INVESTMENTS

BODIE KANE MARCUS

eighth edition

INVESTMENTS

EIGHTH EDITION

ZVI BODIE

Boston University

ALEX KANE

University of California, San Diego

ALAN J. MARCUS

Boston College

McGraw-Hill Irwin

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INVESTMENTS

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Commonly Used Notation

b	Retention or plowback ratio
C	Call option value
CF	Cash flow
D	Duration
E	Exchange rate
$E(x)$	Expected value of random variable x
F	Futures price
e	2.718, the base for the natural logarithm, used for continuous compounding
e_{it}	The firm-specific return, also called the residual return, of security i in period t
f	Forward rate of interest
g	Growth rate of dividends
H	Hedge ratio for an option, sometimes called the option's delta
i	Inflation rate
k	Market capitalization rate, the required rate of return on a firm's stock
ln	Natural logarithm function
M	The market portfolio
$N(d)$	Cumulative normal function, the probability that a standard normal random variable will have value less than d
p	Probability
P	Put value
PV	Present value
P/E	Price-to-earnings multiple
r	Rate of return on a security; for fixed-income securities, r may denote the rate of interest for a particular period
r_f	The risk-free rate of interest
r_M	The rate of return on the market portfolio
ROE	Return on equity, incremental economic earnings per dollar reinvested in the firm
S_p	Reward-to-volatility ratio of a portfolio, also called Sharpe's measure; the excess expected return divided by the standard deviation
t	Time
T_p	Treynor's measure for a portfolio, excess expected return divided by beta
V	Intrinsic value of a firm, the present value of future dividends per share
X	Exercise price of an option
y	Yield to maturity
α	Rate of return beyond the value that would be forecast from the market's return and the systematic risk of the security
β	Systematic or market risk of a security
ρ_{ij}	Correlation coefficient between returns on securities i and j
σ	Standard deviation
σ^2	Variance
$\mathrm{Cov}(r_i, r_j)$	Covariance between returns on securities i and j

INVESTMENTS

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Zvi Bodie is the Norman and Adele Barron Professor of Management at Boston University. He holds a PhD from the Massachusetts Institute of Technology and has served on the finance faculty at the Harvard Business School and MIT's Sloan School of Management. Professor Bodie has published widely on pension finance and investment strategy in leading professional journals. In cooperation with the Research Foundation of the CFA Institute, he has recently produced a series of Webcasts and a monograph entitled *The Future of Life Cycle Saving and Investing.*

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BRIEF CONTENTS

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PREFACE

We wrote the first edition of this textbook two decades ago. The intervening years have been a period of rapid, profound, and ongoing change in the investments industry. This is due in part to an abundance of newly designed securities, in part to the creation of new trading strategies that would have been impossible without concurrent advances in computer technology, and in part to rapid advances in the theory of investments that have come out of the academic community. In no other field, perhaps, is the transmission of theory to real-world practice as rapid as is now commonplace in the financial industry. These developments place new burdens on practitioners and teachers of investments far beyond what was required only a short while ago. Of necessity, our text has evolved along with financial markets.

Investments, Eighth Edition, is intended primarily as a textbook for courses in investment analysis. Our guiding principle has been to present the material in a framework that is organized by a central core of consistent fundamental principles. We make every attempt to strip away unnecessary mathematical and technical detail, and we have concentrated on providing the intuition that may guide students and practitioners as they confront new ideas and challenges in their professional lives.

This text will introduce you to major issues currently of concern to all investors. It can give you the skills to conduct a sophisticated assessment of current issues and debates covered by both the popular media as well as more-specialized finance journals. Whether you plan to become an investment professional, or simply a sophisticated individual investor, you will find these skills essential.

Our primary goal is to present material of practical value, but all three of us are active researchers in the science of financial economics and find virtually all of the material in this book to be of great intellectual interest. Fortunately, we think, there is no contradiction in the field of investments between the pursuit of truth and the pursuit of money. Quite the opposite. The capital asset pricing model, the arbitrage pricing model, the efficient markets hypothesis, the option-pricing model, and the other centerpieces of modern financial research are as much intellectually satisfying subjects of scientific inquiry as they are of immense practical importance for the sophisticated investor.

