**, so we call the result **compound interest**. With **simple interest**, the interest is not reinvested, so interest is earned each period only on the original principal.

compounding
The process of accumulating interest on an investment over time to earn more interest.

interest on interest
Interest earned on the reinvestment of previous interest payments.

compound interest
Interest earned on both the initial principal and the interest reinvested from prior periods.

simple interest
Interest earned only on the original principal amount invested.

Interest on Interest — EXAMPLE 5.1

Suppose you locate a two-year investment that pays 14 percent per year. If you invest $325, how much will you have at the end of the two years? How much of this is simple interest? How much is compound interest?

At the end of the first year, you will have $325 × (1 + .14) = $370.50. If you reinvest this entire amount and thereby compound the interest, you will have $370.50 × 1.14 = $422.37 at the end of the second year. The total interest you earn is thus $422.37 − 325 = $97.37. Your $325 original principal earns $325 × .14 = $45.50 in interest each year, for a two-year total of $91 in simple interest. The remaining $97.37 − 91 = $6.37 results from compounding. You can check this by noting that the interest earned in the first year is $45.50. The interest on interest earned in the second year thus amounts to $45.50 × .14 = $6.37, as we calculated.

We now take a closer look at how we calculated the $121 future value. We multiplied $110 by 1.1 to get $121. The $110, however, was $100 also multiplied by 1.1. In other words:

$$\begin{aligned}\$121 &= \$110 \times 1.1\\ &= (\$100 \times 1.1) \times 1.1\\ &= \$100 \times (1.1 \times 1.1)\\ &= \$100 \times 1.1^2\\ &= \$100 \times 1.21\end{aligned}$$

At the risk of belaboring the obvious, let's ask: How much would our $100 grow to after three years? Once again, in two years, we'll be investing $121 for one period at 10 percent. We'll end up with $1.10 for every dollar we invest, or $121 × 1.1 = $133.10 total. This $133.10 is thus:

$$\begin{aligned}\$133.10 &= \$121 \times 1.1\\ &= (\$110 \times 1.1) \times 1.1\\ &= (\$100 \times 1.1) \times 1.1 \times 1.1\\ &= \$100 \times (1.1 \times 1.1 \times 1.1)\\ &= \$100 \times 1.1^3\\ &= \$100 \times 1.331\end{aligned}$$

You're probably noticing a pattern to these calculations, so we can now go ahead and state the general result. As our examples suggest, the future value of $1 invested for t periods at a rate of r per period is this:

Future value = $1 × $(1 + r)^t$ 5.1

The expression $(1 + r)^t$ is sometimes called the *future value interest factor* (or just *future value factor*) for $1 invested at r percent for t periods and can be abbreviated as FVIF(r, t).

In our example, what would your $100 be worth after five years? We can first compute the relevant future value factor as follows:

$$(1 + r)^t = (1 + .10)^5 = 1.1^5 = 1.6105$$

Your $100 will thus grow to:

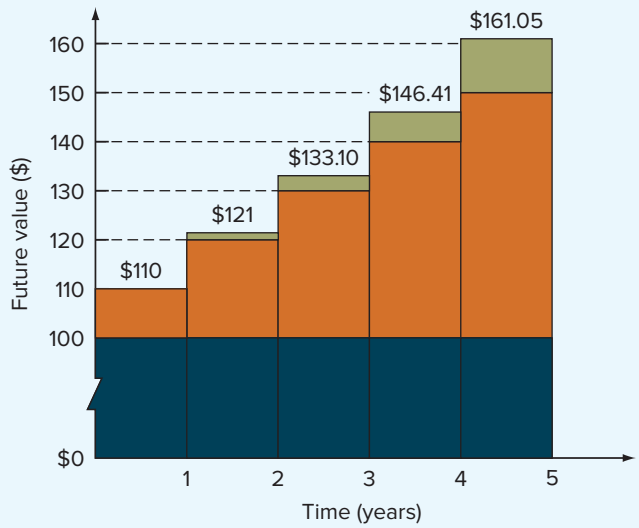
$$\$100 \times 1.6105 = \$161.05$$

The growth of your $100 each year is illustrated in Table 5.1. As shown, the interest earned in each year is equal to the beginning amount multiplied by the interest rate of 10 percent.

In Table 5.1, notice the total interest you earn is $61.05. Over the five-year span of this investment, the simple interest is $100 × .10 = $10 per year, so you accumulate $50 this way. The other $11.05 is from compounding.

Year	Beginning Amount	Simple Interest	Compound Interest	Total Interest Earned	Ending Amount
1	$100.00	$10	$ .00	$10.00	$110.00
2	110.00	10	1.00	11.00	121.00
3	121.00	10	2.10	12.10	133.10
4	133.10	10	3.31	13.31	146.41
5	146.41	10	4.64	14.64	161.05
Total		$50	$11.05	$61.05	

TABLE 5.1
Future Value of $100 at 10 percent



Growth of $100 original amount at 10 percent per year. The orange shaded area shows the simple interest. The green shaded area represents the portion of the total that results from compounding of interest.

FIGURE 5.1
Future Value, Simple Interest, and Compound Interest

Figure 5.1 illustrates the growth of the compound interest in Table 5.1. Notice how the simple interest is constant each year, but the amount of compound interest you earn gets bigger every year. The amount of the compound interest keeps increasing because more and more interest builds up and there is thus more to compound.

Future values depend critically on the assumed interest rate, particularly for long-lived investments. Figure 5.2 illustrates this relationship by plotting the growth of $1 for different rates and lengths of time. Notice the future value of $1 after 10 years is about $6.20 at a 20 percent rate, but it is only about $2.60 at 10 percent. In this case, doubling the interest rate more than doubles the future value.

To solve future value problems, we need to come up with the relevant future value factors. There are several different ways of doing this. In our example, we could have multiplied 1.1 by itself five times. This would work just fine, but it would get to be very tedious for, say, a 30-year investment.

A brief introduction to key financial concepts is available at **www.teachmefinance.com**.

FIGURE 5.2

Future Value of $1 for Different Periods and Rates

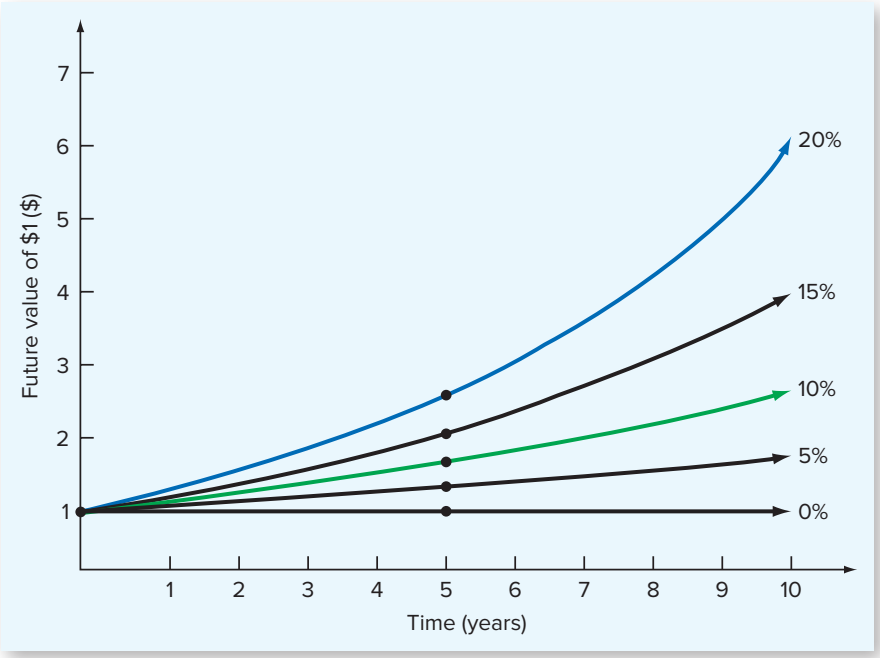


TABLE 5.2

Future Value Interest Factors

	Interest Rate			
Number of Periods	5%	10%	15%	20%
1	1.0500	1.1000	1.1500	1.2000
2	1.1025	1.2100	1.3225	1.4400
3	1.1576	1.3310	1.5209	1.7280
4	1.2155	1.4641	1.7490	2.0736
5	1.2763	1.6105	2.0114	2.4883

Fortunately, there are several easier ways to get future value factors. Most calculators have a key labeled "y^x". You can usually just enter 1.1, press this key, enter 5, and press the "=" key to get the answer. This is an easy way to calculate future value factors because it's quick and accurate.

Alternatively, you can use a table that contains future value factors for some common interest rates and time periods. Table 5.2 contains some of these factors. Table A.1 in the appendix at the end of the book contains a much larger set. To use the table, find the column that corresponds to 10 percent. Then look down the rows until you come to five periods. You should find the factor that we calculated, 1.6105.

Future value interest factor tables such as Table 5.2 are not as common as they once were because they predate inexpensive calculators and are available only for a relatively small number of rates. Interest rates are often quoted to three or four decimal places, so the tables needed to deal with these accurately would be quite large. As a result, the real world has moved away from using them. We will emphasize the use of a calculator in this chapter.

These tables still serve a useful purpose, however. To make sure you are doing the calculations correctly, pick a factor from the table and then calculate it yourself to see that you get the same answer. There are plenty of numbers to choose from.

Compound Interest — EXAMPLE 5.2

You've located an investment that pays 12 percent per year. That rate sounds good to you, so you invest $400. How much will you have in three years? How much will you have in seven years? At the end of seven years, how much interest will you have earned? How much of that interest results from compounding?

Based on our discussion, we can calculate the future value factor for 12 percent and three years as follows:

$$(1 + r)^t = 1.12^3 = 1.4049$$

Your $400 thus grows to:

$$\$400 \times 1.4049 = \$561.97$$

After seven years, you will have:

$$\$400 \times 1.12^7 = \$400 \times 2.2107 = \$884.27$$

Thus, you will more than double your money over seven years.

Because you invested $400, the interest in the $884.27 future value is $884.27 – 400 = $484.27. At 12 percent, your $400 investment earns $400 × .12 = $48 in simple interest every year. Over seven years, the simple interest thus totals 7 × $48 = $336. The other $484.27 – 336 = $148.27 is from compounding.

The effect of compounding is not great over short time periods, but it really starts to add up as the horizon grows. To take an extreme case, suppose one of your more frugal ancestors had invested $5 for you at a 6 percent interest rate 200 years ago. How much would you have today? The future value factor is a substantial $1.06^{200} = 115{,}125.90$ (you won't find this one in a table), so you would have $5 × 115,125.90 = $575,629.52 today. Notice that the simple interest is just $5 × .06 = $.30 per year. After 200 years, this amounts to $60. The rest is from reinvesting. Such is the power of compound interest!

How Much for That Island? — EXAMPLE 5.3

To further illustrate the effect of compounding for long horizons, consider the case of Peter Minuit and the American Indians. In 1626, Minuit bought all of Manhattan Island for about $24 in goods and trinkets. This sounds cheap, but the Indians may have gotten the better end of the deal. To see why, suppose the Indians had sold the goods and invested the $24 at 10 percent. How much would it be worth today?

About 391 years have passed since the transaction. At 10 percent, $24 will grow by quite a bit over that time. How much? The future value factor is roughly:

$$(1 + r)^t = 1.1^{391} \approx 15{,}295{,}000{,}000{,}000{,}000$$

That is, 15.295 followed by 12 zeroes. The future value is thus on the order of $24 × 15.295 = $367 *quadrillion* (give or take a few hundreds of trillions).

Well, $367 quadrillion is a lot of money. How much? If you had it, you could buy the United States. All of it. Cash. With money left over to buy Canada, Mexico, and the rest of the world, for that matter.

This example is something of an exaggeration, of course. In 1626, it would not have been easy to locate an investment that would pay 10 percent every year without fail for the next 391 years.

CALCULATOR HINTS

Using a Financial Calculator

Although there are the various ways of calculating future values we have described so far, many of you will decide that a financial calculator is the way to go. If you are planning on using one, you should read this extended hint; otherwise, skip it.

A financial calculator is an ordinary calculator with a few extra features. In particular, it knows some of the most commonly used financial formulas, so it can directly compute things like future values.

Financial calculators have the advantage that they handle a lot of the computation, but that is really all. In other words, you still have to understand the problem; the calculator just does some of the arithmetic. In fact, there is an old joke (somewhat modified) that goes like this: Anyone can make a mistake on a time value of money problem, but to really screw one up takes a financial calculator! We therefore have two goals for this section. First, we'll discuss how to compute future values. After that, we'll show you how to avoid the most common mistakes people make when they start using financial calculators.

How to Calculate Future Values with a Financial Calculator

Examining a typical financial calculator, you will find five keys of particular interest. They usually look like this:

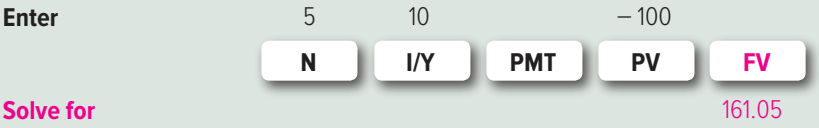
For now, we need to focus on four of these. The keys labeled PV and FV are just what you would guess: present value and future value. The key labeled N refers to the number of periods, which is what we have been calling *t*. Finally, I/Y stands for the interest rate, which we have called *r*[1].

If we have the financial calculator set up right (see our next section), then calculating a future value is very simple. Take a look back at our question involving the future value of $100 at 10 percent for five years. We have seen that the answer is $161.05. The exact keystrokes will differ depending on what type of calculator you use, but here is basically all you do:

1. Enter –100. Press the PV key. (The negative sign is explained in the next section.)
2. Enter 10. Press the I/Y key. (Notice that we entered 10, not .10; see the next section.)
3. Enter 5. Press the N key.

Now we have entered all of the relevant information. To solve for the future value, we need to ask the calculator what the FV is. Depending on your calculator, either you press the button labeled "CPT" (for compute) and then press FV, or you just press FV. Either way, you should get 161.05. If you don't (and you probably won't if this is the first time you have used a financial calculator!), we will offer some help in our next section.

Before we explain the kinds of problems you are likely to run into, we want to establish a standard format for showing you how to use a financial calculator. Using the example we just looked at, in the future, we will illustrate such problems like this:



Here is an important tip: Appendix D contains more detailed instructions for the most common types of financial calculators. See if yours is included; if it is, follow the instructions there if you need help. Of course, if all else fails, you can read the manual that came with the calculator.

How to Get the Wrong Answer Using a Financial Calculator

There are a couple of common (and frustrating) problems that cause a lot of trouble with financial calculators. In this section, we provide some important *dos* and *don'ts*. If you just can't seem to get a problem to work out, you should refer back to this section.

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[1]The reason financial calculators use *N* and *I/Y* is that the most common use for these calculators is determining loan payments. In this context, *N* is the number of payments and *I/Y* is the interest rate on the loan. But as we will see, there are many other uses of financial calculators that don't involve loan payments and interest rates.

There are two categories we examine: Three things you need to do only once and three things you need to do every time you work a problem. The things you need to do just once deal with the following calculator settings:

1. *Make sure your calculator is set to display a large number of decimal places.* Most financial calculators display only two decimal places; this causes problems because we frequently work with numbers—like interest rates—that are very small.
2. *Make sure your calculator is set to assume only one payment per period or per year.* Most financial calculators assume monthly payments (12 per year) unless you specify otherwise.
3. *Make sure your calculator is in "end" mode.* This is usually the default, but you can accidentally change to "begin" mode.

If you don't know how to set these three things, see Appendix D or your calculator's operating manual. There are also three things you need to do *every time you work a problem*:

1. *Before you start, completely clear out the calculator.* This is very important. Failure to do this is the number one reason for wrong answers; you must get in the habit of clearing the calculator every time you start a problem. How you do this depends on the calculator (see Appendix D), but you must do more than just clear the display. For example, on a Texas Instruments BA II Plus you must press 2nd then CLR TVM for *clear time value of money.* There is a similar command on your calculator. Learn it!

   Note that turning the calculator off and back on won't do it. Most financial calculators remember everything you enter, even after you turn them off. In other words, they remember all your mistakes unless you explicitly clear them out. Also, if you are in the middle of a problem and make a mistake, *clear it out and start over.* Better to be safe than sorry.
2. *Put a negative sign on cash outflows.* Most financial calculators require you to put a negative sign on cash outflows and a positive sign on cash inflows. As a practical matter, this usually just means that you should enter the present value amount with a negative sign (because normally the present value represents the amount you give up today in exchange for cash inflows later). By the same token, when you solve for a present value, you shouldn't be surprised to see a negative sign.
3. *Enter the rate correctly.* Financial calculators assume that rates are quoted in percent, so if the rate is .08 (or 8 percent), you should enter 8, not .08.

If you follow these guidelines (especially the one about clearing out the calculator), you should have no problem using a financial calculator to work almost all of the problems in this and the next few chapters. We'll provide some additional examples and guidance where appropriate.

A NOTE ABOUT COMPOUND GROWTH

If you are considering depositing money in an interest-bearing account, then the interest rate on that account is just the rate at which your money grows, assuming you don't remove any of it. If that rate is 10 percent, then each year you have 10 percent more money than you had the year before. In this case, the interest rate is just an example of a compound growth rate.

The way we calculated future values is actually quite general and lets you answer some other types of questions related to growth. For example, say your company currently has 10,000 employees. You've estimated that the number of employees grows by 3 percent per year. How many employees will there be in five years? Here, we start with 10,000 people instead of dollars, and we don't think of the growth rate as an interest rate, but the calculation is exactly the same:

$$10{,}000 \times 1.03^5 = 10{,}000 \times 1.1593 = 11{,}593 \text{ employees}$$

There will be about 1,593 net new hires over the coming five years.

To give another example, according to the company, Walmart's 2016 sales were about $481 billion. Suppose sales are projected to increase at a rate of 15 percent per year. What will Walmart's sales be in the year 2021 if this is correct? Verify for yourself that the answer is about $968 billion—just over twice as large.

EXAMPLE 5.4 Dividend Growth

The TICO Corporation currently pays a cash dividend of $5 per share. You believe the dividend will be increased by 4 percent each year indefinitely. How big will the dividend be in eight years?

Here we have a cash dividend growing because it is being increased by management; but once again the calculation is the same:

$$\text{Future value} = \$5 \times 1.04^8 = \$5 \times 1.3686 = \$6.84$$

The dividend will grow by $1.84 over that period. Dividend growth is a subject we will return to in a later chapter.

Concept Questions

5.1a What do we mean by the future value of an investment?

5.1b What does it mean to compound interest? How does compound interest differ from simple interest?

5.1c In general, what is the future value of $1 invested at *r* per period for *t* periods?

5.2 Present Value and Discounting

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When we discuss future value, we are thinking of questions like: What will my $2,000 investment grow to if it earns a 6.5 percent return every year for the next six years? The answer to this question is what we call the future value of $2,000 invested at 6.5 percent for six years (verify that the answer is about $2,918).

Another type of question that comes up even more often in financial management is obviously related to future value. Suppose you need to have $10,000 in 10 years, and you can earn 6.5 percent on your money. How much do you have to invest today to reach your goal? You can verify that the answer is $5,327.26. How do we know this? Read on.

THE SINGLE-PERIOD CASE

present value (PV)
The current value of future cash flows discounted at the appropriate discount rate.

We've seen that the future value of $1 invested for one year at 10 percent is $1.10. We now ask a slightly different question: How much do we have to invest today at 10 percent to get $1 in one year? In other words, we know the future value here is $1, but what is the **present value (PV)**? The answer isn't too hard to figure out. Whatever we invest today will be 1.1 times bigger at the end of the year. Because we need $1 at the end of the year:

$$\text{Present value} \times 1.1 = \$1$$

Or solving for the present value:

$$\text{Present value} = \$1/1.1 = \$.909$$

discount
Calculate the present value of some future amount.

In this case, the present value is the answer to the following question: What amount, invested today, will grow to $1 in one year if the interest rate is 10 percent? Present value is thus the reverse of future value. Instead of compounding the money forward into the future, we **discount** it back to the present.

Single-Period PV — EXAMPLE 5.5

Suppose you need $400 to buy textbooks next year. You can earn 7 percent on your money. How much do you have to put up today?

We need to know the PV of $400 in one year at 7 percent. Proceeding as in the previous example:

Present value × 1.07 = $400

We can now solve for the present value:

Present value = $400 × (1/1.07) = $373.83

Thus, $373.83 is the present value. Again, this means that investing this amount for one year at 7 percent will give you a future value of $400.

From our examples, the present value of $1 to be received in one period is generally given as follows:

$$PV = \$1 \times [1/(1 + r)] = \$1/(1 + r)$$

We next examine how to get the present value of an amount to be paid in two or more periods into the future.

PRESENT VALUES FOR MULTIPLE PERIODS

Suppose you need to have $1,000 in two years. If you can earn 7 percent, how much do you have to invest to make sure you have the $1,000 when you need it? In other words, what is the present value of $1,000 in two years if the relevant rate is 7 percent?

Based on your knowledge of future values, you know the amount invested must grow to $1,000 over the two years. In other words, it must be the case that:

$$\begin{aligned} \$1{,}000 &= PV \times 1.07 \times 1.07 \\ &= PV \times 1.07^2 \\ &= PV \times 1.1449 \end{aligned}$$

Given this, we can solve for the present value:

Present value = $1,000/1.1449 = $873.44

Therefore, $873.44 is the amount you must invest to achieve your goal.

Saving Up — EXAMPLE 5.6

You would like to buy a new automobile. You have $50,000 or so, but the car costs $68,500. If you can earn 9 percent, how much do you have to invest today to buy the car in two years? Do you have enough? Assume the price will stay the same.

What we need to know is the present value of $68,500 to be paid in two years, assuming a 9 percent rate. Based on our discussion, this is:

PV = $68,500/$1.09^2$ = $68,500/1.1881 = $57,655.08

You're still about $7,655 short, even if you're willing to wait two years.

TABLE 5.3
Present Value Interest Factors

	Interest Rate			
Number of Periods	5%	10%	15%	20%
1	.9524	.9091	.8696	.8333
2	.9070	.8264	.7561	.6944
3	.8638	.7513	.6575	.5787
4	.8227	.6830	.5718	.4823
5	.7835	.6209	.4972	.4019

As you have probably recognized by now, calculating present values is quite similar to calculating future values, and the general result looks much the same. The present value of $1 to be received t periods into the future at a discount rate of r is:

$$\mathbf{PV = \$1 \times [1/(1 + r)^t] = \$1/(1 + r)^t}$$ 5.2

The quantity in brackets, $1/(1 + r)^t$, goes by several different names. Because it's used to discount a future cash flow, it is often called a *discount factor*. With this name, it is not surprising that the rate used in the calculation is often called the **discount rate**. We will tend to call it this in talking about present values. The quantity in brackets is also called the *present value interest factor* (or just *present value factor*) for $1 at r percent for t periods and is sometimes abbreviated as PVIF(r, t). Finally, calculating the present value of a future cash flow to determine its worth today is commonly called **discounted cash flow (DCF) valuation**.

discount rate
The rate used to calculate the present value of future cash flows.

discounted cash flow (DCF) valuation
Calculating the present value of a future cash flow to determine its value today.

To illustrate, suppose you need $1,000 in three years. You can earn 15 percent on your money. How much do you have to invest today? To find out, we have to determine the present value of $1,000 in three years at 15 percent. We do this by discounting $1,000 back three periods at 15 percent. With these numbers, the discount factor is:

$$1/(1 + .15)^3 = 1/1.5209 = .6575$$

The amount you must invest is thus:

$$\$1{,}000 \times .6575 = \$657.50$$

We say that $657.50 is the present or discounted value of $1,000 to be received in three years at 15 percent.

There are tables for present value factors just as there are tables for future value factors, and you use them in the same way (if you use them at all). Table 5.3 contains a small set. A much larger set can be found in Table A.2 in the book's appendix.

In Table 5.3, the discount factor we just calculated (.6575) can be found by looking down the column labeled "15%" until you come to the third row.

CALCULATOR HINTS

You solve present value problems on a financial calculator just as you do future value problems. For the example we just examined (the present value of $1,000 to be received in three years at 15 percent), you would do the following:

	N	I/Y	PMT	PV	FV
Enter	3	15			1,000
Solve for				−657.52	

Notice that the answer has a negative sign; as we discussed earlier, that's because it represents an outflow today in exchange for the $1,000 inflow later.

Deceptive Advertising? EXAMPLE 5.7

Businesses sometimes advertise that you should "Come try our product. If you do, we'll give you $100 just for coming by!" If you read the fine print, what you find out is that they will give you a savings certificate that will pay you $100 in 25 years or so. If the going interest rate on such certificates is 10 percent per year, how much are they really giving you today?

What you're actually getting is the present value of $100 to be paid in 25 years. If the discount rate is 10 percent per year, then the discount factor is:

$$1/1.1^{25} = 1/10.8347 = .0923$$

This tells you that a dollar in 25 years is worth a little more than nine cents today, assuming a 10 percent discount rate. Given this, the promotion is actually paying you about .0923 × $100 = $9.23. Maybe this is enough to draw customers, but it's not $100.

As the length of time until payment grows, present values decline. As Example 5.7 illustrates, present values tend to become small as the time horizon grows. If you look out far enough, they will always approach zero. Also, for a given length of time, the higher the discount rate is, the lower the present value will be. Put another way, present values and discount rates are inversely related. Increasing the discount rate decreases the PV and vice versa.

The relationship between time, discount rates, and present values is illustrated in Figure 5.3. Notice that by the time we get to 10 years, the present values are all substantially smaller than the future amounts.

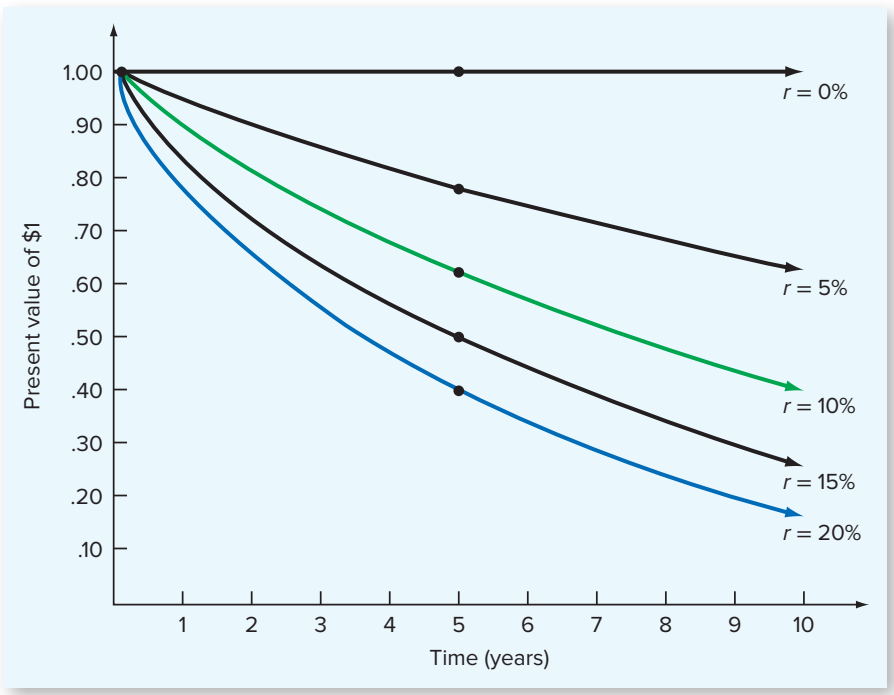

FIGURE 5.3
Present Value of $1 for Different Periods and Rates

Concept Questions

5.2a What do we mean by the *present value* of an investment?

5.2b The process of discounting a future amount back to the present is the opposite of doing what?

5.2c What do we mean by *discounted cash flow,* or *DCF, valuation*?

5.2d In general, what is the present value of $1 to be received in t periods, assuming a discount rate of r per period?

5.3 More about Present and Future Values

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If you look back at the expressions we came up with for present and future values, you will see a simple relationship between the two. We explore this relationship and some related issues in this section.

PRESENT VERSUS FUTURE VALUE

What we called the present value factor is the reciprocal of (that is, 1 divided by) the future value factor:

$$\text{Future value factor} = (1 + r)^t$$

$$\text{Present value factor} = 1/(1 + r)^t$$

In fact, the easy way to calculate a present value factor on many calculators is to first calculate the future value factor and then press the "$1/x$" key to flip it over.

If we let FV_t stand for the future value after t periods, then the relationship between future value and present value can be written as one of the following:

$$\mathbf{PV \times (1 + r)^t = FV_t}$$

$$\mathbf{PV = FV_t/(1 + r)^t = FV_t \times [1/(1 + r)^t]}$$

5.3

This last result we will call the *basic present value equation*. We will use it throughout the text. A number of variations come up, but this simple equation underlies many of the most important ideas in corporate finance.

EXAMPLE 5.8 Evaluating Investments

To give you an idea of how we will be using present and future values, consider the following simple investment. Your company proposes to buy an asset for $335. This investment is very safe. You would sell off the asset in three years for $400. You know you could invest the $335 elsewhere at 10 percent with very little risk. What do you think of the proposed investment?

This is not a good investment. Why not? Because you can invest the $335 elsewhere at 10 percent. If you do, after three years it will grow to:

$$\begin{aligned}\$335 \times (1 + r)^t &= \$335 \times 1.1^3 \\ &= \$335 \times 1.331 \\ &= \$445.89\end{aligned}$$

Because the proposed investment pays out only $400, it is not as good as other alternatives we have. Another way of seeing the same thing is to notice that the present value of $400 in three years at 10 percent is:

$$\$400 \times [1/(1 + r)^t] = \$400/1.1^3 = \$400/1.331 = \$300.53$$

This tells us that we have to invest only about $300 to get $400 in three years, not $335. We will return to this type of analysis later on.

DETERMINING THE DISCOUNT RATE

We frequently need to determine what discount rate is implicit in an investment. We can do this by looking at the basic present value equation:

$$PV = FV_t/(1 + r)^t$$

There are only four parts to this equation: The present value (PV), the future value (FV_t), the discount rate (r), and the life of the investment (t). Given any three of these, we can always find the fourth.

For a downloadable, Windows-based financial calculator, go to **www.calculator.org**.

Finding *r* for a Single-Period Investment — EXAMPLE 5.9

You are considering a one-year investment. If you put up $1,250, you will get back $1,350. What rate is this investment paying?

First, in this single-period case, the answer is fairly obvious. You are getting a total of $100 in addition to your $1,250. The implicit rate on this investment is thus $100/$1,250 = 8 percent.

More formally, from the basic present value equation, the present value (the amount you must put up today) is $1,250. The future value (what the present value grows to) is $1,350. The time involved is one period, so we have:

$$\$1{,}250 = \$1{,}350/(1 + r)^1$$
$$1 + r = \$1{,}350/\$1{,}250 = 1.08$$
$$r = .08, \text{ or } 8\%$$

In this simple case, of course, there was no need to go through this calculation. But as we describe next, it gets a little harder with more than one period.

To illustrate what happens with multiple periods, let's say we are offered an investment that costs us $100 and will double our money in eight years. To compare this to other investments, we would like to know what discount rate is implicit in these numbers. This discount rate is called the *rate of return*, or sometimes just the *return*, on the investment. In this case, we have a present value of $100, a future value of $200 (double our money), and an eight-year life. To calculate the return, we can write the basic present value equation as:

$$PV = FV_t/(1 + r)^t$$
$$\$100 = \$200/(1 + r)^8$$

It could also be written as:

$$(1 + r)^8 = \$200/\$100 = 2$$

We now need to solve for r. There are three ways to do this:

1. Use a financial calculator.
2. Solve the equation for $1 + r$ by taking the eighth root of both sides. Because this is the same thing as raising both sides to the power of ⅛ or .125, this is actually easy to do with the "y^x" key on a calculator. Just enter 2, then press "y^x," enter .125, and press the "=" key. The eighth root should be about 1.09, which implies that r is 9 percent.
3. Use a future value table. The future value factor after eight years is equal to 2. If you look across the row corresponding to eight periods in Table A.1, you will see that a future value factor of 2 corresponds to the 9 percent column, again implying that the return here is 9 percent.

Actually, in this particular example, there is a useful "back of the envelope" means of solving for r—the Rule of 72. For reasonable rates of return, the time it takes to double your money is given approximately by $72/r\%$. In our example, this means that $72/r\% = 8$ years, implying that r is 9 percent, as we calculated. This rule is fairly accurate for discount rates in the 5 percent to 20 percent range.

EXAMPLE 5.10 Sneakers as Investments

In December 2016, a pair of game-worn shoes with graffiti-style writing that said "Oakland Strong" used by Stephen Curry were auctioned off to benefit the Oakland Fire Relief Fund. The shoes sold for $30,101. The record for game-worn shoes by an active NBA player is $37,740 for a pair of Kobe Bryant shoes used in the 2008 Olympics. "Experts" often argue that collectibles such as this will double in value over a 10-year period.

So were the sneakers a good investment? By the Rule of 72, you already know the experts were predicting that the sneakers would double in value in 10 years; so the return predicted would be about $72/10 = 7.2$ percent per year, which is only so-so.

Why does the Rule of 72 work? See **www.moneychimp.com.**

At one time at least, a rule of thumb in the rarefied world of fine art collecting was "your money back in 5 years, double your money in 10 years." Given this, let's see how an investment stacked up. In 2013, the Pablo Picasso painting *Le Rêve* was sold for $155 million. The painting had reached a level of notoriety in part because its owner, casino magnate Steve Wynn, had put his elbow through the middle of the painting. Wynn had purchased the painting 12 years earlier in 2001 for an estimated $60 million. So was Wynn's gamble a winner?

The rule of thumb has us doubling our money in 10 years; so, from the Rule of 72, we have that 7.2 percent per year was the norm. The painting was resold in about 12 years. The present value is $60 million, and the future value is $155 million. We need to solve for the unknown rate, r, as follows:

$$\$60{,}000{,}000 = \$155{,}000{,}000/(1 + r)^{12}$$
$$(1 + r)^{12} = 2.5833$$

Solving for r, we find that Wynn earned about 8.23 percent per year—a little better than the 7.2 percent rule of thumb.

What about other collectibles? To a philatelist (a stamp collector to you and us), one of the most prized stamps is the 1918 24-cent inverted Jenny C3a. The stamp is a collectible because it has a picture of an upside-down biplane. One of these stamps sold at auction for $1,175,000 in 2016. At what rate did its value grow? Verify for yourself that the answer is about 17.02 percent, assuming a 98-year period.

Collectible autos can also have good returns. For example, a 1939 Alfa Romeo 8C 2900B Lungo Spider was reported to have sold for £1,150 when it was brand new. When it was auctioned in 2016, it became the most expensive prewar car to date when it sold for £19.8 million. Assuming that 77 years had passed, see if you don't agree that the increase in the value of the car was 13.50 percent per year.

Not all collectibles do as well. In 2016, a 1792 Silver Center Cent, believed to be the first coin produced outside the U.S. Mint, was auctioned for $352,500. While this seems like a huge return to the untrained eye, check that, over the 224-year period, the gain was only about 8.07 percent.

One of the rarest coins is the 1894-S dime, struck at the San Francisco mint. Only 24 were ever produced, with nine believed to be still in existence. In 2016, one of these dimes sold at auction for $2 million. See if you agree that this collectible gained about 14.77 percent per year.

A slightly more extreme example involves money bequeathed by Benjamin Franklin, who died on April 17, 1790. In his will, he gave 1,000 pounds sterling to Massachusetts and the city of Boston. He gave a like amount to Pennsylvania and the city of Philadelphia. The money had been paid to Franklin when he held political office, but he believed that politicians should not be paid for their service (it appears that this view is not widely shared by modern politicians).

Franklin originally specified that the money should be paid out 100 years after his death and used to train young people. Later, however, after some legal wrangling, it was agreed that the money would be paid out in 1990, 200 years after Franklin's death. By that time, the Pennsylvania bequest had grown to about $2 million; the Massachusetts bequest had grown to $4.5 million. The money was used to fund the Franklin Institutes in Boston and Philadelphia. Assuming that 1,000 pounds sterling was equivalent to $1,000, what rate of return did the two states earn? (The dollar did not become the official U.S. currency until 1792.)

For Pennsylvania, the future value is $2 million and the present value is $1,000. There are 200 years involved, so we need to solve for r in the following:

$$\$1{,}000 = \$2 \text{ million}/(1 + r)^{200}$$
$$(1 + r)^{200} = 2{,}000$$

Solving for r, we see that the Pennsylvania money grew at about 3.87 percent per year. The Massachusetts money did better; verify that the rate of return in this case was 4.3 percent. Small differences in returns can add up!

CALCULATOR HINTS

We can illustrate how to calculate unknown rates using a financial calculator with these numbers. For Pennsylvania, you would do the following:

	N	I/Y	PMT	PV	FV
Enter	200			–1,000	2,000,000
Solve for		3.87			

As in our previous examples, notice the minus sign on the present value, representing Franklin's outlay made many years ago. What do you change to work the problem for Massachusetts?

Saving for College — EXAMPLE 5.11

You estimate that you will need about $80,000 to send your child to college in eight years. You have about $35,000 now. If you can earn 20 percent per year, will you make it? At what rate will you just reach your goal?

If you can earn 20 percent, the future value of your $35,000 in eight years will be:

$$\text{FV} = \$35{,}000 \times 1.20^{8} = \$35{,}000 \times 4.2998 = \$150{,}493.59$$

So, you will make it easily. The minimum rate is the unknown r in the following:

$$FV = \$35{,}000 \times (1 + r)^8 = \$80{,}000$$
$$(1 + r)^8 = \$80{,}000/\$35{,}000 = 2.2857$$

Therefore, the future value factor is 2.2857. Looking at the row in Table A.1 that corresponds to eight periods, we see that our future value factor is roughly halfway between the ones shown for 10 percent (2.1436) and 12 percent (2.4760), so you will just reach your goal if you earn approximately 11 percent. To get the exact answer, we could use a financial calculator or we could solve for r:

$$(1 + r)^8 = \$80{,}000/\$35{,}000 = 2.2857$$
$$1 + r = 2.2857^{1/8} = 2.2857^{.125} = 1.1089$$
$$r = .1089, \text{ or } 10.89\%$$

EXAMPLE 5.12 Only 18,262.5 Days to Retirement

You would like to retire in 50 years as a millionaire. If you have $10,000 today, what rate of return do you need to earn to achieve your goal?

