



AN INTRODUCTION TO

Derivatives and Risk Management

10TH EDITION

Don M. Chance & Robert Brooks



TENTH EDITION

An Introduction to Derivatives and Risk Management

DON M. CHANCE

Louisiana State University

ROBERT BROOKS

University of Alabama

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Product Manager: Clara Goosman

Content Developer: Kendra Brown

Senior Product Assistant: Adele Scholtz

Marketing Director: Natalie King

Marketing Manager: Heather Mooney

Senior Marketing Coordinator: Eileen Corcoran

Art and Cover Direction, Production Management, and Composition: Lumina Datamatics, Inc.

Associate Media Developer: Mark Hopkinson

Intellectual Property

Analyst: Christina Ciaramella

Project Manager: Anne Sheroff

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Preface

DON CHANCE

As this book moves into its tenth edition, I continue to be amazed at how much has changed in the world of derivatives since the first edition, copyright 1989. But then, the entire world has changed. We had no real exotic derivatives back then, but we also had no smartphones and a lot of other technology we take for granted. And although life has generally gotten better for the human species, it seems to have gotten a bit more dangerous, so we take far more security precautions than ever—likewise with derivatives. The growing emphasis on practicing good risk management has been paralleled by the growing need to improve the safety and security of people, so the changes in the derivatives world are somewhat correlated with changes in life in general.

Although some would argue that derivatives make the financial world more dangerous, we would argue that the dangers are merely more noticeable. When derivatives are misused, stories hit the news and we automatically assume that new laws are needed. When derivatives are used successfully, as they almost always are, there is no story in the news. So, Robert and I continue to defend the tools, while believing that a solid educational foundation offers the best chance of ensuring that the user will not hurt himself or someone else with the tool.

Once again, I express my appreciation to my wife Jan for many years of love and support. Our derivatives, otherwise known as our children, are long since gone from home and managing their own derivatives, but they too play an indirect role in the success of this book. I also thank my students and colleagues who over the years have asked many challenging questions that contribute to my own body of knowledge that plays a role in this book.

ROBERT BROOKS

With the rapid changes in technology along with significant changes in the financial market infrastructure, the need for quality content on financial derivatives and risk management has never been greater. It is a privilege for me to continue collaborating with Don on such a successful book. My goal remains to aid students in understanding how to make financial derivatives theories work in practice. The financial derivatives and risk management subject area is a rapidly changing field that provides those who learn to navigate its complexities the opportunity for a rewarding career. By straddling the fence between the academic community and the practitioner community, I seek to continually enhance our book's quest to equip the next generation of financial risk managers.

I would like to encourage college students and others reading this book to consider a rewarding career in this field of study. Whether serving in a corporation, a financial services firm, or an investment management company, the ability to provide wise financial counsel inevitably leads to a fulfilling career. Knowing that you have contributed to protecting your firm from inappropriate financial risk or investing in an unsuitable strategy for your clients is both financially rewarding and personally gratifying.

I am deeply grateful to the unwavering support of my wife Ann. We have six children, two daughters-in-law, and one grandchild who provide constant opportunities to refine teaching financial principles as well as applying risk management in practice.

My family is a constant source of encouragement, and they are all very supportive of my activities related to this book.

DON AND BOB

We would like to thank Mike Reynolds, Executive Editor, Finance, for his support over the years and for solving in a timely manner every problem that arose during the project. We would also like to thank Marketing Manager Heather Mooney, to whose expertise we trust the future sales of the book.

We would like to thank all the people over the years who have both taught from this book and learned from it. They have, all along, generously provided constructive comments and corrections. After over 25 years, this list of names is too long to print without leaving someone out. So to all of you unnamed heroes, we express our thanks.

We used to believe that the errors in a book should, through attrition over the years, disappear; however, we have learned otherwise. Although no one wants errors to remain, if you ever find a book in its tenth edition without any errors, you can be assured that the author is simply correcting old material and not keeping the book up to date. With a field as dynamic as derivatives, extensive changes are inevitable. Despite Herculean efforts to cleanse this work, there are ineluctably some errors that remain. We are fairly confident, however, that these are not errors of fact but merely accidental oversights and perhaps typos that did not get caught as we read and reread the material. Unlike many authors, who we think would rather hide known errors, we maintain a list of such errors on this book's website. (Go to www.cengagebrain.com and search ISBN 9781305104969.) If you see something that does not make sense, check the Web address mentioned above and see if it's there. If not, send us an email by using the *Contact Us* form on the book's website.

Or just send us an email anyway, whether you are students or faculty. Tell us what you like or don't like about the book. We would love to hear from you.