In our effort to link theory to practice, we also have attempted to make our approach consistent with that of the CFA Institute. In addition to fostering research in finance, the CFA Institute administers an education and certification program to candidates seeking the designation of Chartered Financial Analyst (CFA). The CFA curriculum represents the consensus of a committee of distinguished scholars and practitioners regarding the core of knowledge required by the investment professional. This text also is used in many certification programs for the Financial Planning Association and by the Society of Actuaries.

There are many features of this text that make it consistent with and relevant to the CFA curriculum. Questions from past CFA exams appear at the end of nearly every chapter, and, for students who will be taking the exam, those same questions and the exam from which they've been taken, are listed at the end of the book. Chapter 3 includes excerpts from the "Code of Ethics and Standards of Professional Conduct" of the CFA Institute. Chapter 28, which discusses investors and the investment process, presents the CFA Institute's framework for systematically relating investor objectives and constraints to ultimate investment policy.

In the Eighth Edition, we have further extended our systematic collection of Excel spreadsheets that give tools to explore concepts more deeply than was previously possible. These spreadsheets are available on the Web site for this text **(www.mhhe.com/bkm),** and provide a taste of the sophisticated analytic tools available to professional investors.

UNDERLYING PHILOSOPHY

In the Eighth Edition, we address many of the changes in the investment environment.

At the same time, many basic *principles* remain important. We believe that attention to these few important principles can simplify the study of otherwise difficult material and that fundamental principles should organize and motivate all study. These principles are crucial to understanding the securities already traded in financial markets and in understanding new securities that will be introduced in the future. For this reason, we have made this book thematic, meaning we never offer rules of thumb without reference to the central tenets of the modern approach to finance.

The common theme unifying this book is that *security markets are nearly efficient,* meaning most securities are usually priced appropriately given their risk and return attributes. There are few free lunches found in markets as competitive as the financial market. This simple observation is, nevertheless, remarkably powerful in its implications for the design of investment strategies; as a result, our discussions of strategy are always guided by the implications of the efficient markets hypothesis. While the degree of market efficiency is, and always will be, a matter of debate (and in fact, in this edition, we devote a full chapter to the behavioral challenge to the efficient market hypothesis), we hope our discussions throughout the book convey a good dose of healthy criticism concerning much conventional wisdom.

Distinctive Themes

Investments is organized around several important themes:

1. **The central theme** is the near-informational-efficiency of well-developed security markets, such as those in the United States, and the general awareness that competitive markets do not offer "free lunches" to participants.

   A second theme is the risk–return trade-off. This too is a no-free-lunch notion, holding that in competitive security markets, higher expected returns come only at a price: the need to bear greater investment risk. However, this notion leaves several questions unanswered. How should one measure the risk of an asset? What should be the quantitative trade-off between risk (properly measured) and expected return? The approach we present to these issues is known as *modern portfolio theory,* which is another organizing principle of this book. Modern portfolio theory focuses on the techniques and implications of *efficient diversification,* and we devote considerable attention to the effect of diversification on portfolio risk as well as the implications of efficient diversification for the proper measurement of risk and the risk–return relationship.

2. **This text places** greater emphasis on asset allocation than most of its competitors. We prefer this emphasis for two important reasons. First, it corresponds to the procedure that most individuals actually follow. Typically, you start with all of your money in a bank account, only then considering how much to invest in something riskier that might offer a higher expected return. The logical step at this point is to consider other risky asset classes, such as stock, bonds, or real estate. This is an asset allocation decision. Second, in most cases, the asset allocation choice is far more important in determining overall investment performance than is the set of security selection decisions. Asset allocation is the primary determinant of the risk–return profile of the investment portfolio, and so it deserves primary attention in a study of investment policy.