The future value is $1,000,000. The present value is $10,000, and there are 50 years until payment. We need to calculate the unknown discount rate in the following:

$$\$10{,}000 = \$1{,}000{,}000/(1 + r)^{50}$$
$$(1 + r)^{50} = 100$$

The future value factor is thus 100. You can verify that the implicit rate is about 9.65 percent.

Not taking the time value of money into account when computing growth rates or rates of return often leads to some misleading numbers in the real world. For example, the most loved (and hated) team in baseball, the New York Yankees, had the highest payroll during the 1988 season, about $19 million. In 2016, the Los Angeles Dodgers had the highest payroll, a staggering $223 million—an increase of 1,074 percent! If history is any guide, we can get a rough idea of the future growth in baseball payrolls. See if you don't agree that this represents an annual increase of 9.19 percent, a substantial growth rate, but much less than the gaudy 1,074 percent.

How about classic maps? A few years ago, the first map of America, printed in Rome in 1507, was valued at about $135,000, 69 percent more than the $80,000 it was worth 10 years earlier. Your return on investment if you were the proud owner of the map over those 10 years? Verify that it's about 5.4 percent per year—far worse than the 69 percent reported increase in price.

Whether with maps or baseball payrolls, it's easy to be misled when returns are quoted without considering the time value of money. However, it's not just the uninitiated who are guilty of this slight form of deception. The title of a feature article in a leading business magazine predicted the Dow Jones Industrial Average would soar to a 70 percent gain over the coming five years. Do you think it meant a 70 percent return per year on your money? Think again!

FINDING THE NUMBER OF PERIODS

Suppose we are interested in purchasing an asset that costs $50,000. We currently have $25,000. If we can earn 12 percent on this $25,000, how long until we have the $50,000?

Finding the answer involves solving for the last variable in the basic present value equation, the number of periods. You already know how to get an approximate answer to this particular problem. Notice that we need to double our money. From the Rule of 72, this will take about $72/12 = 6$ years at 12 percent.

To come up with the exact answer, we can again manipulate the basic present value equation. The present value is $25,000, and the future value is $50,000. With a 12 percent discount rate, the basic equation takes one of the following forms:

$$\$25{,}000 = \$50{,}000/1.12^t$$
$$\$50{,}000/\$25{,}000 = 1.12^t = 2$$

We thus have a future value factor of 2 for a 12 percent rate. We now need to solve for t. If you look down the column in Table A.1 that corresponds to 12 percent, you will see that a future value factor of 1.9738 occurs at six periods. It will thus take about six years, as we calculated. To get the exact answer, we have to explicitly solve for t (or use a financial calculator). If you do this, you will see that the answer is 6.1163 years, so our approximation was quite close in this case.

CALCULATOR HINTS

If you use a financial calculator, here are the relevant entries:

Enter	12			−25,000	50,000
	N	I/Y	PMT	PV	FV
Solve for	6.1163				

Waiting for Godot — EXAMPLE 5.13

You've been saving up to buy the Godot Company. The total cost will be $10 million. You currently have about $2.3 million. If you can earn 5 percent on your money, how long will you have to wait? At 16 percent, how long must you wait?

At 5 percent, you'll have to wait a long time. From the basic present value equation:

$$\$2.3 \text{ million} = \$10 \text{ million}/1.05^t$$
$$1.05^t = 4.35$$
$$t = 30 \text{ years}$$

At 16 percent, things are a little better. Verify for yourself that it will take about 10 years.

Consider the U.S. EE Savings Bonds that we discussed at the beginning of the chapter. You purchase them for half of their $50 face value. In other words, you pay $25 today and get $50 at some point in the future when the bond "matures." You receive no interest in between, and the interest rate is adjusted every six months, so the length of time until your $25 grows to $50 depends on future interest rates. However, at worst, the bonds are guaranteed to be worth $50 at the end of 20 years, so this is the longest you would ever have to wait. If you do have to wait the full 20 years, what rate do you earn?

Learn more about using Excel for time value and other calculations at **www.studyfinance.com**.

TABLE 5.4
Summary of Time Value Calculations

I. Symbols:
PV = Present value, what future cash flows are worth today
FV_t = Future value, what cash flows are worth in the future
r = Interest rate, rate of return, or discount rate per period—typically, but not always, one year
t = Number of periods—typically, but not always, the number of years
C = Cash amount
II. Future Value of *C* Invested at *r* Percent for *t* Periods:
$FV_t = C \times (1 + r)^t$
The term $(1 + r)^t$ is called the *future value factor*.
III. Present Value of *C* to Be Received in *t* Periods at *r* Percent per Period:
$PV = C/(1 + r)^t$
The term $1/(1 + r)^t$ is called the *present value factor*.
IV. The Basic Present Value Equation Giving the Relationship between Present and Future Value:
$PV = FV_t/(1 + r)^t$

Because this investment is doubling in value in 20 years, the Rule of 72 tells you the answer right away: 72/20 = .036, or 3.6%. Remember, this is the *minimum* guaranteed return, so you might do better. This example finishes our introduction to basic time value concepts. Table 5.4 summarizes present and future value calculations for future reference. As our nearby *Work the Web* box shows, online calculators are widely available to handle these calculations; however, it is still important to know what is really going on.

SPREADSHEET STRATEGIES

Using a Spreadsheet for Time Value of Money Calculations

More and more, businesspeople from many different areas (not just finance and accounting) rely on spreadsheets to do all the different types of calculations that come up in the real world. As a result, in this section, we will show you how to use a spreadsheet to handle the various time value of money problems we presented in this chapter. We will use Microsoft Excel™, but the commands are similar for other types of software. We assume you are already familiar with basic spreadsheet operations.

As we have seen, you can solve for any one of the following four potential unknowns: Future value, present value, the discount rate, or the number of periods. With a spreadsheet, there is a separate formula for each. In Excel, these are shown in a nearby box.

To Find	Enter This Formula
Future value	= FV (rate,nper,pmt,pv)
Present value	= PV (rate,nper,pmt,fv)
Discount rate	= RATE (nper,pmt,pv,fv)
Number of periods	= NPER (rate,pmt,pv,fv)

In these formulas, *pv* and *fv* are present and future value, respectively; *nper* is the number of periods; and *rate* is the discount, or interest, rate. We will talk about *pmt* in the next chapter.

Two things are a little tricky here. First, unlike a financial calculator, the spreadsheet requires that the rate be entered as a decimal. Second, as with most financial calculators, you have to put a negative sign on either the present value or the future value to solve for the rate or the number of periods. For the same reason, if you solve for a present value, the answer will have a negative sign unless you input a negative future value. The same is true when you compute a future value.

To illustrate how you might use these formulas, we will go back to an example in the chapter. If you invest $25,000 at 12 percent per year, how long until you have $50,000? You might set up a spreadsheet like this:

	A	B	C	D	E	F	G	H
1								
2	**Using a spreadsheet for time value of money calculations**							
3								
4	If we invest $25,000 at 12 percent, how long until we have $50,000? We need to solve							
5	for the unknown number of periods, so we use the formula NPER(rate,pmt,pv,fv).							
6								
7	Present value (pv):	$25,000						
8	Future value (fv):	$50,000						
9	Rate (rate):	.12						
10								
11	Periods:	**6.1162554**						
12								
13	The formula entered in cell B11 is =NPER(B9,0,-B7,B8); notice that pmt is zero and that pv							
14	has a negative sign on it. Also notice that rate is entered as a decimal, not a percentage.							

SOURCE: Microsoft Excel

Concept Questions

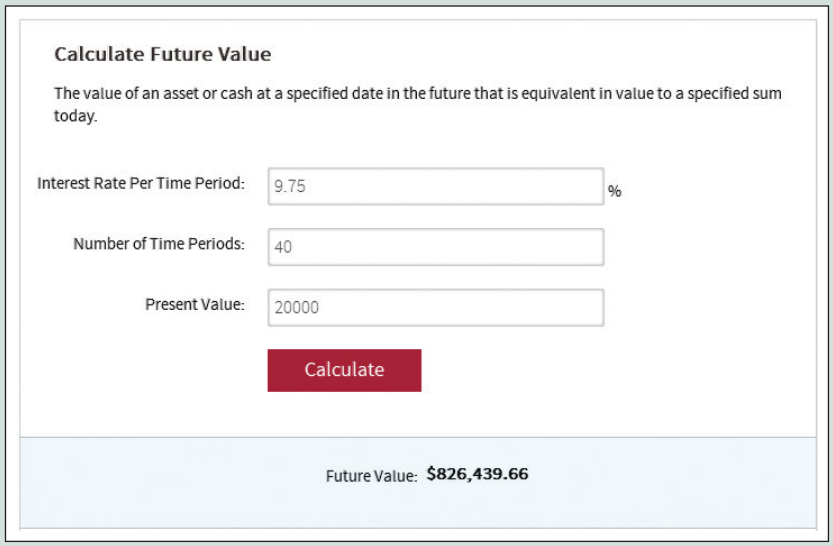
5.3a What is the basic present value equation?

5.3b What is the Rule of 72?

WORK THE WEB

How important is the time value of money? A recent search on one web search engine returned over 689 million hits! Although you must understand the calculations behind the time value of money, the advent of financial calculators and spreadsheets has eliminated the need for tedious calculations. In fact, many websites offer time value of money calculators. The following is one example from www.investopedia.com.

You have $20,000 today and will invest it at 9.75 percent for 40 years. How much will it be worth at that time? With the Investopedia calculator, you enter the values and hit "Calculate". The results look like this:



Who said time value of money calculations are hard?

Questions

1. *Use the present value calculator on this website to answer the following: Suppose you want to have $140,000 in 25 years. If you can earn a 10 percent return, how much do you have to invest today?*
2. *Use the future value calculator on this website to answer the following question: Suppose you have $8,000 today that you plan to save for your retirement in 40 years. If you earn a return of 10.8 percent per year, how much will this account be worth when you are ready to retire?*

5.4 Summary and Conclusions

This chapter has introduced you to the basic principles of present value and discounted cash flow valuation. In it, we explained a number of things about the time value of money, including these:

1. For a given rate of return, we can determine the value at some point in the future of an investment made today by calculating the future value of that investment.
2. We can determine the current worth of a future cash flow or series of cash flows for a given rate of return by calculating the present value of the cash flow(s) involved.
3. The relationship between present value (PV) and future value (FV) for a given rate r and time t is given by the basic present value equation:

   $$PV = FV_t/(1 + r)^t$$

   As we have shown, it is possible to find any one of the four components (PV, FV_t, r, or t) given the other three.

The principles developed in this chapter will figure prominently in the chapters to come. The reason for this is that most investments, whether they involve real assets or financial assets, can be analyzed using the discounted cash flow (DCF) approach. As a result, the DCF approach is broadly applicable and widely used in practice. Before going on you might want to do some of the problems that follow.

CONNECT TO FINANCE

Connect Finance offers you plenty of opportunities to practice mastering time value of money concepts. Log on to connect.mheducation.com to learn more. If you like what you see, ask your professor about using *Connect Finance!*

Can you answer the following *Connect* Quiz questions?

Section 5.1 You deposited $2,000 in a bank account that pays 5 percent simple interest. How much will you have in this account after three years?

Section 5.2 What is the present value of $11,500 discounted at 9 percent for 11 years?

Section 5.3 Charlie invested $6,200 in a stock last year. Currently, this investment is worth $6,788.38. What is the rate of return on this investment?

CHAPTER REVIEW AND SELF-TEST PROBLEMS

5.1 Calculating Future Values Assume you deposit $10,000 today in an account that pays 6 percent interest. How much will you have in five years?

5.2 Calculating Present Values Suppose you have just celebrated your 19th birthday. A rich uncle has set up a trust fund for you that will pay you $150,000 when you turn 30. If the relevant discount rate is 9 percent, how much is this fund worth today?

5.3 Calculating Rates of Return You've been offered an investment that will double your money in 10 years. What rate of return are you being offered? Check your answer using the Rule of 72.

5.4 Calculating the Number of Periods You've been offered an investment that will pay you 9 percent per year. If you invest $15,000, how long until you have $30,000? How long until you have $45,000?

ANSWERS TO CHAPTER REVIEW AND SELF-TEST PROBLEMS

5.1 We need to calculate the future value of $10,000 at 6 percent for five years. The future value factor is:

$$1.06^5 = 1.3382$$

The future value is thus $10,000 × 1.3382 = $13,382.26.

5.2 We need the present value of $150,000 to be paid in 11 years at 9 percent. The discount factor is:

$$1/1.09^{11} = 1/2.5804 = .3875$$

The present value is thus about $58,130.

5.3 Suppose you invest $1,000. You will have $2,000 in 10 years with this investment. So, $1,000 is the amount you have today, or the present value, and $2,000 is the amount you will have in 10 years, or the future value. From the basic present value equation, we have:

$$\$2{,}000 = \$1{,}000 \times (1 + r)^{10}$$
$$2 = (1 + r)^{10}$$

From here, we need to solve for r, the unknown rate. As shown in the chapter, there are several different ways to do this. We will take the 10th root of 2 (by raising 2 to the power of 1/10):

$$2^{1/10} = 1 + r$$
$$1.0718 = 1 + r$$
$$r = .0718, \text{ or } 7.18\%$$

Using the Rule of 72, we have $72/t = r\%$, or $72/10 = .072$, or 7.2%; so, our answer looks good (remember that the Rule of 72 is only an approximation).

5.4 The basic equation is this:

$$\$30{,}000 = \$15{,}000 \times (1 + .09)^t$$
$$2 = (1 + .09)^t$$

If we solve for t, we find that $t = 8.04$ years. Using the Rule of 72, we get $72/9 = 8$ years, so once again our answer looks good. To get $45,000, verify for yourself that you will have to wait 12.75 years.

CONCEPTS REVIEW AND CRITICAL THINKING QUESTIONS

1. **Present Value [LO2]** The basic present value equation has four parts. What are they?
2. **Compounding [LO1, 2]** What is compounding? What is discounting?
3. **Compounding and Periods [LO1, 2]** As you increase the length of time involved, what happens to future values? What happens to present values?
4. **Compounding and Interest Rates [LO1, 2]** What happens to a future value if you increase the rate *r*? What happens to a present value?
5. **Ethical Considerations [LO2]** Take a look back at Example 5.7. Is it deceptive advertising? Is it unethical to advertise a future value like this without a disclaimer?

Use the following information for Questions 6–10:

On March 28, 2008, Toyota Motor Credit Corporation (TMCC), a subsidiary of Toyota Motor, offered some securities for sale to the public. Under the terms of the deal, TMCC promised to repay the owner of one of these securities $100,000 on March 28, 2038, but investors would receive nothing until then. Investors paid TMCC $24,099 for each of these securities; so they gave up $24,099 on March 28, 2008, for the promise of a $100,000 payment 30 years later.

6. **Time Value of Money [LO2]** Why would TMCC be willing to accept such a small amount today ($24,099) in exchange for a promise to repay about four times that amount ($100,000) in the future?
7. **Call Provisions [LO2]** TMCC has the right to buy back the securities on the anniversary date at a price established when the securities were issued (this feature is a term of this particular deal). What impact does this feature have on the desirability of this security as an investment?
8. **Time Value of Money [LO2]** Would you be willing to pay $24,099 today in exchange for $100,000 in 30 years? What would be the key considerations in answering yes or no? Would your answer depend on who is making the promise to repay?
9. **Investment Comparison [LO2]** Suppose that when TMCC offered the security for $24,099, the U.S. Treasury had offered an essentially identical security. Do you think it would have had a higher or lower price? Why?
10. **Length of Investment [LO2]** The TMCC security is bought and sold on the New York Stock Exchange. If you looked at the price today, do you think the price would exceed the $24,099 original price? Why? If you looked in the year 2019, do you think the price would be higher or lower than today's price? Why?

QUESTIONS AND PROBLEMS

BASIC
(Questions 1–14)

1. **Simple Interest versus Compound Interest [LO1]** First City Bank pays 9 percent simple interest on its savings account balances, whereas Second City Bank pays 9 percent interest compounded annually. If you made a deposit of $7,500 in each bank, how much more money would you earn from your Second City Bank account at the end of eight years?
2. **Calculating Future Values [LO1]** For each of the following, compute the future value:

Present Value	Years	Interest Rate	Future Value
$ 2,328	11	13%	
7,513	7	9	
74,381	14	12	
192,050	16	6	

3. **Calculating Present Values [LO2]** For each of the following, compute the present value:

Present Value	Years	Interest Rate	Future Value
	13	9%	$ 16,832
	4	7	48,318
	29	13	886,073
	40	21	550,164

4. **Calculating Interest Rates [LO3]** Solve for the unknown interest rate in each of the following:

Present Value	Years	Interest Rate	Future Value
$ 181	5		$ 317
335	17		1,080
48,000	13		185,382
40,353	30		531,618

5. **Calculating the Number of Periods [LO4]** Solve for the unknown number of years in each of the following:

Present Value	Years	Interest Rate	Future Value
$ 560		7%	$ 1,389
810		8	1,821
18,400		9	289,715
21,500		11	430,258

6. **Calculating Interest Rates [LO3]** Assume the total cost of a college education will be $345,000 when your child enters college in 18 years. You presently have $73,000 to invest. What annual rate of interest must you earn on your investment to cover the cost of your child's college education?
7. **Calculating the Number of Periods [LO4]** At 6.1 percent interest, how long does it take to double your money? To quadruple it?
8. **Calculating Interest Rates [LO3]** According to the Census Bureau, in October 2016, the average house price in the United States was $354,900. In October 2000, the average price was $215,100. What was the annual increase in the price of the average house sold?
9. **Calculating the Number of Periods [LO4]** You're trying to save to buy a new $245,000 Ferrari. You have $50,000 today that can be invested at your bank. The bank pays 4.3 percent annual interest on its accounts. How long will it be before you have enough to buy the car?
10. **Calculating Present Values [LO2]** Imprudential, Inc., has an unfunded pension liability of $415 million that must be paid in 20 years. To assess the value of the firm's stock, financial analysts want to discount this liability back to the present. If the relevant discount rate is 5.2 percent, what is the present value of this liability?

11. Calculating Present Values [LO2] You have just received notification that you have won the $2 million first prize in the Centennial Lottery. However, the prize will be awarded on your 100th birthday (assuming you're around to collect), 80 years from now. What is the present value of your windfall if the appropriate discount rate is 8.4 percent?

12. Calculating Future Values [LO1] Your coin collection contains fifty 1952 silver dollars. If your grandparents purchased them for their face value when they were new, how much will your collection be worth when you retire in 2067, assuming they appreciate at an annual rate of 4.3 percent?

13. Calculating Interest Rates and Future Values [LO1, 3] In 1895, the first U.S. Open Golf Championship was held. The winner's prize money was $150. In 2016, the winner's check was $1,800,000. What was the percentage increase per year in the winner's check over this period? If the winner's prize increases at the same rate, what will it be in 2040?

14. Calculating Rates of Return [LO3] Although appealing to more refined tastes, art as a collectible has not always performed so profitably. During 2003, Sotheby's sold the Edgar Degas bronze sculpture *Petite Danseuse de Quatorze Ans* at auction for a price of $10,311,500. Unfortunately for the previous owner, he had purchased it in 1999 at a price of $12,377,500. What was his annual rate of return on this sculpture?

INTERMEDIATE
(Questions 15–20)

15. Calculating Rates of Return [LO3] The "Brasher doubloon," which was featured in the plot of the Raymond Chandler novel, *The High Window*, was sold at auction in 2014 for $4,582,500. The coin had a face value of $15 when it was first issued in 1787 and had been previously sold for $430,000 in 1979. At what annual rate did the coin appreciate from its minting to the 1979 sale? What annual rate did the 1979 buyer earn on his purchase? At what annual rate did the coin appreciate from its minting to the 2014 sale?

16. Calculating Rates of Return [LO3] Refer back to the Series EE savings bonds we discussed at the very beginning of the chapter.

a. Assuming you purchased a $50 face value bond, what is the exact rate of return you would earn if you held the bond for 20 years until it doubled in value?

b. If you purchased a $50 face value bond in early 2017 at the then current interest rate of .10 percent per year, how much would the bond be worth in 2027?

c. In 2027, instead of cashing the bond in for its then current value, you decide to hold the bond until it doubles in face value in 2037. What rate of return will you earn over the last 10 years?

17. Calculating Present Values [LO2] Suppose you are still committed to owning a $245,000 Ferrari (see Problem 9). If you believe your mutual fund can achieve an annual rate of return of 11.2 percent and you want to buy the car in 9 years (on the day you turn 30), how much must you invest today?

18. Calculating Future Values [LO1] You have just made your first $5,500 contribution to your retirement account. Assuming you earn a return of 10 percent per year and make no additional contributions, what will your account be worth when you retire in 45 years? What if you wait 10 years before contributing? (Does this suggest an investment strategy?)

19. Calculating Future Values [LO1] You are scheduled to receive $20,000 in two years. When you receive it, you will invest it for six more years at 6.8 percent per year. How much will you have in eight years?

20. Calculating the Number of Periods [LO4] You expect to receive $10,000 at graduation in two years. You plan on investing it at 9 percent until you have $60,000. How long will you wait from now?

Discounted Cash Flow Valuation

Chapter 6

THE SIGNING OF BIG-NAME ATHLETES is frequently accompanied by great fanfare, but the numbers are often misleading. For example, in late 2016, catcher Jason Castro reached a deal with the Minnesota Twins, signing a contract with a reported value of $24.5 million. Not bad, especially for someone who makes a living using the "tools of ignorance" (jock jargon for a catcher's equipment). Another example is the contract signed by DeMar DeRozan with the Toronto Raptors, which had a stated value of $139 million.

It looks like Jason and DeMar did pretty well, but now consider Andrew Luck, who signed to play in front of the Indianapolis Colts' fans. Andrew's contract also had a stated value of about $139 million, but this amount was actually payable over several years. The contract consisted of a $6.4 million signing bonus, along with $12 million in salary in the first year plus $120.725 million in future salary to be paid in the years 2017 through 2021. The payments to Jason and DeMar were similarly spread over time.

Because all three contracts call for payments to be made at future dates, we must consider the time value of money, which means none of these players received the quoted amounts. How much did they really get? This chapter gives you the "tools of knowledge" to answer this question.

Learning Objectives

After studying this chapter, you should be able to:

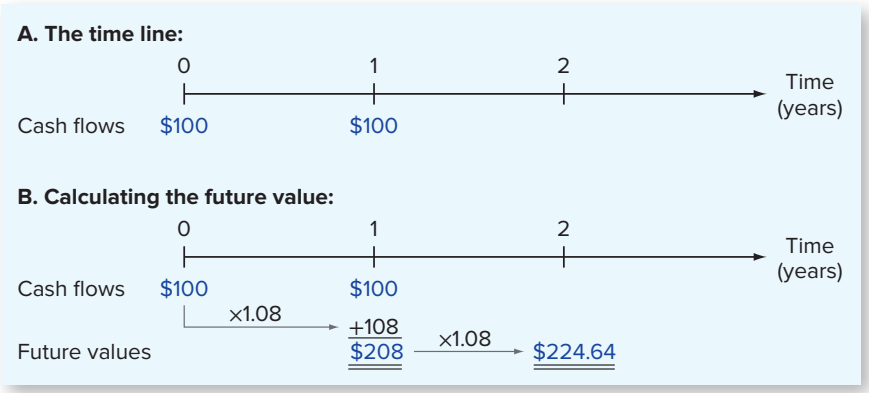
- **LO1** Determine the future and present value of investments with multiple cash flows.
- **LO2** Explain how loan payments are calculated and how to find the interest rate on a loan.
- **LO3** Describe how loans are amortized or paid off.
- **LO4** Show how interest rates are quoted (and misquoted).

For updates on the latest happenings in finance, visit fundamentalsofcorporatefinance.blogspot.com.

In our previous chapter, we covered the basics of discounted cash flow valuation. However, so far, we have dealt with only single cash flows. In reality, most investments have multiple cash flows. For example, if Target is thinking of opening a new department store, there will be a large cash outlay in the beginning and then cash inflows for many years. In this chapter, we begin to explore how to value such investments.

When you finish this chapter, you should have some very practical skills. For example, you will know how to calculate your own car payments or student loan payments. You will also be able to determine how long it will take to pay off a credit card if you make the minimum payment each month (a practice we do not recommend). We will show you how to compare interest rates to determine which are the highest and which are the lowest, and we will also show you how interest rates can be quoted in different—and at times deceptive—ways.

FIGURE 6.1
Drawing and Using a Time Line



6.1 Future and Present Values of Multiple Cash Flows

Excel Master It!
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Thus far, we have restricted our attention to either the future value of a lump sum present amount or the present value of some single future cash flow. In this section, we begin to study ways to value multiple cash flows. We start with future value.

FUTURE VALUE WITH MULTIPLE CASH FLOWS

Suppose you deposit $100 today in an account paying 8 percent interest. In one year, you will deposit another $100. How much will you have in two years? This particular problem is relatively easy. At the end of the first year, you will have $108 plus the second $100 you deposit, for a total of $208. You leave this $208 on deposit at 8 percent for another year. At the end of this second year, it is worth:

$$\$208 \times 1.08 = \$224.64$$

Figure 6.1 is a *time line* that illustrates the process of calculating the future value of these two $100 deposits. Figures such as this are useful for solving complicated problems. Almost anytime you are having trouble with a present or future value problem, drawing a time line will help you see what is happening.

In the first part of Figure 6.1, we show the cash flows on the time line. The most important thing is that we write them down where they actually occur. Here, the first cash flow occurs today, which we label as Time 0. We therefore put $100 at Time 0 on the time line. The second $100 cash flow occurs one year from today, so we write it down at the point labeled as Time 1. In the second part of Figure 6.1, we calculate the future values one period at a time to come up with the final $224.64.

EXAMPLE 6.1 Saving Up Revisited

You think you will be able to deposit $4,000 at the end of each of the next three years in a bank account paying 8 percent interest. You currently have $7,000 in the account. How much will you have in three years? In four years?

At the end of the first year, you will have:

$$\$7{,}000 \times 1.08 + 4{,}000 = \$11{,}560$$

At the end of the second year, you will have:

$$\$11,560 \times 1.08 + 4,000 = \$16,484.80$$

Repeating this for the third year gives:

$$\$16,484.80 \times 1.08 + 4,000 = \$21,803.58$$

Therefore, you will have $21,803.58 in three years. If you leave this on deposit for one more year (and don't add to it), at the end of the fourth year, you'll have:

$$\$21,803.58 \times 1.08 = \$23,547.87$$

When we calculated the future value of the two $100 deposits, we calculated the balance as of the beginning of each year and then rolled that amount forward to the next year. We could have done it another, quicker way. The first $100 is on deposit for two years at 8 percent, so its future value is:

$$\$100 \times 1.08^2 = \$100 \times 1.1664 = \$116.64$$

The second $100 is on deposit for one year at 8 percent, and its future value is thus:

$$\$100 \times 1.08 = \$108$$

The total future value, as we previously calculated, is equal to the sum of these two future values:

$$\$116.64 + 108 = \$224.64$$

Based on this example, there are two ways to calculate future values for multiple cash flows: (1) Compound the accumulated balance forward one year at a time or (2) calculate the future value of each cash flow first and then add them up. Both give the same answer, so you can do it either way.

To illustrate the two different ways of calculating future values, consider the future value of $2,000 invested at the end of each of the next five years. The current balance is zero, and the rate is 10 percent. We first draw a time line, as shown in Figure 6.2.

On the time line, notice that nothing happens until the end of the first year, when we make the first $2,000 investment. This first $2,000 earns interest for the next four (not five) years. Also notice that the last $2,000 is invested at the end of the fifth year, so it earns no interest at all.

Figure 6.3 illustrates the calculations involved if we compound the investment one period at a time. As illustrated, the future value is $12,210.20.

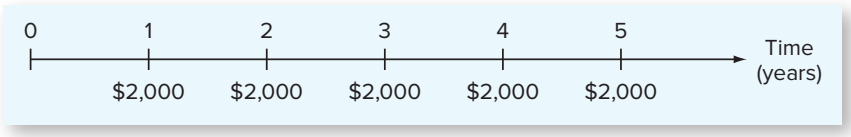


FIGURE 6.2
Time Line for $2,000 per Year for Five Years

FIGURE 6.3 **Future Value Calculated by Compounding Forward One Period at a Time**

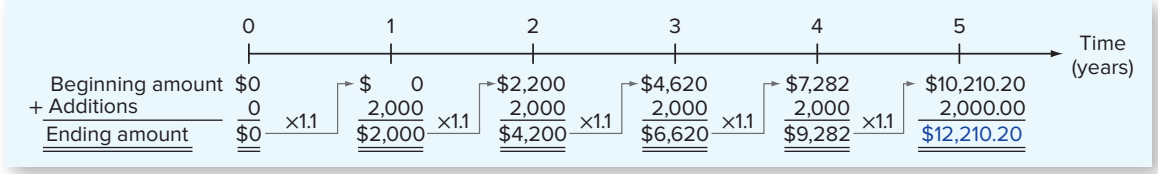


FIGURE 6.4 Future Value Calculated by Compounding Each Cash Flow Separately

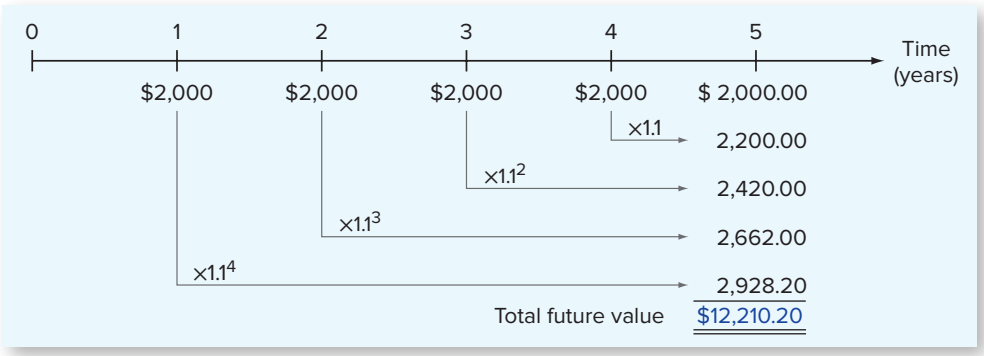


Figure 6.4 goes through the same calculations, but the second technique is used. Naturally, the answer is the same.

EXAMPLE 6.2 Saving Up Once Again

If you deposit $100 in one year, $200 in two years, and $300 in three years, how much will you have in three years? How much of this is interest? How much will you have in five years if you don't add additional amounts? Assume a 7 percent interest rate throughout.

We will calculate the future value of each amount in three years. Notice that the $100 earns interest for two years, and the $200 earns interest for one year. The final $300 earns no interest. The future values are thus:

$$\begin{aligned} \$100 \times 1.07^2 &= \$114.49 \\ \$200 \times 1.07 &= 214.00 \\ +\$300 &= 300.00 \\ \text{Total future value} &= \$628.49 \end{aligned}$$

The total future value is thus $628.49. The total interest is:

$$\$628.49 - (100 + 200 + 300) = \$28.49$$

How much will you have in five years? We know that you will have $628.49 in three years. If you leave that in for two more years, it will grow to:

$$\$628.49 \times 1.07^2 = \$628.49 \times 1.1449 = \$719.56$$

Notice that we could have calculated the future value of each amount separately. Once again, be careful about the lengths of time. As we previously calculated, the first $100 earns interest for only four years, the second ($200) deposit earns three years' interest, and the last ($300) deposit earns two years' interest:

$$\begin{aligned} \$100 \times 1.07^4 &= \$100 \times 1.3108 = \$131.08 \\ \$200 \times 1.07^3 &= \$200 \times 1.2250 = 245.01 \\ +\$300 \times 1.07^2 &= \$300 \times 1.1449 = 343.47 \\ \text{Total future value} &= \$719.56 \end{aligned}$$

PRESENT VALUE WITH MULTIPLE CASH FLOWS

We often need to determine the present value of a series of future cash flows. As with future values, there are two ways we can do it. We can either discount back one period at a time, or we can calculate the present values individually and add them up.

Suppose you need $1,000 in one year and $2,000 more in two years. If you can earn 9 percent on your money, how much do you have to put up today to exactly cover these amounts in the future? In other words, what is the present value of the two cash flows at 9 percent?

The present value of $2,000 in two years at 9 percent is:

$$\$2{,}000/1.09^2 = \$1{,}683.36$$

The present value of $1,000 in one year at 9 percent is:

$$\$1{,}000/1.09 = \$917.43$$

Therefore, the total present value is:

$$\$1{,}683.36 + 917.43 = \$2{,}600.79$$

To see why $2,600.79 is the right answer, we can check to see that after the $2,000 is paid out in two years, there is no money left. If we invest $2,600.79 for one year at 9 percent, we will have:

$$\$2{,}600.79 \times 1.09 = \$2{,}834.86$$

We take out $1,000, leaving $1,834.86. This amount earns 9 percent for another year, leaving us with:

$$\$1{,}834.86 \times 1.09 = \$2{,}000$$

This is just as we planned. As this example illustrates, the present value of a series of future cash flows is the amount you would need today to exactly duplicate those future cash flows (for a given discount rate).

An alternative way of calculating present values for multiple future cash flows is to discount back to the present, one period at a time. To illustrate, suppose we had an investment that was going to pay $1,000 at the end of every year for the next five years. To find the present value, we could discount each $1,000 back to the present separately and then add them up. Figure 6.5 illustrates this approach for a 6 percent discount rate; as shown, the answer is $4,212.37 (ignoring a small rounding error).

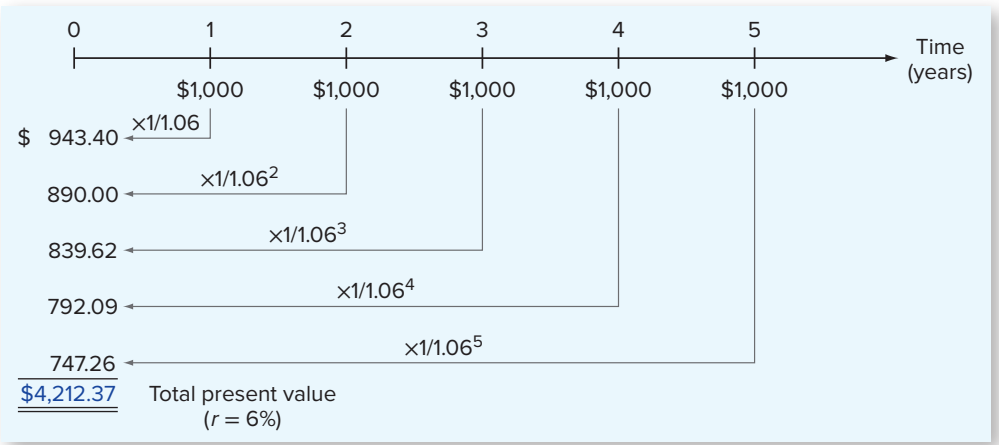
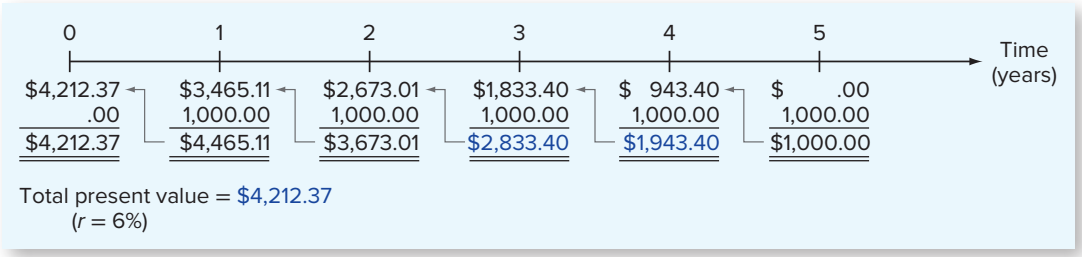


FIGURE 6.5
Present Value Calculated by Discounting Each Cash Flow Separately

FIGURE 6.6 Present Value Calculated by Discounting Back One Period at a Time



Alternatively, we could discount the last cash flow back one period and add it to the next-to-the-last cash flow:

($1,000/1.06) + 1,000 = $943.40 + 1,000 = $1,943.40

We could then discount this amount back one period and add it to the Year 3 cash flow:

($1,943.40/1.06) + 1,000 = $1,833.40 + 1,000 = $2,833.40

This process could be repeated as necessary. Figure 6.6 illustrates this approach and the remaining calculations.

EXAMPLE 6.3 How Much Is It Worth?

You are offered an investment that will pay you $200 in one year, $400 the next year, $600 the next year, and $800 at the end of the fourth year. You can earn 12 percent on very similar investments. What is the most you should pay for this one?

We need to calculate the present value of these cash flows at 12 percent. Taking them one at a time gives:

$$
\begin{aligned}
\$200 \times 1/1.12^1 = \$200/1.1200 &= \$\ \ 178.57 \\
\$400 \times 1/1.12^2 = \$400/1.2544 &= \ \ \ 318.88 \\
\$600 \times 1/1.12^3 = \$600/1.4049 &= \ \ \ 427.07 \\
+\$800 \times 1/1.12^4 = \$800/1.5735 &= \ \ \ 508.41 \\
\text{Total present value} &= \$1{,}432.93
\end{aligned}
$$

If you can earn 12 percent on your money, then you can duplicate this investment's cash flows for $1,432.93, so this is the most you should be willing to pay.

EXAMPLE 6.4 How Much Is It Worth? Part 2

You are offered an investment that will make three $5,000 payments. The first payment will occur four years from today. The second will occur in five years, and the third will follow in six years. If you can earn 11 percent, what is the most this investment is worth today? What is the future value of the cash flows?

