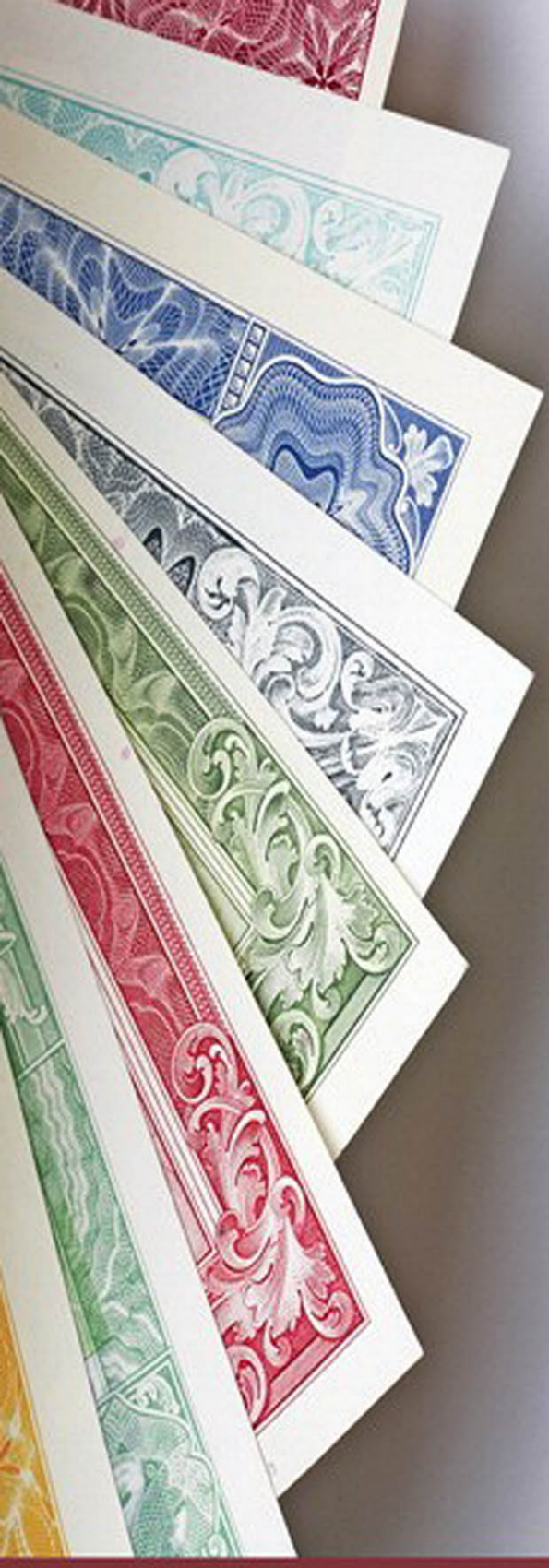

BOND MARKETS, ANALYSIS, AND STRATEGIES

9TH EDITION

FRANK J. FABOZZI

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Ninth Edition

Bond Markets, Analysis, and Strategies

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Professor of Finance
EDHEC Business School

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PEARSON

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To the memory of my parents, Josephine and Alfonso Fabozzi.

Contents

Preface

The objective of the first edition of *Bond Markets, Analysis, and Strategies* published in 1989 was to provide coverage of the products, analytical techniques for valuing bonds and quantifying their exposure to changes in interest rates, and portfolio strategies for achieving a client's objectives. In the seven editions subsequently published and in the current edition, the coverage of each of these areas has been substantially updated. Throughout this book there are practical applications of principles as provided by third-party commercial vendors.

Each edition has benefited from the feedback of readers and instructors using the book at universities and training programs. I benefited from many discussions with chief investment officers, portfolio managers, analysts, traders, and regulators, as well as my experiences serving on the board of directors of two BlackRock fund complexes and consulting engagements.

I am confident that the ninth edition continues the tradition of providing up-to-date information about the bond market and the tools for managing bond portfolios.

CHAPTERS NEW TO THE NINTH EDITION

Chapter 16: Pooled Investment Vehicles for Fixed-Income Investors

The chapters prior to this chapter in the book focus on individual debt instruments. This new chapter describes investment vehicles that represent pooled investments and are also referred to as collective investment vehicles. They include investment company shares, exchange-traded shares, hedge funds, and real estate investment trusts. We discuss them from two perspectives: their investment characteristics and their use as part of a bond portfolio strategy.