Don M. Chance, dchance@lsu.edu
James C. Flores Endowed Chair of MBA Studies & Professor of Finance
Department of Finance
2909 Business Education Complex
E. J. Ourso College of Business
Louisiana State University
Baton Rouge, LA 70803

Robert Brooks, rbrooks@cba.ua.edu
Wallace D. Malone, Jr. Endowed Chair of Financial Management
Department of Finance
The University of Alabama
200 Alston Hall, Box 870224
Tuscaloosa, AL 35487
October 2014

HIGHLIGHTS OF THE TENTH EDITION

The following is a partial list of the features and updates in the tenth edition. For expanded descriptions of these and other updates as well as the book's organization, see the "Book Overview" section in Chapter 1:

- Located in selected chapters, new "Taking Risk in Life" features present real-life situations, illustrating the application of risk management principles for decisions in general.

- The tenth edition includes a new and completely revised Chapter 2, Structure of Derivatives Markets. This chapter combines the old Chapters 2 and 8, which were the descriptive chapters on options and forward/futures markets, respectively. We have consolidated that material into a single more general Chapter 2 on derivatives markets. This change reflects the fact that the markets are not nearly as segmented as they were once. Indeed, the markets for options, swaps, futures, and forwards are essentially one large market.
- Chapter 11 contains a new section that addresses some recent changes in industry practice regarding estimating the appropriate risk-free rate and monetizing the various credit exposures.
- This edition also contains more than 120 figures and more than 90 tables, which reinforce the concepts presented in the text. Figures build on each other to illustrate links between stocks, risk-free bonds, futures, options, forwards, Black–Scholes–Merton call or put pricing, and similar concepts.
- “Making the Connection” boxes give students insight into how the chapter content applies directly to real-world financial decision making. Each box presents real business examples and actual market conditions to emphasize the practicality of chapter theories.
- End-of-chapter “Concept Checks” questions help students understand the basic materials covered in the text. Solutions to these questions are located at the end of the book and on the companion website, allowing students to check their own comprehension.

INSTRUCTOR SUPPLEMENTS

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- **Solutions Manual.** Revised by the authors, the Solutions Manual contains detailed solutions to Questions and Problems at the end of each chapter.
- **Test Bank.** The test bank, which has also been revised by the authors, contains over 440 multiple choice questions and over 440 true or false questions.
- **Cognero™ Test Bank.** Cengage Learning Testing Powered by Cognero™ is a flexible online system that allows you to author, edit, and manage test bank content from multiple Cengage Learning solutions; create multiple test versions in an instant; and deliver tests from your LMS, your classroom, or wherever you want. The Cognero™ Test Bank contains the same questions that are in the Microsoft® Word Test Bank. All question content is now tagged according to Tier I (Business Program Interdisciplinary Learning Outcomes) and Tier II (Finance-Specific) standards topic, Bloom’s taxonomy, and difficulty level.
- **PowerPoint Slides.** The PowerPoint Slides clarify content and provide a solid guide for student note-taking. These slides provide detailed and systematic coverage of the content of each chapter.

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- **PowerPoint Slides.** The PowerPoint Slides clarify content and provide a solid guide for student note-taking. These slides provide detailed and systematic coverage of the content of each chapter.
- **Technical Notes.** Several Technical Notes are online derivations and proofs that take the material a step further than is covered in the book. These documents provide the instructor with the ability to easily assign more advanced material or allow certain students to take their study to a higher level. The number of these items has been increased from that in the ninth edition. Now with over 20 technical note references in the chapters, this feature allows more complex materials to be available to those faculty and students who want to explore the book's subject in more depth without distracting others.
- **Second City Case.** The Second City Case illustrates various strategies using index options. This case integrates a variety of materials covered in the option section of the book. The case is introduced as an end-of-chapter problem in Chapter 7.

The solutions to end-of-chapter Concept Checks, chapter references, and lists of symbols and important formulas are also available on the student companion website.

ADDITIONAL COURSE TOOLS

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In life you just can't leave the future to chance. The best way to predict the future is to create the future.

Tim Ogunbiyi
Futures, February 2003, p. 90

Introduction

What's good about finance is that it lubricates the machinery of capitalism.

John Bogle

Journal of Indexes, Fourth Quarter, 2003, p. 41

In the course of running a business, decisions are made in the presence of risk. A decision maker can confront one of two general types of risk. Some risks are related to the underlying nature of the business and deal with such matters as the uncertainty of future sales or the cost of inputs. These risks are called **business risks**. Most businesses are accustomed to accepting business risks. Indeed, the acceptance of business risks and its potential rewards are the foundations of capitalism. Another class of risks deals with uncertainties such as interest rates, exchange rates, stock prices, and commodity prices. These are called **financial risks**.