We will answer the questions in reverse order to illustrate a point. The future value of the cash flows in six years is:

$$
\begin{aligned}
(\$5{,}000 \times 1.11^2) + (5{,}000 \times 1.11) + 5{,}000 &= \$6{,}160.50 + 5{,}550 + 5{,}000 \\
&= \$16{,}710.50
\end{aligned}
$$

The present value must be:

$\$16{,}710.50/1.11^6 = \$8{,}934.12$

Let's check this. Taking them one at a time, the PVs of the cash flows are:

$$\begin{aligned}
\$5{,}000 \times 1/1.11^6 = \$5{,}000/1.8704 &= \$2{,}673.20 \\
\$5{,}000 \times 1/1.11^5 = \$5{,}000/1.6851 &= 2{,}967.26 \\
+\$5{,}000 \times 1/1.11^4 = \$5{,}000/1.5181 &= 3{,}293.65 \\
\text{Total present value} &= \$8{,}934.12
\end{aligned}$$

This is as we previously calculated. The point we want to make is that we can calculate present and future values in any order and convert between them using whatever way seems most convenient. The answers will always be the same as long as we stick with the same discount rate and are careful to keep track of the right number of periods.

CALCULATOR HINTS

How to Calculate Present Values with Multiple Future Cash Flows Using a Financial Calculator

To calculate the present value of multiple cash flows with a financial calculator, we will discount the individual cash flows one at a time using the same technique we used in our previous chapter, so this is not really new. However, we can show you a shortcut. We will use the numbers in Example 6.3 to illustrate.

To begin, of course, we first remember to clear out the calculator! Next, from Example 6.3, the first cash flow is $200 to be received in one year and the discount rate is 12 percent, so we do the following:

	N	I/Y	PMT	PV	FV
Enter	1	12			200
Solve for				−178.57	

Now, you can write down this answer to save it, but that's inefficient. All calculators have a memory where you can store numbers. Why not just save it there? Doing so cuts down on mistakes because you don't have to write down and/or rekey numbers, and it's much faster.

Next, we value the second cash flow. We need to change N to 2 and FV to 400. As long as we haven't changed anything else, we don't have to reenter I/Y or clear out the calculator, so we have:

	N	I/Y	PMT	PV	FV
Enter	2				400
Solve for				−318.88	

You save this number by adding it to the one you saved in your first calculation, and so on for the remaining two calculations.

As we will see in a later chapter, some financial calculators will let you enter all of the future cash flows at once, but we'll discuss that subject when we get to it.

SPREADSHEET STRATEGIES

How to Calculate Present Values with Multiple Future Cash Flows Using a Spreadsheet

Just as we did in our previous chapter, we can set up a basic spreadsheet to calculate the present values of the individual cash flows as follows. Notice that we have calculated the present values one at a time and added them up:

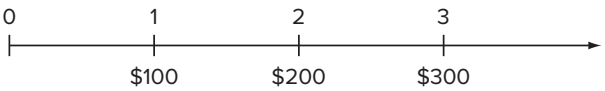
	A	B	C	D	E
1					
2	**Using a spreadsheet to value multiple future cash flows**				
3					
4	What is the present value of $200 in one year, $400 the next year, $600 the next year, and				
5	$800 the last year if the discount rate is 12 percent?				
6					
7	Rate:	.12			
8					
9	Year	Cash flows	Present values	Formula used	
10	1	$200	$178.57	=PV($B$7,A10,0,−B10)	
11	2	$400	$318.88	=PV($B$7,A11,0,−B11)	
12	3	$600	$427.07	=PV($B$7,A12,0,−B12)	
13	4	$800	$508.41	=PV($B$7,A13,0,−B13)	
14					
15		Total PV:	**$1,432.93**	=SUM(C10:C13)	
16					
17	Notice the negative signs inserted in the PV formulas. These just make the present values have				
18	positive signs. Also, the discount rate in cell B7 is entered as $B$7 (an "absolute" reference)				
19	because it is used over and over. We could have just entered ".12" instead, but our approach is				
20	more flexible.				
21					
22					

SOURCE: Microsoft Excel

A NOTE ABOUT CASH FLOW TIMING

In working present and future value problems, cash flow timing is critically important. In almost all such calculations, it is implicitly assumed that the cash flows occur at the *end* of each period. In fact, all the formulas we have discussed, all the numbers in a standard present value or future value table, and (very important) all the preset (or default) settings on a financial calculator assume that cash flows occur at the end of each period. Unless you are explicitly told otherwise, you should always assume that this is what is meant.

As a quick illustration of this point, suppose you are told that a three-year investment has a first-year cash flow of $100, a second-year cash flow of $200, and a third-year cash flow of $300. You are asked to draw a time line. Without further information, you should always assume that the time line looks like this:



On our time line, notice how the first cash flow occurs at the end of the first period, the second at the end of the second period, and the third at the end of the third period.

We will close this section by answering the question we posed at the beginning of the chapter concerning quarterback Andrew Luck's contract. Recall that the contract called for a $6.4 million signing bonus and $12 million in salary in 2016. The remaining $120.725 million was to be paid as $19.4 million in 2017, $24.4 million in 2018, $27.525 million

in 2019, $28.4 million in 2020, and $21 million in 2021. If 12 percent is the appropriate discount rate, how much money was really thrown at the Colts' quarterback?

To answer, we can calculate the present value by discounting each year's salary back to the present as follows (notice we assume that all the payments are made at year-end):

$$\begin{aligned}
&\text{Year 0 (2016): } \$18{,}400{,}000 && = \$18{,}400{,}000.00\\
&\text{Year 1 (2017): } \$19{,}400{,}000 \times 1 / 1.12^{1} && = \$17{,}321{,}428.57\\
&\text{Year 2 (2018): } \$24{,}400{,}000 \times 1 / 1.12^{2} && = \$19{,}451{,}530.61\\
&\ldots\\
&\ldots\\
&\text{Year 5 (2021): } \$\ 21{,}000{,}000 \times 1 / 1.12^{5} && = \$11{,}915{,}963.97
\end{aligned}$$

If you fill in the missing rows and then add (do it for practice), you will see that Andrew's contract had a present value of $104.7 million, or about 75 percent of the stated $139.125 million value.

Concept Questions

6.1a Describe how to calculate the future value of a series of cash flows.

6.1b Describe how to calculate the present value of a series of cash flows.

6.1c Unless we are explicitly told otherwise, what do we always assume about the timing of cash flows in present and future value problems?

6.2 Valuing Level Cash Flows: Annuities and Perpetuities

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We will frequently encounter situations in which we have multiple cash flows that are all the same amount. For example, a common type of loan repayment plan calls for the borrower to repay the loan by making a series of equal payments over some length of time. Almost all consumer loans (such as car loans) and home mortgages feature equal payments, usually made each month.

More generally, a series of constant or level cash flows that occur at the end of each period for some fixed number of periods is called an ordinary **annuity**; more correctly, the cash flows are said to be in *ordinary annuity form*. Annuities appear frequently in financial arrangements, and there are some useful shortcuts for determining their values. We consider these next.

annuity
A level stream of cash flows for a fixed period of time.

PRESENT VALUE FOR ANNUITY CASH FLOWS

Suppose we were examining an asset that promised to pay $500 at the end of each of the next three years. The cash flows from this asset are in the form of a three-year, $500 annuity. If we wanted to earn 10 percent on our money, how much would we offer for this annuity?

From the previous section, we know that we can discount each of these $500 payments back to the present at 10 percent to determine the total present value:

$$\begin{aligned}
\text{Present value} &= (\$500/1.1^{1}) + (500/1.1^{2}) + (500/1.1^{3})\\
&= (\$500/1.1) + (500/1.21) + (500/1.331)\\
&= \$454.55 + 413.22 + 375.66\\
&= \$1{,}243.43
\end{aligned}$$

This approach works just fine. However, we will often encounter situations in which the number of cash flows is quite large. For example, a typical home mortgage calls for monthly payments over 30 years, for a total of 360 payments. If we were trying to determine the present value of those payments, it would be useful to have a shortcut.

Because the cash flows of an annuity are all the same, we can come up with a handy variation on the basic present value equation. The present value of an annuity of C dollars per period for t periods when the rate of return or interest rate is r is given by:

$$\text{Annuity present value} = C \times \left(\frac{1 - \text{Present value factor}}{r}\right) \qquad 6.1$$

$$= C \times \left\{\frac{1 - [1/(1 + r)^t]}{r}\right\}$$

The term in parentheses on the first line is sometimes called the *present value interest factor for annuities* and abbreviated PVIFA(r, t).

The expression for the annuity present value may look a little complicated, but it isn't difficult to use. Notice that the term in square brackets on the second line, $1/(1 + r)^t$, is the same present value factor we've been calculating. In our example from the beginning of this section, the interest rate is 10 percent and there are three years involved. The usual present value factor is:

$$\text{Present value factor} = 1/1.1^3 = 1/1.331 = .751315$$

To calculate the annuity present value factor, we just plug this in:

$$\begin{aligned}\text{Annuity present value factor} &= (1 - \text{Present value factor})/r \\ &= (1 - .751315)/.10 \\ &= .248685/.10 = 2.48685\end{aligned}$$

As we calculated before, the present value of our $500 annuity is therefore:

$$\text{Annuity present value} = \$500 \times 2.48685 = \$1{,}243.43$$

EXAMPLE 6.5 How Much Can You Afford?

After carefully going over your budget, you have determined you can afford to pay $632 per month toward a new sports car. You call your local bank and find out that the going rate is 1 percent per month for 48 months. How much can you borrow?

To determine how much you can borrow, we need to calculate the present value of $632 per month for 48 months at 1 percent per month. The loan payments are in ordinary annuity form, so the annuity present value factor is:

$$\begin{aligned}\text{Annuity PV factor} &= (1 - \text{Present value factor})/r \\ &= [1 - (1/1.01^{48})]/.01 \\ &= (1 - .6203)/.01 = 37.9740\end{aligned}$$

With this factor, we can calculate the present value of the 48 payments of $632 each as:

$$\text{Present value} = \$632 \times 37.9740 = \$24{,}000$$

Therefore, $24,000 is what you can afford to borrow and repay.

Annuity Tables Just as there are tables for ordinary present value factors, there are tables for annuity factors as well. Table 6.1 contains a few such factors; Table A.3 in the appendix to the book contains a larger set. To find the annuity present value factor we calculated just before Example 6.5, look for the row corresponding to three periods and then find the column for 10 percent. The number you see at that intersection should be 2.4869 (rounded to four decimal places), as we calculated. Once again, try calculating a few of

TABLE 6.1
Annuity Present Value Interest Factors

	Interest Rate			
Number of Periods	5%	10%	15%	20%
1	.9524	.9091	.8696	.8333
2	1.8594	1.7355	1.6257	1.5278
3	2.7232	2.4869	2.2832	2.1065
4	3.5460	3.1699	2.8550	2.5887
5	4.3295	3.7908	3.3522	2.9906

these factors yourself and compare your answers to the ones in the table to make sure you know how to do it. If you are using a financial calculator, just enter $1 as the payment and calculate the present value; the result should be the annuity present value factor.

CALCULATOR HINTS

Annuity Present Values

To find annuity present values with a financial calculator, we need to use the **PMT** key (you were probably wondering what it was for). Compared to finding the present value of a single amount, there are two important differences. First, we enter the annuity cash flow using the **PMT** key. Second, we don't enter anything for the future value, **FV**. So, for example, the problem we have been examining is a three-year, $500 annuity. If the discount rate is 10 percent, we need to do the following (after clearing out the calculator!):

Enter	3	10	500		
	N	**I/Y**	**PMT**	**PV**	**FV**
Solve for				−1,243.43	

As usual, we get a negative sign on the PV.

SPREADSHEET STRATEGIES

Annuity Present Values

Using a spreadsheet to find annuity present values goes like this:

	A	B	C	D	E	F	G
1							
2	**Using a spreadsheet to find annuity present values**						
3							
4	What is the present value of $500 per year for three years if the discount rate is 10 percent?						
5	We need to solve for the unknown present value, so we use the formula PV(rate,nper,pmt,fv).						
6							
7	Payment amount per period:	$500					
8	Number of payments:	3					
9	Discount rate:	.1					
10							
11	Annuity present value:	**$1,243.43**					
12							
13	The formula entered in cell B11 is =PV(B9,B8,-B7,0); notice that fv is zero and that						
14	pmt has a negative sign on it. Also notice that rate is entered as a decimal, not a percentage.						
15							
16							
17							

SOURCE: Microsoft Excel

Finding the Payment Suppose you wish to start up a new business that specializes in the latest of health food trends, frozen yak milk. To produce and market your product, the Yakkee Doodle Dandy, you need to borrow $100,000. Because it strikes you as unlikely that this particular fad will be long-lived, you propose to pay off the loan quickly by making five equal annual payments. If the interest rate is 18 percent, what will the payment be?

In this case, we know the present value is $100,000. The interest rate is 18 percent, and there are five years. The payments are all equal, so we need to find the relevant annuity factor and solve for the unknown cash flow:

$$\begin{aligned}\text{Annuity present value} = \$100{,}000 &= C \times [(1 - \text{Present value factor})/r] \\ &= C \times \{[1 - (1/1.18^5)]/.18\} \\ &= C \times [(1 - .4371)/.18] \\ &= C \times 3.1272 \\ C &= \$100{,}000/3.1272 = \$31{,}977.78\end{aligned}$$

Therefore, you'll make five payments of just under $32,000 each.

CALCULATOR HINTS

Annuity Payments

Finding annuity payments is easy with a financial calculator. In our yak milk example, the PV is $100,000, the interest rate is 18 percent, and there are five years. We find the payment as follows:

	N	I/Y	PMT	PV	FV
Enter	5	18		100,000	
Solve for			−31,977.78		

Here, we get a negative sign on the payment because the payment is an outflow for us.

SPREADSHEET STRATEGIES

Annuity Payments

Using a spreadsheet to work the same problem goes like this:

	A	B	C	D	E	F	G
1							
2	**Using a spreadsheet to find annuity payments**						
3							
4	What is the annuity payment if the present value is $100,000, the interest rate is 18 percent, and						
5	there are five periods? We need to solve for the unknown payment in an annuity, so we use the						
6	formula PMT(rate,nper,pv,fv).						
7							
8	Annuity present value:	$100,000					
9	Number of payments:	5					
10	Discount rate:	.18					
11							
12	Annuity payment:	**-$31,977.78**					
13							
14	The formula entered in cell B12 is =PMT(B10,B9,B8,0); notice that fv is zero and that the payment						
15	has a negative sign because it is an outflow for us.						
16							

SOURCE: Microsoft Excel

Finding the Number of Payments — EXAMPLE 6.6

You ran a little short on your spring break vacation, so you put $1,000 on your credit card. You can afford only the minimum payment of $20 per month. The interest rate on the credit card is 1.5 percent per month. How long will you need to pay off the $1,000?

What we have here is an annuity of $20 per month at 1.5 percent per month for some unknown length of time. The present value is $1,000 (the amount you owe today). We need to do a little algebra (or use a financial calculator):

$$\$1{,}000 = \$20 \times [(1 - \text{Present value factor})/.015]$$
$$(\$1{,}000/20) \times .015 = 1 - \text{Present value factor}$$
$$\text{Present value factor} = .25 = 1/(1 + r)^t$$
$$1.015^t = 1/.25 = 4$$

At this point, the problem boils down to asking: How long does it take for your money to quadruple at 1.5 percent per month? Based on our previous chapter, the answer is about 93 months:

$$1.015^{93} = 3.99 \approx 4$$

It will take you about 93/12 = 7.75 years to pay off the $1,000 at this rate. If you use a financial calculator for problems like this, you should be aware that some automatically round up to the next whole period.

CALCULATOR HINTS

Finding the Number of Payments

To solve Example 6.6 on a financial calculator, do the following:

Enter		1.5	−20	1,000	
	N	**I/Y**	**PMT**	**PV**	**FV**
Solve for	93.11				

Notice that we put a negative sign on the payment you must make, and we have solved for the number of months. You still have to divide by 12 to get our answer. Also, some financial calculators won't report a fractional value for N; they automatically (without telling you) round up to the next whole period (not to the nearest value). With a spreadsheet, use the function =NPER(rate,pmt,pv,fv); be sure to put in a zero for fv and to enter −20 as the payment.

Finding the Rate The last question we might want to ask concerns the interest rate implicit in an annuity. For example, an insurance company offers to pay you $1,000 per year for 10 years if you will pay $6,710 up front. What rate is implicit in this 10-year annuity?

In this case, we know the present value ($6,710), we know the cash flows ($1,000 per year), and we know the life of the investment (10 years). What we don't know is the discount rate:

$$\$6{,}710 = \$1{,}000 \times [(1 - \text{Present value factor})/r]$$
$$\$6{,}710/\$1{,}000 = 6.71 = \{1 - [1/(1 + r)^{10}]\}/r$$

So, the annuity factor for 10 periods is equal to 6.71, and we need to solve this equation for the unknown value of r. Unfortunately, this is mathematically impossible to do directly. The only way to do it is to use a table or trial and error to find a value for r.

If you look across the row corresponding to 10 periods in Table A.3, you will see a factor of 6.7101 for 8 percent, so we see right away that the insurance company is offering just about 8 percent. Alternatively, we could start trying different values until we got very close to the answer. Using this trial-and-error approach can be a little tedious, but fortunately machines are good at that sort of thing.[1]

To illustrate how to find the answer by trial and error, suppose a relative of yours wants to borrow $3,000. She offers to repay you $1,000 every year for four years. What interest rate are you being offered?

The cash flows here have the form of a four-year, $1,000 annuity. The present value is $3,000. We need to find the discount rate, *r*. Our goal in doing so is primarily to give you a feel for the relationship between annuity values and discount rates.

We need to start somewhere, and 10 percent is probably as good a place as any to begin. At 10 percent, the annuity factor is:

$$\text{Annuity present value factor} = [1 - (1/1.10^4)]/.10 = 3.1699$$

The present value of the cash flows at 10 percent is thus:

$$\text{Present value} = \$1{,}000 \times 3.1699 = \$3{,}169.90$$

You can see that we're already in the right ballpark.

Is 10 percent too high or too low? Recall that present values and discount rates move in opposite directions: Increasing the discount rate lowers the PV and vice versa. Our present value here is too high, so the discount rate is too low. If we try 12 percent, we're almost there:

$$\text{Present value} = \$1{,}000 \times \{[1 - (1/1.12^4)]/.12\} = \$3{,}037.35$$

We are still a little low on the discount rate (because the PV is a little high), so we'll try 13 percent:

$$\text{Present value} = \$1{,}000 \times \{[1 - (1/1.13^4)]/.13\} = \$2{,}974.47$$

This is less than $3,000, so we now know that the answer is between 12 percent and 13 percent, and it looks to be about 12.5 percent. For practice, work at it for a while longer and see if you find that the answer is about 12.59 percent.

CALCULATOR HINTS

Finding the Rate

Alternatively, you could use a financial calculator to do the following:

Enter	4		1,000	−3,000	
	N	**I/Y**	**PMT**	**PV**	**FV**
Solve for		12.59			

Notice that we put a negative sign on the present value (why?). With a spreadsheet, use the function =RATE(nper,pmt,pv,fv); be sure to put in a zero for fv and to enter 1,000 as the payment and −3,000 as the pv.

To illustrate a situation in which finding the unknown rate can be useful, let us consider that the Tri-State Megabucks lottery in Maine, Vermont, and New Hampshire offers you a choice of how to take your winnings (most lotteries do this). In a recent drawing, participants were offered the option of receiving a lump sum payment of $250,000 or an annuity

[1] Financial calculators rely on trial and error to find the answer. That's why they sometimes appear to be "thinking" before coming up with the answer. Actually, it is possible to directly solve for *r* if there are fewer than five periods, but it's usually not worth the trouble.

of $500,000 to be received in equal installments over a 25-year period. (At the time, the lump sum payment was always half the annuity option.) Which option was better?

To answer, suppose you were to compare $250,000 today to an annuity of $500,000/25 = $20,000 per year for 25 years. At what rate do these have the same value? This is the same type of problem we've been looking at; we need to find the unknown rate, *r*, for a present value of $250,000, a $20,000 payment, and a 25-year period. If you grind through the calculations (or get a little machine assistance), you should find that the unknown rate is about 6.24 percent. You should take the annuity option if that rate is attractive relative to other investments available to you. Notice that we have ignored taxes in this example, and taxes can significantly affect our conclusion. Be sure to consult your tax adviser anytime you win the lottery.

In another example, in early 2014, Warren Buffett and Dan Gilbert, founder of Quicken Loans, teamed up to offer $1 billion to anyone who could correctly predict a perfect NCAA March Madness bracket. The odds of winning: 1 in 9.2 quintillion! Of course, you wouldn't receive the $1 billion today, but rather $25 million per year for 40 years, or a lump sum of $500 million. See if you don't agree that the rate of return on this arrangement is 3.93 percent. Unfortunately, this was a one-time event, as legal and financial disagreements squashed the challenge.

FUTURE VALUE FOR ANNUITIES

On occasion, it's also handy to know a shortcut for calculating the future value of an annuity. As you might guess, there are future value factors for annuities as well as present value factors. In general, here is the future value factor for an annuity:

6.2

$$\text{Annuity FV factor} = (\text{Future value factor} - 1)/r$$
$$= [(1 + r)^t - 1]/r$$

To see how we use annuity future value factors, suppose you plan to contribute $2,000 every year to a retirement account paying 8 percent. If you retire in 30 years, how much will you have?

The number of years here, *t*, is 30, and the interest rate, *r*, is 8 percent; so we can calculate the annuity future value factor as:

$$\begin{aligned}\text{Annuity FV factor} &= (\text{Future value factor} - 1)/r \\ &= (1.08^{30} - 1)/.08 \\ &= (10.0627 - 1)/.08 \\ &= 113.2832\end{aligned}$$

The future value of this 30-year, $2,000 annuity is thus:

$$\begin{aligned}\text{Annuity future value} &= \$2{,}000 \times 113.28 \\ &= \$226{,}566.42\end{aligned}$$

CALCULATOR HINTS

Future Values of Annuities

Of course, you could solve this problem using a financial calculator by doing the following:

	N	I/Y	PMT	PV	FV
Enter	30	8	−2,000		
Solve for					226,566.42

Notice that we put a negative sign on the payment (why?). With a spreadsheet, use the function =FV(rate,nper, pmt,pv); be sure to put in a zero for pv and to enter −2,000 as the payment.

Sometimes we need to find the unknown rate, r, in the context of an annuity future value. For example, if you had invested $100 per month in stocks over the 25-year period ended December 1978, your investment would have grown to $76,374. This period had the *worst* stretch of stock returns of any 25-year period between 1925 and 2016. How bad was it?

Here we have the cash flows ($100 per month), the *future* value ($76,374), and the time period (25 years, or 300 months). We need to find the implicit rate, r:

$$\$76{,}374 = \$100 \times [(\text{Future value factor} - 1)/r]$$
$$\$763.74 = [(1 + r)^{300} - 1]/r$$

Because this is the worst period, let's try 1 percent:

$$\text{Annuity future value factor} = (1.01^{300} - 1)/.01 = 1{,}878.85$$

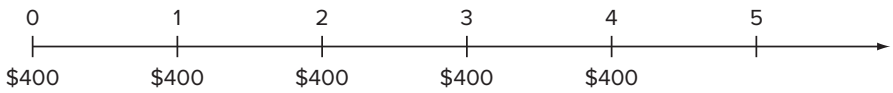
We see that 1 percent is too high. From here, it's trial and error. See if you agree that r is about .55 percent per month. As you will see later in the chapter, this works out to be about 6.8 percent per year.

A NOTE ABOUT ANNUITIES DUE

So far we have only discussed ordinary annuities. These are the most important, but there is a fairly common variation. Remember that with an ordinary annuity, the cash flows occur at the end of each period. When you take out a loan with monthly payments, for example, the first loan payment normally occurs one month after you get the loan. However, when you lease an apartment, the first lease payment is usually due immediately. The second payment is due at the beginning of the second month, and so on. A lease is an example of an **annuity due**. An annuity due is an annuity for which the cash flows occur at the beginning of each period. Almost any type of arrangement in which we have to prepay the same amount each period is an annuity due.

annuity due
An annuity for which the cash flows occur at the beginning of the period.

There are several different ways to calculate the value of an annuity due. With a financial calculator, you switch it into "due" or "beginning" mode. (Remember to switch it back when you are done!) Another way to calculate the present value of an annuity due can be illustrated with a time line. Suppose an annuity due has five payments of $400 each, and the relevant discount rate is 10 percent. The time line looks like this:



Notice how the cash flows here are the same as those for a *four*-year ordinary annuity, except that there is an extra $400 at Time 0. For practice, check to see that the value of a four-year ordinary annuity at 10 percent is $1,267.95. If we add on the extra $400, we get $1,667.95, which is the present value of this annuity due.

Time value applications abound on the web. See, for example, **www.collegeboard.org** and **personal.fidelity.com**.

There is an even easier way to calculate the present or future value of an annuity due. If we assume cash flows occur at the end of each period when they really occur at the beginning, then we discount each one by one period too many. We could fix this by multiplying our answer by $(1 + r)$, where r is the discount rate. In fact, the relationship between the value of an annuity due and an ordinary annuity is:

Annuity due value = Ordinary annuity value × (1 + *r*) 6.3

This works for both present and future values, so calculating the value of an annuity due involves two steps: (1) Calculate the present or future value as though it were an ordinary annuity and (2) multiply your answer by $(1 + r)$.

TABLE 6.2

Summary of Annuity and Perpetuity Calculations

I.	**Symbols:**
	PV = Present value, what future cash flows are worth today
	FV_t = Future value, what cash flows are worth in the future
	r = Interest rate, rate of return, or discount rate per period—typically, but not always, one year
	t = Number of periods—typically, but not always, the number of years
	C = Cash amount
II.	**Future Value of *C* per Period for *t* Periods at *r* Percent per Period:**
	$FV_t = C \times \{[(1 + r)^t - 1]/r\}$
	A series of identical cash flows is called an *annuity*, and the term $[(1 + r)^t - 1]/r$ is called the *annuity future value factor*.
III.	**Present Value of *C* per Period for *t* Periods at *r* Percent per Period:**
	$PV = C \times \{1 - [1/(1 + r)^t]\}/r$
	The term $\{1 - [1/(1 + r)^t]\}/r$ is called the *annuity present value factor.*
IV.	**Present Value of a Perpetuity of *C* per Period:**
	$PV = C/r$
	A *perpetuity* has the same cash flow every year forever.

PERPETUITIES

We've seen that a series of level cash flows can be valued by treating those cash flows as an annuity. An important special case of an annuity arises when the level stream of cash flows continues forever. Such an asset is called a **perpetuity** because the cash flows are perpetual. Perpetuities are also called **consols**, particularly in Canada and the United Kingdom. See Example 6.7 for an important example of a perpetuity.

perpetuity
An annuity in which the cash flows continue forever.

consol
A type of perpetuity.

Because a perpetuity has an infinite number of cash flows, we obviously can't compute its value by discounting each one. Fortunately, valuing a perpetuity turns out to be the easiest possible case. The present value of a perpetuity is:

6.4

PV for a perpetuity = C/r

For example, an investment offers a perpetual cash flow of $500 every year. The return you require on such an investment is 8 percent. What is the value of this investment? The value of this perpetuity is:

$$\text{Perpetuity PV} = C/r = \$500/.08 = \$6{,}250$$

For future reference, Table 6.2 contains a summary of the annuity and perpetuity basic calculations we have described in this section. By now, you probably think that you'll just use online calculators to handle annuity problems. Before you do, see our nearby *Work the Web* box!

Preferred Stock — EXAMPLE 6.7

Preferred stock (or preference stock) is an important example of a perpetuity. When a corporation sells preferred stock, the buyer is promised a fixed cash dividend every period (usually every quarter) forever. This dividend must be paid before any dividend can be paid to regular stockholders—hence the term *preferred*.

Suppose the Fellini Co. wants to sell preferred stock at $100 per share. A similar issue of preferred stock already outstanding has a price of $40 per share and offers a dividend of $1 every quarter. What dividend will Fellini have to offer if the preferred stock is going to sell?

The issue that is already out has a present value of $40 and a cash flow of $1 every quarter forever. Because this is a perpetuity:

$$\text{Present value} = \$40 = \$1 \times (1/r)$$
$$r = .025, \text{ or } 2.5\%$$

To be competitive, the new Fellini issue will also have to offer 2.5 percent *per quarter*; so if the present value is to be $100, the dividend must be such that:

$$\text{Present value} = \$100 = C \times (1/.025)$$
$$C = \$2.50 \text{ (per quarter)}$$

WORK THE WEB

As we discussed in our previous chapter, many websites have financial calculators. One of these sites is Calculatoredge, which is located at www.calculatoredge.com. Suppose you retire with $1,750,000 and want to withdraw an equal amount each year for the next 30 years. If you can earn a 7 percent return, how much can you withdraw each year? Here is what Calculatoredge says:

According to the Calculatoredge calculator, the answer is $131,800.19. How important is it to understand what you are doing? Calculate this one for yourself, and you should get $141,026.21. Who is right? You are, of course! What's going on is that Calculatoredge assumes (but does not tell you) that the annuity is in the form of an annuity due, not an ordinary annuity. Recall that with an annuity due, the payments occur at the beginning of the period rather than the end of the period. The moral of the story is clear: *Caveat calculator*.

Questions

1. *Go to the calculator at www.calculatoredge.com and find out how much the website says you could withdraw each year if you have $2,500,000, earn an 8 percent interest rate, and make annual withdrawals for 35 years. How much more are the withdrawals if they are in the form of an ordinary annuity?*
2. *Suppose you have $500,000 and want to make withdrawals each month for the next 10 years. The first withdrawal is today and the appropriate interest rate is 9 percent compounded monthly. Using the calculator at this website, how much are your withdrawals?*

GROWING ANNUITIES AND PERPETUITIES

Annuities commonly have payments that grow over time. Suppose, for example, that we are looking at a lottery payout over a 20-year period. The first payment, made one year from now, will be $200,000. Every year thereafter, the payment will grow by 5 percent, so the payment in the second year will be $200,000 × 1.05 = $210,000. The payment in the third year will be $210,000 × 1.05 = $220,500, and so on. What's the present value if the appropriate discount rate is 11 percent?

If we use the symbol g to represent the growth rate, we can calculate the value of a growing annuity using a modified version of our regular annuity formula:

$$\text{Growing annuity present value} = C \times \left[\frac{1 - \left(\frac{1+g}{1+r}\right)^t}{r-g}\right] \quad \textbf{6.5}$$

Plugging in the numbers from our lottery example (and letting $g = .05$), we get:

$$\text{PV} = \$200{,}000 \times \left[\frac{1 - \left(\frac{1+.05}{1+.11}\right)^{20}}{.11-.05}\right] = \$200{,}000 \times 11.18169 = \$2{,}236{,}337.06$$

There is also a formula for the present value of a growing perpetuity:

$$\text{Growing perpetuity present value} = C \times \left[\frac{1}{r-g}\right] = \frac{C}{r-g} \quad \textbf{6.6}$$

Returning to our lottery example, now suppose the payments continue forever. In this case, the present value is:

$$\text{PV} = \$200{,}000 \times \frac{1}{.11-.05} = \$200{,}000 \times 16.6667 = \$3{,}333{,}333.33$$

The notion of a growing perpetuity may seem a little odd because the payments get bigger every period forever; but, as we will see in a later chapter, growing perpetuities play a key role in our analysis of stock prices.

Before we go on, there is one important item to note in regard to our formulas for growing annuities and perpetuities. In both cases, the cash flow in the formula, C, is the cash flow that is going to occur exactly one period from today.

Concept Questions

6.2a In general, what is the present value of an annuity of C dollars per period at a discount rate of r per period? The future value?

6.2b In general, what is the present value of a perpetuity?

Comparing Rates: The Effect of Compounding 6.3

The next issue we need to discuss has to do with the way interest rates are quoted. This subject causes a fair amount of confusion because rates are quoted in many different ways. Sometimes the way a rate is quoted is the result of tradition, and sometimes it's the result of legislation. Unfortunately, at times, rates are quoted in deliberately deceptive ways to mislead borrowers and investors. We will discuss these topics in this section.

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EFFECTIVE ANNUAL RATES AND COMPOUNDING

If a rate is quoted as 10 percent compounded semiannually, this means the investment actually pays 5 percent every six months. A natural question then arises: Is 5 percent every six months the same thing as 10 percent per year? It's easy to see that it is not. If you invest $1 at 10 percent per year, you will have $1.10 at the end of the year. If you invest at 5 percent every six months, then you'll have the future value of $1 at 5 percent for two periods:

$$\$1 \times 1.05^2 = \$1.1025$$

This is $.0025 more. The reason is simple: Your account was credited with $1 × .05 = 5 cents in interest after six months. In the following six months, you earned 5 percent on that nickel, for an extra 5 × .05 = .25 cents.

As our example illustrates, 10 percent compounded semiannually is actually equivalent to 10.25 percent per year. Put another way, we would be indifferent between 10 percent compounded semiannually and 10.25 percent compounded annually. Anytime we have compounding during the year, we need to be concerned about what the rate really is.

stated interest rate
The interest rate expressed in terms of the interest payment made each period. Also known as the *quoted interest rate*.

In our example, the 10 percent is called a **stated**, or **quoted, interest rate**. Other names are used as well. The 10.25 percent, which is actually the rate you will earn, is called the **effective annual rate (EAR)**. To compare different investments or interest rates, we will always need to convert to effective rates. Some general procedures for doing this are discussed next.

effective annual rate (EAR)
The interest rate expressed as if it were compounded once per year.

CALCULATING AND COMPARING EFFECTIVE ANNUAL RATES

To see why it is important to work only with effective rates, suppose you've shopped around and come up with the following three rates:

Bank A: 15 percent compounded daily

Bank B: 15.5 percent compounded quarterly

Bank C: 16 percent compounded annually

Which of these is the best if you are thinking of opening a savings account? Which of these is best if they represent loan rates?

To begin, Bank C is offering 16 percent per year. Because there is no compounding during the year, this is the effective rate. Bank B is actually paying .155/4 = .03875 or 3.875 percent per quarter. At this rate, an investment of $1 for four quarters would grow to:

$$\$1 \times 1.03875^4 = \$1.1642$$

The EAR, therefore, is 16.42 percent. For a saver, this is much better than the 16 percent rate Bank C is offering; for a borrower, it's worse.

Bank A is compounding every day. This may seem a little extreme, but it is common to calculate interest daily. In this case, the daily interest rate is actually:

$$.15/365 = .000411$$

This is .0411 percent per day. At this rate, an investment of $1 for 365 periods would grow to:

$$\$1 \times 1.000411^{365} = \$1.1618$$

The EAR is 16.18 percent. This is not as good as Bank B's 16.42 percent for a saver, and not as good as Bank C's 16 percent for a borrower.

This example illustrates two things. First, the highest quoted rate is not necessarily the best. Second, compounding during the year can lead to a significant difference between the quoted rate and the effective rate. Remember that the effective rate is what you actually get or what you pay.

If you look at our examples, you see that we computed the EARs in three steps. We first divided the quoted rate by the number of times that the interest is compounded. We then added 1 to the result and raised it to the power of the number of times the interest is compounded. Finally, we subtracted the 1. If we let m be the number of times the interest is compounded during the year, these steps can be summarized as:

EAR = [1 + (Quoted rate/m)]^m − 1 6.7

For example, suppose you are offered 12 percent compounded monthly. In this case, the interest is compounded 12 times a year; so m is 12. You can calculate the effective rate as:

$$\begin{aligned}\text{EAR} &= [1 + (\text{Quoted rate}/m)]^m - 1\\ &= [1 + (.12/12)]^{12} - 1\\ &= 1.01^{12} - 1\\ &= 1.126825 - 1\\ &= .126825, \text{ or } 12.6825\%\end{aligned}$$

What's the EAR? EXAMPLE 6.8

A bank is offering 12 percent compounded quarterly. If you put $100 in an account, how much will you have at the end of one year? What's the EAR? How much will you have at the end of two years?

The bank is effectively offering 12%/4 = 3% every quarter. If you invest $100 for four periods at 3 percent per period, the future value is:

$$\begin{aligned}\text{Future value} &= \$100 \times 1.03^4\\ &= \$100 \times 1.1255\\ &= \$112.55\end{aligned}$$

The EAR is 12.55 percent: $100 × (1 + .1255) = $112.55.

We can determine what you would have at the end of two years in two different ways. One way is to recognize that two years is the same as eight quarters. At 3 percent per quarter, after eight quarters, you would have:

$$\$100 \times 1.03^8 = \$100 \times 1.2668 = \$126.68$$

Alternatively, we could determine the value after two years by using an EAR of 12.55 percent; so after two years you would have:

$$\$100 \times 1.1255^2 = \$100 \times 1.2668 = \$126.68$$

Thus, the two calculations produce the same answer. This illustrates an important point. Anytime we do a present or future value calculation, the rate we use must be an actual or effective rate. In this case, the actual rate is 3 percent per quarter. The effective annual rate is 12.55 percent. It doesn't matter which one we use once we know the EAR.

Quoting a Rate EXAMPLE 6.9

Now that you know how to convert a quoted rate to an EAR, consider going the other way. As a lender, you know you want to actually earn 18 percent on a particular loan. You want to quote a rate that features monthly compounding. What rate do you quote?

In this case, we know the EAR is 18 percent, and we know this is the result of monthly compounding. Let q stand for the quoted rate. We have:

$$\begin{aligned} \text{EAR} &= [1 + (\text{Quoted rate}/m)]^m - 1 \\ .18 &= [1 + (q/12)]^{12} - 1 \\ 1.18 &= [1 + (q/12)]^{12} \end{aligned}$$

We need to solve this equation for the quoted rate. This calculation is the same as the ones we did to find an unknown interest rate in Chapter 5:

$$\begin{aligned} 1.18^{(1/12)} &= 1 + (q/12) \\ 1.18^{.08333} &= 1 + (q/12) \\ 1.0139 &= 1 + (q/12) \\ q &= .0139 \times 12 \\ &= .1667, \text{ or } 16.67\% \end{aligned}$$

Therefore, the rate you would quote is 16.67 percent, compounded monthly.