Chapter 21: Measuring Credit Spread Exposures of Corporate Bonds

Earlier chapters in the book explain how to quantify the interest-rate sensitivity of a bond and a bond portfolio to a change in the level of Treasury rates. In this new chapter, the focus is on how to best model credit spread behavior and how to measure exposure to credit spread risk when Treasury rates change.

Chapter 26: Considerations in Corporate Bond Portfolio Management

Whereas earlier chapters in the book describe bond portfolio strategies and management in general, this new chapter covers issues associated specifically with the management of corporate bond portfolios. Coverage includes the stability of the investment characteristics of bond market indexes, credit relative value trades, constraint-tolerating investing, and how to quantify liquidity risk for corporate bonds.

Chapter 27: Liability-Driven Investing for Defined Benefit Pension Plans

The eighth edition of the book had a chapter entitled "Liability-Driven Strategies," which just described immunization and cash flow matching strategies. That chapter (Chapter 24) is replaced with this new chapter that focuses on liability-driven investing for defined

benefit pension plans. The chapter begins with a description of how historically pension plan sponsors incorrectly formulated investment policy by focusing solely on the asset side. After covering measures used to describe the health of a defined benefit pension plan, liability-driven investing strategies are described that take into account their liability obligations.

SIGNIFICANTLY REVISED CHAPTERS

Chapter 22: Corporate Bond Credit Analysis (Chapter 19 in the previous edition)

Expanded coverage and the addition of two cases—credit analysis and covenant analysis of Sirius XM Holdings Inc. and credit analysis of Sino-Forest Corporation (a commercial forestry company in China)—are provided.

Chapter 24: Bond Portfolio Management Strategies (Chapter 22 in the previous edition)

New material on selection of bond benchmarks, problems with market-capitalization-weighted bond indexes, customized indexes, alternative bond benchmarks, and smart beta strategies are provided.

OTHER NOTEWORTHY CHANGES TO CHAPTERS

Chapter 19: Analysis of Residential Mortgage-Backed Securities (Chapter 18 in the previous edition)

Two real-world illustrations provided by FactSet are included.

Chapter 23: Credit Risk Modeling (Chapter 21 in the previous edition)

An illustration of how to use risk models in relative value analysis provided by Kamakura Corporation is presented.

INSTRUCTOR SUPPLEMENTS

The following supplements are available to adopting instructors:

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Need help? Our dedicated Technical Support team is ready to assist instructors with questions about the media supplements that accompany this text. Visit http://247pearsoned.custhelp.com/ for answers to frequently asked questions and toll-free user support phone numbers. The following supplements are available to adopting instructors. Detailed descriptions of the following supplements are provided on the Instructor's Resource Center.

Electronic Instructor's Manual with Solutions

Prepared by Dr. Rob Hull of Washburn University School of Business, the Instructor's Manual contains chapter summaries and suggested answers to all end-of-chapter questions.

PowerPoint Presentation

Prepared by Dr. Rob Hull of Washburn University School of Business, the PowerPoint slides provide the instructor with individual lecture outlines to accompany the text. The slides include all of the figures and tables from the text. These lecture notes can be used as is or professors can easily modify them to reflect specific presentation needs.

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Bond Markets, Analysis, and Strategies