Financial risks are a different matter. The paralyzing uncertainty of volatile interest rates can cripple the ability of a firm to acquire financing at a reasonable cost, which enables it to provide its products and services. Firms that operate in foreign markets can have excellent sales performance offset if their own currency is strong. Companies that use raw materials can find it difficult to obtain their basic inputs at a price that will permit profitability. Managers of stock portfolios deal on a day-to-day basis with wildly unpredictable and sometimes seemingly irrational financial markets.

Although our financial system is replete with risk, it also provides a means of dealing with risk. One way is by using derivatives. **Derivatives** are financial contracts whose returns are derived from those of an underlying factor. The word *factor* is used here in the broadest possible way to include securities, financial contracts, and even such concepts as the weather and credit losses. That is, the performance of a derivative depends on how something else performs. Derivatives derive their performance from something else. In so doing, they serve a valuable purpose in providing a means of managing financial risk. By using derivatives, companies and individuals can transfer, for a price, any undesired risk to other parties who either have risks that offset it or who want to assume that risk.

Although derivatives have been around in some form for centuries, their growth has accelerated rapidly during the last several decades. They are now widely used by corporations, financial institutions, professional investors, and individuals. Certain types of derivatives are traded actively in public markets, similar to the stock exchanges with which you are probably already somewhat familiar. Others are created in private transactions in over-the-counter markets. Just as a corporation may buy a tract of land for the purpose of ultimately putting up a factory, the company may also engage in a derivatives transaction. In neither case is the existence or amount of the transaction easy for outsiders to determine. Nonetheless, we have fairly accurate

CHAPTER OBJECTIVES

- Provide brief introductions to the different types of derivatives: options, forward contracts, futures contracts, and swaps
- Reacquaint you with the concepts of risk preference, short selling, repurchase agreements, the risk–return relationship, and market efficiency
- Define the important concept of theoretical fair value, which will be used throughout the book
- Explain the relationship between spot and derivative markets through the mechanisms of arbitrage, storage, and delivery
- Identify the role that derivative markets play through their four main advantages
- Address some criticisms

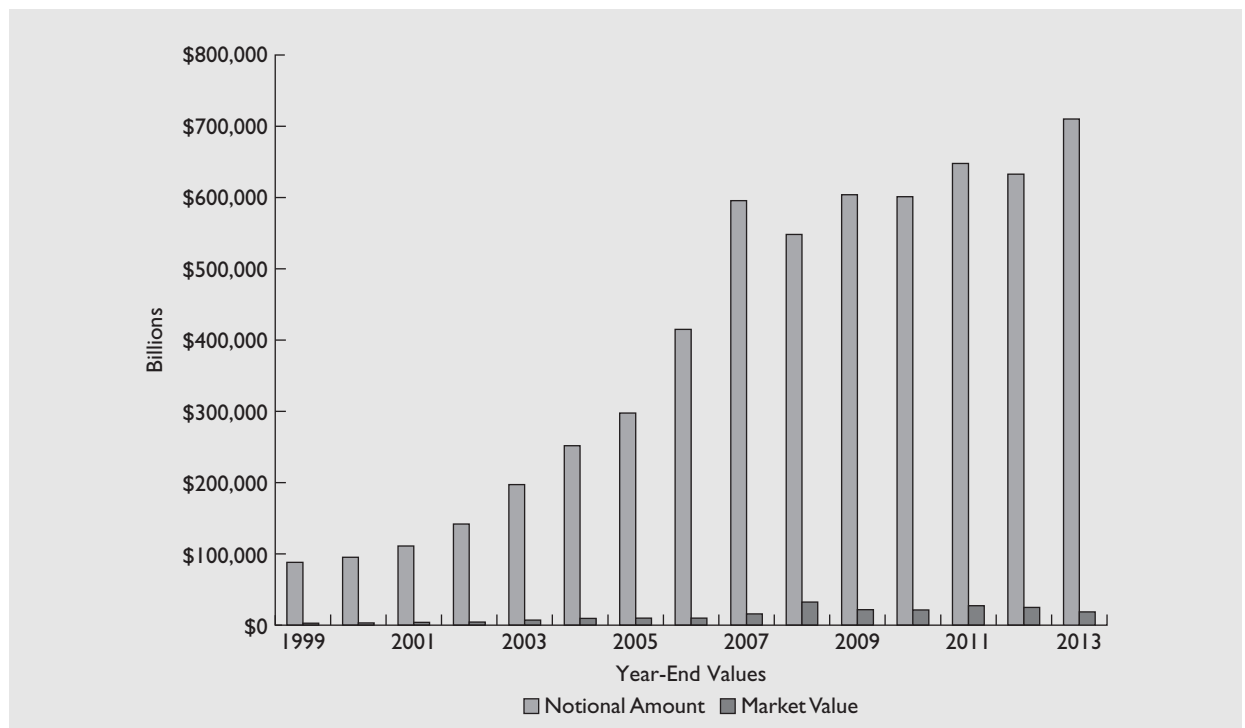
data on the amount of derivatives activity in public markets and reasonably accurate data, based on surveys, on the amount of derivatives activity in private markets. We shall take a look at exchange-traded market data shortly. For now, let us look at over-the-counter market data.