EARs AND APRs

annual percentage rate (APR)
The interest rate charged per period multiplied by the number of periods per year.

Sometimes it's not altogether clear whether a rate is an effective annual rate. A case in point concerns what is called the **annual percentage rate (APR)** on a loan. Truth-in-lending laws in the United States require that lenders disclose an APR on virtually all consumer loans. This rate must be displayed on a loan document in a prominent and unambiguous way.[2]

Given that an APR must be calculated and displayed, an obvious question arises: Is an APR an effective annual rate? Put another way, if a bank quotes a car loan at 12 percent APR, is the consumer actually paying 12 percent interest? Surprisingly, the answer is no. There is some confusion over this point, which we discuss next.

The confusion over APRs arises because lenders are required by law to compute the APR in a particular way. By law, the APR is equal to the interest rate per period multiplied by the number of periods in a year. For example, if a bank is charging 1.2 percent per month on car loans, then the APR that must be reported is $1.2\% \times 12 = 14.4\%$. So, an APR is in fact a quoted, or stated, rate in the sense we've been discussing. For example, an APR of 12 percent on a loan calling for monthly payments is really 1 percent per month. The EAR on such a loan is thus:

$$\begin{aligned} \text{EAR} &= [1 + (\text{APR}/12)]^{12} - 1 \\ &= 1.01^{12} - 1 = .126825, \text{ or } 12.6825\% \end{aligned}$$

[2] By law, lenders are required to report the APR on all consumer loans. In this text, we compute the APR as the interest rate per period multiplied by the number of periods in a year. According to federal law, the APR is a measure of the cost of consumer credit expressed as a yearly rate, and it includes interest and certain noninterest charges and fees. In practice, the APR can be much higher than the interest rate on the loan if the lender charges substantial fees that must be included in the federally mandated APR calculation.

EXAMPLE 6.10 What Rate Are You Paying?

Depending on the issuer, a typical credit card agreement quotes an interest rate of 18 percent APR. Monthly payments are required. What is the actual interest rate you pay on such a credit card?

Based on our discussion, an APR of 18 percent with monthly payments is really .18/12 = .015 or 1.5 percent per month. The EAR is thus:

$$\begin{aligned}\text{EAR} &= [1 + (.18/12)]^{12} - 1\\ &= 1.015^{12} - 1\\ &= 1.1956 - 1\\ &= .1956, \text{ or } 19.56\%\end{aligned}$$

This is the rate you actually pay.

It is somewhat ironic that truth-in-lending laws sometimes require lenders to be *un*truthful about the actual rate on a loan. There are also truth-in-savings laws that require banks and other borrowers to quote an "annual percentage yield," or APY, on things like savings accounts. To make things a little confusing, an APY is an EAR. As a result, by law, the rates quoted to borrowers (APRs) and those quoted to savers (APYs) are not computed the same way.

There can be a huge difference between the APR and EAR when interest rates are large. For example, consider "payday loans." Payday loans are short-term loans made to consumers, often for less than two weeks, and are offered by companies such as AmeriCash Advance and National Payday. The loans work like this: You write a check today that is postdated (the date on the check is in the future) and give it to the company. They give you some cash. When the check date arrives, you either go to the store and pay the cash amount of the check, or the company cashes it (or else automatically renews the loan).

For example, in one particular state, Check Into Cash allows you to write a check for $115 dated 14 days in the future, for which you get $100 today. So what are the APR and EAR on this arrangement? First, we need to find the interest rate, which we can find by the FV equation as follows:

$$\begin{aligned}\text{FV} &= \text{PV} \times (1 + r)^1\\ \$115 &= \$100 \times (1 + r)^1\\ 1.15 &= (1 + r)\\ r &= .15, \text{ or } 15\%\end{aligned}$$

That doesn't seem too bad until you remember this is the interest rate for *14 days*! The APR of the loan is:

$$\begin{aligned}\text{APR} &= .15 \times 365/14\\ \text{APR} &= 3.9107, \text{ or } 391.07\%\end{aligned}$$

And the EAR for this loan is:

$$\begin{aligned}\text{EAR} &= (1 + \text{Quoted rate}/m)^m - 1\\ \text{EAR} &= (1 + .15)^{365/14} - 1\\ \text{EAR} &= 37.2366, \text{ or } 3{,}723.66\%\end{aligned}$$

Now that's an interest rate! Just to see what a difference a small difference in fees can make, Advance America Cash Advance will let you write a check for $117.50 in exchange for the same $100 amount. Check for yourself that the APR of this arrangement is 456.25 percent and the EAR is 6,598.65 percent—not a loan we would like to take out!

TABLE 6.3
Compounding Frequency and Effective Annual Rates

Compounding Period	Number of Times Compounded	Effective Annual Rate
Year	1	10.00000%
Quarter	4	10.38129
Month	12	10.47131
Week	52	10.50648
Day	365	10.51558
Hour	8,760	10.51703
Minute	525,600	10.51709

TAKING IT TO THE LIMIT: A NOTE ABOUT CONTINUOUS COMPOUNDING

If you made a deposit in a savings account, how often could your money be compounded during the year? If you think about it, there isn't really any upper limit. We've seen that daily compounding, for example, isn't a problem. There is no reason to stop here, however. We could compound every hour or minute or second. How high would the EAR get in this case? Table 6.3 illustrates the EARs that result as 10 percent is compounded at shorter and shorter intervals. Notice that the EARs do keep getting larger, but the differences get very small.

As the numbers in Table 6.3 seem to suggest, there is an upper limit to the EAR. If we let q stand for the quoted rate, then, as the number of times the interest is compounded gets extremely large, the EAR approaches:

$$\textbf{EAR} = e^{q} - 1 \qquad (6.8)$$

where e is the number 2.71828 (look for a key labeled "e^x" on your calculator). For example, with our 10 percent rate, the highest possible EAR is:

$$\begin{aligned} \text{EAR} &= e^{q} - 1 \\ &= 2.71828^{.10} - 1 \\ &= 1.1051709 - 1 \\ &= .1051709, \text{ or } 10.51709\% \end{aligned}$$

In this case, we say that the money is continuously, or instantaneously, compounded. Interest is being credited the instant it is earned, so the amount of interest grows continuously.

EXAMPLE 6.11 What's the Law?

At one time, commercial banks and savings and loan associations (S&Ls) were restricted in the interest rates they could offer on savings accounts. Under what was known as Regulation Q, S&Ls were allowed to pay at most 5.5 percent, and banks were not allowed to pay more than 5.25 percent (the idea was to give the S&Ls a competitive advantage; it didn't work). The law did not say how often these rates could be compounded, however. Under Regulation Q, then, what were the maximum allowed interest rates?

The maximum allowed rates occurred with continuous, or instantaneous, compounding. For the commercial banks, 5.25 percent compounded continuously would be:

$$\begin{aligned} \text{EAR} &= e^{.0525} - 1 \\ &= 2.71828^{.0525} - 1 \\ &= 1.0539026 - 1 \\ &= .0539026, \text{ or } 5.39026\% \end{aligned}$$

This is what banks could actually pay. Check for yourself to see that S&Ls could effectively pay 5.65406 percent.

Concept Questions

6.3a If an interest rate is given as 12 percent compounded daily, what do we call this rate?

6.3b What is an APR? What is an EAR? Are they the same thing?

6.3c In general, what is the relationship between a stated interest rate and an effective interest rate? Which is more relevant for financial decisions?

6.3d What does continuous compounding mean?

6.4 Loan Types and Loan Amortization

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Whenever a lender extends a loan, some provision will be made for repayment of the principal (the original loan amount). A loan might be repaid in equal installments, for example, or it might be repaid in a single lump sum. Because the way that the principal and interest are paid is up to the parties involved, there are actually an unlimited number of possibilities.

In this section, we describe a few forms of repayment that come up quite often, and more complicated forms can usually be built up from these. The three basic types of loans are pure discount loans, interest-only loans, and amortized loans. Working with these loans is a very straightforward application of the present value principles that we have already developed.

PURE DISCOUNT LOANS

The *pure discount loan* is the simplest form of loan. With such a loan, the borrower receives money today and repays a single lump sum at some time in the future. A one-year, 10 percent pure discount loan, for example, would require the borrower to repay $1.10 in one year for every dollar borrowed today.

Because a pure discount loan is so simple, we already know how to value one. Suppose a borrower was able to repay $25,000 in five years. If we, acting as the lender, wanted a 12 percent interest rate on the loan, how much would we be willing to lend? Put another way, what value would we assign today to that $25,000 to be repaid in five years? Based on our work in Chapter 5, we know the answer is the present value of $25,000 at 12 percent for five years:

$$\begin{aligned}\text{Present value} &= \$25{,}000/1.12^5 \\ &= \$25{,}000/1.7623 \\ &= \$14{,}186\end{aligned}$$

Pure discount loans are common when the loan term is short—say a year or less. In recent years, they have become increasingly common for much longer periods.

Treasury Bills — EXAMPLE 6.12

When the U.S. government borrows money on a short-term basis (a year or less), it does so by selling what are called *Treasury bills*, or *T-bills* for short. A T-bill is a promise by the government to repay a fixed amount at some time in the future—for example, in 3 months or 12 months.

Treasury bills are pure discount loans. If a T-bill promises to repay $10,000 in 12 months, and the market interest rate is 7 percent, how much will the bill sell for in the market?

Because the going rate is 7 percent, the T-bill will sell for the present value of $10,000 to be repaid in one year at 7 percent:

Present value = $10,000/1.07 = $9,345.79

INTEREST-ONLY LOANS

A second type of loan repayment plan calls for the borrower to pay interest each period and to repay the entire principal (the original loan amount) at some point in the future. Loans with such a repayment plan are called *interest-only loans*. Notice that if there is just one period, a pure discount loan and an interest-only loan are the same thing.

For example, with a three-year, 10 percent, interest-only loan of $1,000, the borrower would pay $1,000 × .10 = $100 in interest at the end of the first and second years. At the end of the third year, the borrower would return the $1,000 along with another $100 in interest for that year. Similarly, a 50-year interest-only loan would call for the borrower to pay interest every year for the next 50 years and then repay the principal. In the extreme, the borrower pays the interest every period forever and never repays any principal. As we discussed earlier in the chapter, the result is a perpetuity.

Most corporate bonds have the general form of an interest-only loan. Because we will be considering bonds in some detail in the next chapter, we will defer further discussion of them for now.

AMORTIZED LOANS

With a pure discount or interest-only loan, the principal is repaid all at once. An alternative is an *amortized loan*, with which the lender may require the borrower to repay parts of the loan amount over time. The process of providing for a loan to be paid off by making regular principal reductions is called *amortizing* the loan.

A simple way of amortizing a loan is to have the borrower pay the interest each period plus some fixed amount. This approach is common with medium-term business loans. For example, suppose a business takes out a $5,000, five-year loan at 9 percent. The loan agreement calls for the borrower to pay the interest on the loan balance each year and to reduce the loan balance each year by $1,000. Because the loan amount declines by $1,000 each year, it is fully paid in five years.

In the case we are considering, notice that the total payment will decline each year. The reason is that the loan balance goes down, resulting in a lower interest charge each year, whereas the $1,000 principal reduction is constant. For example, the interest in the first year will be $5,000 × .09 = $450. The total payment will be $1,000 + 450 = $1,450. In the second year, the loan balance is $4,000, so the interest is $4,000 × .09 = $360, and the total payment is $1,360. We can calculate the total payment in each of the remaining years by preparing a simple *amortization schedule* as follows:

Year	Beginning Balance	Total Payment	Interest Paid	Principal Paid	Ending Balance
1	$5,000	$1,450	$ 450	$1,000	$4,000
2	4,000	1,360	360	1,000	3,000
3	3,000	1,270	270	1,000	2,000
4	2,000	1,180	180	1,000	1,000
5	1,000	1,090	90	1,000	0
Totals		$6,350	$1,350	$5,000	

Notice that in each year, the interest paid is given by the beginning balance multiplied by the interest rate. Also notice that the beginning balance is given by the ending balance from the previous year.

Probably the most common way of amortizing a loan is to have the borrower make a single, fixed payment every period. Almost all consumer loans (such as car loans) and

mortgages work this way. For example, suppose our five-year, 9 percent, $5,000 loan was amortized this way. How would the amortization schedule look?

We first need to determine the payment. From our discussion earlier in the chapter, we know that this loan's cash flows are in the form of an ordinary annuity. In this case, we can solve for the payment as follows:

$$\begin{aligned} \$5{,}000 &= C \times \{[1 - (1/1.09^5)]/.09\} \\ &= C \times [(1 - .6499)/.09] \end{aligned}$$

This gives us:

$$\begin{aligned} C &= \$5{,}000/3.8897 \\ &= \$1{,}285.46 \end{aligned}$$

The borrower will therefore make five equal payments of $1,285.46. Will this pay off the loan? We will check by filling in an amortization schedule.

In our previous example, we knew the principal reduction each year. We then calculated the interest owed to get the total payment. In this example, we know the total payment. We will calculate the interest and then subtract it from the total payment to calculate the principal portion in each payment.

In the first year, the interest is $450, as we calculated before. Because the total payment is $1,285.46, the principal paid in the first year must be:

$$\text{Principal paid} = \$1{,}285.46 - 450 = \$835.46$$

The ending loan balance is:

$$\text{Ending balance} = \$5{,}000 - 835.46 = \$4{,}164.54$$

The interest in the second year is $4,164.54 × .09 = $374.81, and the loan balance declines by $1,285.46 − 374.81 = $910.65. We can summarize all of the relevant calculations in the following schedule:

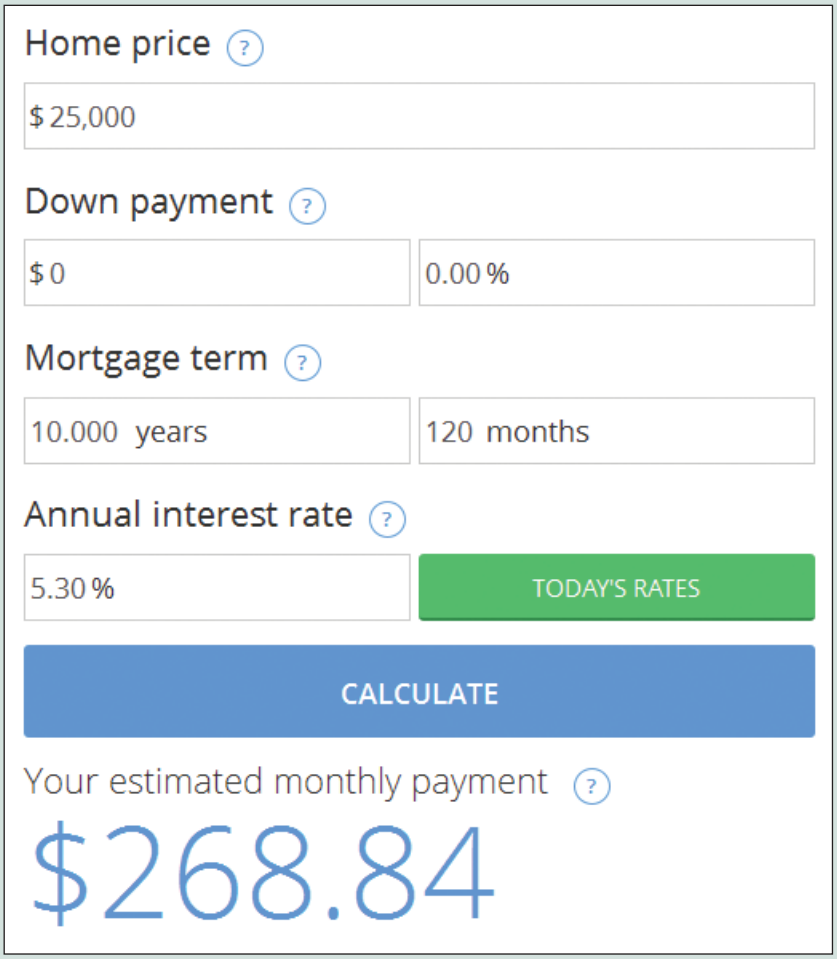
Year	Beginning Balance	Total Payment	Interest Paid	Principal Paid	Ending Balance
1	$5,000.00	$1,285.46	$ 450.00	$ 835.46	$4,164.54
2	4,164.54	1,285.46	374.81	910.65	3,253.88
3	3,253.88	1,285.46	292.85	992.61	2,261.27
4	2,261.27	1,285.46	203.51	1,081.95	1,179.32
5	1,179.32	1,285.46	106.14	1,179.32	0.00
Totals		$6,427.31	$1,427.31	$5,000.00	

Because the loan balance declines to zero, the five equal payments do pay off the loan. Notice that the interest paid declines each period. This isn't surprising because the loan balance is going down. Given that the total payment is fixed, the principal paid must be rising each period.

If you compare the two loan amortizations in this section, you will see that the total interest is greater for the equal total payment case: $1,427.31 versus $1,350. The reason for this is that the loan is repaid more slowly early on, so the interest is somewhat higher. This doesn't mean that one loan is better than the other; it means that one is effectively paid off faster than the other. For example, the principal reduction in the first year is $835.46 in the equal total payment case as compared to $1,000 in the first case. Many websites offer loan amortization schedules. See our nearby *Work the Web* box for an example.

WORK THE WEB

Preparing an amortization table is one of the more tedious time value of money applications. Using a spreadsheet makes it relatively easy, but there are also websites available that will prepare an amortization schedule very quickly. One such site is www.bankrate.com. This site has a mortgage calculator for home loans, but the same calculations apply to most other types of loans such as car loans and student loans. Suppose you graduate with a student loan of $25,000 and will repay the loan over the next 10 years at 5.3 percent. What are your monthly payments? Using the calculator we get:



Try this example yourself and click the "Show Amortization Schedule" button. You will find that your first payment will consist of $158.43 in principal and $110.42 in interest. Over the life of the loan you will pay a total of $7,261 in interest.

Questions

1. *Suppose you take out a 30-year mortgage for $250,000 at an interest rate of 6.8 percent. Use this website to construct an amortization table for the loan. What are the interest payment and principal amounts in the 110th payment? How much in total interest will you pay over the life of the loan?*
2. *You take out a 30-year mortgage for $275,000 at an interest rate of 7.3 percent. How much will you pay in interest over the life of this loan? Now assume you pay an extra $100 per month on this loan. How much is your total interest now? How much sooner will the mortgage be paid off?*

We will close this chapter with an example that may be of particular relevance. Federal Stafford loans are an important source of financing for many college students, helping to cover the cost of tuition, books, new cars, condominiums, and many other things. Sometimes students do not seem to fully realize that Stafford loans have a serious drawback: They must be repaid in monthly installments, usually beginning six months after the student leaves school.

Some Stafford loans are subsidized, meaning that the interest does not begin to accrue until repayment begins (this is a good thing). If you are a dependent undergraduate student under this particular option, the total debt you can run up is, at most, $23,000. The interest rate in 2017–2018 is 4.45 percent, or 4.45/12 = .3708 percent per month. Under the "standard repayment plan," the loans are amortized over 10 years (subject to a minimum payment of $50).

Suppose you max out borrowing under this program. Beginning six months after you graduate (or otherwise depart the ivory tower), what will your monthly payment be? How much will you owe after making payments for four years?

Given our earlier discussions, see if you don't agree that your monthly payment (assuming a $23,000 total loan) is $237.81 per month. Also, as explained in Example 6.13, after making payments for four years, you still owe the present value of the remaining payments. There are 120 payments in all. After you make 48 of them (the first four years), you have 72 to go. By now, it should be easy for you to verify that the present value of $237.81 per month for 72 months at .3708 percent per month is about $15,003.07, so you still have a long way to go.

Partial Amortization, or "Bite the Bullet" — EXAMPLE 6.13

A common arrangement in real estate lending might call for a 5-year loan with, say, a 15-year amortization. What this means is that the borrower makes a payment every month of a fixed amount based on a 15-year amortization. However, after 60 months, the borrower makes a single, much larger payment called a "balloon" or "bullet" to pay off the loan. Because the monthly payments don't fully pay off the loan, the loan is said to be partially amortized.

Suppose we have a $100,000 commercial mortgage with a 12 percent APR and a 20-year (240-month) amortization. Further suppose the mortgage has a five-year balloon. What will the monthly payment be? How big will the balloon payment be?

The monthly payment can be calculated based on an ordinary annuity with a present value of $100,000. There are 240 payments, and the interest rate is 1 percent per month. The payment is:

$$\begin{aligned} \$100{,}000 &= C \times [(1 - 1/1.01^{240})/.01] \\ &= C \times 90.8194 \\ C &= \$1{,}101.09 \end{aligned}$$

Now, there is an easy way and a hard way to determine the balloon payment. The hard way is to actually amortize the loan for 60 months to see what the balance is at that time. The easy way is to recognize that after 60 months, we have a 240 – 60 = 180-month loan. The payment is still $1,101.09 per month, and the interest rate is still 1 percent per month. The loan balance is thus the present value of the remaining payments:

$$\begin{aligned} \text{Loan balance} &= \$1{,}101.09 \times [(1 - 1/1.01^{180})/.01] \\ &= \$1{,}101.09 \times 83.3217 \\ &= \$91{,}744.33 \end{aligned}$$

The balloon payment is a substantial $91,744.33. Why is it so large? To get an idea, consider the first payment on the mortgage. The interest in the first month is $100,000 × .01 = $1,000. Your payment is $1,101.09, so the loan balance declines by only $101.09. Because the loan balance declines so slowly, the cumulative "pay down" over five years is not great.

SPREADSHEET STRATEGIES

Loan Amortization Using a Spreadsheet

Loan amortization is a common spreadsheet application. To illustrate, we will set up the problem that we examined earlier in this section: a five-year, $5,000, 9 percent loan with constant payments. Our spreadsheet looks like this:

	A	B	C	D	E	F	G	H
1								
2				**Using a spreadsheet to amortize a loan**				
3								
4			Loan amount:	$5,000				
5			Interest rate:	.09				
6			Loan term:	5				
7			Loan payment:	**$1,285.46**				
8				*Note:* Payment is calculated using PMT(rate,nper,-pv,fv).				
9		*Amortization table:*						
10								
11		Year	Beginning	Total	Interest	Principal	Ending	
12			Balance	Payment	Paid	Paid	Balance	
13		1	$5,000.00	$1,285.46	$450.00	$835.46	$4,164.54	
14		2	4,164.54	1,285.46	374.81	910.65	3,253.88	
15		3	3,253.88	1,285.46	292.85	992.61	2,261.27	
16		4	2,261.27	1,285.46	203.51	1,081.95	1,179.32	
17		5	1,179.32	1,285.46	106.14	1,179.32	.00	
18		Totals		6,427.31	1,427.31	5,000.00		
19								
20		*Formulas in the amortization table:*						
21								
22		Year	Beginning	Total	Interest	Principal	Ending	
23			Balance	Payment	Paid	Paid	Balance	
24		1	=+D4	=$D$7	=+$D$5*C13	=+D13-E13	=+C13-F13	
25		2	=+G13	=$D$7	=+$D$5*C14	=+D14-E14	=+C14-F14	
26		3	=+G14	=$D$7	=+$D$5*C15	=+D15-E15	=+C15-F15	
27		4	=+G15	=$D$7	=+$D$5*C16	=+D16-E16	=+C16-F16	
28		5	=+G16	=$D$7	=+$D$5*C17	=+D17-E17	=+C17-F17	
29								
30		*Note:* Totals in the amortization table are calculated using the SUM formula.						
31								

SOURCE: Microsoft Excel

Of course, it is possible to rack up much larger debts. According to the Association of American Medical Colleges, medical students who borrowed to attend medical school and graduated in 2015 had an average student loan balance of $180,723. Ouch! In fact, it was reported that former Federal Reserve Chairman Ben Bernanke's son was on track to graduate with over $400,000 in student loans, although that included his undergraduate degree as well. How long will it take the average student to pay off her medical school loans?

Let's say she makes a monthly payment of $1,200, and the loan has an interest rate of 7 percent per year, or .5833 percent per month. See if you agree that it will take about 362 months, or about 30 years, to pay off the loan. Maybe MD really stands for "mucho debt"!

Concept Questions

6.4a What is a pure discount loan? An interest-only loan?

6.4b What does it mean to amortize a loan?

6.4c What is a balloon payment? How do you determine its value?

6.5 Summary and Conclusions

This chapter rounded out your understanding of fundamental concepts related to the time value of money and discounted cash flow valuation. Several important topics were covered:

1. There are two ways of calculating present and future values when there are multiple cash flows. Both approaches are straightforward extensions of our earlier analysis of single cash flows.
2. A series of constant cash flows that arrive or are paid at the end of each period is called an ordinary annuity, and we described some useful shortcuts for determining the present and future values of annuities.
3. Interest rates can be quoted in a variety of ways. For financial decisions, any rates being compared must first be converted to effective rates. The relationship between a quoted rate, such as an annual percentage rate (APR), and an effective annual rate (EAR) is given by:

   $$\text{EAR} = [1 + (\text{Quoted rate}/m)]^m - 1$$

   where m is the number of times during the year the money is compounded or, equivalently, the number of payments during the year.
4. Many loans are annuities. The process of providing for a loan to be paid off gradually is called amortizing the loan, and we discussed how amortization schedules are prepared and interpreted.

The principles developed in this chapter will figure prominently in the chapters to come. The reason for this is that most investments, whether they involve real assets or financial assets, can be analyzed using the discounted cash flow (DCF) approach. As a result, the DCF approach is broadly applicable and widely used in practice. For example, the next two chapters show how to value bonds and stocks using an extension of the techniques presented in this chapter. Before going on, therefore, you might want to do some of the problems that follow.

CONNECT TO FINANCE

Do you use *Connect Finance* to practice what you learn? If you don't, you should—we can help you master the topics presented in this chapter. Log on to connect.mheducation.com to learn more!

Can you answer the following *Connect* Quiz questions?

Section 6.1 Two years ago, you opened an investment account and deposited $5,000. One year ago, you added another $2,000 to the account. Today, you are making a final deposit of $7,500. How much will you have in this account three years from today if you earn a 14 percent rate of return?

Section 6.2 A stream of equal payments that occur at the beginning of each month for one year is called a(n) _____.

Section 6.3 Your credit card charges interest of 1.2 percent per month. What is the annual percentage rate?

Section 6.4 What type of loan is repaid in a single lump sum?

CHAPTER REVIEW AND SELF-TEST PROBLEMS

6.1 **Present Values with Multiple Cash Flows** A first-round draft choice quarterback has been signed to a three-year, $25 million contract. The details provide for an immediate cash bonus of $2 million. The player is to receive $5 million in salary at the end of the first year, $8 million the next, and $10 million at the end of the last year. Assuming a 15 percent discount rate, is this package worth $25 million? If not, how much is it worth?

6.2 **Future Value with Multiple Cash Flows** You plan to make a series of deposits in an individual retirement account. You will deposit $1,000 today, $2,000 in two years, and $2,000 in five years. If you withdraw $1,500 in three years and $1,000 in seven years, assuming no withdrawal penalties, how much will you have after eight years if the interest rate is 7 percent? What is the present value of these cash flows?

6.3 **Annuity Present Value** You are looking into an investment that will pay you $12,000 per year for the next 10 years. If you require a 15 percent return, what is the most you would pay for this investment?

6.4 **APR versus EAR** The going rate on student loans is quoted as 8 percent APR. The terms of the loans call for monthly payments. What is the effective annual rate (EAR) on such a student loan?

6.5 **It's the Principal That Matters** Suppose you borrow $10,000. You are going to repay the loan by making equal annual payments for five years. The interest rate on the loan is 14 percent per year. Prepare an amortization schedule for the loan. How much interest will you pay over the life of the loan?

6.6 **Just a Little Bit Each Month** You've recently finished your MBA at the Darnit School. Naturally, you must purchase a new BMW immediately. The car costs about $36,000. The bank quotes an interest rate of 15 percent APR for a 72-month loan with a 10 percent down payment. You plan on trading the car in for a new one in two years. What will your monthly payment be? What is the effective interest rate on the loan? What will the loan balance be when you trade the car in?

ANSWERS TO CHAPTER REVIEW AND SELF-TEST PROBLEMS

6.1 Obviously, the package is not worth $25 million because the payments are spread out over three years. The bonus is paid today, so it's worth $2 million. The present values for the three subsequent salary payments are:

$$\begin{aligned}(\$5/1.15) + (8/1.15^2) + (10/1.15^3) &= (\$5/1.15) + (8/1.3225) + (10/1.5209)\\ &= \$16.9721 \text{ million}\end{aligned}$$

The package is worth a total of $18.9721 million.

6.2 We will calculate the future values for each of the cash flows separately and then add them up. Notice that we treat the withdrawals as negative cash flows:

$$\begin{aligned}\$1{,}000 \times 1.07^8 &= \$1{,}000 \times 1.7182 = \$\ 1{,}718.19\\ 2{,}000 \times 1.07^6 &= 2{,}000 \times 1.5007 = 3{,}001.46\\ -1{,}500 \times 1.07^5 &= -1{,}500 \times 1.4026 = -2{,}103.83\\ 2{,}000 \times 1.07^3 &= 2{,}000 \times 1.2250 = 2{,}450.09\\ -1{,}000 \times 1.07^1 &= -1{,}000 \times 1.0700 = \underline{-1{,}070.00}\\ \text{Total future value} &= \underline{\underline{\$\ 3{,}995.91}}\end{aligned}$$

To calculate the present value, we could discount each cash flow back to the present or we could discount back a single year at a time. However, because we already know that the future value in eight years is $3,995.91, the easy way to get the PV is just to discount this amount back eight years:

$$\begin{aligned}\text{Present value} &= \$3{,}995.91/1.07^8 \\ &= \$3{,}995.91/1.7182 \\ &= \$2{,}325.65\end{aligned}$$

For practice, you can verify that this is what you get if you discount each cash flow back separately.

6.3 The most you would be willing to pay is the present value of $12,000 per year for 10 years at a 15 percent discount rate. The cash flows here are in ordinary annuity form, so the relevant present value factor is:

$$\begin{aligned}\text{Annuity present value factor} &= (1 - \text{Present value factor})/r \\ &= [1 - (1/1.15^{10})]/.15 \\ &= (1 - .2472)/.15 \\ &= 5.0188\end{aligned}$$

The present value of the 10 cash flows is thus:

$$\begin{aligned}\text{Present value} &= \$12{,}000 \times 5.0188 \\ &= \$60{,}225\end{aligned}$$

This is the most you would pay.

6.4 A rate of 8 percent APR with monthly payments is actually 8%/12 = .67% per month. The EAR is thus:

$$\text{EAR} = [1 + (.08/12)]^{12} - 1 = .0830, \text{ or } 8.30\%$$

6.5 We first need to calculate the annual payment. With a present value of $10,000, an interest rate of 14 percent, and a term of five years, the payment can be determined from:

$$\begin{aligned}\$10{,}000 &= \text{Payment} \times \{[1 - (1/1.14^5)]/.14\} \\ &= \text{Payment} \times 3.4331\end{aligned}$$

Therefore, the payment is $10,000/3.4331 = $2,912.84 (actually, it's $2,912.8355; this will create some small rounding errors in the following schedule). We can now prepare the amortization schedule as follows:

Year	Beginning Balance	Total Payment	Interest Paid	Principal Paid	Ending Balance
1	$10,000.00	$ 2,912.84	$1,400.00	$ 1,512.84	$8,487.16
2	8,487.16	2,912.84	1,188.20	1,724.63	6,762.53
3	6,762.53	2,912.84	946.75	1,966.08	4,796.45
4	4,796.45	2,912.84	671.50	2,241.33	2,555.12
5	2,555.12	2,912.84	357.72	2,555.12	0.00
Totals		$14,564.17	$4,564.17	$10,000.00	

6.6 The cash flows on the car loan are in annuity form, so we need to find only the payment. The interest rate is 15%/12 = 1.25% per month, and there are 72 months. The first thing we need is the annuity factor for 72 periods at 1.25 percent per period:

$$\begin{aligned}\text{Annuity present value factor} &= (1 - \text{Present value factor})/r \\ &= [1 - (1/1.0125^{72})]/.0125 \\ &= [1 - (1/2.4459)]/.0125 \\ &= (1 - .4088)/.0125 \\ &= 47.2925\end{aligned}$$

The present value is the amount we finance. With a 10 percent down payment, we will be borrowing 90 percent of $36,000, or $32,400. To find the payment, we need to solve for C:

$$\begin{aligned}\$32{,}400 &= C \times \text{Annuity present value factor} \\ &= C \times 47.2925\end{aligned}$$

Rearranging things a bit, we have:

$$\begin{aligned}C &= \$32{,}400 \times (1/47.2925) \\ &= \$32{,}400 \times .02115 \\ &= \$685.10\end{aligned}$$

Your payment is just over $685 per month.

The actual interest rate on this loan is 1.25 percent per month. Based on our work in the chapter, we can calculate the effective annual rate as:

$$\text{EAR} = (1.0125)^{12} - 1 = .1608, \text{ or } 16.08\%$$

The effective rate is about one point higher than the quoted rate.

To determine the loan balance in two years, we could amortize the loan to see what the balance is at that time. This would be fairly tedious to do by hand. Using the information already determined in this problem, we can instead calculate the present value of the remaining payments. After two years, we have made 24 payments, so there are 72 − 24 = 48 payments left. What is the present value of 48 monthly payments of $685.10 at 1.25 percent per month? The relevant annuity factor is:

$$\begin{aligned}\text{Annuity present value factor} &= (1 - \text{Present value factor})/r \\ &= [1 - (1/1.0125^{48})]/.0125 \\ &= [1 - (1/1.8154)]/.0125 \\ &= (1 - .5509)/.0125 \\ &= 35.9315\end{aligned}$$

The present value is thus:

$$\text{Present value} = \$685.10 \times 35.9315 = \$24{,}616.60$$

You will owe about $24,617 on the loan in two years.

CONCEPTS REVIEW AND CRITICAL THINKING QUESTIONS

1. **Annuity Factors** [LO1] There are four pieces to an annuity present value. What are they?
2. **Annuity Period** [LO1] As you increase the length of time involved, what happens to the present value of an annuity? What happens to the future value?

3. **Interest Rates** [LO1] What happens to the future value of an annuity if you increase the rate *r*? What happens to the present value?
4. **Present Value** [LO1] What do you think about the Tri-State Megabucks lottery discussed in the chapter advertising a $500,000 prize when the lump sum option is $250,000? Is it deceptive advertising?
5. **Present Value** [LO1] If you were an athlete negotiating a contract, would you want a big signing bonus payable immediately and smaller payments in the future, or vice versa? How about looking at it from the team's perspective?
6. **Present Value** [LO1] Suppose two athletes each sign 10-year contracts for $80 million. In one case, we're told that the $80 million will be paid in 10 equal installments. In the other case, we're told that the $80 million will be paid in 10 installments, but the installments will increase by 5 percent per year. Who got the better deal?
7. **APR and EAR** [LO4] Should lending laws be changed to require lenders to report EARs instead of APRs? Why or why not?
8. **Time Value** [LO1] On subsidized Stafford loans, a common source of financial aid for college students, interest does not begin to accrue until repayment begins. Who receives a bigger subsidy, a freshman or a senior? Explain. In words, how would you go about valuing the subsidy on a subsidized Stafford loan?
9. **Time Value** [LO1] Eligibility for a subsidized Stafford loan is based on current financial need. However, both subsidized and unsubsidized Stafford loans are repaid out of future income. Given this, do you see a possible objection to having two types?
10. **Time Value** [LO1] A viatical settlement is a lump sum of money given to a terminally ill individual in exchange for his life insurance policy. When the insured person dies, the purchaser receives the payout from the life insurance policy. What factors determine the value of the viatical settlement? Do you think such settlements are ethical? Why or why not?
11. **Perpetuity Values** [LO1] What happens to the future value of a perpetuity if interest rates increase? What if interest rates decrease?
12. **Loans and Interest Rates** [LO4] In the chapter, we gave several examples of so-called payday loans. As you saw, the interest rates on these loans can be extremely high and are even called predatory by some. Do you think such high interest loans are ethical? Why or why not?

QUESTIONS AND PROBLEMS

BASIC
(Questions 1–28)

1. **Present Value and Multiple Cash Flows** [LO1] McCann Co. has identified an investment project with the following cash flows. If the discount rate is 10 percent, what is the present value of these cash flows? What is the present value at 18 percent? At 24 percent?

Year	Cash Flow
1	$ 530
2	690
3	875
4	1,090

2. **Present Value and Multiple Cash Flows** [LO1] Investment X offers to pay you $4,200 per year for eight years, whereas Investment Y offers to pay you $6,100 per year for five years. Which of these cash flow streams has the higher present value if the discount rate is 5 percent? If the discount rate is 15 percent?

3. **Future Value and Multiple Cash Flows** [LO1] Fuente, Inc., has identified an investment project with the following cash flows. If the discount rate is 8 percent, what is the future value of these cash flows in Year 4? What is the future value at a discount rate of 11 percent? At 24 percent?