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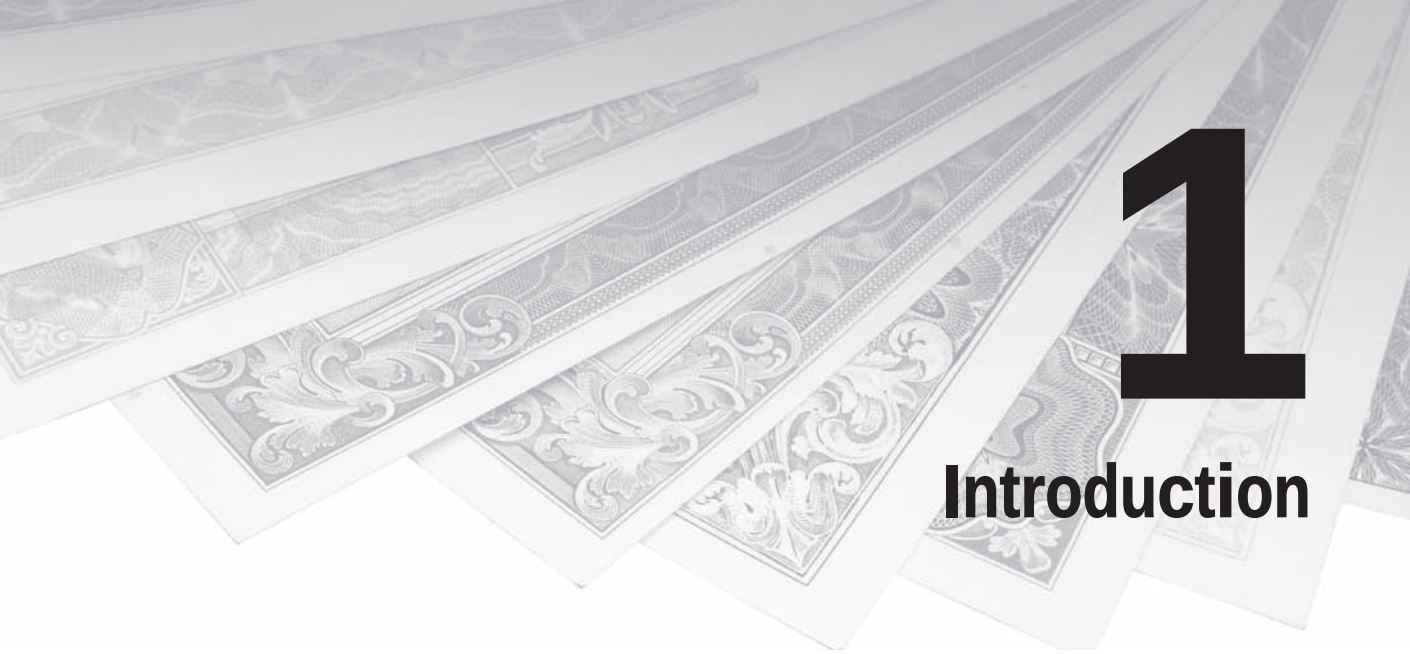

1 Introduction

LEARNING OBJECTIVES

After reading this chapter, you will understand

- the fundamental features of bonds
- the types of issuers
- the importance of the term to maturity of a bond
- floating-rate and inverse-floating-rate securities
- what is meant by a bond with an embedded option and the effect of an embedded option on a bond's cash flow
- the various types of embedded options
- convertible bonds
- the types of risks faced by investors in fixed-income securities
- the secondary market for bonds

A bond is a debt instrument requiring the **issuer** (also called the **debtor** or **borrower**) to repay to the lender/investor the amount borrowed plus interest over a specified period of time. A typical ("plain vanilla") bond issued in the United States specifies (1) a fixed date when the amount borrowed (the principal) is due, and (2) the contractual amount of interest, which typically is paid every six months. The date on which the principal is required to be repaid is called the **maturity date**. Assuming that the issuer does not default or redeem the issue prior to the maturity date, an investor holding a bond until the maturity date is assured of a known cash flow pattern.

For a variety of reasons to be discussed later in this chapter, since the early 1980s a wide range of bond structures has been introduced into the bond market. In the residential mortgage market particularly, new types of mortgage designs were introduced. The practice

of pooling individual mortgages to form mortgage pass-through securities grew dramatically. Using the basic instruments in the mortgage market (mortgages and mortgage pass-through securities), issuers created derivative mortgage instruments such as collateralized mortgage obligations and stripped mortgage-backed securities that met the specific investment needs of a broadening range of institutional investors.

SECTORS OF THE U.S. BOND MARKET

The U.S. bond market is the largest bond market in the world. The market is divided into six sectors: U.S. Treasury sector, agency sector,[1] municipal sector, corporate sector, asset-backed securities sector, and mortgage sector. The **Treasury sector** includes securities issued by the U.S. government. These securities include Treasury bills, notes, and bonds. This sector plays a key role in the valuation of securities and the determination of interest rates throughout the world.