Now, if you need to be convinced that derivatives are worth studying, consider this fact: *The Bank for International Settlements of Basel, Switzerland, estimated that at the end of 2013, the notional amount of over-the-counter derivatives contracts outstanding worldwide is over \$710 trillion. In comparison, gross domestic product in the United States in the fourth quarter of 2013 was about \$17 trillion.*

The **notional amount**, sometimes called **notional principal**, is a measure of the size of a derivative contract, stated in units of a currency, on which the payments are calculated. As we shall see later, measuring the derivatives market this way can give a false impression of the size of the market. Although notional amount reflects the size of the market on which derivatives are based, market value reflects the amount of actual money under exposure. The market value of these contracts totals about \$19 trillion, making the derivatives market an extremely sizable force in the global economy. So, by either measure, the derivatives market is extremely large.

Figure 1.1 illustrates the notional amount and market value of over-the-counter derivatives from 1998 through December 2013. Historically, the notional amount has increased in most years. It is clear, however, that the financial crisis that emerged in 2008 had a significant impact on the size of the derivatives market. Clearly, these two measures of the size of the derivatives market capture different effects. Thus, in the fast-moving markets of 2008, the notional amount fell, but the remaining market value rose. That is, derivatives activity may have dropped off, but the values of derivatives rose. This effect is not surprising.

FIGURE 1.1 Notional Amount and Market Value of Over-the-Counter Derivatives



Source: <http://www.bis.org/statistics/derstats.htm> (various issues of their *Regular OTC Derivatives Market*).

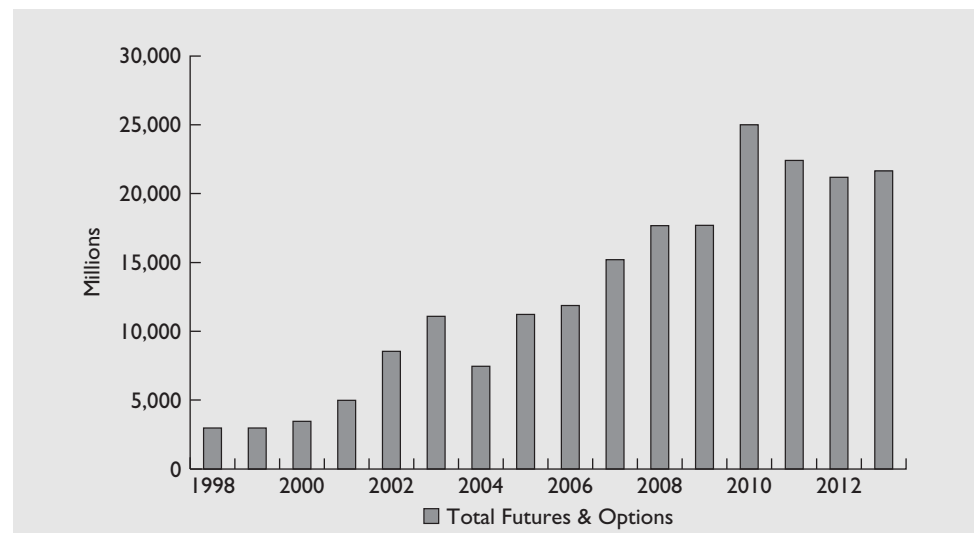
Notional amount and market value are good measures of the size of the over-the-counter derivatives market, but they do not include the entire derivatives market. Over-the-counter transactions are conducted in a relatively private manner between two parties. Derivatives also trade on exchanges in a similar manner to how stocks are traded on the New York Stock Exchange, National Association of Securities Dealers Automatic Quotation System (Nasdaq), and many leading securities exchanges around the world. For exchange-listed derivatives, trading volume is a widely used measure. Each derivative transaction is denominated in contract units. Volume is the sum of the number of contracts traded. Figure 1.2 shows the history of trading volume of exchange-listed derivatives over the 1998–2013 period.