Year	Cash Flow
1	$1,075
2	1,210
3	1,340
4	1,420

4. **Calculating Annuity Present Value** [LO1] An investment offers $4,350 per year for 15 years, with the first payment occurring one year from now. If the required return is 6 percent, what is the value of the investment? What would the value be if the payments occurred for 40 years? For 75 years? Forever?
5. **Calculating Annuity Cash Flows** [LO1] If you put up $41,000 today in exchange for a 5.1 percent, 15-year annuity, what will the annual cash flow be?
6. **Calculating Annuity Values** [LO1] Your company will generate $47,000 in annual revenue each year for the next seven years from a new information database. If the appropriate interest rate is 7.1 percent, what is the present value of the savings?
7. **Calculating Annuity Values** [LO1] If you deposit $4,500 at the end of each of the next 20 years into an account paying 9.7 percent interest, how much money will you have in the account in 20 years? How much will you have if you make deposits for 40 years?
8. **Calculating Annuity Values** [LO1] You want to have $60,000 in your savings account 12 years from now, and you're prepared to make equal annual deposits into the account at the end of each year. If the account pays 6.4 percent interest, what amount must you deposit each year?
9. **Calculating Annuity Values** [LO2] Prescott Bank offers you a five-year loan for $75,000 at an annual interest rate of 6.8 percent. What will your annual loan payment be?
10. **Calculating Perpetuity Values** [LO1] The Maybe Pay Life Insurance Co. is trying to sell you an investment policy that will pay you and your heirs $35,000 per year forever. If the required return on this investment is 4.7 percent, how much will you pay for the policy?
11. **Calculating Perpetuity Values** [LO1] In the previous problem, suppose a sales associate told you the policy costs $800,000. At what interest rate would this be a fair deal?
12. **Calculating EAR** [LO4] Find the EAR in each of the following cases:

Stated Rate (APR)	Number of Times Compounded	Effective Rate (EAR)
9%	Quarterly	
16	Monthly	
12	Daily	
11	Infinite	

13. **Calculating APR** [LO4] Find the APR, or stated rate, in each of the following cases:

Stated Rate (APR)	Number of Times Compounded	Effective Rate (EAR)
	Semiannually	11.1%
	Monthly	19.6
	Weekly	10.5
	Infinite	8.4

14. **Calculating EAR [LO4]** First National Bank charges 13.1 percent compounded monthly on its business loans. First United Bank charges 13.4 percent compounded semiannually. As a potential borrower, which bank would you go to for a new loan?
15. **Calculating APR [LO4]** Elliott Credit Corp. wants to earn an effective annual return on its consumer loans of 17.1 percent per year. The bank uses daily compounding on its loans. What interest rate is the bank required by law to report to potential borrowers? Explain why this rate is misleading to an uninformed borrower.
16. **Calculating Future Values [LO1]** What is the future value of $3,100 in 17 years assuming an interest rate of 8.4 percent compounded semiannually?
17. **Calculating Future Values [LO1]** Spartan Credit Bank is offering 8.1 percent compounded daily on its savings accounts. If you deposit $6,500 today, how much will you have in the account in 5 years? In 10 years? In 20 years?
18. **Calculating Present Values [LO1]** An investment will pay you $80,000 in 10 years. If the appropriate discount rate is 9 percent compounded daily, what is the present value?
19. **EAR versus APR [LO4]** Big Dom's Pawn Shop charges an interest rate of 27 percent per month on loans to its customers. Like all lenders, Big Dom must report an APR to consumers. What rate should the shop report? What is the effective annual rate?
20. **Calculating Loan Payments [LO2, 4]** You want to buy a new sports coupe for $84,500, and the finance office at the dealership has quoted you an APR of 5.2 percent for a 60-month loan to buy the car. What will your monthly payments be? What is the effective annual rate on this loan?
21. **Calculating Number of Periods [LO3]** One of your customers is delinquent on his accounts payable balance. You've mutually agreed to a repayment schedule of $450 per month. You will charge 1.3 percent per month interest on the overdue balance. If the current balance is $18,000, how long will it take for the account to be paid off?
22. **Calculating EAR [LO4]** Friendly's Quick Loans, Inc., offers you "three for four or I knock on your door." This means you get $3 today and repay $4 when you get your paycheck in one week (or else). What's the effective annual return Friendly's earns on this lending business? If you were brave enough to ask, what APR would Friendly's say you were paying?
23. **Valuing Perpetuities [LO1]** Live Forever Life Insurance Co. is selling a perpetuity contract that pays $1,250 monthly. The contract currently sells for $245,000. What is the monthly return on this investment vehicle? What is the APR? The effective annual return?
24. **Calculating Annuity Future Values [LO1]** You are planning to make monthly deposits of $475 into a retirement account that pays 10 percent interest compounded monthly. If your first deposit will be made one month from now, how large will your retirement account be in 30 years?
25. **Calculating Annuity Future Values [LO1]** In the previous problem, suppose you make $5,700 annual deposits into the same retirement account. How large will your account balance be in 30 years?
26. **Calculating Annuity Present Values [LO1]** Beginning three months from now, you want to be able to withdraw $2,500 each quarter from your bank account to cover college expenses over the next four years. If the account pays .57 percent interest per quarter, how much do you need to have in your bank account today to meet your expense needs over the next four years?

27. **Discounted Cash Flow Analysis** [LO1] If the appropriate discount rate for the following cash flows is 9 percent compounded quarterly, what is the present value of the cash flows?

Year	Cash Flow
1	$ 815
2	990
3	0
4	1,520

28. **Discounted Cash Flow Analysis** [LO1] If the appropriate discount rate for the following cash flows is 7.17 percent per year, what is the present value of the cash flows?

Year	Cash Flow
1	$2,480
2	0
3	3,920
4	2,170

INTERMEDIATE
(Questions 29–56)

29. **Simple Interest versus Compound Interest** [LO4] First Simple Bank pays 6.4 percent simple interest on its investment accounts. If First Complex Bank pays interest on its accounts compounded annually, what rate should the bank set if it wants to match First Simple Bank over an investment horizon of 10 years?

30. **Calculating EAR** [LO4] You are looking at an investment that has an effective annual rate of 11.6 percent. What is the effective semiannual return? The effective quarterly return? The effective monthly return?

31. **Calculating Interest Expense** [LO2] You receive a credit card application from Shady Banks Savings and Loan offering an introductory rate of 1.25 percent per year, compounded monthly for the first six months, increasing thereafter to 17.8 percent compounded monthly. Assuming you transfer the $8,000 balance from your existing credit card and make no subsequent payments, how much interest will you owe at the end of the first year?

32. **Calculating Annuities** [LO1] You are planning to save for retirement over the next 30 years. To do this, you will invest $750 per month in a stock account and $250 per month in a bond account. The return of the stock account is expected to be 10 percent, and the bond account will pay 6 percent. When you retire, you will combine your money into an account with a return of 5 percent. How much can you withdraw each month from your account assuming a 25-year withdrawal period?

33. **Calculating Future Values** [LO1] You have an investment that will pay you .67 percent per month. How much will you have per dollar invested in one year? In two years?

34. **Calculating Annuity Payments** [LO1] You want to be a millionaire when you retire in 40 years. How much do you have to save each month if you can earn an annual return of 9.7 percent? How much do you have to save each month if you wait 10 years before you begin your deposits? 20 years?

35. **Calculating Rates of Return** [LO2] Suppose an investment offers to triple your money in 12 months (don't believe it). What rate of return per quarter are you being offered?

36. Comparing Cash Flow Streams [LO1] You've just joined the investment banking firm of Dewey, Cheatum, and Howe. They've offered you two different salary arrangements. You can have $85,000 per year for the next two years, or you can have $74,000 per year for the next two years, along with a $20,000 signing bonus today. The bonus is paid immediately, and the salary is paid in equal amounts at the end of each month. If the interest rate is 7 percent compounded monthly, which do you prefer?

37. Growing Annuity [LO1] You have just won the lottery and will receive $1,500,000 in one year. You will receive payments for 30 years, and the payments will increase by 2.7 percent per year. If the appropriate discount rate is 6.8 percent, what is the present value of your winnings?

38. Growing Annuity [LO1] Your job pays you only once a year for all the work you did over the previous 12 months. Today, December 31, you just received your salary of $55,000 and you plan to spend all of it. However, you want to start saving for retirement beginning next year. You have decided that one year from today you will begin depositing 9 percent of your annual salary in an account that will earn 10 percent per year. Your salary will increase at 3 percent per year throughout your career. How much money will you have on the date of your retirement 40 years from today?

39. Present Value and Interest Rates [LO1] What is the relationship between the value of an annuity and the level of interest rates? Suppose you just bought an annuity with 11 annual payments of $8,500 per year at the current interest rate of 10 percent per year. What happens to the value of your investment if interest rates suddenly drop to 5 percent? What if interest rates suddenly rise to 15 percent?

40. Calculating the Number of Payments [LO2] You're prepared to make monthly payments of $175, beginning at the end of this month, into an account that pays 7 percent interest compounded monthly. How many payments will you have made when your account balance reaches $15,000?

41. Calculating Annuity Present Values [LO2] You want to borrow $115,000 from your local bank to buy a new sailboat. You can afford to make monthly payments of $2,250, but no more. Assuming monthly compounding, what is the highest rate you can afford on a 60-month APR loan?

42. Calculating Loan Payments [LO2] You need a 30-year, fixed-rate mortgage to buy a new home for $235,000. Your mortgage bank will lend you the money at an APR of 5.35 percent for this 360-month loan. However, you can afford monthly payments of only $925, so you offer to pay off any remaining loan balance at the end of the loan in the form of a single balloon payment. How large will this balloon payment have to be for you to keep your monthly payments at $925?

43. Present and Future Values [LO1] The present value of the following cash flow stream is $7,500 when discounted at 9 percent annually. What is the value of the missing cash flow?

Year	Cash Flow
1	$1,700
2	?
3	2,450
4	2,980

44. Calculating Present Values [LO1] You just won the TVM Lottery. You will receive $1 million today plus another 10 annual payments that increase by $375,000 per year. Thus, in one year, you receive $1.375 million. In two years, you get $1.75 million, and so on. If the appropriate interest rate is 6.5 percent, what is the value of your winnings today?

45. EAR versus APR [LO4] You have just purchased a new warehouse. To finance the purchase, you've arranged for a 30-year mortgage loan for 80 percent of the $3,400,000 purchase price. The monthly payment on this loan will be $16,500. What is the APR on this loan? The EAR?

46. Present Value and Break-Even Interest [LO1] Consider a firm with a contract to sell an asset for $145,000 four years from now. The asset costs $91,700 to produce today. Given a relevant discount rate of 11 percent per year, will the firm make a profit on this asset? At what rate does the firm just break even?

47. Present Value and Multiple Cash Flows [LO1] What is the value today of $4,400 per year, at a discount rate of 8.3 percent, if the first payment is received 6 years from today and the last payment is received 20 years from today?

48. Variable Interest Rates [LO1] A 15-year annuity pays $1,475 per month, and payments are made at the end of each month. If the interest rate is 9 percent compounded monthly for the first seven years, and 6 percent compounded monthly thereafter, what is the present value of the annuity?

49. Comparing Cash Flow Streams [LO1] You have your choice of two investment accounts. Investment A is a 13-year annuity that features end-of-month $1,250 payments and has an interest rate of 7.5 percent compounded monthly. Investment B is a 7 percent continuously compounded lump sum investment, also good for 13 years. How much money would you need to invest in Investment B today for it to be worth as much as Investment A 13 years from now?

50. Calculating Present Value of a Perpetuity [LO1] Given an interest rate of 5.3 percent per year, what is the value at date $t = 7$ of a perpetual stream of $6,400 payments that begins at date $t = 15$?

51. Calculating EAR [LO4] A local finance company quotes an interest rate of 17.1 percent on one-year loans. So, if you borrow $20,000, the interest for the year will be $3,420. Because you must repay a total of $23,420 in one year, the finance company requires you to pay $23,420/12, or $1,951.67, per month over the next 12 months. Is the interest rate on this loan 17.1 percent? What rate would legally have to be quoted? What is the effective annual rate?

52. Calculating Present Values [LO1] A five-year annuity of 10 $5,900 semiannual payments will begin 9 years from now, with the first payment coming 9.5 years from now. If the discount rate is 8 percent compounded monthly, what is the value of this annuity five years from now? What is the value three years from now? What is the current value of the annuity?

53. Calculating Annuities Due [LO1] Suppose you are going to receive $13,500 per year for five years. The appropriate interest rate is 6.8 percent.

a. What is the present value of the payments if they are in the form of an ordinary annuity? What is the present value if the payments are an annuity due?

b. Suppose you plan to invest the payments for five years. What is the future value if the payments are an ordinary annuity? What if the payments are an annuity due?

c. Which has the highest present value, the ordinary annuity or the annuity due? Which has the highest future value? Will this always be true?

54. Calculating Annuities Due [LO1] You want to buy a new sports car from Muscle Motors for $57,500. The contract is in the form of a 60-month annuity due at an APR of 5.9 percent. What will your monthly payment be?

55. Amortization with Equal Payments [LO3] Prepare an amortization schedule for a five-year loan of $71,500. The interest rate is 7 percent per year, and the loan calls for equal annual payments. How much interest is paid in the third year? How much total interest is paid over the life of the loan?

56. Amortization with Equal Principal Payments [LO3] Rework Problem 55 assuming that the loan agreement calls for a principal reduction of $14,300 every year instead of equal annual payments.

CHALLENGE
(Questions 57–80)

57. Calculating Annuity Values [LO1] Bilbo Baggins wants to save money to meet three objectives. First, he would like to be able to retire 30 years from now with retirement income of $17,500 per month for 25 years, with the first payment received 30 years and 1 month from now. Second, he would like to purchase a cabin in Rivendell in 10 years at an estimated cost of $345,000. Third, after he passes on at the end of the 25 years of withdrawals, he would like to leave an inheritance of $2,000,000 to his nephew Frodo. He can afford to save $2,350 per month for the next 10 years. If he can earn an EAR of 10 percent before he retires and an EAR of 7 percent after he retires, how much will he have to save each month in Years 11 through 30?

58. Calculating Annuity Values [LO1] After deciding to buy a new car, you can either lease the car or purchase it on a three-year loan. The car you wish to buy costs $43,000. The dealer has a special leasing arrangement where you pay $4,300 today and $505 per month for the next three years. If you purchase the car, you will pay it off in monthly payments over the next three years at an APR of 6 percent. You believe you will be able to sell the car for $28,000 in three years. Should you buy or lease the car? What break-even resale price in three years would make you indifferent between buying and leasing?

59. Calculating Annuity Values [LO1] An All-Pro defensive lineman is in contract negotiations. The team has offered the following salary structure:

Time	Salary
0	$8,400,000
1	$4,700,000
2	$5,100,000
3	$5,700,000
4	$6,400,000
5	$7,100,000
6	$7,800,000

All salaries are to be paid in lump sums. The player has asked you as his agent to renegotiate the terms. He wants a $10 million signing bonus payable today and a contract value increase of $2 million. He also wants an equal salary paid every three months, with the first paycheck three months from now. If the interest rate is 4.8 percent compounded daily, what is the amount of his quarterly check? Assume 365 days in a year.

60. Discount Interest Loans [LO4] This question illustrates what is known as *discount interest*. Imagine you are discussing a loan with a somewhat unscrupulous lender. You want to borrow $25,000 for one year. The interest rate is 14.9 percent. You and

the lender agree that the interest on the loan will be .149 × $25,000 = $3,725. So the lender deducts this interest amount from the loan up front and gives you $21,275. In this case, we say that the discount is $3,725. What's wrong here?

61. Calculating Annuity Values [LO1] You are serving on a jury. A plaintiff is suing the city for injuries sustained after a freak street sweeper accident. In the trial, doctors testified that it will be five years before the plaintiff is able to return to work. The jury has already decided in favor of the plaintiff. You are the foreperson of the jury and propose that the jury give the plaintiff an award to cover the following: (a) The present value of two years' back pay. The plaintiff's annual salary for the last two years would have been $43,000 and $46,000, respectively. (b) The present value of five years' future salary. You assume the salary will be $51,000 per year. (c) $150,000 for pain and suffering. (d) $20,000 for court costs. Assume that the salary payments are equal amounts paid at the end of each month. If the interest rate you choose is an EAR of 6.5 percent, what is the size of the settlement? If you were the plaintiff, would you like to see a higher or lower interest rate?

62. Calculating EAR with Points [LO4] You are looking at a one-year loan of $10,000. The interest rate is quoted as 9.8 percent plus 2 points. A *point* on a loan is 1 percent (one percentage point) of the loan amount. Quotes similar to this one are common with home mortgages. The interest rate quotation in this example requires the borrower to pay 2 points to the lender up front and repay the loan later with 9.8 percent interest. What rate would you actually be paying here?

63. Calculating EAR with Points [LO4] The interest rate on a one-year loan is quoted as 12 percent plus 3 points (see the previous problem). What is the EAR? Is your answer affected by the loan amount?

64. Calculating Interest Rates [LO2] You are buying a house and will borrow $225,000 on a 30-year fixed rate mortgage with monthly payments to finance the purchase. Your loan officer has offered you a mortgage with an APR of 4.3 percent. Alternatively, she tells you that you can "buy down" the interest rate to 4.05 percent if you pay points up front on the loan. A point on a loan is 1 percent (one percentage point) of the loan value. How many points, at most, would you be willing to pay to buy down the interest rate?

65. Calculating Interest Rates [LO2] In the previous problem, suppose that you believe that you will only live in the house for eight years before selling the house and buying another house. This means that in eight years, you will pay off the remaining balance of the original mortgage. What is the maximum number of points that you would be willing to pay now?

66. EAR versus APR [LO4] Two banks in the area offer 30-year, $275,000 mortgages at 5.1 percent and charge a $4,300 loan application fee. However, the application fee charged by Insecurity Bank and Trust is refundable if the loan application is denied, whereas that charged by I.M. Greedy and Sons Mortgage Bank is not. The current disclosure law requires that any fees that will be refunded if the applicant is rejected be included in calculating the APR, but this is not required with nonrefundable fees (presumably because refundable fees are part of the loan rather than a fee). What are the EARs on these two loans? What are the APRs?

67. Calculating EAR with Add-On Interest [LO4] This problem illustrates a deceptive way of quoting interest rates called *add-on interest*. Imagine that you see an advertisement for Crazy Judy's Stereo City that reads something like this: "$1,000 Instant Credit! 17.3% Simple Interest! Three Years to Pay! Low, Low Monthly Payments!" You're not exactly sure what all this means and somebody has spilled ink over the APR on the loan contract, so you ask the manager for clarification.

Judy explains that if you borrow $1,000 for three years at 17.3 percent interest, in three years you will owe:

$$\$1{,}000 \times 1.173^3 = \$1{,}000 \times 1.61396 = \$1{,}613.96$$

Now, Judy recognizes that coming up with $1,613.96 all at once might be a strain, so she lets you make "low, low monthly payments" of $1,613.96/36 = $44.83 per month, even though this is extra bookkeeping work for her.

Is the interest rate on this loan 17.3 percent? Why or why not? What is the APR on this loan? What is the EAR? Why do you think this is called add-on interest?

68. Growing Annuities [LO1] You have successfully started and operated a company for the past 10 years. You have decided that it is time to sell your company and spend time on the beaches of Hawaii. A potential buyer is interested in your company, but he does not have the necessary capital to pay you a lump sum. Instead, he has offered $500,000 today and annuity payments for the balance. The first payment will be for $150,000 in three months. The payments will increase at 2 percent per quarter and a total of 25 quarterly payments will be made. If you require an EAR of 11 percent, how much are you being offered for your company?

69. Calculating the Number of Periods [LO2] Your Christmas ski vacation was great, but it unfortunately ran a bit over budget. All is not lost: You just received an offer in the mail to transfer your $15,000 balance from your current credit card, which charges an annual rate of 17.5 percent, to a new credit card charging a rate of 8.9 percent. How much faster could you pay the loan off by making your planned monthly payments of $250 with the new card? What if there was a fee of 2 percent charged on any balances transferred?

70. Future Value and Multiple Cash Flows [LO1] An insurance company is offering a new policy to its customers. Typically, the policy is bought by a parent or grandparent for a child at the child's birth. The purchaser (say, the parent) makes the following six payments to the insurance company:

First birthday:	$700
Second birthday:	$700
Third birthday:	$800
Fourth birthday:	$800
Fifth birthday:	$900
Sixth birthday:	$900

After the child's sixth birthday, no more payments are made. When the child reaches age 65, he or she receives $300,000. If the relevant interest rate is 10 percent for the first six years and 7 percent for all subsequent years, is the policy worth buying?

71. Calculating a Balloon Payment [LO2] You have just arranged for a $2,350,000 mortgage to finance the purchase of a large tract of land. The mortgage has an APR of 5.2 percent, and it calls for monthly payments over the next 30 years. However, the loan has an eight-year balloon payment, meaning that the loan must be paid off then. How big will the balloon payment be?

72. Calculating Interest Rates [LO4] A financial planning service offers a college savings program. The plan calls for you to make six annual payments of $15,000 each, with the first payment occurring today, your child's 12th birthday. Beginning

on your child's 18th birthday, the plan will provide $32,000 per year for four years. What return is this investment offering?

73. Break-Even Investment Returns [LO4] Your financial planner offers you two different investment plans. Plan X is an annual perpetuity of $35,000 per year. Plan Y is an annuity for 15 years and an annual payment of $47,000. Both plans will make their first payment one year from today. At what discount rate would you be indifferent between these two plans?

74. Perpetual Cash Flows [LO1] What is the value of an investment that pays $25,000 every *other* year forever, if the first payment occurs one year from today and the discount rate is 7 percent compounded daily? What is the value today if the first payment occurs four years from today?

75. Ordinary Annuities and Annuities Due [LO1] As discussed in the text, an annuity due is identical to an ordinary annuity except that the periodic payments occur at the beginning of each period instead of at the end of the period. Show that the relationship between the value of an ordinary annuity and the value of an otherwise equivalent annuity due is:

$$\text{Annuity due value} = \text{Ordinary annuity value} \times (1 + r)$$

Show this for both present and future values.

76. Calculating Growing Annuities [LO1] You have 45 years left until retirement and want to retire with $4 million. Your salary is paid annually, and you will receive $50,000 at the end of the current year. Your salary will increase at 3 percent per year, and you can earn an annual return of 9 percent on the money you invest. If you save a constant percentage of your salary, what percentage of your salary must you save each year?

77. Calculating EAR [LO4] A check-cashing store is in the business of making personal loans to walk-up customers. The store makes only one-week loans at 6.8 percent interest per week.

a. What APR must the store report to its customers? What EAR are customers actually paying?

b. Now suppose the store makes one-week loans at 6.8 percent discount interest per week (see Problem 60). What's the APR now? The EAR?

c. The check-cashing store also makes one-month add-on interest loans at 6.8 percent discount interest per week. Thus if you borrow $100 for one month (four weeks), the interest will be ($100 × 1.068^4) − 100 = $30.10. Because this is discount interest, your net loan proceeds today will be $69.90. You must then repay the store $100 at the end of the month. To help you out, though, the store lets you pay off this $100 in installments of $25 per week. What is the APR of this loan? What is the EAR?

78. Present Value of a Growing Perpetuity [LO1] What is the equation for the present value of a growing perpetuity with a payment of C one period from today if the payments grow by C each period?

79. Rule of 72 [LO4] Earlier, we discussed the Rule of 72, a useful approximation for many interest rates and periods for the time it takes a lump sum to double in value. For a 10 percent interest rate, show that the "Rule of 73" is slightly better. For what rate is the Rule of 72 exact? (*Hint*: Use the Solver function in Excel.)

80. Rule of 69.3 [LO4] A corollary to the Rule of 72 is the Rule of 69.3. The Rule of 69.3 is exactly correct except for rounding when interest rates are compounded continuously. Prove the Rule of 69.3 for continuously compounded interest.

EXCEL MASTER-IT! PROBLEM

This is a classic retirement problem. A friend is celebrating her birthday and wants to start saving for her anticipated retirement. She has the following years to retirement and retirement spending goals:

Years until retirement:	30
Amount to withdraw each year:	$90,000
Years to withdraw in retirement:	20
Interest rate:	8%

Because your friend is planning ahead, the first withdrawal will not take place until one year after she retires. She wants to make equal annual deposits into her account for her retirement fund.

a. If she starts making these deposits in one year and makes her last deposit on the day she retires, what amount must she deposit annually to be able to make the desired withdrawals at retirement?

b. Suppose your friend has just inherited a large sum of money. Rather than making equal annual payments, she has decided to make one lump sum deposit today to cover her retirement needs. What amount does she have to deposit today?

c. Suppose your friend's employer will contribute to the account each year as part of the company's profit sharing plan. In addition, your friend expects a distribution from a family trust 20 years from now. What amount must she deposit annually now to be able to make the desired withdrawals at retirement?

Employer's annual contribution:	$ 1,500
Years until trust fund distribution:	20
Amount of trust fund distribution:	$25,000

MINICASE

The MBA Decision

Ben Bates graduated from college six years ago with a finance undergraduate degree. Although he is satisfied with his current job, his goal is to become an investment banker. He feels that an MBA degree would allow him to achieve this goal. After examining schools, he has narrowed his choice to either Wilton University or Mount Perry College. Although internships are encouraged by both schools, to get class credit for the internship, no salary can be paid. Other than internships, neither school will allow its students to work while enrolled in its MBA program.

Ben currently works at the money management firm of Dewey and Louis. His annual salary at the firm is $53,000 per year, and his salary is expected to increase at 3 percent per year until retirement. He is currently 28 years old and expects to work for 38 more years. His current job includes a fully paid health insurance plan, and his current average tax rate is 26 percent. Ben has a savings account with enough money to cover the entire cost of his MBA program.

The Ritter College of Business at Wilton University is one of the top MBA programs in the country. The MBA degree requires two years of full-time enrollment at the university. The annual tuition is $58,000, payable at the beginning of each school year. Books and other supplies are estimated to cost $2,000 per year. Ben expects that after graduation from Wilton, he will receive a job offer for about $87,000 per year, with a $10,000 signing bonus. The salary at this job will increase at 4 percent per year. Because of the higher salary, his average income tax rate will increase to 31 percent.

The Bradley School of Business at Mount Perry College began its MBA program 16 years ago. The Bradley School is smaller and less well known than the Ritter College. Bradley offers an accelerated one-year program, with a tuition cost of $75,000 to be paid upon matriculation. Books and other supplies for the program are expected to cost $4,200. Ben thinks that he will receive an offer of $78,000 per year upon graduation, with an $8,000 signing bonus. The salary at this job will

increase at 3.5 percent per year. His average tax rate at this level of income will be 29 percent.

Both schools offer a health insurance plan that will cost $3,000 per year, payable at the beginning of the year. Ben has also found that both schools offer graduate housing. His room and board expenses will decrease by $4,000 per year at either school he attends. The appropriate discount rate is 5.5 percent.

QUESTIONS

1. How does Ben's age affect his decision to get an MBA?
2. What other, perhaps nonquantifiable, factors affect Ben's decision to get an MBA?
3. Assuming all salaries are paid at the end of each year, what is the best option for Ben from a strictly financial standpoint?
4. Ben believes that the appropriate analysis is to calculate the future value of each option. How would you evaluate this statement?
5. What initial salary would Ben need to receive to make him indifferent between attending Wilton University and staying in his current position?
6. Suppose, instead of being able to pay cash for his MBA, Ben must borrow the money. The current borrowing rate is 5.4 percent. How would this affect his decision?

Interest Rates and Bond Valuation

Chapter 7

GENERALLY, WHEN AN INVESTMENT is made, you expect that you will get back more money in the future than you invested today. In December 2017, this wasn't the case for many bond investors. The yield on a 5-year German government bond was about negative .20 percent, and the yields on 2-year and 5-year Japanese government bonds were negative .14 percent and negative .09 percent, respectively. In fact, in 2016, the amount of debt worldwide that had a negative yield reached a record $13.4 trillion! And negative yields were not restricted to government bonds, as the yield on the chocolate maker Nestlé's bond was negative as well.

As you will see in this chapter, a bond's yield is an important determinant of a bond's price. In addition to showing you how to value a bond, we will talk about various bond features and the factors that affect bond yields.

Learning Objectives

After studying this chapter, you should be able to:

- **LO1** Define important bond features and types of bonds.
- **LO2** Explain bond values and yields and why they fluctuate.
- **LO3** Describe bond ratings and what they mean.
- **LO4** Outline the impact of inflation on interest rates.
- **LO5** Illustrate the term structure of interest rates and the determinants of bond yields.

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Our goal in this chapter is to introduce you to bonds. We begin by showing how the techniques we developed in Chapters 5 and 6 can be applied to bond valuation. From there, we go on to discuss bond features and how bonds are bought and sold. One important thing we learn is that bond values depend, in large part, on interest rates. We therefore close the chapter with an examination of interest rates and their behavior.

7.1 Bonds and Bond Valuation

Excel Master It!
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When a corporation or government wishes to borrow money from the public on a long-term basis, it usually does so by issuing or selling debt securities that are generically called *bonds*. In this section, we describe the various features of corporate bonds and some of the terminology associated with bonds. We then discuss the cash flows associated with a bond and how bonds can be valued using our discounted cash flow procedure.

BOND FEATURES AND PRICES

As we mentioned in our previous chapter, a bond is normally an interest-only loan, meaning that the borrower will pay the interest every period, but none of the principal will be repaid until the end of the loan. For example, suppose the Beck Corporation wants to borrow $1,000 for 30 years. The interest rate on similar debt issued by similar corporations is 12 percent. Beck will thus pay .12 × $1,000 = $120 in interest every year for 30 years. At the end of 30 years, Beck will repay the $1,000. As this example suggests, a bond is a fairly simple financing arrangement. There is, however, a rich jargon associated with bonds, so we will use this example to define some of the more important terms.

coupon
The stated interest payment made on a bond.

face value
The principal amount of a bond that is repaid at the end of the term. Also called *par value*.

coupon rate
The annual coupon divided by the face value of a bond.

maturity
The specified date on which the principal amount of a bond is paid.

In our example, the $120 regular interest payments that Beck promises to make are called the bond's **coupons**. Because the coupon is constant and paid every year, the type of bond we are describing is sometimes called a *level coupon bond*. The amount that will be repaid at the end of the loan is called the bond's **face value**, or **par value**. As in our example, this par value is usually $1,000 for corporate bonds, and a bond that sells for its par value is called a *par value bond*. Government bonds frequently have much larger face, or par, values. Finally, the annual coupon divided by the face value is called the **coupon rate** on the bond; in this case, because $120/1,000 = 12%, the bond has a 12 percent coupon rate.

The number of years until the face value is paid is called the bond's time to **maturity**. A corporate bond will frequently have a maturity of 30 years when it is originally issued, but this varies. Once the bond has been issued, the number of years to maturity declines as time goes by.

BOND VALUES AND YIELDS

As time passes, interest rates change in the marketplace. The cash flows from a bond, however, stay the same. As a result, the value of the bond will fluctuate. When interest rates rise, the present value of the bond's remaining cash flows declines, and the bond is worth less. When interest rates fall, the bond is worth more.

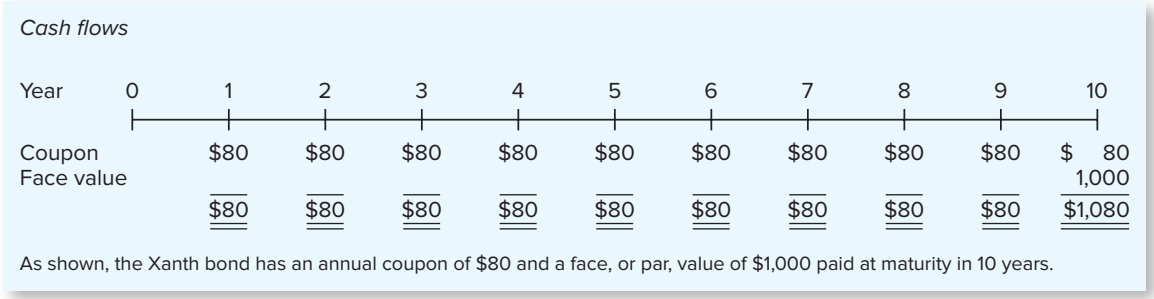
To determine the value of a bond at a particular point in time, we need to know the number of periods remaining until maturity, the face value, the coupon, and the market interest rate for bonds with similar features. This interest rate required in the market on a bond is called the bond's **yield to maturity (YTM)**. This rate is sometimes called the bond's *yield* for short. Given all this information, we can calculate the present value of the cash flows as an estimate of the bond's current market value.

yield to maturity (YTM)
The rate required in the market on a bond.

For example, suppose the Xanth (pronounced "zanth") Co. were to issue a bond with 10 years to maturity. The Xanth bond has an annual coupon of $80. Similar bonds have a yield to maturity of 8 percent. Based on our preceding discussion, the Xanth bond will pay $80 per year for the next 10 years in coupon interest. In 10 years, Xanth will pay $1,000 to the owner of the bond. The cash flows from the bond are shown in Figure 7.1. What would this bond sell for?

As illustrated in Figure 7.1, the Xanth bond's cash flows have an annuity component (the coupons) and a lump sum (the face value paid at maturity). We thus estimate the market

FIGURE 7.1 Cash Flows for Xanth Co. Bond



As shown, the Xanth bond has an annual coupon of $80 and a face, or par, value of $1,000 paid at maturity in 10 years.

value of the bond by calculating the present value of these two components separately and adding the results together. First, at the going rate of 8 percent, the present value of the $1,000 paid in 10 years is:

$$\text{Present value} = \$1{,}000/1.08^{10} = \$1{,}000/2.1589 = \$463.19$$

Second, the bond offers $80 per year for 10 years; the present value of this annuity stream is:

$$\begin{aligned}\text{Annuity present value} &= \$80 \times (1-1/1.08^{10})/.08\\ &= \$80 \times (1-1/2.1589)/.08\\ &= \$80 \times 6.7101\\ &= \$536.81\end{aligned}$$

We can now add the values for the two parts together to get the bond's value:

$$\text{Total bond value} = \$463.19 + 536.81 = \$1{,}000$$

This bond sells for exactly its face value. This is not a coincidence. The going interest rate in the market is 8 percent. Considered as an interest-only loan, what interest rate does this bond have? With an $80 coupon, this bond pays exactly 8 percent interest only when it sells for $1,000.

To illustrate what happens as interest rates change, suppose a year has gone by. The Xanth bond now has nine years to maturity. If the interest rate in the market has risen to 10 percent, what will the bond be worth? To find out, we repeat the present value calculations with 9 years instead of 10, and a 10 percent yield instead of an 8 percent yield. First, the present value of the $1,000 paid in nine years at 10 percent is:

$$\text{Present value} = \$1{,}000/1.10^{9} = \$1{,}000/2.3579 = \$424.10$$

Second, the bond now offers $80 per year for nine years; the present value of this annuity stream at 10 percent is:

$$\begin{aligned}\text{Annuity present value} &= \$80 \times (1-1/1.10^{9})/.10\\ &= \$80 \times (1-1/2.3579)/.10\\ &= \$80 \times 5.7590\\ &= \$460.72\end{aligned}$$

We can now add the values for the two parts together to get the bond's value:

$$\text{Total bond value} = \$424.10 + 460.72 = \$884.82$$

A good bond site to visit is **finance.yahoo.com/bonds**, which has loads of useful information.

Therefore, the bond should sell for about $885. In the vernacular, we say that this bond, with its 8 percent coupon, is priced to yield 10 percent at $885.

The Xanth Co. bond now sells for less than its $1,000 face value. Why? The market interest rate is 10 percent. Considered as an interest-only loan of $1,000, this bond pays only 8 percent, its coupon rate. Because this bond pays less than the going rate, investors are willing to lend only something less than the $1,000 promised repayment. Because the bond sells for less than face value, it is said to be a *discount bond*.

The only way to get the interest rate up to 10 percent is to lower the price to less than $1,000 so that the purchaser, in effect, has a built-in gain. For the Xanth bond, the price of $885 is $115 less than the face value, so an investor who purchases and keeps the bond will get $80 per year and will have a $115 gain at maturity as well. This gain compensates the lender for the below-market coupon rate.

Another way to see why the bond is discounted by $115 is to note that the $80 coupon is $20 below the coupon on a newly issued par value bond, based on current market conditions. The bond would be worth $1,000 only if it had a coupon of $100 per year. In a sense, an investor who buys and keeps the bond gives up $20 per year for nine years. At 10 percent, this annuity stream is worth:

$$\begin{aligned}\text{Annuity present value} &= \$20 \times (1 - 1/1.10^{9})/.10 \\ &= \$20 \times 5.7590 \\ &= \$115.18\end{aligned}$$

This is the amount of the discount.

Online bond calculators are available at **personal.fidelity.com**; interest rate information is available at **money.cnn.com/data/bonds** and **www.bankrate.com**.

What would the Xanth bond sell for if interest rates had dropped by 2 percent instead of rising by 2 percent? As you might guess, the bond would sell for more than $1,000. Such a bond is said to sell at a *premium* and is called a *premium bond*.

This case is the opposite of that of a discount bond. The Xanth bond now has a coupon rate of 8 percent when the market rate is only 6 percent. Investors are willing to pay a premium to get this extra coupon amount. In this case, the relevant discount rate is 6 percent, and there are nine years remaining. The present value of the $1,000 face amount is:

$$\text{Present value} = \$1{,}000/1.06^{9} = \$1{,}000/1.6895 = \$591.90$$

The present value of the coupon stream is:

$$\begin{aligned}\text{Annuity present value} &= \$80 \times (1-1/1.06^{9})/.06 \\ &= \$80 \times (1-1/1.6895)/.06 \\ &= \$80 \times 6.8017 \\ &= \$544.14\end{aligned}$$

We can now add the values for the two parts together to get the bond's value:

$$\text{Total bond value} = \$591.90 + 544.14 = \$1{,}136.03$$

Total bond value is therefore about $136 in excess of par value. Once again, we can verify this amount by noting that the coupon is now $20 too high, based on current market conditions. The present value of $20 per year for nine years at 6 percent is:

$$\begin{aligned}\text{Annuity present value} &= \$20 \times (1-1/1.06^{9})/.06 \\ &= \$20 \times 6.8017 \\ &= \$136.03\end{aligned}$$

This is just as we calculated.

Based on our examples, we can now write the general expression for the value of a bond. If a bond has (1) a face value of F paid at maturity, (2) a coupon of C paid per period, (3) t periods to maturity, and (4) a yield of r per period, its value is:

$$\text{Bond value} = C \times [1 - 1/(1 + r)^t]/r + F/(1 + r)^t \quad (7.1)$$

$$\text{Bond value} = \begin{matrix}\text{Present value} \\ \text{of the coupons}\end{matrix} + \begin{matrix}\text{Present value} \\ \text{of the face amount}\end{matrix}$$

Semiannual Coupons — EXAMPLE 7.1

In practice, bonds issued in the United States usually make coupon payments twice a year. So, if an ordinary bond has a coupon rate of 14 percent, then the owner will get a total of $140 per year, but this $140 will come in two payments of $70 each. Suppose we are examining such a bond. The yield to maturity is quoted at 16 percent.