The **agency sector** includes securities issued by federally related institutions and government-sponsored enterprises. The distinction between these issuers is described in Chapter 6. The securities issued are not backed by any collateral and are referred to as **agency debenture securities**. This sector is the smallest sector of the bond market.

The **municipal sector** is where state and local governments and their authorities raise funds. This sector is divided into two subsectors based on how the interest received by investors is taxed at the federal income tax level. The tax-exempt market is the largest sector where interest received by investors is exempt from federal income taxes. Historically, the taxable sector was a small sector of the municipal bond market. The municipal bond market includes two types of structures: (1) tax-backed bonds and (2) revenue bonds.

The **corporate sector** includes securities issued by U.S. corporations and securities issued in the United States by non–U.S. corporations. Issuers in the corporate sector issue bonds, medium-term notes, structured notes, and commercial paper. In addition to their issuance of these securities, corporations borrow funds from banks. At one time commercial banks that made these loans held them in their loan portfolio. Today, certain commercial loans are traded in the market. The corporate sector is divided into the investment-grade and noninvestment-grade sectors. The classification is based on the assignment of a credit rating determined by a third-party commercial entity. We will discuss credit ratings in Chapter 7.

An alternative to the corporate sector where a corporation can raise funds is the **asset-backed securities sector**. In this sector, a corporation pools loans or receivables and uses the pool of assets as collateral for the issuance of a security. Captive finance companies, that is, subsidiaries of operating companies that provide funding for loans to customers of the parent company to buy the product manufactured, are typically issuers of asset-backed securities. Harley-Davidson Financial Services, Ford Motor Credit Company, and Caterpillar Financial Services Corporation are just a few examples. Probably the most well-known asset-backed securities (although a very tiny part of the market) are those issued by performing artists such as David Bowie, Ashford & Simpson, and James Brown, backed by music royalty future receivables.[2] The various types of asset-backed securities are described in Chapter 15.

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[1] In later chapters, we will see how organizations that create bond market indexes provide a more detailed breakdown of the sectors.

[2] David Bowie was the first recording artist to issue these bonds, in 1997, and hence these bonds are popularly referred to as "Bowie bonds." The bond issue, a $55 million, 10-year issue, was purchased by Prudential and was backed by future royalties from a substantial portion of Bowie's music catalogue.

The mortgage sector is the sector where the securities issued are backed by mortgage loans. These are loans obtained by borrowers in order to purchase residential property or to purchase commercial property (i.e., income-producing property). The mortgage sector is thus divided into the **residential mortgage sector** and the **commercial mortgage sector**. The residential mortgage sector, which includes loans for one- to four-family homes, is covered in Chapters 10 through 13. The commercial mortgage sector, backed by commercial loans for income-producing property such as apartment buildings, office buildings, industrial properties, shopping centers, hotels, and health care facilities, is the subject of Chapter 14.

Chapter 10 discusses the different types of residential mortgage loans and the classification of mortgage loans in terms of the credit quality of the borrower: prime loans and subprime loans. The latter loans are loans to borrowers with impaired credit ratings. Also, loans are classified as to whether or not they conform to the underwriting standards of a federal agency or government-sponsored enterprise that packages residential loans to create residential mortgage-backed securities. Residential mortgage-backed securities issued by a federal agency (the Government National Mortgage Association, or Ginnie Mae) or Fannie Mae or Freddie Mac (two government-sponsored enterprises) are referred to as **agency mortgage-backed securities**. Chapter 11 is devoted to the basic type of such security, an **agency mortgage pass-through security**, while Chapter 12 covers securities created from agency mortgage pass-through securities: **collateralized mortgage obligations** and **stripped mortgage-backed securities.**

Residential mortgage-backed securities not issued by Ginnie Mae, Fannie Mae, or Freddie Mac are called **nonagency mortgage-backed securities** and are the subject of Chapter 13. This sector is divided into securities backed by prime loans and those backed by subprime loans. The securities in the latter sector, referred to as **subprime mortgage-backed securities**, have had major difficulties due to defaults. The turmoil in the financial market caused by the defaults in this sector is referred to as "the subprime mortgage crisis."

Non-U.S. bond markets include the Eurobond market and other national bond markets. We discuss these markets in Chapter 9.