As with OTC derivatives, we see that the derivatives world has grown explosively over these last 16 years. Notice the declines above that occurred in 2004 and 2011. Yet also note that volume rose in 2008. As noted, OTC activity dropped off, which was due to concerns over potential credit losses. Yet volume in exchange-traded derivatives increased as market participants moved toward instruments that were guaranteed against credit losses. We will explore these issues in detail later.

This book is an introductory treatment of derivatives. Derivatives can be based on **real assets**, which are physical assets that include agricultural commodities, metals, and sources of energy. Although a few of these will come up from time to time in this book, our focus will be directed on derivatives on **financial assets**, which are stocks, bonds or loans, and currencies. In this book, you will learn about the characteristics of the institutions and markets where these instruments trade, the manner in which derivative prices are determined, and the strategies in which they are used. Toward the end of the book, we will cover the way in which derivatives are used to manage the risk of a company.

This chapter welcomes you to the world of derivatives and provides an introduction to or a review of some financial concepts that you will need to understand derivatives. Let us begin by exploring the derivatives markets more closely and defining what we mean by these types of instruments.

FIGURE 1.2 Trading Volume in Exchange-Listed Derivatives



Source: <http://www.futuresindustry.org/bibliography.asp> (various issues of their annual volume survey).

1-1 DERIVATIVE MARKETS AND INSTRUMENTS

An asset is an item of ownership having positive monetary value. A liability is an item of ownership having negative monetary value. The term *instrument* is used to describe either assets or liabilities. Again, instrument is the more general term, vague enough to encompass the underlying asset or liability of derivative contracts. A contract is an enforceable legal agreement. A security is a tradable instrument representing a claim on a group of assets.

In the markets for assets, transactions usually require that the underlying asset be delivered immediately or shortly thereafter. Payment usually is made immediately, although credit arrangements are sometimes used. Because of these characteristics, we refer to these markets as **cash markets** or **spot markets**. The sale is made, the payment is remitted, and the good or security is delivered. In other situations, the good or security is to be delivered at a later date. Still other types of arrangements allow the buyer or seller to choose whether to go through with the sale. These types of arrangements are conducted in derivative markets. This section briefly introduces the principal types of derivative contracts: options, forward contracts, futures contracts, and swaps. We first, however, review the current derivatives markets where many derivatives contracts are traded.

1-1a Derivatives Markets

In contrast to the market for assets, derivative markets are markets for contractual instruments whose performance is determined by the way in which another factor performs. Notice that we referred to derivatives as contracts. Like all contracts, derivatives are agreements between two parties—a buyer and a seller—in which each party does something for the other. These contracts have a price, and buyers try to buy as cheaply as possible, whereas sellers try to sell as dearly as possible. All derivatives have a definite life, as indicated by the fact that they have an expiration date. As noted, derivatives are created either privately between two parties, the over-the-counter market, or on a public exchange, the exchange-listed market. Privately created derivatives are customized to the specific terms desired by the parties. Exchange-listed derivatives have standardized terms and conditions, though the price is negotiated between the two parties.

We now turn to introducing various types of derivative contracts.

1-1b Options

An **option** is a contract between two parties—a buyer and a seller—that gives the buyer the right, but not the obligation, to purchase or sell something at a later date at a price agreed upon today. An option to buy something is referred to as a **call**; an option to sell something is called a **put**. The option buyer pays the seller a sum of money called the price or premium. The option seller stands ready to sell or buy according to the contract terms if and when the buyer so desires. So, a call option buyer has the right to buy something at a fixed price from the seller, who stands ready to sell it at that fixed price. A put option buyer has the right to sell something at a fixed price to the seller, who stands ready to buy it at that fixed price. We emphasize that options are rights, not obligations, that are purchased by the option buyer from the option seller.

1-1c Forward Contracts

A **forward contract** is a contract between two parties—a buyer and a seller—to purchase or sell something at a later date at a price agreed upon today. A forward contract sounds a lot like an option, but an option carries the right, not the obligation, to go through with the transaction. If the price of the underlying good changes, the option holder

may decide to forgo buying or selling at the fixed price. On the other hand, the two parties in a forward contract incur the obligation to ultimately buy and sell the good. That is, the forward contract buyer is obligated to buy the underlying from the seller, who is clearly obligated to sell it, at a future date at a price agreed upon when they initiate the transaction.

1-1d Futures Contracts

A **futures contract** is also a contract between two parties—a buyer and a seller—to buy or sell something at a future date at a price agreed upon today. The contract trades on a futures exchange and is subject to a daily settlement procedure. Futures contracts evolved out of forward contracts and possess many of the same characteristics. In essence, they are like liquid forward contracts. Unlike forward contracts, however, futures contracts trade on organized exchanges, called **futures markets**. For example, the buyer of a futures contract, who has the obligation to buy the good at the later date, can sell the contract in the futures market, which relieves her of the obligation to purchase the good. Likewise, the seller of a futures contract, who is obligated to sell the good at the later date, can buy the contract back in the futures market, relieving him of the obligation to sell the good.