Bond yields are quoted like APRs; the quoted rate is equal to the actual rate per period multiplied by the number of periods. In this case, with a 16 percent quoted yield and semiannual payments, the true yield is 8 percent per six months. The bond matures in seven years. What is the bond's price? What is the effective annual yield on this bond?

Based on our discussion, we know the bond will sell at a discount because it has a coupon rate of 7 percent every six months when the market requires 8 percent every six months. So, if our answer exceeds $1,000, we know we have made a mistake.

To get the exact price, we first calculate the present value of the bond's face value of $1,000 paid in seven years. This seven-year period has 14 periods of six months each. At 8 percent per period, the value is:

$$\text{Present value} = \$1{,}000/1.08^{14} = \$1{,}000/2.9372 = \$340.46$$

The coupons can be viewed as a 14-period annuity of $70 per period. At an 8 percent discount rate, the present value of such an annuity is:

$$\begin{aligned}\text{Annuity present value} &= \$70 \times (1 - 1/1.08^{14})/.08 \\ &= \$70 \times (1 - .3405)/.08 \\ &= \$70 \times 8.2442 \\ &= \$577.10\end{aligned}$$

The total present value gives us what the bond should sell for:

$$\text{Total present value} = \$340.46 + 577.10 = \$917.56$$

To calculate the effective yield on this bond, note that 8 percent every six months is equivalent to:

$$\text{Effective annual rate} = (1 + .08)^2 - 1 = 16.64\%$$

The effective yield is 16.64 percent.

As we have illustrated in this section, bond prices and interest rates always move in opposite directions. When interest rates rise, a bond's value, like any other present value, will decline. Similarly, when interest rates fall, bond values rise. Even if we are considering a bond that is riskless in the sense that the borrower is certain to make all the payments, there is still risk in owning a bond. We discuss this next.

Visit **investorguide.com** to learn more about bonds.

INTEREST RATE RISK

The risk that arises for bond owners from fluctuating interest rates is called *interest rate risk*. How much interest rate risk a bond has depends on how sensitive its price is to interest rate changes. This sensitivity directly depends on two things: The time to maturity and the coupon rate. As we will see momentarily, you should keep the following in mind when looking at a bond:

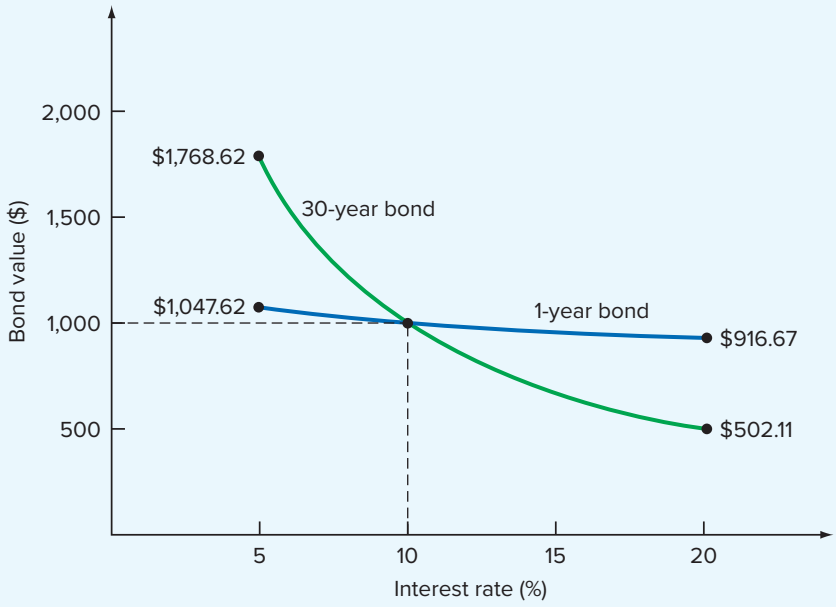
1. All other things being equal, the longer the time to maturity, the greater the interest rate risk.
2. All other things being equal, the lower the coupon rate, the greater the interest rate risk.

We illustrate the first of these two points in Figure 7.2. As shown, we compute and plot prices under different interest rate scenarios for 10 percent coupon bonds with maturities of 1 year and 30 years. Notice how the slope of the line connecting the prices is much steeper for the 30-year maturity than it is for the 1-year maturity. This steepness tells us that a relatively small change in interest rates will lead to a substantial change in the bond's value. In comparison, the 1-year bond's price is relatively insensitive to interest rate changes.

Intuitively, we can see that longer-term bonds have greater interest rate sensitivity because a large portion of a bond's value comes from the $1,000 face amount. The present value of this amount isn't greatly affected by a small change in interest rates if the

FIGURE 7.2

Interest Rate Risk and Time to Maturity



Value of a Bond with a 10 Percent Coupon Rate for Different Interest Rates and Maturities

	Time to Maturity	
Interest Rate	1 Year	30 Years
5%	$1,047.62	$1,768.62
10	1,000.00	1,000.00
15	956.52	671.70
20	916.67	502.11

amount is to be received in one year. Even a small change in the interest rate, however, once it is compounded for 30 years, can have a significant effect on the present value. As a result, the present value of the face amount will be much more volatile with a longer-term bond.

The other thing to know about interest rate risk is that, like most things in finance and economics, it increases at a decreasing rate. In other words, if we compared a 10-year bond to a 1-year bond, we would see that the 10-year bond has much greater interest rate risk. If you were to compare a 20-year bond to a 30-year bond, you would find that the 30-year bond has somewhat greater interest rate risk because it has a longer maturity, but the difference in the risk would be fairly small.

The reason that bonds with lower coupons have greater interest rate risk is essentially the same. As we discussed earlier, the value of a bond depends on the present value of its coupons and the present value of the face amount. If two bonds with different coupon rates have the same maturity, then the value of the one with the lower coupon is proportionately more dependent on the face amount to be received at maturity. As a result, all other things being equal, its value will fluctuate more as interest rates change. Put another way, the bond with the higher coupon has a larger cash flow early in its life, so its value is less sensitive to changes in the discount rate.

Bonds are rarely issued with maturities longer than 30 years. However, low interest rates in recent years have led to the issuance of much longer-term issues. In the 1990s, Walt Disney issued "Sleeping Beauty" bonds with a 100-year maturity. Similarly, BellSouth (now known as AT&T), Coca-Cola, and Dutch banking giant ABN AMRO all issued bonds with 100-year maturities. These companies evidently wanted to lock in the historical low interest rates for a *long* time. The current record holder for corporations looks to be Republic National Bank, which sold bonds with 1,000 years to maturity. Although somewhat rare, 100-year bond issues still occur, and recently they have even been issued by governments. For example, Belgium issued 100-year bonds in 2015, and Ireland issued 100-year bonds in 2016. The Irish bonds had a yield to maturity of only 2.35 percent when they were originally issued, something to keep in mind when we discuss the term structure of interest rates later in this chapter.

We can illustrate the effect of interest rate risk using the 100-year BellSouth (AT&T) issue. The following table provides some basic information about this issue, along with its prices on December 31, 1995, March 6, 2009, and December 29, 2017:

Maturity	Coupon Rate	Price on 12/31/95	Price on 3/6/09	Percentage Change in Price 1995–2009	Price on 12/29/17	Percentage Change in Price 2009–2017
2095	7.00%	$1,000.00	$803.43	−19.66%	$1,166.10	45.14%

Several things emerge from this table. First, interest rates apparently increased between December 31, 1995, and March 6, 2009 (why?). After that, they fell (why?). The bond's price first lost 19.66 percent and then gained 45.14 percent.

FINDING THE YIELD TO MATURITY: MORE TRIAL AND ERROR

Frequently, we will know a bond's price, coupon rate, and maturity date, but not its yield to maturity. For example, suppose we are interested in a six-year, 8 percent coupon bond with annual payments. A broker quotes a price of $955.14. What is the yield on this bond?

We've seen that the price of a bond can be written as the sum of its annuity and lump sum components. Knowing that there is an $80 coupon for six years and a $1,000 face value, we can say that the price is:

$$\$955.14 = \$80 \times [1 - 1/(1 + r)^6]/r + 1{,}000/(1 + r)^6$$

where r is the unknown discount rate, or yield to maturity. We have one equation here and one unknown, but we cannot solve it for r explicitly. The only way to find the answer is to use trial and error.

This problem is essentially identical to the one we examined in the last chapter when we tried to find the unknown interest rate on an annuity. Finding the rate (or yield) on a bond is even more complicated because of the $1,000 face amount.

We can speed up the trial-and-error process by using what we know about bond prices and yields. In this case, the bond has an $80 coupon and is selling at a discount. We know that the yield is greater than 8 percent. If we compute the price at 10 percent:

$$\begin{aligned}\text{Bond value} &= \$80 \times (1 - 1/1.10^6)/.10 + 1{,}000/1.10^6 \\ &= \$80 \times 4.3553 + 1{,}000/1.7716 \\ &= \$912.89\end{aligned}$$

Current market rates are available at **www.bankrate.com**.

At 10 percent, the value we calculate is lower than the actual price, so 10 percent is too high. The true yield must be somewhere between 8 and 10 percent. At this point, it's "plug and chug" to find the answer. You would probably want to try 9 percent next. If you did, you would see that this is in fact the bond's yield to maturity.

current yield
A bond's annual coupon divided by its price.

A bond's yield to maturity should not be confused with its **current yield**, which is a bond's annual coupon divided by its price. In the example we just worked, the bond's annual coupon was $80, and its price was $955.14. Given these numbers, we see that the current yield is $80/955.14 = 8.38 percent, which is less than the yield to maturity of 9 percent. The reason the current yield is too low is that it considers only the coupon portion of your return; it doesn't consider the built-in gain from the price discount. For a premium bond, the reverse is true, meaning that current yield would be higher because it ignores the built-in loss.

Our discussion of bond valuation is summarized in Table 7.1.

TABLE 7.1
Summary of Bond Valuation

I. Finding the Value of a Bond
Bond value = $C \times [1 - 1/(1 + r)^t]/r + F/(1 + r)^t$ where: C = Coupon paid each period r = Rate per period t = Number of periods F = Bond's face value
II. Finding the Yield on a Bond
Given a bond value, coupon, time to maturity, and face value, it is possible to find the implicit discount rate, or yield to maturity, by trial and error only. To do this, try different discount rates until the calculated bond value equals the given value (or let a financial calculator do it for you). Remember that increasing the rate *decreases* the bond value.

Current Events — EXAMPLE 7.2

A bond has a quoted price of $1,080.42. It has a face value of $1,000, a semiannual coupon of $30, and a maturity of five years. What is its current yield? What is its yield to maturity? Which is bigger? Why?

Notice that this bond makes semiannual payments of $30, so the annual payment is $60. The current yield is thus $60/1,080.42 = 5.55 percent. To calculate the yield to maturity, refer back to Example 7.1. In this case, the bond pays $30 every six months and has 10 six-month periods until maturity. So, we need to find r as follows:

$$\$1{,}080.42 = \$30 \times [1 - 1/(1 + r)^{10}]/r + 1{,}000/(1 + r)^{10}$$

After some trial and error, we find that r is equal to about 2.1 percent. But, the tricky part is that this 2.1 percent is the yield *per six months*. We have to double it to get the yield to maturity, so the yield to maturity is 4.2 percent, which is less than the current yield. The reason is that the current yield ignores the built-in loss of the premium between now and maturity.

Bond Yields — EXAMPLE 7.3

You're looking at two bonds identical in every way except for their coupons and, of course, their prices. Both have 12 years to maturity. The first bond has a 10 percent annual coupon rate and sells for $935.08. The second has a 12 percent annual coupon rate. What do you think it would sell for?

Because the two bonds are similar, they will be priced to yield about the same rate. We first need to calculate the yield on the 10 percent coupon bond. Proceeding as before, we know that the yield must be greater than 10 percent because the bond is selling at a discount. The bond has a fairly long maturity of 12 years. We've seen that long-term bond prices are relatively sensitive to interest rate changes, so the yield is probably close to 10 percent. A little trial and error reveals that the yield is actually 11 percent:

$$\begin{aligned}\text{Bond value} &= \$100 \times (1 - 1/1.11^{12})/.11 + 1{,}000/1.11^{12}\\ &= \$100 \times 6.4924 + 1{,}000/3.4985\\ &= \$649.24 + 285.84\\ &= \$935.08\end{aligned}$$

With an 11 percent yield, the second bond will sell at a premium because of its $120 coupon. Its value is:

$$\begin{aligned}\text{Bond value} &= \$120 \times (1 - 1/1.11^{12})/.11 + 1{,}000/1.11^{12}\\ &= \$120 \times 6.4924 + 1{,}000/3.4985\\ &= \$779.08 + 285.84\\ &= \$1{,}064.92\end{aligned}$$

CALCULATOR HINTS

How to Calculate Bond Prices and Yields Using a Financial Calculator

Many financial calculators have fairly sophisticated built-in bond valuation routines. However, these vary quite a lot in implementation, and not all financial calculators have them. As a result, we will illustrate a simple way to handle bond problems that will work on about any financial calculator.

To begin, of course, we first remember to clear out the calculator! Returning to Example 7.3, we have two bonds to consider, both with 12 years to maturity. The first one sells for $935.08 and has a 10 percent annual coupon rate. To find its yield, we can do the following:

	N	I/Y	PMT	PV	FV
Enter	12		100	–935.08	1,000
Solve for		11			

Notice that here we have entered both a future value of $1,000, representing the bond's face value, and a payment of 10 percent of $1,000, or $100, per year, representing the bond's annual coupon. Also, notice that we have a negative sign on the bond's price, which we have entered as the present value.

For the second bond, we now know that the relevant yield is 11 percent. It has a 12 percent annual coupon and 12 years to maturity, so what's the price? To answer, we enter the relevant values and solve for the present value of the bond's cash flows:

	N	I/Y	PMT	PV	FV
Enter	12	11	120		1,000
Solve for				–1,064.92	

There is an important detail that comes up here. Suppose we have a bond with a price of $902.29, 10 years to maturity, and a coupon rate of 6 percent. As we mentioned earlier, most bonds actually make semiannual payments. Assuming that this is the case for the bond here, what's the bond's yield? To answer, we need to enter the relevant numbers like this:

	N	I/Y	PMT	PV	FV
Enter	20		30	–902.29	1,000
Solve for		3.7			

Notice that we entered $30 as the payment because the bond actually makes payments of $30 every six months. Similarly, we entered 20 for N because there are actually 20 six-month periods. When we solve for the yield, we get 3.7 percent. The tricky thing to remember is that this is the yield *per six months*, so we have to double it to get the right answer: $2 \times 3.7 = 7.4$ percent, which would be the bond's reported yield.

SPREADSHEET STRATEGIES

How to Calculate Bond Prices and Yields Using a Spreadsheet

Most spreadsheets have fairly elaborate routines available for calculating bond values and yields; many of these routines involve details we have not discussed. Setting up a spreadsheet to calculate prices or yields is straightforward, as our next two spreadsheets show:

	A	B	C	D	E	F	G	H
1								
2	**Using a spreadsheet to calculate bond values**							
3								
4	Suppose we have a bond with 22 years to maturity, a coupon rate of 8 percent, and a yield to							
5	maturity of 9 percent. If the bond makes semiannual payments, what is its price today?							
6								
7	Settlement date:	1/1/00						
8	Maturity date:	1/1/22						
9	Annual coupon rate:	.08						
10	Yield to maturity:	.09						
11	Face value (% of par):	100						
12	Coupons per year:	2						
13	Bond price (% of par):	**90.49**						
14								
15	The formula entered in cell B13 is =PRICE(B7,B8,B9,B10,B11,B12); notice that face value and bond							
16	price are given as a percentage of face value.							

	A	B	C	D	E	F	G	H
1								
2	**Using a spreadsheet to calculate bond yields**							
3								
4	Suppose we have a bond with 22 years to maturity, a coupon rate of 8 percent, and a price of							
5	$960.17. If the bond makes semiannual payments, what is its yield to maturity?							
6								
7	Settlement date:	1/1/00						
8	Maturity date:	1/1/22						
9	Annual coupon rate:	.08						
10	Bond price (% of par):	96.017						
11	Face value (% of par):	100						
12	Coupons per year:	2						
13	Yield to maturity:	**.084**						
14								
15	The formula entered in cell B13 is =YIELD(B7,B8,B9,B10,B11,B12); notice that face value and bond							
16	price are entered as a percentage of face value.							
17								

In our spreadsheets, notice that we had to enter two dates: A settlement date and a maturity date. The settlement date is the date you actually pay for the bond, and the maturity date is the day the bond actually matures. In most of our problems, we don't explicitly have these dates, so we have to make them up. For example, because our bond has 22 years to maturity, we picked 1/1/2000 (January 1, 2000) as the settlement date and 1/1/2022 (January 1, 2022) as the maturity date. Any two dates would do as long as they are exactly 22 years apart, but these are particularly easy to work with. Finally, notice that we had to enter the coupon rate and yield to maturity in annual terms and then explicitly provide the number of coupon payments per year.

Concept Questions

7.1a What are the cash flows associated with a bond?

7.1b What is the general expression for the value of a bond?

7.1c Is it true that the only risk associated with owning a bond is that the issuer will not make all the payments? Explain.

7.2 More about Bond Features

Excel Master It!

Excel Master coverage online

In this section, we continue our discussion of corporate debt by describing in some detail the basic terms and features that make up a typical long-term corporate bond. We discuss additional issues associated with long-term debt in subsequent sections.

Securities issued by corporations may be classified roughly as *equity securities* and *debt securities*. At the crudest level, a debt represents something that must be repaid; it is the result of borrowing money. When corporations borrow, they generally promise to make regularly scheduled interest payments and to repay the original amount borrowed (that is, the principal). The person or firm making the loan is called the *creditor* or *lender*. The corporation borrowing the money is called the *debtor* or *borrower*.

From a financial point of view, the main differences between debt and equity are the following:

Information for bond investors can be found at **www.investinginbonds.com**.

1. Debt is not an ownership interest in the firm. Creditors generally do not have voting power.
2. The corporation's payment of interest on debt is considered a cost of doing business and is tax deductible (up to certain limits). Dividends paid to stockholders are *not* tax deductible.
3. Unpaid debt is a liability of the firm. If it is not paid, the creditors can legally claim the assets of the firm. This action can result in liquidation or reorganization, two of the possible consequences of bankruptcy. Thus, one of the costs of issuing debt is the possibility of financial failure. This possibility does not arise when equity is issued.

IS IT DEBT OR EQUITY?

Sometimes it is unclear if a particular security is debt or equity. For example, suppose a corporation issues a perpetual bond with interest payable solely from corporate income if and only if earned. Whether this is really a debt is hard to say and is primarily a legal and semantic issue. Courts and taxing authorities would have the final say.

Corporations are adept at creating exotic, hybrid securities that have many features of equity but are treated as debt. Obviously, the distinction between debt and equity is important for tax purposes. So, one reason that corporations try to create a debt security that is really equity is to obtain the tax benefits of debt and the bankruptcy benefits of equity.

As a general rule, equity represents an ownership interest, and it is a residual claim. This means that equity holders are paid after debt holders. As a result of this, the risks and benefits associated with owning debt and equity are different. To give just one example, note that the maximum reward for owning a debt security is ultimately fixed by the amount of the loan, whereas there is no upper limit to the potential reward from owning an equity interest.

LONG-TERM DEBT: THE BASICS

Ultimately, all long-term debt securities are promises made by the issuing firm to pay principal when due and to make timely interest payments on the unpaid balance. Beyond this, a number of features distinguish these securities from one another. We discuss some of these features next.

The maturity of a long-term debt instrument is the length of time the debt remains outstanding with some unpaid balance. Debt securities can be *short-term* (with maturities of

one year or less) or *long-term* (with maturities of more than one year).[1] Short-term debt is sometimes referred to as *unfunded debt*.[2]

Debt securities are typically called *notes*, *debentures*, or *bonds*. Strictly speaking, a bond is a secured debt. However, in common usage, the word *bond* refers to all kinds of secured and unsecured debt. We will continue to use the term generically to refer to long-term debt. Also, usually the only difference between a note and a bond is the original maturity. Issues with an original maturity of 10 years or less are often called notes. Longer-term issues are called bonds.

The two major forms of long-term debt are public-issue and privately placed. We concentrate on public-issue bonds. Most of what we say about them holds true for private-issue, long-term debt as well. The main difference between public-issue and privately placed debt is that the latter is directly placed with a lender and not offered to the public. Because this is a private transaction, the specific terms are up to the parties involved.

There are many other dimensions to long-term debt, including such things as security, call features, sinking funds, ratings, and protective covenants. The following table illustrates these features for a bond issued by technology giant Microsoft. If some of these terms are unfamiliar, have no fear. We will discuss them all presently.

Information about individual bonds can be found at **finra-markets.morningstar.com**.

Features of a Microsoft Bond

Term		Explanation
Amount of issue	$4.5 billion	The company issued $4.5 billion worth of bonds.
Date of issue	8/8/2016	The bonds were sold on 8/8/2016.
Maturity	8/8/2046	The bonds mature on 8/8/2046.
Face value	$2,000	The denomination of the bonds is $2,000.
Annual coupon	3.700	Each bondholder will receive $74 per bond per year (3.700% of face value).
Offer price	99.515	The offer price will be 99.515% of the $2,000 face value, or $1,990, per bond.
Coupon payment dates	2/8, 8/8	Coupons of $74/2 = $37 will be paid on these dates.
Security	None	The bonds are not secured by specific assets.
Sinking fund	None	The bonds have no sinking fund.
Call provision	At any time	The bonds do not have a deferred call.
Call price	Treasury rate plus .25%	The bonds have a "make-whole" call price.
Rating	Moody's Aaa S&P AAA	The bonds have the highest possible credit rating.

Many of these features will be detailed in the bond indenture, so we discuss this first.

[1]There is no universally agreed-upon distinction between short-term and long-term debt. In addition, people often refer to *intermediate-term debt*, which has a maturity of more than 1 year and less than 3 to 5, or even 10, years.

[2]The word *funding* is part of the jargon of finance. It generally refers to the long term. A firm planning to "fund" its debt requirements may be replacing short-term debt with long-term debt.

THE INDENTURE

indenture
The written agreement between the corporation and the lender detailing the terms of the debt issue.

The **indenture** is the written agreement between the corporation (the borrower) and its creditors. It is sometimes referred to as the *deed of trust*.[3] Usually, a trustee (a bank, perhaps) is appointed by the corporation to represent the bondholders. The trust company must (1) make sure the terms of the indenture are obeyed, (2) manage the sinking fund (described in the following pages), and (3) represent the bondholders in default—that is, if the company defaults on its payments to them.

The bond indenture is a legal document. It can run several hundred pages and generally makes for tedious reading. It is an important document because it generally includes the following provisions:

1. The basic terms of the bonds.
2. The total amount of bonds issued.
3. A description of property used as security.
4. The repayment arrangements.
5. The call provisions.
6. Details of the protective covenants.

We discuss these features next.

Terms of a Bond Corporate bonds usually have a face value (that is, a denomination) of $1,000, although par values of $2,000 like the Microsoft bond have become relatively common. Other par values also exist. For example, municipal bonds often have par values of $5,000, and Treasury bonds with par values of $10,000 or $100,000 are often sold. This *principal value* is stated on the bond certificate. So, if a corporation wanted to borrow $1 million, 1,000 bonds would have to be sold. The par value (that is, the initial accounting value) of a bond is almost always the same as the face value, and the terms are used interchangeably in practice.

registered form
The form of bond issue in which the registrar of the company records ownership of each bond; payment is made directly to the owner of record.

Corporate bonds are usually in **registered form**. For example, the indenture might read as follows:

> **Interest is payable semiannually on July 1 and January 1 of each year to the person in whose name the bond is registered at the close of business on June 15 or December 15, respectively.**

This means that the company has a registrar who will record the ownership of each bond and record any changes in ownership. The company will pay the interest and principal by check mailed directly to the address of the owner of record. A corporate bond may be registered and have attached "coupons." To obtain an interest payment, the owner must separate a coupon from the bond certificate and send it to the company registrar (the paying agent).

bearer form
The form of bond issue in which the bond is issued without record of the owner's name; payment is made to whomever holds the bond.

Alternatively, the bond could be in **bearer form**. This means that the certificate is the basic evidence of ownership, and the corporation will "pay the bearer." Ownership is not otherwise recorded, and, as with a registered bond with attached coupons, the holder of the bond certificate detaches the coupons and sends them to the company to receive payment.

There are two drawbacks to bearer bonds. First, they are difficult to recover if they are lost or stolen. Second, because the company does not know who owns its bonds, it cannot notify bondholders of important events. Bearer bonds were once the dominant type, but they are now much less common (in the United States) than registered bonds.

[3]The words *loan agreement* or *loan contract* are usually used for privately placed debt and term loans.

Security Debt securities are classified according to the collateral and mortgages used to protect the bondholder.

Collateral is a general term that frequently means securities (for example, bonds and stocks) that are pledged as security for payment of debt. For example, collateral trust bonds often involve a pledge of common stock held by the corporation. However, the term *collateral* is commonly used to refer to any asset pledged on a debt.

Mortgage securities are secured by a mortgage on the real property of the borrower. The property involved is usually real estate—for example, land or buildings. The legal document that describes the mortgage is called a *mortgage trust indenture* or *trust deed*.

Sometimes mortgages are on specific property, such as a railroad car. More often, blanket mortgages are used. A *blanket mortgage* pledges all the real property owned by the company.[4]

Bonds frequently represent unsecured obligations of the company. A **debenture** is an unsecured bond, for which no specific pledge of property is made. The term **note** is generally used for such instruments if the maturity of the unsecured bond is less than 10 years when the bond is originally issued. Debenture holders have a claim only on property not otherwise pledged—in other words, the property that remains after mortgages and collateral trusts are taken into account. The Microsoft bonds in the table are an example of such an issue.

debenture
An unsecured debt, usually with a maturity of 10 years or more.

note
An unsecured debt, usually with a maturity under 10 years.

The terminology that we use here and elsewhere in this chapter is standard in the United States. Outside the United States, these same terms can have different meanings. For example, bonds issued by the British government ("gilts") are called treasury "stock." Also, in the United Kingdom, a debenture is a *secured* obligation.

At the current time, public bonds issued in the United States by industrial and financial companies are typically debentures. Most utility and railroad bonds are secured by a pledge of assets.

Seniority In general terms, *seniority* indicates preference in position over other lenders, and debts are sometimes labeled as *senior* or *junior* to indicate seniority. Some debt is *subordinated*, as in, for example, a subordinated debenture.

In the event of default, holders of subordinated debt must give preference to other specified creditors. Usually, this means that the subordinated lenders will be paid off only after the specified creditors have been compensated. However, debt cannot be subordinated to equity.

The Securities Industry and Financial Markets Association (SIFMA) website is **www.sifma.org**.

Repayment Bonds can be repaid at maturity, at which time the bondholder will receive the stated, or face, value of the bond; or they may be repaid in part or in entirety before maturity. Early repayment in some form is more typical and is often handled through a sinking fund.

A **sinking fund** is an account managed by the bond trustee for the purpose of repaying the bonds. The company makes annual payments to the trustee, who then uses the funds to retire a portion of the debt. The trustee does this by either buying up some of the bonds in the market or calling in a fraction of the outstanding bonds. This second option is discussed in the next section.

sinking fund
An account managed by the bond trustee for early bond redemption.

There are many different kinds of sinking fund arrangements, and the details are spelled out in the indenture. For example:

1. Some sinking funds start about 10 years after the initial issuance.
2. Some sinking funds establish equal payments over the life of the bond.

[4]Real property includes land and things "affixed thereto." It does not include cash or inventories.

3. Some high-quality bond issues establish payments to the sinking fund that are not sufficient to redeem the entire issue. As a consequence, there is the possibility of a large "balloon payment" at maturity.

call provision
An agreement giving the corporation the option to repurchase a bond at a specified price prior to maturity.

call premium
The amount by which the call price exceeds the par value of a bond.

deferred call provision
A call provision prohibiting the company from redeeming a bond prior to a certain date.

call-protected bond
A bond that, during a certain period, cannot be redeemed by the issuer.

The Call Provision A **call provision** allows the company to repurchase or "call" part or all of the bond issue at stated prices over a specific period. Corporate bonds are usually callable.

Generally, the call price is above the bond's stated value (that is, the par value). The difference between the call price and the stated value is the **call premium**. The amount of the call premium may become smaller over time. One arrangement is to initially set the call premium equal to the annual coupon payment and then make it decline to zero as the call date moves closer to the time of maturity.

Call provisions are often not operative during the first part of a bond's life. This makes the call provision less of a worry for bondholders in the bond's early years. For example, a company might be prohibited from calling its bonds for the first 10 years. This is a **deferred call provision**. During this period of prohibition, the bond is said to be **call-protected**.

In recent years, a new type of call provision, a "make-whole" call, has become widespread in the corporate bond market. With such a feature, bondholders receive approximately what the bonds are worth if they are called. Because bondholders don't suffer a loss in the event of a call, they are "made whole."

To determine the make-whole call price, we calculate the present value of the remaining interest and principal payments at a rate specified in the indenture. For example, looking at our Microsoft issue, we see that the discount rate is "Treasury rate plus .25%." What this means is that we determine the discount rate by first finding a U.S. Treasury issue with the same maturity. We calculate the yield to maturity on the Treasury issue and then add on .25 percent to get the discount rate we use.

Notice that with a make-whole call provision, the call price is higher when interest rates are lower and vice versa (why?). Also notice that, as is common with a make-whole call, the Microsoft issue does not have a deferred call feature. Why might investors not be too concerned about the absence of this feature?

protective covenant
A part of the indenture limiting certain actions that might be taken during the term of the loan, usually to protect the lender's interest.

Protective Covenants A **protective covenant** is that part of the indenture or loan agreement that limits certain actions a company might otherwise wish to take during the term of the loan. Protective covenants can be classified into two types: negative covenants and positive (or affirmative) covenants.

A *negative covenant* is a "thou shalt not" type of covenant. It limits or prohibits actions the company might take. Here are some typical examples:

1. The firm must limit the amount of dividends it pays according to some formula.
2. The firm cannot pledge any assets to other lenders.
3. The firm cannot merge with another firm.
4. The firm cannot sell or lease any major assets without approval by the lender.
5. The firm cannot issue additional long-term debt.

Want detailed information about the amount and terms of the debt issued by a particular firm? Check out its latest financial statements by searching SEC filings at **www.sec.gov**

A *positive covenant* is a "thou shalt" type of covenant. It specifies an action the company agrees to take or a condition the company must abide by. Here are some examples:

1. The company must maintain its working capital at or above some specified minimum level.
2. The company must periodically furnish audited financial statements to the lender.
3. The firm must maintain any collateral or security in good condition.

This is only a partial list of covenants; a particular indenture may feature many different ones.

Concept Questions

7.2a What are the distinguishing features of debt compared to equity?

7.2b What is the indenture? What are protective covenants? Give some examples.

7.2c What is a sinking fund?

7.3 Bond Ratings

Firms frequently pay to have their debt rated. The two leading bond-rating firms are Moody's and Standard & Poor's (S&P). The debt ratings are an assessment of the creditworthiness of the corporate issuer. The definitions of creditworthiness used by Moody's and S&P are based on how likely the firm is to default and the protection creditors have in the event of a default.

It is important to recognize that bond ratings are concerned *only* with the possibility of default. Earlier, we discussed interest rate risk, which we defined as the risk of a change in the value of a bond resulting from a change in interest rates. Bond ratings do not address this issue. As a result, the price of a highly rated bond can still be quite volatile.

Bond ratings are constructed from information supplied by the corporation. The rating classes and some information concerning them are shown in the following table:

		Investment-Quality Bond Ratings				Low-Quality, Speculative, and/or "Junk" Bond Ratings					
		High Grade		Medium Grade		Low Grade		Very Low Grade			
Standard & Poor's		AAA	AA	A	BBB	BB	B	CCC	CC	C	D
Moody's		Aaa	Aa	A	Baa	Ba	B	Caa	Ca	C	
Moody's	**S&P**										
Aaa	AAA	Debt rated Aaa and AAA has the highest rating. Capacity to pay interest and principal is extremely strong.									
Aa	AA	Debt rated Aa and AA has a very strong capacity to pay interest and repay principal. Together with the highest rating, this group comprises the high-grade bond class.									
A	A	Debt rated A has a strong capacity to pay interest and repay principal, although it is somewhat more susceptible to the adverse effects of changes in circumstances and economic conditions than debt in high-rated categories.									
Baa	BBB	Debt rated Baa and BBB is regarded as having an adequate capacity to pay interest and repay principal. Whereas it normally exhibits adequate protection parameters, adverse economic conditions or changing circumstances are more likely to lead to a weakened capacity to pay interest and repay principal for debt in this category than in higher-rated categories. These bonds are medium-grade obligations.									
Ba; B Caa Ca C	BB; B CCC CC C	Debt rated in these categories is regarded, on balance, as predominantly speculative with respect to capacity to pay interest and repay principal in accordance with the terms of the obligation. BB and Ba indicate the lowest degree of speculation, and Ca, CC, and C the highest degree of speculation. Although such debt is likely to have some quality and protective characteristics, these are outweighed by large uncertainties or major risk exposures to adverse conditions. Issues rated C by Moody's are typically in default.									
	D	Debt rated D is in default, and payment of interest and/or repayment of principal is in arrears.									

NOTE: At times, both Moody's and S&P use adjustments (called notches) to these ratings. S&P uses plus and minus signs: A+ is the strongest A rating and A− the weakest. Moody's uses a 1, 2, or 3 designation, with 1 being the highest.

Want to know what criteria are commonly used to rate corporate and municipal bonds? Go to **www.standardandpoors.com, www.moodys.com**, or **www.fitchinv.com.**

The highest rating a firm's debt can have is AAA or Aaa, and such debt is judged to be the best quality and to have the lowest degree of risk. For example, the 100-year BellSouth issue we discussed earlier was originally rated AAA. This rating is not awarded very often: As of January 2018, only two nonfinancial U.S. companies, Johnson & Johnson and Microsoft, had AAA ratings. AA or Aa ratings indicate very good quality debt and are much more common.

A large part of corporate borrowing takes the form of low-grade, or "junk," bonds. If these low-grade corporate bonds are rated at all, they are rated below investment grade by the major rating agencies. Investment-grade bonds are bonds rated at least BBB by S&P or Baa by Moody's.

Rating agencies don't always agree. To illustrate, some bonds are known as "crossover" or "5B" bonds. The reason is that they are rated triple-B (or Baa) by one rating agency and double-B (or Ba) by another, a "split rating." For example, in February 2016, India-based textile and chemical company Standard Industries sold an issue of 10-year notes rated BBB– by S&P and Ba2 by Moody's.

A bond's credit rating can change as the issuer's financial strength improves or deteriorates. For example, in May 2016, Fitch Ratings cut the bond rating on retailer The Gap from BBB– to BB+, lowering the company's bond rating from investment grade to junk bond status. Bonds that drop into junk territory like this are called *fallen angels*. Fitch was concerned about the decline in same-store sales and gross margin at the company.

If you're nervous about the level of debt piled up by the U.S. government, don't go to **www.fiscal.treasury.gov** or to **www.usdebtclock.org/world-debt-clock.html**! Learn all about government bonds at **www.newyorkfed.org**.

Credit ratings are important because defaults really do occur, and when they do, investors can lose heavily. For example, in 2000, AmeriServe Food Distribution, Inc., which supplied restaurants such as Burger King with everything from burgers to giveaway toys, defaulted on $200 million in junk bonds. After the default, the bonds traded at just 18 cents on the dollar, leaving investors with a loss of more than $160 million.

Even worse in AmeriServe's case, the bonds had been issued only four months earlier, thereby making AmeriServe an NCAA champion. Although that might be a good thing for a college basketball team such as the University of Kentucky Wildcats, in the bond market it means "No Coupon At All," and it's not a good thing for investors.

Concept Questions

7.3a What does a bond rating say about the risk of fluctuations in a bond's value resulting from interest rate changes?

7.3b What is a junk bond?

7.4 Some Different Types of Bonds

Thus far we have considered only "plain vanilla" corporate bonds. In this section, we briefly look at bonds issued by governments and also at bonds with unusual features.

GOVERNMENT BONDS

The biggest borrower in the world—by a wide margin—is everybody's favorite family member, Uncle Sam. In early 2018, the total debt of the U.S. government was $20 *trillion*, or about $63,000 per citizen (and growing!). When the government wishes to borrow money for more than one year, it sells what are known as Treasury notes and bonds to the

public (in fact, it does so every month). Currently, outstanding Treasury notes and bonds have original maturities ranging from 2 to 30 years.

Most U.S. Treasury issues are just ordinary coupon bonds. There are two important things to keep in mind. First, U.S. Treasury issues, unlike essentially all other bonds, have no default risk because (we hope) the Treasury can always come up with the money to make the payments. Second, Treasury issues are exempt from state income taxes (though not federal income taxes). In other words, the coupons you receive on a Treasury note or bond are taxed only at the federal level.

State and local governments also borrow money by selling notes and bonds. Such issues are called *municipal* notes and bonds, or just "munis." Unlike Treasury issues, munis have varying degrees of default risk, and, in fact, they are rated much like corporate issues. Also, they are almost always callable. The most intriguing thing about munis is that their coupons are exempt from federal income taxes (though not necessarily state income taxes). This makes them very attractive to high-income, high-tax bracket investors.

For information on municipal bonds, including prices, check out **emma.msrb.org**.

Because of the enormous tax break they receive, the yields on municipal bonds are much lower than the yields on taxable bonds. For example, in December 2017, long-term Aa-rated corporate bonds were yielding about 3.42 percent. At the same time, long-term Aa munis were yielding about 2.20 percent. Suppose an investor was in a 30 percent tax bracket. All else being the same, would this investor prefer a Aa corporate bond or a Aa municipal bond?

Another good bond market site is **money.cnn.com/data/bonds**.