Bond investors—retail investors and institutional investors—have an opportunity to invest in a pooled investment vehicle in lieu of constructing their own portfolio to obtain exposure to the broad bond market and/or specific sectors of the bond market. For retail investors, the benefits of investing in pooled funds rather than the direct purchase of individual bonds to create a portfolio are (1) better diversification in obtaining the desired exposure, (2) better liquidity, and (3) professional management. These investment instruments, referred to as collective investment vehicles and the subject of Chapter 16, include investment company shares, exchange-traded shares, hedge funds, and real estate investment trusts.

OVERVIEW OF BOND FEATURES

In this section, we provide an overview of some important features of bonds. A more detailed treatment of these features is presented in later chapters.

Type of Issuer

A key feature of a bond is the nature of the issuer. There are three issuers of bonds: the federal government and its agencies, municipal governments, and corporations (domestic and foreign). Within the municipal and corporate bond markets, there is a wide range of issuers, each with different abilities to satisfy their contractual obligation to lenders.

Term to Maturity

The term to maturity of a bond is the number of years over which the issuer has promised to meet the conditions of the obligation. The maturity of a bond refers to the date that the debt will cease to exist, at which time the issuer will redeem the bond by paying the outstanding principal. The practice in the bond market, however, is to refer to the **term to maturity** of a bond as simply its **maturity** or **term**. As we explain subsequently, there may be provisions in the indenture that allow either the issuer or bondholder to alter a bond's term to maturity.

Generally, bonds with a maturity of between one and five years are considered **short-term**. Bonds with a maturity between 5 and 12 years are viewed as **intermediate-term**, and **long-term** bonds are those with a maturity of more than 12 years.

The term to maturity of a bond is important for three reasons. The most obvious is that it indicates the time period over which the holder of the bond can expect to receive the coupon payments and the number of years before the principal will be paid in full. The second reason that term to maturity is important is that the yield on a bond depends on it. As explained in Chapter 5, the shape of the yield curve determines how term to maturity affects the yield. Finally, the price of a bond will fluctuate over its life as yields in the market change. As demonstrated in Chapter 4, the volatility of a bond's price is dependent on its maturity. More specifically, with all other factors constant, the longer the maturity of a bond, the greater the price volatility resulting from a change in market yields.

Principal and Coupon Rate

The **principal value** (or simply **principal**) of a bond is the amount that the issuer agrees to repay the bondholder at the maturity date. This amount is also referred to as the **redemption value**, **maturity value**, **par value**, or **face value**.

The **coupon rate,** also called the **nominal rate**, is the interest rate that the issuer agrees to pay each year. The annual amount of the interest payment made to owners during the term of the bond is called the **coupon**.[3] The coupon rate multiplied by the principal of the bond provides the dollar amount of the coupon. For example, a bond with an 8% coupon rate and a principal of $1,000 will pay annual interest of $80. In the United States and Japan, the usual practice is for the issuer to pay the coupon in two semiannual installments. For bonds issued in certain European bond markets, coupon payments are made only once per year.

Note that all bonds make periodic coupon payments, except for one type that makes none. The holder of a **zero-coupon bond** realizes interest by buying the bond substantially below its principal value. Interest is then paid at the maturity date, with the exact amount being the difference between the principal value and the price paid for the bond.

Floating-rate bonds are issues where the coupon rate resets periodically (the coupon reset date) based on a formula. The formula, referred to as the **coupon reset formula**, has the following general form:

$$\text{reference rate} + \text{quoted margin}$$

[3] Here is the reason why the interest paid on a bond is called its "coupon." At one time, the bondholder received a physical bond, and the bond had coupons attached to it that represented the interest amount owed and when it was due. The coupons would then be deposited in a bank by the bondholder to obtain the interest payment. Although in the United States most bonds are registered bonds and, therefore, there are no physical "coupons," the term *coupon interest* or *coupon rate* is still used.

The quoted margin is the additional amount that the issuer agrees to pay above the reference rate. For example, suppose that the reference rate is the 1-month London interbank offered rate (LIBOR), an interest rate that we discuss in later chapters. Suppose that the quoted margin is 150 basis points. Then the coupon reset formula is

1-month LIBOR + 150 basis points

So, if 1-month LIBOR on the coupon reset date is 3.5%, the coupon rate is reset for that period at 5.0% (3.5% plus 150 basis points).