3. **This text offers** a much broader and deeper treatment of futures, options, and other derivative security markets than most investments texts. These markets have become both crucial and integral to the financial universe and are the major sources of innovation in that universe. Your only choice is to become conversant in these markets—whether you are to be a finance professional or simply a sophisticated individual investor.

NEW IN THE EIGHTH EDITION

The following is a guide to changes in the Eighth Edition. This is not an exhaustive road map, but instead is meant to provide an overview of substantial additions and changes to coverage from the last edition of the text.

Chapter 3 How Securities Are Traded

This chapter has been largely rewritten to reflect the ongoing transformation of trading practices, the growing dominance of electronic trading, the accelerating consolidation of securities markets, and continuing regulatory reform, in particular the response to the Sarbanes-Oxley Act.

Chapter 7 Optimal Risky Portfolios

This chapter contains additional material on the "art" of selecting reasonable parameter values for portfolio construction, and a discussion of what can go wrong when inputs are derived solely from recent historical experience.

Chapter 9 The Capital Asset Pricing Model

We introduce new material generalizing the intuition of the simple CAPM to more sophisticated treatments of risk, for example, consumption risk. We have also updated the material on liquidity and asset pricing throughout the set of chapters dealing with portfolio theory.

Chapter 11 The Efficient Market Hypothesis

We critically evaluate recent suggestions for "fundamental indexing" as a response to market errors in security valuation. We show that these strategies are nothing more than variations on the value-tilted portfolio strategies discussed earlier in the chapter.

Chapter 13 Empirical Evidence on Security Returns

We add considerable new material on the interpretation of risk premiums. For example, we examine new evidence on the relation between the Fama-French risk factors and more fundamental measures of security risk.

Chapter 14 Bond Prices and Yields

The chapter has new material explaining collateralized debt obligations (CDOs) as well as the role of credit rating agencies in the recent credit market crisis.

Chapter 19 Financial Statement Analysis

The chapter has been updated to address current issues in fair value accounting. It also contains additional discussion of the proper interpretation of market-to-book ratios.

Chapter 20 Options Markets

We have added a discussion of options backdating to this chapter.

Chapter 23 Futures, Swaps, and Risk Management

We have added new material on credit default swaps to this chapter. We show how these securities are constructed, and how they are used to transfer credit risk.

Chapter 26 Hedge Funds

This new chapter covers various hedge fund strategies; market-neutral investing and portable alpha; performance evaluation for hedge funds with changing risk exposures; selection bias in hedge fund performance; tail risk in hedge fund portfolios; and hedge fund fees.

Chapter 28 Investment Policy and the Framework of the CFA Institute

This chapter has been updated to reflect the CFA Institute's expanded rubric for constructing a statement of investment policy.

ORGANIZATION AND CONTENT

The text is composed of seven sections that are fairly independent and may be studied in a variety of sequences. Because there is enough material in the book for a two-semester course, clearly a one-semester course will require the instructor to decide which parts to include.

Part One is introductory and contains important institutional material focusing on the financial environment. We discuss the major players in the financial markets, provide an overview of the types of securities traded in those markets, and explain how and where securities are traded. We also discuss in depth mutual funds and other investment companies, which have become an increasingly important means of investing for individual investors.

The material presented in Part One should make it possible for instructors to assign term projects early in the course. These projects might require the student to analyze in detail a particular group of securities. Many instructors like to involve their students in some sort of investment game, and the material in these chapters will facilitate this process.

Parts Two and Three contain the core of modern portfolio theory. Chapter 5 is a general discussion of risk and return, making the general point that historical returns on broad asset classes are consistent with a risk–return trade-off, and examining the distribution of stock returns. We focus more closely in Chapter 6 on how to describe investors' risk preferences and how they bear on asset allocation. In the next two chapters, we turn to to portfolio optimization (Chapter 7) and its implementation using index models (Chapter 8).