To answer, we need to compare the *aftertax* yields on the two bonds. Ignoring state and local taxes, the muni pays 2.20 percent on both a pretax and an aftertax basis. The corporate issue pays 3.42 percent before taxes, but it pays only $.0342 \times (1 - .30) = .0239$, or 2.39 percent, once we account for the 30 percent tax bite. Given this, the corporate bond has a better yield, but the difference is much smaller after we account for the tax bite.

Taxable versus Municipal Bonds — EXAMPLE 7.4

Suppose taxable bonds are currently yielding 8 percent, while at the same time, munis of comparable risk and maturity are yielding 6 percent. Which is more attractive to an investor in a 40 percent bracket? What is the break-even tax rate? How do you interpret this rate?

For an investor in a 40 percent tax bracket, a taxable bond yields $8 \times (1 - .40) = 4.8$ percent after taxes, so the muni is much more attractive. The break-even tax rate is the tax rate at which an investor would be indifferent between a taxable and a nontaxable issue. If we let t^* stand for the break-even tax rate, then we can solve for it as follows:

$$\begin{aligned} .08 \times (1 - t^*) &= .06 \\ 1 - t^* &= .06/.08 = .75 \\ t^* &= .25 \end{aligned}$$

An investor in a 25 percent tax bracket would make 6 percent after taxes from either bond.

ZERO COUPON BONDS

zero coupon bond
A bond that makes no coupon payments and is thus initially priced at a deep discount.

A bond that pays no coupons at all must be offered at a price that is much lower than its stated value. Such bonds are called **zero coupon bonds**, or just *zeroes*.[5]

[5]A bond issued with a very low coupon rate (as opposed to a zero coupon rate) is an *original-issue discount* (*OID*) *bond*.

TABLE 7.2
Interest Expense for EIN's Zeroes

Year	Beginning Value	Ending Value	Implicit Interest Expense	Straight-Line Interest Expense
1	$508.35	$ 582.01	$ 73.66	$ 98.33
2	582.01	666.34	84.33	98.33
3	666.34	762.90	96.56	98.33
4	762.90	873.44	110.54	98.33
5	873.44	1,000.00	126.56	98.33
Total			$491.65	$491.65

Suppose the Eight-Inch Nails (EIN) Company issues a $1,000 face value, five-year zero coupon bond. The initial price is set at $508.35. Even though no interest payments are made on the bond, zero coupon bond calculations use semiannual periods to be consistent with coupon bond calculations. Using semiannual periods, it is straightforward to verify that, at this price, the bond yields about 14 percent to maturity. The total interest paid over the life of the bond is $1,000 − 508.35 = $491.65.

For tax purposes, the issuer of a zero coupon bond deducts interest every year even though no interest is actually paid. Similarly, the owner must pay taxes on interest accrued every year, even though no interest is actually received.

The way in which the yearly interest on a zero coupon bond is calculated is governed by tax law. Before 1982, corporations could calculate the interest deduction on a straight-line basis. For EIN, the annual interest deduction would have been $491.65/5 = $98.33 per year.

Under current tax law, the implicit interest is determined by amortizing the loan. We do this by first calculating the bond's value at the beginning of each year. For example, after one year, the bond will have four years until maturity, so it will be worth $1,000/$1.07^8$ = $582.01; the value in two years will be $1,000/$1.07^6$ = $666.34; and so on. The implicit interest each year is the change in the bond's value for the year. The values and interest expenses for the EIN bond are listed in Table 7.2.

Notice that under the old rules, zero coupon bonds were more attractive because the deductions for interest expense were larger in the early years (compare the implicit interest expense with the straight-line expense).

Under current tax law, EIN could deduct $73.66 in interest paid the first year and the owner of the bond would pay taxes on $73.66 in taxable income (even though no interest was actually received). This second tax feature makes taxable zero coupon bonds less attractive to individuals. They are still a very attractive investment for tax-exempt investors with long-term dollar-denominated liabilities, such as pension funds, because the future dollar value is known with relative certainty.

Some bonds are zero coupon bonds for only part of their lives. For example, General Motors has a debenture outstanding that matures on March 15, 2036. For the first 20 years of its life, no coupon payments will be made; but, after 20 years, it will begin paying coupons semiannually at a rate of 7.75 percent per year.

FLOATING-RATE BONDS

The conventional bonds we have talked about in this chapter have fixed-dollar obligations because the coupon rates are set as fixed percentages of the par values. Similarly, the principal amounts are set equal to the par values. Under these circumstances, the coupon payments and principal are completely fixed.

With *floating-rate bonds (floaters)*, the coupon payments are adjustable. The adjustments are tied to an interest rate index such as the Treasury bill interest rate or the 30-year Treasury bond rate.

The value of a floating-rate bond depends on exactly how the coupon payment adjustments are defined. In most cases, the coupon adjusts with a lag to some base rate. For example, suppose a coupon rate adjustment is made on June 1. The adjustment might be based on the simple average of Treasury bond yields during the previous three months. In addition, the majority of floaters have the following features:

1. The holder has the right to redeem the note at par on the coupon payment date after some specified amount of time. This is called a *put* provision, and it is discussed in the following section.
2. The coupon rate has a floor and a ceiling, meaning that the coupon is subject to a minimum and a maximum. In this case, the coupon rate is said to be "capped," and the upper and lower rates are sometimes called the *collar*.

A particularly interesting type of floating-rate bond is an *inflation-linked* bond. Such bonds have coupons that are adjusted according to the rate of inflation (the principal amount may be adjusted as well). The U.S. Treasury began issuing such bonds in January of 1997. The issues are sometimes called "TIPS," or Treasury Inflation-Protected Securities. Other countries, including Canada, Israel, and Britain, have issued similar securities.

Official information about U.S. inflation-indexed bonds is at **www.treasurydirect.gov**.

OTHER TYPES OF BONDS

Many bonds have unusual or exotic features. So-called catastrophe, or cat, bonds provide an interesting example. In May 2016, United Services Automobile Association (USAA), the company that specializes in insurance for military veterans, issued $250 million in cat bonds. These cat bonds covered U.S. storms, wildfires, meteor strikes, and solar flares. In the event of one of these triggering events, investors would lose some or all of their money.

The largest single cat bond issue to date is a series of six bonds sold by Merna Reinsurance in 2007 (reinsurance companies sell insurance to insurance companies). The six bond issues were to cover various catastrophes the company faced due to its reinsurance of State Farm. The six bonds totaled about $1.2 billion in par value. During 2016, about $7.1 billion in cat bonds were issued, and there was about $26.8 billion par value in cat bonds outstanding at the end of the year.

At this point, cat bonds probably seem pretty risky. It might be surprising to learn that since cat bonds were first issued in 1997, only four have not been paid in full. Because of Hurricane Katrina, cat bondholders lost $190 million. Cat bondholders also lost $300 million due to the 2011 tsunami in Japan. During 2011, two other cat bond issues, each worth $100 million, were triggered due to an unusually active tornado season.

Another possible bond feature is a *warrant*. A warrant gives the buyer of a bond the right to purchase shares of stock in the company at a fixed price. Such a right is very valuable if the stock price climbs substantially (a later chapter discusses this subject in greater depth). Because of the value of this feature, bonds with warrants are often issued at a very low coupon rate.

As these examples illustrate, bond features are really limited only by the imaginations of the parties involved. Unfortunately, there are far too many variations for us to cover in detail here. We close this discussion by mentioning a few of the more common types.

Income bonds are similar to conventional bonds, except that coupon payments depend on company income. Specifically, coupons are paid to bondholders only if the firm's income is sufficient. This would appear to be an attractive feature, but income bonds are not very common.

A *convertible bond* can be swapped for a fixed number of shares of stock anytime before maturity at the holder's option. Convertibles are relatively common, but the number has been decreasing in recent years.

A *put bond* allows the *holder* to force the issuer to buy back the bond at a stated price. For example, International Paper Co. has bonds outstanding that allow the holder to force International Paper to buy the bonds back at 100 percent of face value if certain "risk" events happen. One such event is a change in credit rating from investment grade to lower than investment grade by Moody's or S&P. The put feature is therefore just the reverse of the call provision.

The *reverse convertible* is a relatively new type of structured note. One type generally offers a high coupon rate, but the redemption at maturity can be paid in cash at par value or paid in shares of stock. For example, one recent General Motors (GM) reverse convertible had a coupon rate of 16 percent, which is a very high coupon rate in today's interest rate environment. However, at maturity, if GM's stock declined sufficiently, bondholders would receive a fixed number of GM shares that were worth less than par value. So, while the income portion of the bond return would be high, the potential loss in par value could easily erode the extra return.

Perhaps the most unusual bond (and certainly the most ghoulish) is the "death bond." Companies such as Stone Street Financial purchase life insurance policies from individuals who are expected to die within the next 10 years. They then sell bonds that are paid off from the life insurance proceeds received when the policyholders pass away. The return on the bonds to investors depends on how long the policyholders live. A major risk is that if medical treatment advances quickly, it will raise the life expectancy of the policyholders, thereby decreasing the return to the bondholder.

Structured notes are bonds that are based on stocks, bonds, commodities, or currencies. One particular type of structured note has a return based on a stock market index. At expiration, if the stock index has declined, the bond returns the principal. However, if the stock index has increased, the bond will return a portion of the stock index return, say 80 percent. Another type of structured note will return twice the stock index return, but with the potential for loss of principal.

A given bond may have many unusual features. Two of the most recent exotic bonds are *CoCo bonds*, which have a coupon payment, and *NoNo bonds*, which are zero coupon bonds. CoCo and NoNo bonds are contingent convertible, putable, callable, subordinated bonds. The contingent convertible clause is similar to the normal conversion feature, except the contingent feature must be met. For example, a contingent feature may require that the company stock trade at 110 percent of the conversion price for 20 out of the most recent 30 days. Valuing a bond of this sort can be quite complex, and the yield to maturity calculation is often meaningless.

You can find out more about sukuk at **www.sukuk.com**.

SUKUK

Worldwide demand for assets that comply with sharia, or Islamic law and cultural tradition, has grown dramatically. Assets, including deposits at Islamic financial institutions, totaled about $2.1 trillion in 2016, up from $1.3 trillion in 2011. One of the major differences between Western financial practices and sharia is that Islamic law does not permit charging or paying *riba*, or interest. Given our current discussion about bonds, this means that anyone following sharia cannot buy or issue conventional bonds.

To accommodate the restriction on interest payments, Islamic bonds, or *sukuk*, have been created. There are many possible structures to sukuk, such as partial ownership in a debt (sukuk al-murabaha) or an asset (sukuk al-ijara). In the case of a sukuk al-ijara, there is a binding promise to repurchase a certain asset by the issuer at maturity. Before the sukuk matures, rent is paid on the asset. While we have noted that traditional bonds can be relatively illiquid, most sukuk are bought and held to maturity. As a result, secondary markets in sukuk are extremely illiquid.

IN THEIR OWN WORDS ...

Edward I. Altman on Junk Bonds and Leveraged Loans

One of the most important developments in corporate finance over the last 40 years has been the reemergence of publicly owned and traded low-rated corporate debt. Originally offered to the public in the early 1900s to help finance some of our emerging growth industries, these high-yield, high-risk bonds (sometimes called "junk bonds") virtually disappeared after the rash of bond defaults during the Depression. Starting in the late 1970s, however, the junk bond market catapulted from being an insignificant element in the corporate fixed-income market to being one of the fastest-growing and most controversial types of financing mechanisms. Technically, high-yield bonds are bonds issued by companies whose rating given by one or more of the major rating agencies, i.e., Fitch, Moody's or Standard & Poor's, is below investment grade, e.g., below BBB– by S&P.

The term *junk* emanates from the dominant type of low-rated bond issues outstanding prior to 1977 when the "market" consisted almost exclusively of original-issue investment-grade bonds that fell from their lofty status to a higher-default risk, speculative-grade level. These so-called fallen angels amounted to about $8.5 billion in 1977. In 2016, fallen angels comprised about 12 percent of the $1.6 trillion publicly owned junk bond market. The balance are "original-issue," high-yield bonds.

The high-yield bond market in Europe, although in existence for decades, only began to grow significantly starting in 2009 from about €100 billion to about €500 billion at the end of 2016, and is now a fairly well diversified market, about 1/3 the size of the U.S. market.

Beginning in 1977, some speculative-grade issuers began to go directly to the public to raise debt capital for growth purposes. Early issuers of junk bonds were energy-related firms, cable TV companies, airlines, and assorted other industrial companies. The emerging growth company rationale coupled with relatively high returns to early investors helped legitimize this asset class and attract interest from the more established investment banks and asset managers in the mid-1980s. The pioneers in the high-yield market were Drexel Burnham Lambert, a boutique bank, and its junk bond "king," Michael Milken. I, personally, became interested in this new financing innovation in the early 1980s, when a major bank asked me to assess the market's potential.

By far the most important and controversial aspect of the early junk bond financings was its role in the corporate restructuring movement from 1985 to 1989. High-leverage transactions and acquisitions, such as leveraged buyouts (LBOs), which occur when a firm is taken private and the old shareholders are paid a premium to sell their shares, became numerous and threatening to many firms. Funds for this buyout were raised from traditional bank loans and high-yield bonds, plus equity. These leveraged recapitalizations helped to transform the face of corporate America, leading to a heated debate as to the economic and social consequences of firms' being bought by private-equity firms with debt-equity ratios of at least 6:1 in the restructured firm. Similar, but less emotional, comments accompanied a second LBO movement in 2004–2007, and even less so in the most recent heavy activity by private-equity firms in what is now (in 2017) an established and impressive market. The latter trend is not without some concerns, as the prices paid to buyout firms soared to above 10 times EBITA in 2015 and 2016, a very high multiple.

LBOs involved increasingly large companies, and the multi-billion dollar takeover became fairly common in the 1980s. The first mega-buyout was the huge $25+ billion RJR Nabisco LBO in 1989. LBOs were typically financed with about 60 percent senior bank and insurance company debt, about 25–30 percent subordinated public debt (usually junk bonds), and 10–15 percent equity. The junk bond segment is sometimes referred to as "mezzanine" financing because it lies between the "balcony" senior debt and the "basement" equity. In the most recent LBO binge, however, more than 30 percent of the financing has been equity but the transactions are, on average, much larger than in the late 1980s.

These restructurings resulted in huge fees to advisers and underwriters and large premiums (at least 30 to 40 percent in most cases) to the old shareholders who were bought out. They continued as long as the market was willing to buy these new debt offerings at what appeared to be a favorable risk–return trade-off. The bottom fell out of the market in the last six months of 1989 due to a number of factors, including a marked increase in defaults, government regulation against S&Ls holding junk bonds, and at least one highly publicized bankruptcy of a highly leveraged financial restructuring—Federated Department Stores. In addition, the leading underwriter, Drexel Burnham, went bankrupt and Milken was prosecuted and sent to jail. As a result, in the early 1990s, the financial market was questioning the very survival of the junk bond market. The answer as to its survival was a resounding "yes," as the amount of new issues soared to record annual levels of $40 billion in 1992, almost $80 billion in 1993, and in 1997 reached an impressive $119 billion. Coupled with plummeting default rates (under 2 percent each year in the 1993–97 period) and attractive returns in these years, the risk–return characteristics were extremely favorable. Despite legal and financial problems, Drexel's and Milken's positive legacy for pioneering the high-yield market is clear and important.

The junk bond market in the late 1990s was a quieter one compared to that of the 1980s, but, in terms of growth and returns, it was healthier than ever before. While the low default rates in 1992–1998 helped to fuel new investment funds and new issues, the market experienced its ups and downs in subsequent years. Indeed, default rates started to rise in 1999 and accelerated in 2000–2002. The latter year saw default rates reach record levels of over 12 percent as the economy slipped into a recession and investors suffered from the excesses of lending in the late 1990s.

Since the mid-1990s, a "sister" high-yield debt market developed in the private leveraged loan (LL) market. This low-quality (non-investment grade), higher-interest rate market grew enormously in the United States and Europe in the 2005–2007 period and was at least 30 percent larger than the high-yield bond market in 2008. Since the great financial crisis of 2008, the private LL market has once again become extremely popular and is a major source of funds in the private debt market. One of the main reasons for the recent growth and popularity of leveraged loans was that the issuing bank could, in most environments, easily sell these loans into structured finance vehicles called collateralized loan obligations (CLOs).

Private, leveraged loan debt facilities have registered lower default rates than high-yield bonds and higher recovery rates due to their senior status. They have continued to be a major source of corporate debt at levels exceeding $400 billion a year in the last five years, and with attractive risk–return trade-offs for major banks and the new and growing "shadow-banking" markets made up of non-bank lenders. I estimate that the shadow-banking market has perhaps more than $200 billion under management in 2017.

The market for leveraged financing rebounded quickly in 2003 and continued to prosper until the credit crisis of 2008–2009. With the "flight-to-quality" caused by the sub-prime mortgage market meltdown in the second half of 2007 and 2008, returns to investors in high-yield bonds and leveraged loans fell considerably, new issues dried up, and default rates increased from the unusually low-risk years that coincided with the leveraged excesses. Despite these highly volatile events and problems with liquidity, we were convinced that high-yield bonds, and their private debt companion, leveraged loans, would continue in the future to be a major source of corporate debt financing and a legitimate asset class for investors.

Indeed, the high yield bond market, as well as all risky bonds and common stocks, staged a remarkable recovery after the first quarter of 2009, and for the entire year 2009 the returns to high yield bond and leveraged loan investors were the highest in the almost 40 years of the modern era of leveraged finance markets. This amazing turnaround, despite near-record defaults in 2009, was remarkable in the speed and extent of the recovery, with returns of about 60 percent for high-yield bond investors. Impressive positive returns and record new issuance of highly leveraged financed projects and refinancing has continued almost unabated through 2016. And, the market was incredibly accepting of higher yielding bonds and loans, especially in the low interest rate environment of 2012–2016. But, we are now (2017) concerned about another bubble building as the current benign credit cycle, with low default rates and highly risky new issuance, continues for more than seven years since the last market downturn. Perhaps the next few years will be quite volatile with rising default rates and lower recoveries and returns. But, as always, the leveraged finance market will continue to exist and probably expand in the U.S., in Europe, and in other parts of the world.

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Concept Questions

7.4a Why might an income bond be attractive to a corporation with volatile cash flows? Can you think of a reason why income bonds are not more popular?

7.4b What do you think would be the effect of a put feature on a bond's coupon? How about a convertibility feature? Why?

7.5 Bond Markets

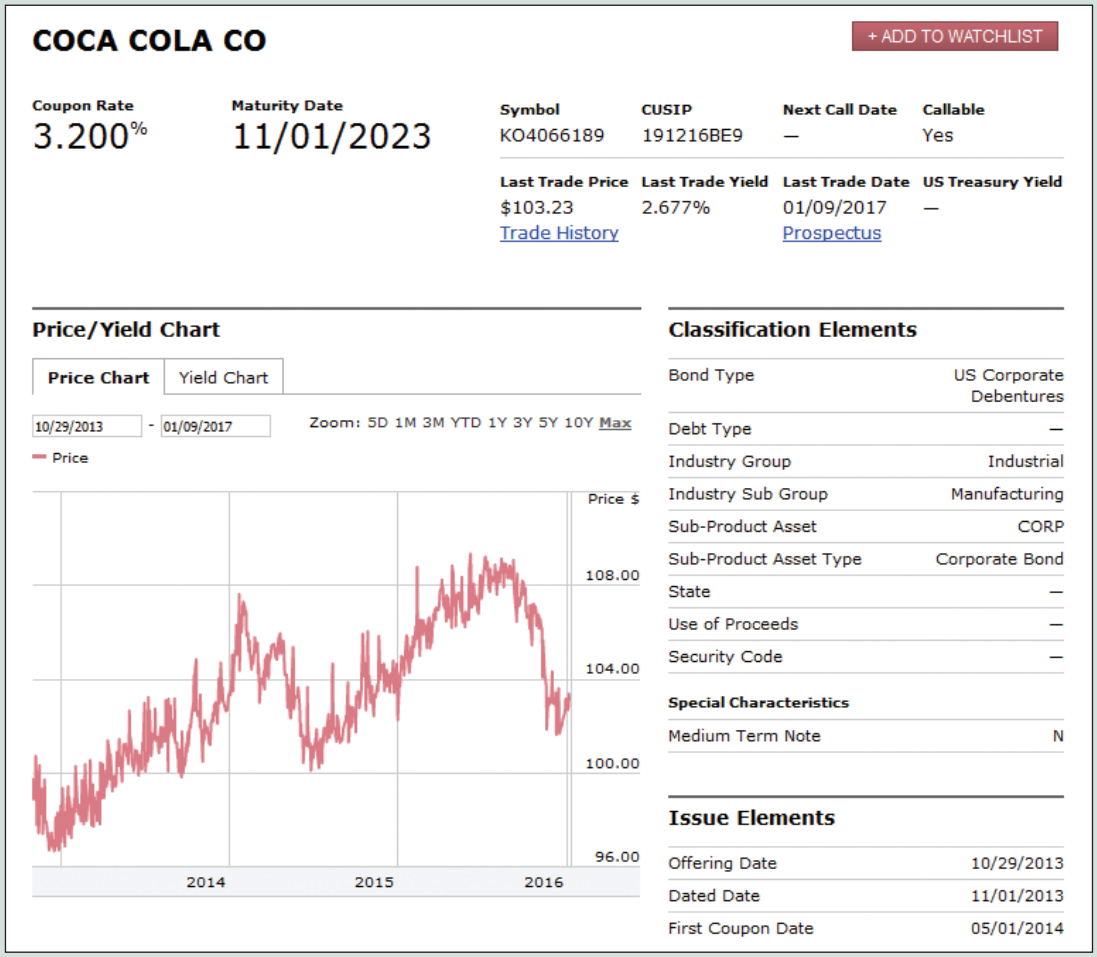
Excel Master It!

Excel Master coverage online

Bonds are bought and sold in enormous quantities every day. You may be surprised to learn that the trading volume in bonds on a typical day is many, many times larger than the trading volume in stocks (by *trading volume* we mean the amount of money that changes hands). Here is a finance trivia question: What is the largest securities market in the world?

WORK THE WEB

Bond quotes have become more available with the rise of the Internet. One site where you can find current bond prices is finra-markets.morningstar.com. We went to the website and searched for bonds issued by Coca-Cola. Here is a look at part of what we found for one of the bonds:



The bond has a coupon rate of 3.20 percent and matures on November 1, 2023. The last sale on this bond was at a price of 103.23 percent of par, which gives a yield to maturity of about 2.677 percent. Not only does the site provide the most recent price and yield information, but it also provides other important information about the bond, such as the credit rating, coupon date, call date, and call price. We'll leave it up to you to have a look at the page and the rest of the information available there.

Questions

1. *Go to this website and find the bond shown above. What is the credit rating on this bond? What was the size of the bond issue? What were the yield to maturity and price when the bond was issued?*
2. *If you search for Chevron bonds (CVX), you will find bonds for several companies listed. Why do you think Chevron has bonds issued with different corporate names?*

Most people would guess the New York Stock Exchange. In fact, the largest securities market in the world in terms of trading volume is the U.S. Treasury market.

HOW BONDS ARE BOUGHT AND SOLD

As we mentioned all the way back in Chapter 1, most trading in bonds takes place over the counter, or OTC. Recall that this means there is no particular place where buying and selling occur. Instead, dealers around the country (and around the world) stand ready to buy and sell. The various dealers are connected electronically.

One reason the bond markets are so big is that the number of bond issues far exceeds the number of stock issues. There are two reasons for this. First, a corporation would typically have only one common stock issue outstanding (there are exceptions to this that we discuss in our next chapter). A large corporation could easily have a dozen or more note and bond issues outstanding. Beyond this, federal, state, and local borrowing is enormous. For example, even a small city would usually have a wide variety of notes and bonds outstanding, representing money borrowed to pay for things like roads, sewers, and schools. When you think about how many small cities there are in the United States, you begin to get the picture!

Because the bond market is almost entirely OTC, it has historically had little or no transparency. A financial market is *transparent* if it is possible to easily observe its prices and trading volume. On the New York Stock Exchange, for example, it is possible to see the price and quantity for every single transaction. In contrast, in the bond market, it is often not possible to observe either. Transactions are privately negotiated between parties, and there is little or no centralized reporting of transactions.

Although the total volume of trading in bonds far exceeds that in stocks, only a small fraction of the total bond issues that exist actually trade on a given day. This fact, combined with the lack of transparency in the bond market, means that getting up-to-date prices on individual bonds can be difficult or impossible, particularly for smaller corporate or municipal issues. Instead, a variety of sources of estimated prices exist and are commonly used.

BOND PRICE REPORTING

To learn more about TRACE, visit **www.finra.org**.

In 2002, transparency in the corporate bond market began to improve dramatically. Under new regulations, corporate bond dealers are now required to report trade information through what is known as the Trade Reporting and Compliance Engine (TRACE). Our nearby *Work the Web* box shows you how to get bond quotes.

TRACE bond quotes are available at finra-markets.morningstar.com. As shown in Figure 7.3, the Financial Industry Regulatory Authority (FINRA) provides a daily snapshot from TRACE by reporting the most active issues. The information shown is largely self-explanatory. Notice that the price of the Microsoft bond dropped about 1.92 percentage points on this day. What do you think happened to the yield to maturity for this bond? Figure 7.3 focuses on the most active bonds with investment grade ratings, but the most active high-yield and convertible bonds are also available on the website.

The Federal Reserve Bank of St. Louis maintains dozens of online files containing macroeconomic data as well as rates on U.S. Treasury issues. Go to **fred.stlouisfed.org**

If you go to the website and click on a particular bond, you will get a lot of information about the bond, including the credit rating, the call schedule, original issue information, and trade information.

As we mentioned before, the U.S. Treasury market is the largest securities market in the world. As with bond markets in general, it is an OTC market, so there is limited transparency. Unlike the situation with bond markets in general, trading in Treasury issues,

FIGURE 7.3 Sample TRACE Bond Quotations

Most Active Investment Grade Bonds

Issuer Name	Symbol	Coupon	Maturity	Moody's/S&P/Fitch	High	Low	Last	Change	Yield%
COMCAST CORP NEW	CMCS4442549	3.300%	02/01/2027	//A-	101.35700	99.42200	99.63300	-0.484000	
TEVA PHARMACEUTICAL FIN NETH III B V	TEVA4384553	3.150%	10/01/2026	Baa2//BBB	94.39000	92.20800	92.22400	-1.096000	4.127938
MPLX LP	MPLX4403827	4.500%	07/15/2023	Baa3/BBB-/BBB-	102.83800	102.67100	102.68200	-0.442000	4.012035
COMCAST CORP NEW	CMCS4442550	3.000%	02/01/2024	//A-	100.04300	99.50700	99.55100	-0.492000	
BARCLAYS PLC	BCS4442016	4.950%	01/10/2047	Baa2//	102.77500	101.17600	101.17600	-1.438000	
ANHEUSER-BUSCH INBEV FIN INC	BUD4327588	4.900%	02/01/2046	A3/A-/BBB	108.92900	107.37500	107.83800	-1.034000	4.414289
MICROSOFT CORP	MSFT4389880	3.700%	08/08/2046	Aaa/AAA/AA+	95.82700	94.54000	94.68900	-1.918286	4.008024
ROYAL BK CDA	RY4297754	2.100%	10/14/2020	Aaa//AAA	99.83700	99.55300	99.73300	-0.035000	2.173974
ANHEUSER-BUSCH INBEV FIN INC	BUD4327481	3.650%	02/01/2026	A3/A-/BBB	103.01100	101.01600	101.07700	-0.598000	3.506954
ACTAVIS FDG SCS	ACT4218879	3.800%	03/15/2025	Baa3//BBB-	100.49600	99.55800	100.14200	-0.566000	3.778990

particularly recently issued ones, is very heavy. Each day, representative prices for outstanding Treasury issues are reported.

Figure 7.4 shows a portion of the daily Treasury note and bond listings from the website wsj.com. Examine the entry that begins "2/15/2036." Reading from left to right, the "2/15/2036" tells us that the bond's maturity is February 15, 2036. The next column is the coupon rate, which is 4.500 percent for this bond. Treasury bonds all make semiannual payments and have a minimum face value of $1,000, so this bond will pay $22.50 every six months until it matures.

The next two pieces of information are the **bid** and **asked prices**. In general, in any OTC or dealer market, the bid price represents what a dealer is willing to pay for a security, and the asked price (or "ask" price) is what a dealer is willing to take for it. The difference between the two prices is called the **bid-ask spread** (or just "spread"), and it represents the dealer's profit.

bid price
The price a dealer is willing to pay for a security.

asked price
The price a dealer is willing to take for a security.

bid–ask spread
The difference between the bid price and the asked price.

Treasury prices are quoted as a percentage of face value. The bid price, or what a dealer is willing to pay, on the 2/15/2036 bond is 128.0781. With a $1,000 face value, this quote represents $1,280.781. The asked price, or the price at which the dealer is willing to sell the bond, is 128.1406, or $1,281.406.

The next number quoted is the change in the asked price from the previous day, measured as a percentage of face value, so this issue's asked price increased by .7031 percent, or $7.031, in value from the previous day. Finally, the last number reported is the yield to maturity, based on the asked price. Notice that this is a premium bond because it sells for more than its face value. Not surprisingly, its yield to maturity (2.618 percent) is less than its coupon rate (4.50 percent).

The very last ordinary bond listed, the 11/15/2046, is often called the "bellwether" bond. This bond's yield is the one that is usually reported in the evening news. So, for example, when you hear that long-term interest rates rose, what is really being said is that the yield on this bond went up (and its price went down).

If you examine the yields on the various issues in Figure 7.4, you will clearly see that they vary by maturity. Why this occurs and what it might mean is one of the things we discuss in our next section. Government (referred to as "sovereign") bond yields also vary by country of origin. Nearby, we show the 10-year bond yields of several countries. The yields vary according to default risks and foreign exchange risks (to be discussed later in the text).

Current and historical Treasury yield information is available at **www.treasury.gov**.

FIGURE 7.4

Sample *Wall Street Journal* U.S. Treasury Note and Bond Prices

SOURCE: Table recreated with data from wsj.com, January 9, 2017.

Treasury Notes and Bonds					
Maturity	Coupon	Bid	Asked	Chg	Asked Yield
11/15/2018	1.250	100.1484	100.1641	0.0391	1.160
4/15/2019	0.875	99.0703	99.0859	0.0625	1.286
4/30/2020	1.125	98.5938	98.6094	0.1016	1.558
8/15/2021	8.125	127.4844	127.5000	0.2344	1.857
7/31/2022	2.000	99.9609	99.9766	0.2266	2.004
2/28/2023	1.500	96.5703	96.5859	0.2500	2.096
5/15/2024	2.500	101.9375	101.9531	0.3125	2.210
8/15/2025	6.875	135.8438	135.8594	0.3438	2.262
8/15/2026	1.500	92.4766	92.4922	0.2969	2.380
8/15/2027	6.375	136.8281	136.8438	0.4688	2.414
8/15/2028	5.500	130.2891	130.3516	0.4531	2.473
11/15/2028	5.250	128.1563	128.2188	0.4453	2.485
2/15/2029	5.250	128.7578	128.8203	0.4609	2.478
8/15/2029	6.125	139.1875	139.2500	0.5391	2.478
5/15/2030	6.250	142.5781	142.6406	0.5938	2.478
2/15/2031	5.375	134.3438	134.4063	0.5625	2.470
2/15/2036	4.500	128.0781	128.1406	0.7031	2.618
2/15/2037	4.750	131.7891	131.8516	0.7500	2.688
5/15/2037	5.000	135.9531	136.0156	0.7656	2.690
5/15/2038	4.500	128.0625	128.1250	0.6875	2.749
2/15/2039	3.500	110.9844	111.0469	0.6406	2.824
8/15/2039	4.500	127.4922	127.5547	0.7344	2.839
2/15/2040	4.625	129.7188	129.7813	0.6953	2.855
11/15/2040	4.250	123.3438	123.4063	0.7422	2.885
2/15/2041	4.750	132.4688	132.5000	0.7578	2.872
2/15/2042	3.125	103.3516	103.3828	0.6484	2.934
2/15/2043	3.125	103.1406	103.1719	0.6250	2.950
5/15/2043	2.875	98.3594	98.3906	0.5625	2.963
2/15/2044	3.625	112.7266	112.7578	0.6484	2.939
2/15/2045	2.500	90.7578	90.7891	0.6016	2.987
11/15/2046	2.875	98.1172	98.1484	0.6719	2.969

SELECTED INTERNATIONAL GOVERNMENT 10-YEAR BOND YIELDS	
	Yield (%)
United States	2.41
United Kingdom	1.19
Japan	.04
Canada	2.04
Australia	2.63
Greece	4.03
Spain	1.55
Italy	2.00
India	7.32

SOURCE: Data pulled from www.bloomberg.com, December 30, 2017.

A NOTE ABOUT BOND PRICE QUOTES

If you buy a bond between coupon payment dates, the price you pay is usually more than the price you are quoted. The reason is that standard convention in the bond market is to quote prices net of "accrued interest," meaning that accrued interest is deducted to arrive at the quoted price. This quoted price is called the **clean price**. The price you actually pay, however, includes the accrued interest. This price is the **dirty price**, also known as the "full" or "invoice" price.

clean price
The price of a bond net of accrued interest; this is the price that is typically quoted.

dirty price
The price of a bond including accrued interest, also known as the *full* or *invoice price*. This is the price the buyer actually pays.

An example is the easiest way to understand these issues. Suppose you buy a bond with a 12 percent annual coupon, payable semiannually. You actually pay $1,080 for this bond, so $1,080 is the dirty, or invoice, price. Further, on the day you buy it, the next coupon is due in four months, so you are between coupon dates. Notice that the next coupon will be $60.

The accrued interest on a bond is calculated by taking the fraction of the coupon period that has passed, in this case two months out of six, and multiplying this fraction by the next coupon, $60. So, the accrued interest in this example is $2/6 \times \$60 = \$20$. The bond's quoted price (that is, its clean price) would be $\$1{,}080 - 20 = \$1{,}060$.[6]

Concept Questions

7.5a Why do we say bond markets may have little or no transparency?
7.5b In general, what are bid and ask prices?
7.5c What is the difference between a bond's clean price and its dirty price?

7.6 Inflation and Interest Rates

So far, we haven't considered the role of inflation in our various discussions of interest rates, yields, and returns. Because this is an important consideration, we consider the impact of inflation next.

REAL VERSUS NOMINAL RATES

In examining interest rates, or any other financial market rates such as discount rates, bond yields, rates of return, and required returns, it is often necessary to distinguish between **real rates** and **nominal rates**. Nominal rates are called "nominal" because they have not been adjusted for inflation. Real rates are rates that have been adjusted for inflation.

real rates
Interest rates or rates of return that have been adjusted for inflation.

nominal rates
Interest rates or rates of return that have not been adjusted for inflation.

To see the effect of inflation, suppose prices are currently rising by 5 percent per year. In other words, the rate of inflation is 5 percent. An investment is available that will be worth $115.50 in one year. It costs $100 today. Notice that with a present value of $100 and a future value in one year of $115.50, this investment has a 15.5 percent rate of return. In calculating this 15.5 percent return, we did not consider the effect of inflation, so this is the nominal return.

What is the impact of inflation here? To answer, suppose pizzas cost $5 apiece at the beginning of the year. With $100, we can buy 20 pizzas. Because the inflation rate is

[6]The way accrued interest is calculated actually depends on the type of bond being quoted—for example, Treasury or corporate. The difference has to do with exactly how the fractional coupon period is calculated. In our example here, we implicitly treated the months as having exactly the same length (30 days each, 360 days in a year), which is consistent with the way corporate bonds are quoted. In contrast, for Treasury bonds, actual day counts are used.

5 percent, pizzas will cost 5 percent more, or $5.25, at the end of the year. If we take the investment, how many pizzas can we buy at the end of the year? Measured in pizzas, what is the rate of return on this investment?

Our $115.50 from the investment will buy us $115.50/$5.25 = 22 pizzas. This is up from 20 pizzas, so our pizza rate of return is 10 percent. What this illustrates is that even though the nominal return on our investment is 15.5 percent, our buying power goes up by only 10 percent because of inflation. Put another way, we are really only 10 percent richer. In this case, we say that the real return is 10 percent.

Alternatively, we can say that with 5 percent inflation, each of the $115.50 nominal dollars we get is worth 5 percent less in real terms, so the real dollar value of our investment in a year is:

$$\$115.50/1.05 = \$110$$

What we have done is to *deflate* the $115.50 by 5 percent. Because we give up $100 in current buying power to get the equivalent of $110, our real return is again 10 percent. Because we have removed the effect of future inflation here, this $110 is said to be measured in current dollars.

The difference between nominal and real rates is important and bears repeating:

The nominal rate on an investment is the percentage change in the number of dollars you have.

The real rate on an investment is the percentage change in how much you can buy with your dollars—in other words, the percentage change in your buying power.

THE FISHER EFFECT

Fisher effect
The relationship between nominal returns, real returns, and inflation.

Our discussion of real and nominal returns illustrates a relationship often called the **Fisher effect** (after the great economist Irving Fisher). Because investors are ultimately concerned with what they can buy with their money, they require compensation for inflation. Let R stand for the nominal rate and r stand for the real rate. The Fisher effect tells us that the relationship between nominal rates, real rates, and inflation can be written as:

$$1 + R = (1 + r) \times (1 + h) \quad (7.2)$$

where h is the inflation rate.

In the preceding example, the nominal rate was 15.50 percent and the inflation rate was 5 percent. What was the real rate? We can determine it by plugging in these numbers:

$$\begin{aligned} 1 + .1550 &= (1 + r) \times (1 + .05) \\ 1 + r &= 1.1550/1.05 = 1.10 \\ r &= .10, \text{ or } 10\% \end{aligned}$$

This real rate is the same as we found before. If we take another look at the Fisher effect, we can rearrange things a little as follows:

$$\begin{aligned} 1 + R &= (1 + r) \times (1 + h) \\ R &= r + h + r \times h \end{aligned} \quad (7.3)$$

What this tells us is that the nominal rate has three components. First, there is the real rate on the investment, r. Next, there is the compensation for the decrease in the value of the

money originally invested because of inflation, h. The third component represents compensation for the fact that the dollars earned on the investment are also worth less because of inflation.