Futures contracts also differ from forward contracts in that they are subject to a daily settlement procedure. In the daily settlement, investors who incur losses pay the losses every day to investors who make profits. Futures prices fluctuate from day to day, and contract buyers and sellers attempt to profit from these price changes and/or to lower the risk of transacting in the underlying goods. We shall learn more about this process later.

1-1e Swaps

Although options, forwards, and futures compose the set of basic instruments in derivative markets, there are many more combinations and variations. One of the most popular is called a **swap**. A swap is a contract in which two parties agree to exchange cash flows. For example, one party is currently receiving cash from one investment but would prefer another type of investment in which the cash flows are different. The party contacts a swap dealer, a firm operating in the over-the-counter market, who takes the opposite side of the transaction. The firm and the dealer, in effect, swap cash flow streams. Depending on what later happens to prices or interest rates, one party might gain at the expense of the other. As we shall show later, swaps can be viewed as a combination of forward contracts, and swaps are special types of options. Although swaps are probably the least known derivative outside of the financial world, they are the most widely used derivative in the financial world.

The different types of derivatives include options, forwards, futures, options on futures, swaps, and hybrids.

1-2 THE UNDERLYING ASSET

As we noted, all derivatives are based on the random performance of some factor. That is why the word *derivative* is appropriate. The derivative *derives* its value from the performance of something else, a factor as we described it. That “something else” is often referred to as the *underlying asset*. The term *underlying asset*, however, is somewhat confusing and misleading. For instance, the underlying asset might be a stock, bond, currency, or commodity, all of which are assets. The underlying “asset,” however, might also be some other random element such as the weather, which is not an asset. It might even be another derivative, such as a futures contract or an option. Hence, to

avoid saying that a derivative is on an “underlying something” or a vaguely specified “factor,” we corrupt the word *underlying*, which is an adjective, and treat it as a noun. Thus, we say that the derivative is “on an underlying.” This incorrect use of the word *underlying* serves a good purpose, however, because it enables us to avoid using the word *asset*, because not all derivatives are on assets.

1-3 IMPORTANT CONCEPTS IN FINANCIAL AND DERIVATIVE MARKETS

Before undertaking any further study of derivative markets, let us review some introductory concepts pertaining to investment opportunities and investors. Many of these ideas may already be familiar and are usually applied in the context of trading in stocks and bonds. These concepts also apply with slight modifications to trading in derivatives. Also important as you begin further study of derivative markets is a thorough mathematical review.

TECHNICAL NOTE:
Mathematics Review for Finance
Go to www.cengagebrain.com and
search ISBN 9781305104969.

1-3a Presuppositions for Financial Markets

A presupposition is something that is assumed beforehand, often not clearly specified but tacitly understood. There are at least three presuppositions for well-functioning financial markets: clear rule of law, clean property rights, and a culture of trust. Complex and ambiguous laws and regulations may result in tyrannical enforcement where particular regulators arbitrarily bring enforcement actions. This lack of clarity impedes markets from functioning well. Well-defined and well-protected property rights are essential for efficient financial transactions. One cannot easily sell property if clean title cannot be produced. A culture of trust cannot be legislated; rather, it flourishes when nurtured from within. As in any business endeavor, trust makes financial transactions much more efficient. It is not surprising that economic development has been slow in countries where there is no culture of trust. Even though many people do not trust the global financial industry, all modern and successful economies are characterized by a high degree of honesty. Millions of financial transactions are successfully conducted without the slightest problem. It is only a small number of cases with dishonest participants that grab the headlines.

1-3b Risk Preference

Suppose you were faced with two equally likely outcomes. If the first outcome occurs, you receive \$5. If the second outcome occurs, you receive \$2. From elementary statistics, you know that the expected outcome is $\$5(0.5) + \$2(0.5) = \$3.50$, which is the amount you would expect to receive on average after playing the game many times. How much would you be willing to pay to take this risk? If you say \$3.50, you are not recognizing the risk inherent in the situation. You are simply saying that a fair trade would be for you to give up \$3.50 for the chance to make \$3.50 on average. You would be described as **risk neutral**, meaning that you are indifferent to the risk. Most individuals, however, would not find this a fair trade. They recognize that the \$3.50 you pay is given up for certain, whereas the \$3.50 you expect to receive is earned only on average. In fact, if you play twice, lose \$1.50 once, and then gain it back, you will likely feel worse than if you had not played.