After our treatment of modern portfolio theory in Part Two, we investigate in Part Three the implications of that theory for the equilibrium structure of expected rates of return on risky assets. Chapter 9 treats the capital asset pricing model and Chapter 10 covers multifactor descriptions of risk and the arbitrage pricing theory. Chapter 11 covers the efficient market hypothesis, including its rationale as well as evidence that supports the hypothesis and challenges it. Chapter 12 is devoted to the behavioral critique of market rationality. Finally, we conclude Part Three with Chapter 13 on empirical evidence on security pricing. This chapter contains evidence concerning the risk–return relationship, as well as liquidity effects on asset pricing.

Part Four is the first of three parts on security valuation. This part treats fixed-income securities—bond pricing (Chapter 14), term structure relationships (Chapter 15), and interest-rate risk management (Chapter 16). **Parts Five and Six** deal with equity securities and derivative securities. For a course emphasizing security analysis and excluding portfolio theory, one may proceed directly from Part One to Part Four with no loss in continuity.

Finally, **Part Seven** considers several topics important for portfolio managers, including performance evaluation, international diversification, active management, and practical issues in the process of portfolio management. This part also contains a new chapter on hedge funds.

A GUIDED TOUR . . .

This book contains several features designed to make it easy for the student to understand, absorb, and apply the concepts and techniques presented.

New and Enhanced Pedagogy

CHAPTER OPENING VIGNETTES

SERVE TO OUTLINE the upcoming material in the chapter and provide students with a road map of what they will learn.

CHAPTER TWO

PART I

ASSET CLASSES AND FINANCIAL INSTRUMENTS

YOU LEARNED IN Chapter 1 that the process of building an investment portfolio usually begins by deciding how much money to allocate to broad classes of assets, such as safe money market securities or bank accounts, longer-term bonds, stocks, or even asset classes like real estate or precious metals. This process is called *asset allocation*. Within each class the investor then selects specific assets from a more detailed menu. This is

markets. Money market instruments include short-term, marketable, liquid, low-risk debt securities. Money market instruments sometimes are called *cash equivalents*, or just *cash* for short. Capital markets, in contrast, include longer-term and riskier securities. Securities in the capital market are much more diverse than those found within the money market. For this reason, we will subdivide the capital market into four segments ... term bond

CONCEPT CHECKS

A UNIQUE FEATURE of this book! These self-test questions and problems found in the body of the text enable the students to determine whether they've understood the preceding material. Detailed solutions are provided at the end of each chapter.

heterogeneous beliefs is for Paul and Mary to "merge their information," that is, for each party to verify that he or she possesses all relevant information and processes the information properly. Of course, the acquisition of information and the extensive communication that is required to eliminate all heterogeneity in expectations is costly, and thus up to a point heterogeneous expectations cannot be taken as irrational. If, however, Paul and Mary enter such contracts frequently, they would recognize the information problem in one of two ways: Either they will realize that they are creating gambles when each wins half of the bets, or the consistent loser will admit that he or she has been betting on the basis of inferior forecasts.

CONCEPT CHECK 1

Assume that dollar-denominated T-bills in the United States and pound-denominated bills in the United Kingdom offer equal yields to maturity. Both are short-term assets, and both are free of default risk. Neither offers investors a risk premium. However, a U.S. investor who holds U.K. bills is subject to exchange rate risk, because the pounds earned on the U.K. bills eventually will be exchanged for dollars at the future exchange rate. Is the U.S. investor engaging in speculation or gambling?

NUMBERED EXAMPLES

NUMBERED AND TITLED examples are integrated throughout chapters. Using the worked-out solutions to these examples as models, students can learn how to solve specific problems step-by-step as well as gain insight into general principles by seeing how they are applied to answer concrete questions.

EXAMPLE 5.1 Approximating the Real Rate

If the nominal interest rate on a 1-year CD is 8%, and you expect inflation to be 5% over the coming year, then using the approximation formula, you expect the real rate of interest to be $r = 8\% - 5\% = 3\%$. Using the exact formula, the real rate is $r = \frac{.08 - .05}{1 + .05} = .0286$, or 2.86%. Therefore, the approximation rule overstates the expected real rate by only .14% (14 basis points). The approximation rule is more exact for small inflation rates and is perfectly exact for continuously compounded rates. We discuss further details in the next section.