This third component is usually small, so it is often dropped. The nominal rate is then approximately equal to the real rate plus the inflation rate:

$$R \approx r + h \quad (7.4)$$

The Fisher Effect **EXAMPLE 7.5**

If investors require a 10 percent real rate of return, and the inflation rate is 8 percent, what must be the approximate nominal rate? The exact nominal rate?

The nominal rate is approximately equal to the sum of the real rate and the inflation rate: 10% + 8% = 18%. From the Fisher effect, we have:

$$\begin{aligned} 1 + R &= (1 + r) \times (1 + h) \\ &= 1.10 \times 1.08 \\ &= 1.1880 \end{aligned}$$

Therefore, the nominal rate will actually be closer to 19 percent.

You would expect that investors would always require a positive real return since a primary purpose of investing is to be able to spend more in the future than you could today. This means that the only time investors would accept a negative yield on a bond would be if there was deflation, or negative inflation. Going back to our discussion at the beginning of the chapter about negative yields, while inflation rates were low at the time, they were not negative, so investors were willing to accept a negative real return. Why? After all, holding cash has a zero real return, which is better. One answer is that holding a huge amount of cash is both expensive and difficult to do, so investors were willing to accept a real return slightly below zero, at what amounts to a storage cost.

It is important to note that financial rates, such as interest rates, discount rates, and rates of return, are almost always quoted in nominal terms. To remind you of this, we will henceforth use the symbol R instead of r in most of our discussions about such rates.

INFLATION AND PRESENT VALUES

One question that often comes up is the effect of inflation on present value calculations. The basic principle is simple: Either discount nominal cash flows at a nominal rate or discount real cash flows at a real rate. As long as you are consistent, you will get the same answer.

To illustrate, suppose you want to withdraw money each year for the next three years, and you want each withdrawal to have $25,000 worth of purchasing power as measured in current dollars. If the inflation rate is 4 percent per year, then the withdrawals will have to increase by 4 percent each year to compensate. The withdrawals each year will thus be:

$$\begin{aligned} C_1 &= \$25{,}000(1.04) = \$26{,}000 \\ C_2 &= \$25{,}000(1.04)^2 = \$27{,}040 \\ C_3 &= \$25{,}000(1.04)^3 = \$28{,}121.60 \end{aligned}$$

What is the present value of these cash flows if the appropriate nominal discount rate is 10 percent? This is a standard calculation, and the answer is:

$$\text{PV} = \$26{,}000/1.10 + \$27{,}040/1.10^2 + \$28{,}121.60/1.10^3 = \$67{,}111.65$$

Notice that we discounted the nominal cash flows at a nominal rate.

To calculate the present value using real cash flows, we need the real discount rate. Using the Fisher equation, the real discount rate is:

$$1 + R = (1 + r)(1 + h)$$
$$1 + .10 = (1 + r)(1 + .04)$$
$$r = .0577, \text{ or } 5.77\%$$

By design, the real cash flows are an annuity of $25,000 per year. So, the present value in real terms is:

$$PV = \$25{,}000[1 - (1/1.0577^3)]/.0577 = \$67{,}111.65$$

Thus, we get exactly the same answer (after allowing for a small rounding error in the real rate). Of course, you could also use the growing annuity equation we discussed in the previous chapter. The withdrawals are increasing at 4 percent per year; so using the growing annuity formula, the present value is:

$$PV = \$26{,}000\left[\frac{1 - \left(\frac{1 + .04}{1 + .10}\right)^3}{.10 - .04}\right] = \$26{,}000(2.58122) = \$67{,}111.65$$

This is exactly the same present value we calculated before.

Concept Questions

7.6a What is the difference between a nominal and a real return? Which is more important to a typical investor?

7.6b What is the Fisher effect?

7.7 Determinants of Bond Yields

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We are now in a position to discuss the determinants of a bond's yield. As we will see, the yield on any particular bond reflects a variety of factors, some common to all bonds and some specific to the issue under consideration.

THE TERM STRUCTURE OF INTEREST RATES

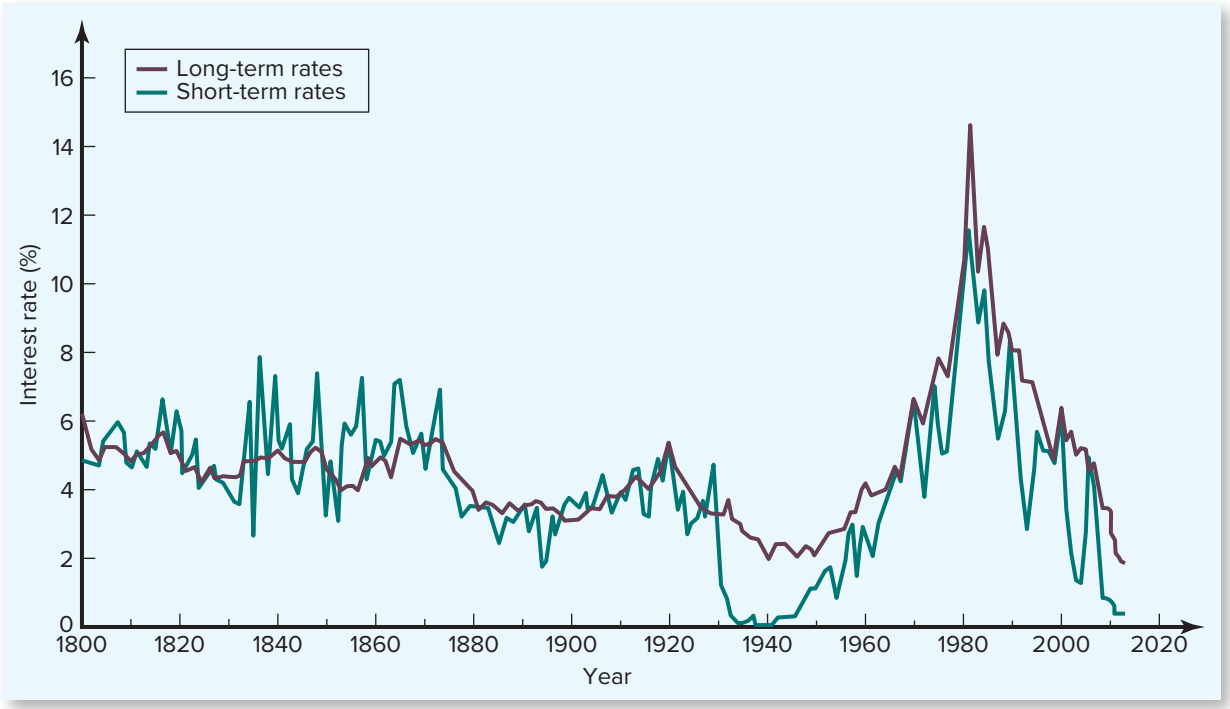
At any point in time, short-term and long-term interest rates will generally be different. Sometimes short-term rates are higher, sometimes lower. Figure 7.5 gives us a long-range perspective on this by showing over two centuries of short- and long-term interest rates. As shown, through time, the difference between short- and long-term rates has ranged from essentially zero to up to several percentage points, both positive and negative.

The relationship between short- and long-term interest rates is known as the **term structure of interest rates**. To be a little more precise, the term structure of interest rates tells us what *nominal* interest rates are on *default-free*, *pure discount* bonds of all maturities. These rates are, in essence, "pure" interest rates because they involve no risk of default and a single, lump sum future payment. In other words, the term structure tells us the pure time value of money for different lengths of time.

term structure of interest rates
The relationship between nominal interest rates on default-free, pure discount securities and time to maturity; that is, the pure time value of money.

When long-term rates are higher than short-term rates, we say that the term structure is upward sloping; when short-term rates are higher, we say it is downward sloping. The term structure can also be "humped." When this occurs, it is usually because rates increase at first, but then begin to decline as we look at longer- and longer-term rates. The most

FIGURE 7.5 U.S. Interest Rates: 1800–2016



SOURCE: Siegel, Jeremy J., *Stocks for the Long Run*, 4th edition. New York: McGraw-Hill, 2008, updated by the authors.

common shape of the term structure, particularly in modern times, is upward sloping; but the degree of steepness has varied quite a bit.

What determines the shape of the term structure? There are three basic components. The first two are the ones we discussed in our previous section: the real rate of interest and the rate of inflation. The real rate of interest is the compensation investors demand for forgoing the use of their money. You can think of it as the pure time value of money after adjusting for the effects of inflation.

The real rate of interest is the basic component underlying every interest rate, regardless of the time to maturity. When the real rate is high, all interest rates will tend to be higher, and vice versa. Thus, the real rate doesn't really determine the shape of the term structure; instead, it mostly influences the overall level of interest rates.

In contrast, the prospect of future inflation strongly influences the shape of the term structure. Investors thinking about lending money for various lengths of time recognize that future inflation erodes the value of the dollars that will be returned. As a result, investors demand compensation for this loss in the form of higher nominal rates. This extra compensation is called the **inflation premium**.

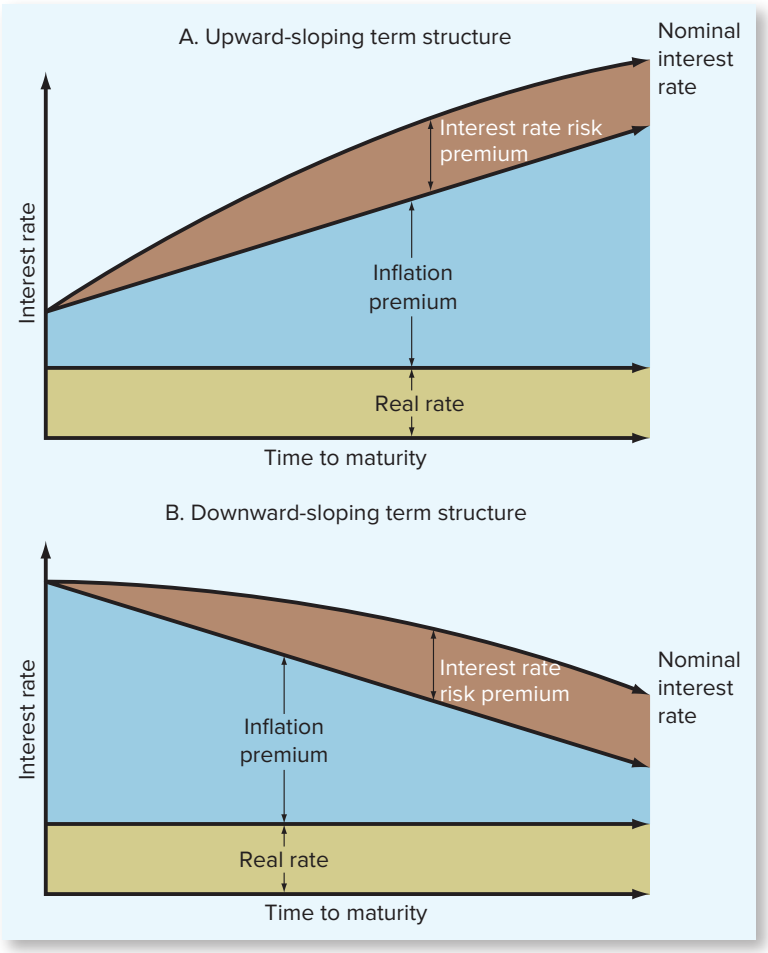
inflation premium
The portion of a nominal interest rate that represents compensation for expected future inflation.

If investors believe the rate of inflation will be higher in the future, then long-term nominal interest rates will tend to be higher than short-term rates. Thus, an upward-sloping term structure may reflect anticipated increases in inflation. Similarly, a downward-sloping term structure probably reflects the belief that inflation will be falling in the future.

The third, and last, component of the term structure has to do with interest rate risk. As we discussed earlier in the chapter, longer-term bonds have much greater risk of loss resulting from changes in interest rates than do shorter-term bonds. Investors recognize this risk, and they demand extra compensation in the form of higher rates for bearing it. This extra compensation is called the **interest rate risk premium**. The longer the term to maturity, the greater the interest rate risk, so the interest rate risk premium increases with

interest rate risk premium
The compensation investors demand for bearing interest rate risk.

FIGURE 7.6
The Term Structure of Interest Rates



maturity. However, as we discussed earlier, interest rate risk increases at a decreasing rate, so the interest rate risk premium does as well.[7]

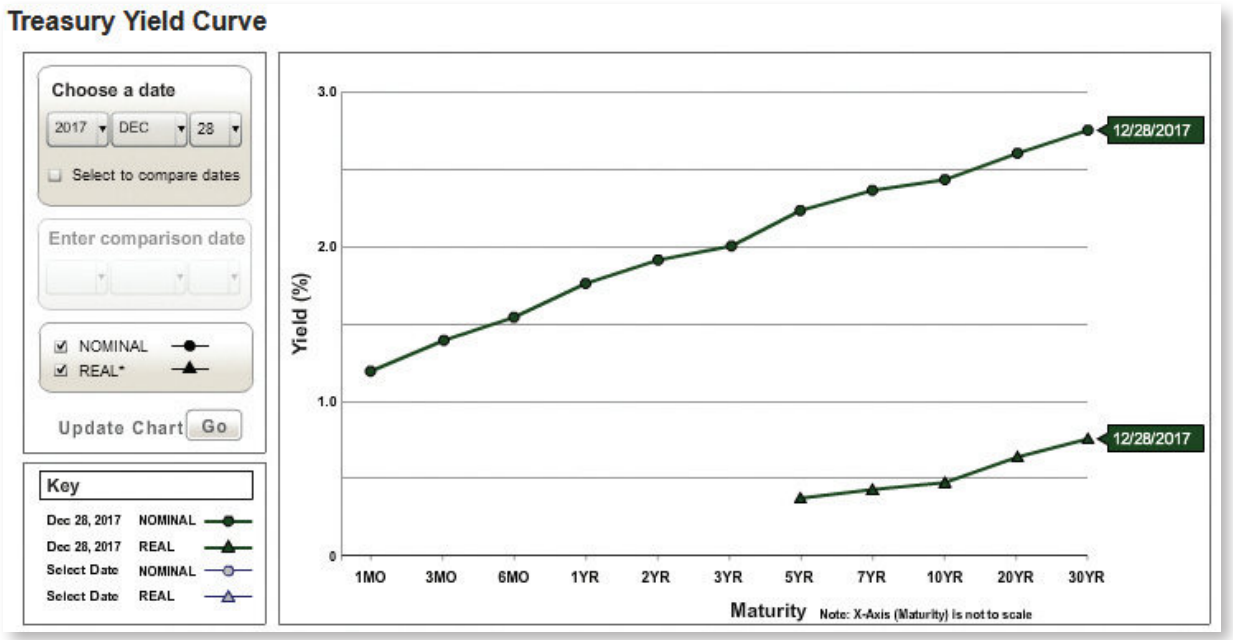
Putting the pieces together, we see that the term structure reflects the combined effect of the real rate of interest, the inflation premium, and the interest rate risk premium. Figure 7.6 shows how these can interact to produce an upward-sloping term structure (in Part A of Figure 7.6) or a downward-sloping term structure (in Part B).

In Part A of Figure 7.6, notice how the rate of inflation is expected to rise gradually. At the same time, the interest rate risk premium increases at a decreasing rate, so the combined effect is to produce a pronounced upward-sloping term structure. In Part B of Figure 7.6, the rate of inflation is expected to fall in the future, and the expected decline is enough to offset the interest rate risk premium and produce a downward-sloping term structure. Notice that if the rate of inflation was expected to decline by only a small amount, we could still get an upward-sloping term structure because of the interest rate risk premium.

We assumed in drawing Figure 7.6 that the real rate would remain the same. Actually, expected future real rates could be larger or smaller than the current real rate. Also, for simplicity, we used straight lines to show expected future inflation rates as rising or declining, but they do not necessarily have to look like this. They could, for example, rise and then fall, leading to a humped yield curve.

[7]In days of old, the interest rate risk premium was called a "liquidity" premium. Today, the term *liquidity premium* has an altogether different meaning, which we explore in our next section. Also, the interest rate risk premium is sometimes called a *maturity risk premium*. Our terminology is consistent with the modern view of the term structure.

FIGURE 7.7 The Treasury Yield Curve: December 29, 2017



SOURCE: www.treasury.gov, December 29, 2017.

BOND YIELDS AND THE YIELD CURVE: PUTTING IT ALL TOGETHER

Going back to Figure 7.4, recall that we saw that the yields on Treasury notes and bonds of different maturities are not the same. Each day, in addition to the Treasury prices and yields shown in Figure 7.4, the U.S. Treasury provides a plot of Treasury yields relative to maturity. This plot is called the **Treasury yield curve** (or just the yield curve). Figure 7.7 shows the yield curve as of December 29, 2017. Note, the yield curve available on the U.S. Treasury website will display both the nominal and real yield curves.

As you probably now suspect, the shape of the yield curve reflects the term structure of interest rates. In fact, the Treasury yield curve and the term structure of interest rates are almost the same thing. The only difference is that the term structure is based on pure discount bonds, whereas the yield curve is based on coupon bond yields. As a result, Treasury yields depend on the three components that underlie the term structure—the real rate, expected future inflation, and the interest rate risk premium.

Treasury notes and bonds have three important features that we need to remind you of: They are default-free, they are taxable, and they are highly liquid. This is not true of bonds in general, so we need to examine what additional factors come into play when we look at bonds issued by corporations or municipalities.

The first thing to consider is credit risk—that is, the possibility of default. Investors recognize that issuers other than the Treasury may or may not make all the promised payments on a bond, so they demand a higher yield as compensation for this risk. This extra compensation is called the **default risk premium**. Earlier in the chapter, we saw how bonds were rated based on their credit risk. What you will find if you start looking at bonds of different ratings is that lower-rated bonds have higher yields.

An important thing to recognize about a bond's yield is that it is calculated assuming that all the promised payments will be made. As a result, it is really a promised yield, and it may or may not be what you will earn. In particular, if the issuer defaults, your actual yield will be lower—probably much lower. This fact is particularly important when it comes to junk bonds. Thanks

Treasury yield curve
A plot of the yields on Treasury notes and bonds relative to maturity.

Online yield curve information is available at **www.bloomberg.com/markets**.

default risk premium
The portion of a nominal interest rate or bond yield that represents compensation for the possibility of default.

To see how the yield curve has changed over time, check out the "living yield curve" at **stockcharts.com/freecharts/yieldcurve.php**.

to a clever bit of marketing, such bonds are now commonly called high-yield bonds, which has a much nicer ring to it; but now you recognize that these are really high *promised* yield bonds.

Next, recall that we discussed earlier how municipal bonds are free from most taxes and, as a result, have much lower yields than taxable bonds. Investors demand the extra yield on a taxable bond as compensation for the unfavorable tax treatment. This extra compensation is the **taxability premium**.

taxability premium
The portion of a nominal interest rate or bond yield that represents compensation for unfavorable tax status.

Finally, bonds have varying degrees of liquidity. As we discussed earlier, there are an enormous number of bond issues, most of which do not trade regularly. As a result, if you wanted to sell quickly, you would probably not get as good a price as you could otherwise. Investors prefer liquid assets to illiquid ones, so they demand a **liquidity premium** on top of all the other premiums we have discussed. As a result, all else being the same, less liquid bonds will have higher yields than more liquid bonds.

liquidity premium
The portion of a nominal interest rate or bond yield that represents compensation for lack of liquidity.

CONCLUSION

If we combine all of the things we have discussed regarding bond yields, we find that bond yields represent the combined effect of no fewer than six things. The first is the real rate of interest. On top of the real rate are five premiums representing compensation for (1) expected future inflation, (2) interest rate risk, (3) default risk, (4) taxability, and (5) lack of liquidity. As a result, determining the appropriate yield on a bond requires careful analysis of each of these effects.

Concept Questions

7.7a What is the term structure of interest rates? What determines its shape?
7.7b What is the Treasury yield curve?
7.7c What six components make up a bond's yield?

7.8 Summary and Conclusions

This chapter has explored bonds, bond yields, and interest rates:

1. Determining bond prices and yields is an application of basic discounted cash flow principles.
2. Bond values move in the direction opposite that of interest rates, leading to potential gains or losses for bond investors.
3. Bonds have a variety of features spelled out in a document called the indenture.
4. Bonds are rated based on their default risk. Some bonds, such as Treasury bonds, have no risk of default, whereas so-called junk bonds have substantial default risk.
5. A wide variety of bonds exist, many of which contain exotic or unusual features.
6. Almost all bond trading is OTC, with little or no market transparency in many cases. As a result, bond price and volume information can be difficult to find for some types of bonds.
7. Bond yields and interest rates reflect the effect of six different things: the real interest rate and five premiums that investors demand as compensation for inflation, interest rate risk, default risk, taxability, and lack of liquidity.

In closing, we note that bonds are a vital source of financing to governments and corporations of all types. Bond prices and yields are a rich subject, and our one chapter, necessarily, touches on only the most important concepts and ideas. There is a great deal more we could say, but, instead, we will move on to stocks in our next chapter.

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Can you answer the following *Connect* Quiz questions?

Section 7.1 An 8 percent, semiannual coupon bond has a face value of $1,000 and a current market value of $1,030. What is the current yield?

Section 7.3 The 10-year bonds issued by KP Enterprises were rated as BBB and Baa last year. This year, the bonds are rated as CC and Ca. What term best applies to these bonds today?

Section 7.4 What type of bonds is most apt to have a "collar"?

Section 7.6 Kate wants to earn a 4 percent real rate of return. To do this, what nominal rate must she earn if the inflation rate is 3.6 percent?

Section 7.7 The term structure of interest rates is based on what type of bonds?

CHAPTER REVIEW AND SELF-TEST PROBLEMS

7.1 Bond Values A Microgates Industries bond has a 10 percent coupon rate and a $1,000 face value. Interest is paid semiannually, and the bond has 20 years to maturity. If investors require a 12 percent yield, what is the bond's value? What is the effective annual yield on the bond?

7.2 Bond Yields A Macrohard Corp. bond carries an 8 percent coupon, paid semiannually. The par value is $1,000, and the bond matures in six years. If the bond currently sells for $911.37, what is its yield to maturity? What is the effective annual yield?

ANSWERS TO CHAPTER REVIEW AND SELF-TEST PROBLEMS

7.1 Because the bond has a 10 percent coupon yield and investors require a 12 percent return, we know that the bond must sell at a discount. Notice that, because the bond pays interest semiannually, the coupons amount to $100/2 = $50 every six months. The required yield is 12%/2 = 6% every six months. Finally, the bond matures in 20 years, so there are a total of 40 six-month periods.

The bond's value is thus equal to the present value of $50 every six months for the next 40 six-month periods plus the present value of the $1,000 face amount:

$$\begin{aligned}\text{Bond value} &= \$50 \times [(1 - 1/1.06^{40})/.06] + 1{,}000/1.06^{40} \\ &= \$50 \times 15.0463 + 1{,}000/10.2857 \\ &= \$849.54\end{aligned}$$

Notice that we discounted the $1,000 back 40 periods at 6 percent per period, rather than 20 years at 12 percent. The reason is that the effective annual yield on the bond is $1.06^2 - 1 = .1236$, or 12.36%, not 12 percent. We thus could have used 12.36 percent per year for 20 years when we calculated the present value of the $1,000 face amount, and the answer would have been the same.

7.2 The present value of the bond's cash flows is its current price, $911.37. The coupon is $40 every six months for 12 periods. The face value is $1,000. So the bond's yield is the unknown discount rate in the following:

$$\$911.37 = \$40 \times [1 - 1/(1 + r)^{12}]/r + 1{,}000/(1 + r)^{12}$$

The bond sells at a discount. Because the coupon rate is 8 percent, the yield must be something in excess of that.

If we were to solve this by trial and error, we might try 12 percent (or 6 percent per six months):

$$\text{Bond value} = \$40 \times (1 - 1/1.06^{12})/.06 + 1{,}000/1.06^{12}$$
$$= \$832.32$$

This is less than the actual value, so our discount rate is too high. We now know that the yield is somewhere between 8 and 12 percent. With further trial and error (or a little machine assistance), the yield works out to be 10 percent, or 5 percent every six months.

By convention, the bond's yield to maturity would be quoted as $2 \times 5\% = 10\%$. The effective yield is thus $1.05^2 - 1 = .1025$, or 10.25%.

CONCEPTS REVIEW AND CRITICAL THINKING QUESTIONS

1. **Treasury Bonds** [LO1] Is it true that a U.S. Treasury security is risk-free?
2. **Interest Rate Risk** [LO2] Which has greater interest rate risk, a 30-year Treasury bond or a 30-year BB corporate bond?
3. **Treasury Pricing** [LO1] With regard to bid and ask prices on a Treasury bond, is it possible for the bid price to be higher? Why or why not?
4. **Yield to Maturity** [LO2] Treasury bid and ask quotes are sometimes given in terms of yields, so there would be a bid yield and an ask yield. Which do you think would be larger? Explain.
5. **Call Provisions** [LO1] A company is contemplating a long-term bond issue. It is debating whether to include a call provision. What are the benefits to the company from including a call provision? What are the costs? How do these answers change for a put provision?
6. **Coupon Rate** [LO1] How does a bond issuer decide on the appropriate coupon rate to set on its bonds? Explain the difference between the coupon rate and the required return on a bond.
7. **Real and Nominal Returns** [LO4] Are there any circumstances under which an investor might be more concerned about the nominal return on an investment than the real return?
8. **Bond Ratings** [LO3] Companies pay rating agencies such as Moody's and S&P to rate their bonds, and the costs can be substantial. However, companies are not required to have their bonds rated; doing so is strictly voluntary. Why do you think they do it?
9. **Bond Ratings** [LO3] Often, junk bonds are not rated. Why?
10. **Term Structure** [LO5] What is the difference between the term structure of interest rates and the yield curve?
11. **Crossover Bonds** [LO3] Looking back at the crossover bonds we discussed in the chapter, why do you think split ratings such as these occur?

12. **Municipal Bonds** [LO1] Why is it that municipal bonds are not taxed at the federal level, but are taxable across state lines? Why are U.S. Treasury bonds not taxable at the state level? (You may need to dust off the history books for this one.)
13. **Bond Market** [LO1] What does the lack of transparency in the bond market imply for bond investors?
14. **Rating Agencies** [LO3] A controversy erupted regarding bond-rating agencies when some agencies began to provide unsolicited bond ratings. Why do you think this is controversial?
15. **Bonds as Equity** [LO1] The 100-year bonds we discussed in the chapter have something in common with junk bonds. Critics charge that, in both cases, the issuers are really selling equity in disguise. What are the issues here? Why would a company want to sell "equity in disguise"?

QUESTIONS AND PROBLEMS

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BASIC
(Questions 1–17)

1. **Interpreting Bond Yields** [LO1] Is the yield to maturity on a bond the same thing as the required return? Is YTM the same thing as the coupon rate? Suppose today a 10 percent coupon bond sells at par. Two years from now, the required return on the same bond is 8 percent. What is the coupon rate on the bond then? The YTM?
2. **Interpreting Bond Yields** [LO2] Suppose you buy a 7 percent coupon, 20-year bond today when it's first issued. If interest rates suddenly rise to 15 percent, what happens to the value of your bond? Why?
3. **Valuing Bonds** [LO2] Even though most corporate bonds in the United States make coupon payments semiannually, bonds issued elsewhere often have annual coupon payments. Suppose a German company issues a bond with a par value of €1,000, 23 years to maturity, and a coupon rate of 3.8 percent paid annually. If the yield to maturity is 4.7 percent, what is the current price of the bond?
4. **Bond Yields** [LO2] A Japanese company has a bond outstanding that sells for 105.43 percent of its ¥100,000 par value. The bond has a coupon rate of 3.4 percent paid annually and matures in 16 years. What is the yield to maturity of this bond?
5. **Coupon Rates** [LO2] Gabriele Enterprises has bonds on the market making annual payments, with eight years to maturity, a par value of $1,000, and selling for $948. At this price, the bonds yield 5.1 percent. What must the coupon rate be on the bonds?
6. **Bond Prices** [LO2] Weismann Co. issued 15-year bonds a year ago at a coupon rate of 4.9 percent. The bonds make semiannual payments and have a par value of $1,000. If the YTM on these bonds is 4.5 percent, what is the current bond price?
7. **Bond Yields** [LO2] West Corp. issued 25-year bonds two years ago at a coupon rate of 5.3 percent. The bonds make semiannual payments. If these bonds currently sell for 105 percent of par value, what is the YTM?
8. **Coupon Rates** [LO2] McConnell Corporation has bonds on the market with 14.5 years to maturity, a YTM of 5.3 percent, a par value of $1,000, and a current price of $1,045. The bonds make semiannual payments. What must the coupon rate be on these bonds?
9. **Zero Coupon Bonds** [LO2] You find a zero coupon bond with a par value of $10,000 and 17 years to maturity. If the yield to maturity on this bond is 4.2 percent, what is the price of the bond? Assume semiannual compounding periods.
10. **Valuing Bonds** [LO2] Yan Yan Corp. has a $2,000 par value bond outstanding with a coupon rate of 4.4 percent paid semiannually and 13 years to maturity. The yield to maturity of the bond is 4.8 percent. What is the price of the bond?

11. **Valuing Bonds** [LO2] Union Local School District has a bond outstanding with a coupon rate of 2.8 percent paid semiannually and 16 years to maturity. The yield to maturity on this bond is 3.4 percent, and the bond has a par value of $5,000. What is the price of the bond?

12. **Calculating Real Rates of Return** [LO4] If Treasury bills are currently paying 4.7 percent and the inflation rate is 2.2 percent, what is the approximate real rate of interest? The exact real rate?

13. **Inflation and Nominal Returns** [LO4] Suppose the real rate is 2.1 percent and the inflation rate is 3.4 percent. What rate would you expect to see on a Treasury bill?

14. **Nominal and Real Returns** [LO4] An investment offers a total return of 12.3 percent over the coming year. Janice Yellen thinks the total real return on this investment will be only 8 percent. What does Janice believe the inflation rate will be over the next year?

15. **Nominal versus Real Returns** [LO4] Say you own an asset that had a total return last year of 11.65 percent. If the inflation rate last year was 2.75 percent, what was your real return?

16. **Using Treasury Quotes** [LO2] Locate the Treasury issue in Figure 7.4 maturing in May 2038. What is its coupon rate? What is its bid price? What was the *previous* day's asked price? Assume a par value of $10,000.

17. **Using Treasury Quotes** [LO2] Locate the Treasury bond in Figure 7.4 maturing in February 2040. Is this a premium or a discount bond? What is its current yield? What is its yield to maturity? What is the bid-ask spread in dollars? Assume a par value of $10,000.

INTERMEDIATE
(Questions 18–31)

18. **Bond Price Movements** [LO2] Bond X is a premium bond making semiannual payments. The bond pays a coupon rate of 7.4 percent, has a YTM of 6.8 percent, and has 13 years to maturity. Bond Y is a discount bond making semiannual payments. This bond pays a coupon rate of 6.8 percent, has a YTM of 7.4 percent, and also has 13 years to maturity. What is the price of each bond today? If interest rates remain unchanged, what do you expect the price of these bonds to be one year from now? In three years? In eight years? In 12 years? In 13 years? What's going on here? Illustrate your answers by graphing bond prices versus time to maturity.

19. **Interest Rate Risk** [LO2] Both Bond Sam and Bond Dave have 7.3 percent coupons, make semiannual payments, and are priced at par value. Bond Sam has three years to maturity, whereas Bond Dave has 20 years to maturity. If interest rates suddenly rise by 2 percent, what is the percentage change in the price of Bond Sam? Of Bond Dave? If rates were to suddenly fall by 2 percent instead, what would the percentage change in the price of Bond Sam be then? Of Bond Dave? Illustrate your answers by graphing bond prices versus YTM. What does this problem tell you about the interest rate risk of longer-term bonds?

20. **Interest Rate Risk** [LO2] Bond J has a coupon rate of 3 percent. Bond K has a coupon rate of 9 percent. Both bonds have 14 years to maturity, make semiannual payments, and have a YTM of 6 percent. If interest rates suddenly rise by 2 percent, what is the percentage price change of these bonds? What if rates suddenly fall by 2 percent instead? What does this problem tell you about the interest rate risk of lower-coupon bonds?

21. **Bond Yields** [LO2] Workman Software has 6.4 percent coupon bonds on the market with 18 years to maturity. The bonds make semiannual payments and currently sell for 94.31 percent of par. What is the current yield on the bonds? The YTM? The effective annual yield?

22. **Bond Yields** [LO2] Chamberlain Co. wants to issue new 20-year bonds for some much-needed expansion projects. The company currently has 6 percent coupon bonds on the market that sell for $1,083, make semiannual payments, and mature in 20 years. What coupon rate should the company set on its new bonds if it wants them to sell at par?

23. **Accrued Interest** [LO2] You purchase a bond with an invoice price of $948. The bond has a coupon rate of 5.9 percent, and there are four months to the next semiannual coupon date. What is the clean price of the bond?

24. **Accrued Interest** [LO2] You purchase a bond with a coupon rate of 5.3 percent and a clean price of $951. If the next semiannual coupon payment is due in two months, what is the invoice price?

25. **Finding the Bond Maturity** [LO2] Excey Corp. has 8 percent coupon bonds making annual payments with a YTM of 7.2 percent. The current yield on these bonds is 7.55 percent. How many years do these bonds have left until they mature?

26. **Using Bond Quotes** [LO2] Suppose the following bond quotes for IOU Corporation appear in the financial page of today's newspaper. Assume the bond has a face value of $2,000 and the current date is April 19, 2018. What is the yield to maturity of the bond? What is the current yield?

Company (Ticker)	Coupon	Maturity	Last Price	Last Yield	EST Vol (000s)
IOU (IOU)	5.7	Apr 19, 2034	108.96	??	1,827

27. **Bond Prices versus Yields** [LO2]
    a. What is the relationship between the price of a bond and its YTM?
    b. Explain why some bonds sell at a premium over par value while other bonds sell at a discount. What do you know about the relationship between the coupon rate and the YTM for premium bonds? What about for discount bonds? For bonds selling at par value?
    c. What is the relationship between the current yield and YTM for premium bonds? For discount bonds? For bonds selling at par value?

28. **Interest on Zeroes** [LO2] Imagination Dragons Corporation needs to raise funds to finance a plant expansion, and it has decided to issue 25-year zero coupon bonds with a par value of $1,000 each to raise the money. The required return on the bonds will be 4.9 percent. Assume semiannual compounding periods.
    a. What will these bonds sell for at issuance?
    b. Using the IRS amortization rule, what interest deduction can the company take on these bonds in the first year? In the last year?
    c. Repeat part (b) using the straight-line method for the interest deduction.
    d. Based on your answers in (b) and (c), which interest deduction method would the company prefer? Why?

29. **Zero Coupon Bonds** [LO2] Suppose your company needs to raise $53 million and you want to issue 20-year bonds for this purpose. Assume the required return on your bond issue will be 5.3 percent, and you're evaluating two issue alternatives: a semiannual coupon bond with a coupon rate of 5.3 percent, and a zero coupon bond. Your company's tax rate is 35 percent. Both bonds will have a par value of $1,000.
    a. How many of the coupon bonds would you need to issue to raise the $53 million? How many of the zeroes would you need to issue?

b. In 20 years, what will your company's repayment be if you issue the coupon bonds? What if you issue the zeroes?

c. Based on your answers in (a) and (b), why would you ever want to issue the zeroes? To answer, calculate the firm's aftertax cash flows for the first year under the two different scenarios. Assume the IRS amortization rules apply for the zero coupon bonds.

30. Finding the Maturity [LO2] You've just found a 10 percent coupon bond on the market that sells for par value. What is the maturity on this bond?

31. Real Cash Flows [LO4] You want to have $2.5 million in real dollars in an account when you retire in 40 years. The nominal return on your investment is 10.3 percent and the inflation rate is 3.7 percent. What real amount must you deposit each year to achieve your goal?

CHALLENGE (Questions 32–38)

32. Components of Bond Returns [LO2] Bond P is a premium bond with a coupon rate of 9 percent. Bond D has a coupon rate of 5 percent and is currently selling at a discount. Both bonds make annual payments, have a YTM of 7 percent, and have 10 years to maturity. What is the current yield for Bond P? For Bond D? If interest rates remain unchanged, what is the expected capital gains yield over the next year for Bond P? For Bond D? Explain your answers and the interrelationships among the various types of yields.

33. Holding Period Yield [LO2] The YTM on a bond is the interest rate you earn on your investment if interest rates don't change. If you actually sell the bond before it matures, your realized return is known as the *holding period yield* (HPY).

a. Suppose that today you buy a bond with an annual coupon rate of 7 percent for $1,060. The bond has 21 years to maturity. What rate of return do you expect to earn on your investment? Assume a par value of $1,000.

b. Two years from now, the YTM on your bond has declined by 1 percent, and you decide to sell. What price will your bond sell for? What is the HPY on your investment? Compare this yield to the YTM when you first bought the bond. Why are they different?

34. Valuing Bonds [LO2] Jallouk Corporation has two different bonds currently outstanding. Bond M has a face value of $20,000 and matures in 20 years. The bond makes no payments for the first six years, then pays $900 every six months over the subsequent eight years, and finally pays $1,300 every six months over the last six years. Bond N also has a face value of $20,000 and a maturity of 20 years; it makes no coupon payments over the life of the bond. If the required return on both these bonds is 5.4 percent compounded semiannually, what is the current price of Bond M? Of Bond N?

35. Valuing the Call Feature [LO2] At one point, certain U.S. Treasury bonds were callable. Consider the prices in the following three Treasury issues as of May 15, 2017:

5/15/2023	6.500	106.31250	106.37500	−.31250	5.28
5/15/2023	8.250	103.43750	103.50000	−.09375	5.24
5/15/2023	12.000	134.78125	134.96875	−.46875	5.32

The bond in the middle is callable in February 2018. What is the implied value of the call feature? Assume a par value of $1,000. (*Hint*: Is there a way to combine the two noncallable issues to create an issue that has the same coupon as the callable bond?)