Thus, we say that most individuals are characterized by **risk aversion**. They would pay less than \$3.50 to take this risk. How much less depends on how risk averse they

are. People differ in their degrees of risk aversion. But let us say you would pay \$3.25. Then the difference between \$3.50 and \$3.25 is considered the **risk premium**. This is the additional return you expect to earn on average to justify taking the risk.

Although most individuals are indeed risk averse, it may surprise you to find that in the world of derivative markets, we can actually value derivatives “as if” price-setting market makers are risk neutral. No, we are not making some heroic but unrealistic assumption. It turns out that we obtain the same valuations in a world of risk aversion as we do in a world of risk neutrality. Although this is a useful point in understanding derivative markets, we shall not explore it in much depth at the level of this book. Yet without realizing it, you will probably grow to accept and understand derivative models and the subtle implication of risk neutrality.

1-3c Short Selling

If you have already taken an investments course, you were probably exposed to the idea of short selling. Short selling is an important transaction related to making a market in derivatives. Therefore, the costs related to short selling have a direct impact on derivative pricing. Nonetheless, the concept is not very straightforward, and a little review will be beneficial.

A typical transaction in the stock market involves one party buying stock from another party. It is possible, however, that the party selling the stock does not actually own the stock. That party could borrow the stock from a broker. That person is said to be **selling short**, or sometimes *shorting*.¹ She is doing so in anticipation of the price falling, at which time the short seller would then buy back the stock at a lower price, capturing a profit and repaying the shares to the broker. You may have heard the expression “Don’t sell yourself short,” which simply means not to view yourself as being less talented or less correct than someone else. Similarly, a short seller views the stock as being worth less than the market price.

Establishing a short position creates a liability. The short seller is obligated to someday buy back the stock and return it to the broker. Unlike an ordinary loan in which a borrower knows exactly how much she must pay back the lender, the short seller does not know how much she will have to pay to buy back the shares. This makes it a rather risky type of borrowing. Indeed, short selling is a very daring investment strategy.

Short selling, however, can be quite beneficial in that the risk of short positions can be useful in offsetting the risk of long positions. Alternatively, taking a short position in a derivative may be more efficient. Short selling of stocks can be quite complex and expensive relative to buying stocks, whereas taking a short position in a derivative is as simple as buying derivatives. Short selling of stocks requires finding someone willing to lend you the stock. The stock lender must also be willing to forgo her voting rights. At times, security lending can be expensive. Thus, it is common to find an investor holding a stock and protecting it by entering into a derivative.

We should note that anyone who has an obligation to purchase something at a later date has the equivalent of a short sale. It is not necessary to have borrowed stock from a broker. In either case, an increase in the price will be harmful.

The terminology of short selling can be confusing. In the context of financial securities, short selling, shorting, or going short are synonymous. In the context of derivative contracts, shorting or going short are synonymous. We do not refer to selling derivative contracts as short selling because the underlying security is not borrowed.

¹If the short seller fails to borrow shares, this is known as naked short selling. In this case, the buyer of the shares is also the lender of the shares. Naked short selling was widely tolerated prior to November 2009.

1-3d Repurchase Agreements

A **repurchase agreement** (known as a **repo**) is a legal contract between a seller and a buyer; the seller agrees to sell currently a specified asset to the buyer—as well as buy it back (usually) at a specified time in the future at an agreed future price. The seller is effectively borrowing money from the buyer at an implied interest rate. Typically, repos involve low-risk securities such as U.S. Treasury bills. Repos are useful because they provide a great deal of flexibility to both the borrower and the lender.

Derivatives traders often need to be able to borrow and lend money in the most cost-effective manner possible. Repos are often a very low-cost way of borrowing money, particularly if the firm holds government securities. Repos are a way to earn interest on short-term funds with minimal risk (for buyers) as well as a way to borrow for short-term needs at a relatively low cost (for sellers).

As we will see in subsequent chapters, derivative market participants must often rely on the ability to borrow and lend money on a short-term basis. Many derivative valuation models are based on the assumption that the price-setting trader, often a dealer, has access to money or can lend money at the risk-free rate. The repo rate is an approximation of the dealer's marginal cost of funds and hence is a good approximation of the dealer's cost of borrowing and lending. Also, due to the strong collateral used in the repo market, the repo rate is roughly analogous to the government rate.