Before the decision to invest, you should realize that conventional certificates of deposit

WORDS FROM THE STREET

GOOGLING FOR GOLD

With the news that shares of online search giant Google Inc. (**GOOG**) had crossed the lofty $400-per-share mark in November 2005, the world may have witnessed something akin to the birth of a new financial planetary system. Given its market cap of $120 billion, double that of its nearest competitor, Yahoo!, Google now has the gravitational pull to draw in a host of institutions and company matchmakers unable to resist the potential profit opportunities. Google stock, with a price–earnings ratio of 70, represents one of the richest dealmaking currencies anywhere. That heft has attracted a growing galaxy of entrepreneurs, venture capitalists, and investment bankers, all of whom are orbiting Google in the hopes of selling it something—a new service, a start-up company, even a new strategy—anything to get their hands on a little of the Google gold.

The Google effect is already changing the delicate balance in Silicon Valley between venture capitalists (VCs) and start-up companies. Instead of nurturing the most promising start-ups with an eye toward taking the fledgling businesses public, a growing number of VCs now scour the landscape for anyone with a technology or service that might fill a gap in Google's portfolio. Google itself and not the larger market has become the exit strategy as VCs plan for the day they can take their money out of their start-ups. Business founders have felt the tug as well. "You're hearing about a lot of entrepreneurs pitching VCs with their end goal to be acquired by Google," says Daniel Primack, editor of *PE Week Wire*, a dealmaking digest popular in VC circles. "It's a complete 180 [degree turn] from the IPO craze of five years ago; now Google is looked at like NASDAQ was then." Other entrepreneurs, meanwhile, are skipping the VC stage altogether, hoping to sell directly to Google.

Source: *BusinessWeek Online*, **www.businessweek.com/magazine.** Reprinted from the December 5, 2005, issue of *BusinessWeek* by special permission. © 2005 McGraw-Hill Companies, Inc.

Allocation of Risk

Virtually all real assets involve some risk. When GM builds its auto plants, for example, it can... for sure w... those pl... ate... ...d the

WORDS FROM THE STREET BOXES

SHORT ARTICLES FROM business periodicals, such as *The Wall Street Journal*, are included in boxes throughout the text. The articles are chosen for real-world relevance and clarity of presentation.

EXCEL APPLICATIONS

THE EIGHTH EDITION has expanded the boxes featuring Excel Spreadsheet Applications. A sample spreadsheet is presented in the Investments text with an interactive version available on the book's Web site at **www.mhhe.com/bkm.**

eXcel APPLICATIONS: short sale

The Online Learning Center (**www.mhhe.com/bkm**) contains this Excel spreadsheet model, built using the text example for Dot Bomb. The model allows you to analyze the effects of returns, margin calls, and different levels of initial and maintenance margins. The model also includes a sensitivity analysis for ending stock price and returnt on investment.

	A	B	C	D	E
1					
2			Action or Formula	Ending	Return on
3			for Column B	St Price	Investment
4	Initial Investment	$50,000.00	Enter data		60.00%
5	Initial Stock Price	$100.00	Enter data	$170.00	-140.00%
6	Number of Shares Sold Short	1,000	(B4/B9)/B5	160.00	-120.00%
7	Ending Stock Price	$70.00	Enter data	150.00	-100.00%
8	Cash Dividends Per Share	$0.00	Enter data	140.00	-80.00%
9	Initial Margin Percentage	50.00%	Enter data	130.00	-60.00%
10	Maintenance Margin Percentage	30.00%	Enter data	120.00	-40.00%
11				110.00	-20.00%
12	Return on Short Sale			100.00	0.00%
13	Capital Gain on Stock	$30,000.00	B6*(B5−B7)	90.00	20.00%
14	Dividends Paid	$0.00	B8*B6	80.00	40.00%
15	Net Income	$30,000.00	B13−B14	70.00	60.00%
16	Initial Investment	$50,000.00	B4	60.00	80.00%
17	Return on Investment	60.00%	B15/B16	50.00	100.00%
18				40.00	[illegible]
19	...in Positions			30.00	