The reference rate for most floating-rate securities is an interest rate or an interest-rate index. The mostly widely used reference rate throughout the world is the **London Interbank Offered Rate** and referred to as LIBOR. This interest rate is the rate at which the highest credit quality banks borrow from each other in the London interbank market. LIBOR is calculated by the British Bankers Association (BBA) in conjunction with Reuters based on interest rates it receives from at least eight banks with the information released every day around 11 a.m. Hence, often in debt agreements LIBOR is referred to as BBA LIBOR. The rate is reported for 10 currencies:[4] U.S. dollar (USD), UK pound sterling (GBP), Japanese yen (JPY), Swiss franc (CHF), Canadian dollar (CAD), Australian dollar (AUD), euro (EUR), New Zealand dollar (NZD), Swedish krona (SEK), and Danish krona (DKK). So, for example, the AUD BBA LIBOR is the rate for a LIBOR loan denominated in Australian dollars as computed by the British Bankers Association.

There are floating-rating securities where the reference rate is some financial index such as the return on the Standard & Poor's 500 or a nonfinancial index such as the price of a commodity. An important non-interest-rate index that has been used with increasing frequency is the rate of inflation. Bonds whose interest rate is tied to the rate of inflation are referred to generically as **linkers**. As we will see in Chapter 6, the U.S. Treasury issues linkers, and they are referred to as Treasury Inflation Protection Securities (TIPS).

Although the coupon on floating-rate bonds benchmarked off an interest rate benchmark typically rises as the benchmark rises and falls as the benchmark falls, there are issues whose coupon interest rate moves in the opposite direction from the change in interest rates. Such issues are called **inverse-floating-rate bonds** (or simply, **inverse floaters**) or **reverse floaters**.

In the 1980s, new structures in the high-yield (junk-bond) sector of the corporate bond market provided variations in the way in which coupon payments are made. One reason is that a leveraged buyout (LBO) or a recapitalization financed with high-yield bonds, with consequent heavy interest payment burdens, placed severe cash flow constraints on the corporation. To reduce this burden, firms involved in LBOs and recapitalizations issued **deferred-coupon bonds** that let the issuer avoid using cash to make interest payments for a specified number of years. There are three types of deferred-coupon structures: (1) deferred-interest bonds, (2) step-up bonds, and (3) payment-in-kind bonds. Another high-yield bond structure requires that the issuer reset the coupon rate so that the bond will trade at a predetermined price. High-yield bond structures are discussed in Chapter 7.

In addition to indicating the coupon payments that the investor should expect to receive over the term of the bond, the coupon rate also indicates the degree to which the

[4] The symbol in parentheses following each currency is the International Organization for Standardization three-letter code used to define a currency.

bond's price will be affected by changes in interest rates. As illustrated in Chapter 4, all other factors constant, the higher the coupon rate, the less the price will change in response to a change in market yields.

Amortization Feature

The principal repayment of a bond issue can call for either (1) the total principal to be repaid at maturity, or (2) the principal repaid over the life of the bond. In the latter case, there is a schedule of principal repayments. This schedule is called an **amortization schedule**. Loans that have this feature are automobile loans and home mortgage loans.

As we will see in later chapters, there are securities that are created from loans that have an amortization schedule. These securities will then have a schedule of periodic principal repayments. Such securities are referred to as **amortizing securities**. Securities that do not have a schedule of periodic principal repayment are called **nonamortizing securities**.

For amortizing securities, investors do not talk in terms of a bond's maturity. This is because the stated maturity of such securities only identifies when the final principal payment will be made. The repayment of the principal is being made over time. For amortizing securities, a measure called the **weighted average life** or simply **average life** of a security is computed. This calculation will be explained later in this book when we cover the two major types of amortizing securities—mortgage-backed securities and asset-backed securities.

Embedded Options

It is common for a bond issue to include a provision in the indenture that gives either the bondholder and/or the issuer an option to take some action against the other party. The most common type of option embedded in a bond is a **call provision**. This provision grants the issuer the right to retire the debt, fully or partially, before the scheduled maturity date. Inclusion of a call feature benefits bond issuers by allowing them to replace an outstanding bond issue with a new bond issue that has a lower coupon rate than the outstanding bond issue because market interest rates have declined. A call provision effectively allows the issuer to alter the maturity of a bond. For reasons explained in the next section, a call provision is detrimental to the bondholder's interests.