1-3e Return and Risk

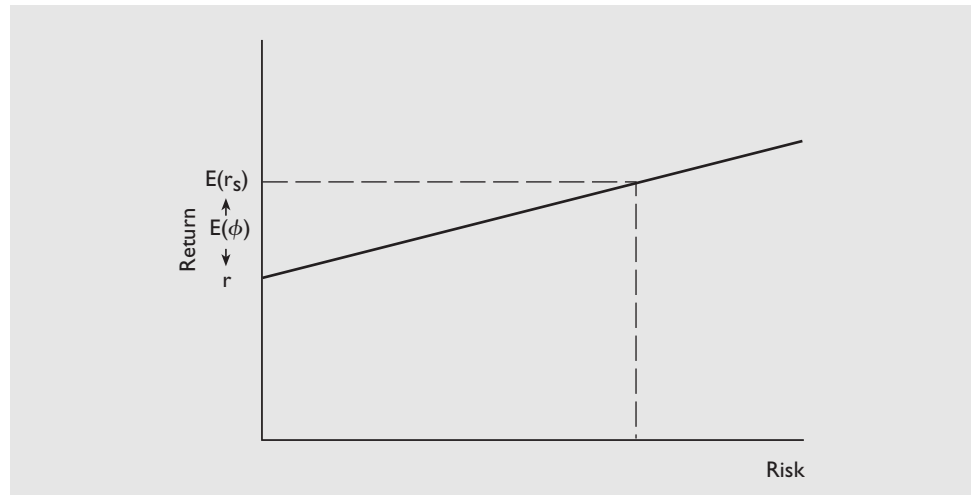
Return is the numerical measure of investment performance. There are two main measures of return: dollar return and percentage return. **Dollar return** measures investment performance as total dollar profit or loss. For example, the dollar return for stocks is the dollar profit from the change in stock price plus any cash dividends paid. It represents the absolute performance. **Percentage return** measures investment performance per dollar invested. It represents the percentage increase in the investor's wealth that results from making the investment. In the case of stocks, the return is the percentage change in price plus the dividend yield. The concept of return also applies to options, but as we shall see later, the definition of the return on a futures or forward contract is somewhat unclear.

One fundamental characteristic of investors is their desire to increase their wealth. This translates into obtaining the highest return possible—but higher returns are accompanied by greater risk. **Risk** is the uncertainty of future returns. As we noted earlier, investors generally dislike risk, and they demonstrate this characteristic by avoiding risky situations when riskless ones that offer equivalent expected returns exist; however, they cannot always avoid uncertainty. Fortunately, the competitive nature of financial and derivative markets enables investors to identify investments by their degree of risk.

For example, the stock of a company that specializes in drilling wildcat oil wells will, all other things being equal, sell for less than the stock of a company that supplies health care.² The stock price is lower due to the drilling company's more uncertain line of business. Risk, of course, runs the spectrum from minimal to high. The prices of securities will reflect the differences in the companies' risk levels. The additional return one expects to earn from assuming risk is the risk premium, which we mentioned earlier.

²In this context, "all other things being equal" means that the comparisons have not been distorted by differences in the number of shares outstanding or the amount of financial leverage.

FIGURE 1.3 Risk–Return Trade-Off



What other factors influence a company's stock price and expected return? Consider a hypothetical company with no risk. Will people be willing to invest money in this company if they expect no return? Certainly not. They will require a minimum return, one sufficient to compensate them for giving up the opportunity to spend their money today. This return is called the **risk-free rate** and is the investment's opportunity cost.³

The return investors expect is composed of the risk-free rate and a risk premium. This relationship is illustrated in Figure 1.3, where $E(r_s)$ is the expected return on the spot asset, r is the risk-free rate, and $E(\phi)$ is the risk premium—the excess of expected return over the risk-free rate.

Note that we have not identified how risk is measured. You might recall risk measures such as standard deviation and beta. At this point, we need not be concerned with the specific measure of risk. The important point is the positive relationship between risk and expected return, known as the **risk–return trade-off**. The risk–return trade-off arises because all investors seek to maximize expected return subject to a minimum level of risk. If a stock moves up the line into a higher risk level, some investors will find it too risky and will sell the stock, which will drive down its price. New investors in the stock will expect to earn higher returns by virtue of paying a lower price for the stock.

The financial markets are very effective at discriminating among firms with different risk levels. Firms with low risk will find capital plentiful and inexpensive. Firms with high risk may have trouble raising capital and will pay dearly. Markets that do a good job of pricing the instruments trading therein are said to be efficient, and the assets are said to be priced at their **theoretical fair values**.

³The concept of the risk-free rate and opportunity cost is well illustrated by the biblical parable about the wealthy man who entrusted three servants to manage some of his money. Two of the servants earned 100-percent returns, whereas the third buried the money and returned only the principal sum. The wealthy man was infuriated that the third servant had not even earned the risk-free interest rate by putting the money in the bank, whereupon he reallocated the funds to one of the other servant's portfolios. The third servant, who was summarily discharged, evidently was not destined for a career as an investment manager (Matthew 25: 14–30).