EXCEL EXHIBITS

SELECTED EXHIBITS ARE set as Excel spreadsheets and are denoted by an icon. They are also available on the book's Web site at **www.mhhe.com/bkm.**

	A	B	C	D	E	F	G	H
1								
2								
3	Rates of return expressed as decimals							
4	Purchase Price =		$100		T-bill Rate =	0.06		
5								
6						Squared		Squared
7	State of the		Year-end	Cash		Deviations	Excess	Deviations
8	Economy	Probability	Price	Dividends	HPR	from Mean	Returns	from Mean
9	Boom	0.3	129.50	4.50	0.34	0.040	0.28	0.040
10	Normal growth	0.5	110.00	4.00	0.14	0.000	0.08	0.000
11	Recession	0.2	80.50	3.50	−0.16	0.090	−0.22	0.090
12	Expected value (mean)		SUMPRODUCT(B9:B11, E9:E11) =		0.14			
13	Standard deviation of HPR			SUMPRODUCT(B9:B11, F9:F11)^.5 = 0.1732				
14	Risk premium				SUMPRODUCT(B9:B11, G9:G11) =		0.08	
15	Standard deviation of excess return					SUMPRODUCT(B9:B11, H9:H11)^0.5 = 0.1732		

SPREADSHEET 5.1

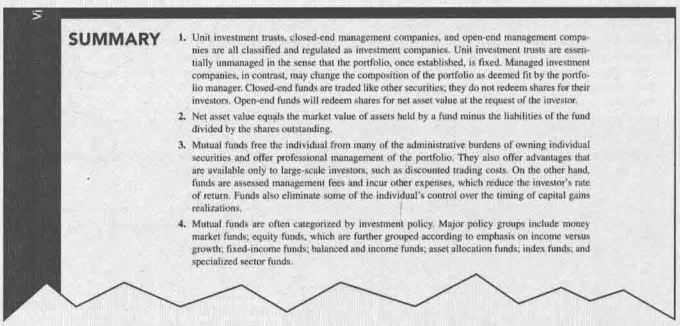
Distribution of HPR on the stock-index fund

eXcel
Please visit us at
www.mhhe.com/bkm

END OF CHAPTER FEATURES . . .

SUMMARY

AT THE END of each chapter, a detailed summary outlines the most important concepts presented. A listing of related Web sites for each chapter can also be found on the book's Web site at **www.mhhe.com/bkm.** These sites make it easy for students to research topics further and retrieve financial data and information.

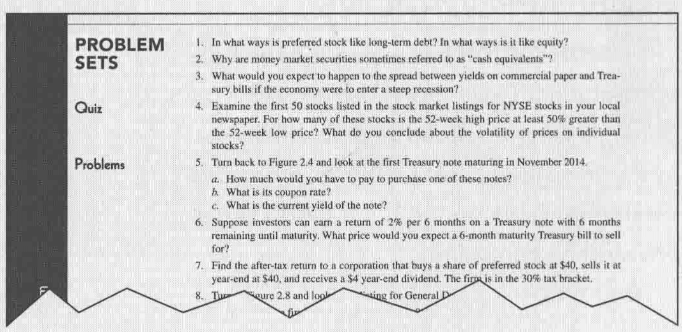


SUMMARY

1. Unit investment trusts, closed-end management companies, and open-end management companies are all classified and regulated as investment companies. Unit investment trusts are essentially unmanaged in the sense that the portfolio, once established, is fixed. Managed investment companies, in contrast, may change the composition of the portfolio as deemed fit by the portfolio manager. Closed-end funds are traded like other securities; they do not redeem shares for their investors. Open-end funds will redeem shares for net asset value at the request of the investor.
2. Net asset value equals the market value of assets held by a fund minus the liabilities of the fund divided by the shares outstanding.
3. Mutual funds free the individual from many of the administrative burdens of owning individual securities and offer professional management of the portfolio. They also offer advantages that are available only to large-scale investors, such as discounted trading costs. On the other hand, funds are assessed management fees and incur other expenses, which reduce the investor's rate of return. Funds also eliminate some of the individual's control over the timing of capital gains realizations.
4. Mutual funds are often categorized by investment policy. Major policy groups include money market funds; equity funds, which are further grouped according to emphasis on income versus growth; fixed-income funds; balanced and income funds; asset allocation funds; index funds; and specialized sector funds.

PROBLEM SETS

WE STRONGLY BELIEVE that practice in solving problems is critical to understanding investments, so a good variety of problems is provided. New to this edition, we separated the questions by level of difficulty: Quiz, Problems, and Challenge Problems.



PROBLEM SETS

Quiz

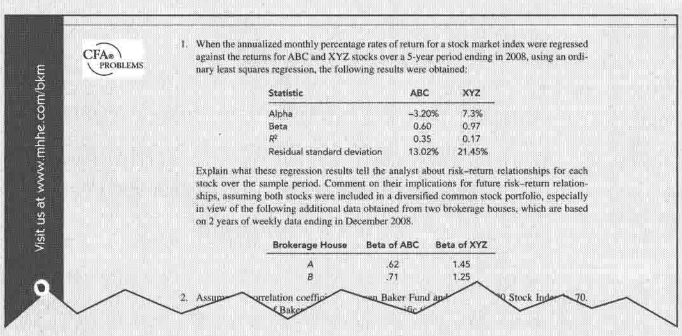
1. In what ways is preferred stock like long-term debt? In what ways is it like equity?
2. Why are money market securities sometimes referred to as "cash equivalents"?
3. What would you expect to happen to the spread between yields on commercial paper and Treasury bills if the economy were to enter a steep recession?
4. Examine the first 50 stocks listed in the stock market listings for NYSE stocks in your local newspaper. For how many of these stocks is the 52-week high price at least 50% greater than the 52-week low price? What do you conclude about the volatility of prices on individual stocks?

Problems

5. Turn back to Figure 2.4 and look at the first Treasury note maturing in November 2014.
   a. How much would you have to pay to purchase one of these notes?
   b. What is its coupon rate?
   c. What is the current yield of the note?
6. Suppose investors can earn a return of 2% per 6 months on a Treasury note with 6 months remaining until maturity. What price would you expect a 6-month maturity Treasury bill to sell for?
7. Find the after-tax return to a corporation that buys a share of preferred stock at $40, sells it at year-end at $40, and receives a $4 year-end dividend. The firm is in the 30% tax bracket.
8. Tu… igure 2.8 and loo… isting for General D…

CFA PROBLEMS

WE PROVIDE SEVERAL questions from recent CFA examination in applicable chapters. These questions represent the kinds of questions that professionals in the field believe are relevant to the "real world." Located at the back of the book is a listing of each CFA question and the level and year of the CFA exam it was included in for easy reference when studying for the exam.



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CFA® PROBLEMS

1. When the annualized monthly percentage rates of return for a stock market index were regressed against the returns for ABC and XYZ stocks over a 5-year period ending in 2008, using an ordinary least squares regression, the following results were obtained:

Statistic	ABC	XYZ
Alpha	–3.20%	7.3%
Beta	0.60	0.97
R^2	0.35	0.17
Residual standard deviation	13.02%	21.45%

Explain what these regression results tell the analyst about risk–return relationships for each stock over the sample period. Comment on their implications for future risk–return relationships, assuming both stocks were included in a diversified common stock portfolio, especially in view of the following additional data obtained from two brokerage houses, which are based on 2 years of weekly data ending in December 2008.

Brokerage House	Beta of ABC	Beta of XYZ
A	.62	1.45
B	.71	1.25

2. Assum… orrelation coeffic… en Baker Fund an… 0 Stock Ind… 70.