The right to call an obligation is also included in most loans and therefore in all securities created from such loans. This is because the borrower typically has the right to pay off a loan at any time, in whole or in part, prior to the stated maturity date of the loan. That is, the borrower has the right to alter the amortization schedule for amortizing securities.

An issue may also include a provision that allows the bondholder to change the maturity of a bond. An issue with a **put provision** included in the indenture grants the bondholder the right to sell the issue back to the issuer at par value on designated dates. Here the advantage to the investor is that if market interest rates rise after the issuance date, thereby reducing the bond's price, the investor can force the issuer to redeem the bond at the principal value.

A **convertible bond** is an issue giving the bondholder the right to exchange the bond for a specified number of shares of common stock. Such a feature allows the bondholder to take advantage of favorable movements in the price of the issuer's common stock. An **exchangeable bond** allows the bondholder to exchange the issue for a specified number of common stock shares of a corporation different from the issuer of the bond. These bonds are discussed and analyzed in Chapter 20.

Some issues allow either the issuer or the bondholder the right to select the currency in which a cash flow will be paid. This option effectively gives the party with the right to choose the currency the opportunity to benefit from a favorable exchange-rate movement. Such issues are described in Chapter 9.

The presence of embedded options makes the valuation of bonds complex. It requires investors to have an understanding of the basic principles of options, a topic covered in Chapter 18 for callable and putable bonds and Chapter 19 for mortgage-backed securities and asset-backed securities. The valuation of bonds with embedded options frequently is complicated further by the presence of several options within a given issue. For example, an issue may include a call provision, a put provision, and a conversion provision, all of which have varying significance in different situations.

Describing a Bond Issue

There are hundreds of thousands of bond issues. Most securities are identified by a nine-character (letters and numbers) CUSIP number. CUSIP stands for Committee on Uniform Security Identification Procedures. The CUSIP International Numbering System (CINS) is used to identify foreign securities and includes 12 characters. The CUSIP numbering system is owned by the American Bankers Association and operated by Standard & Poor's. CUSIP numbers are important for a well-functioning securities market because they aid market participants in properly identifying securities that are the subject of a trade and in the clearing/settlement process.

The CUSIP number is not determined randomly but is assigned in such a way so as to identify an issue's key differentiating characteristics within a common structure. Specifically, the first six characters identify the issuer: the corporation, government agency, or municipality. The next two characters identify whether the issue is debt or equity and the issuer of the issue. The last character is simply a check character that allows for accuracy checking and is sometimes truncated or ignored; that is, only the first characters are listed.

The debt instruments covered are

- asset-backed securities
- banker acceptances
- certificates of deposits
- collateralized debt obligations
- commercial paper
- corporate bonds
- medium-term notes
- mortgage-backed securities
- municipal bonds
- structured products
- U.S. federal government agencies
- U.S. Treasury securities: bonds, bills, and notes

Interest-rate derivatives and credit derivatives are also covered.

In general, when bonds are cited in a trade or listed as holdings in a portfolio, the particular issue is cited by issuer, coupon rate, and maturity date. For example, three bonds issued by Alcoa Inc. and how they would be referred to are shown in the following table.

Coupon	Maturity	
5.95%	Feb. 1, 2037	Alcoa, 5.95%, due 2/1/2037 or Alcoa, 5.95s 2/1/2037
6.15%	Aug. 15, 2020	Alcoa, 6.15%, due 8/15/2020 or Alcoa, 6.15s 8/15/2020
6.75%	July 15, 2018	Alcoa, 6.75%, due 7/15/2018 or Alcoa, 6.75s 7/15/2018

RISKS ASSOCIATED WITH INVESTING IN BONDS

Bonds may expose an investor to one or more of the following risks: (1) interest-rate risk, (2) reinvestment risk, (3) call risk, (4) credit risk, (5) inflation risk, (6) exchange-rate risk, (7) liquidity risk, (8) volatility risk, and (9) risk risk. Although each of these risks is discussed further in later chapters, we describe them briefly in the following sections. In later chapters, other risks, such as yield curve risk, event risk, and tax risk, are also introduced. What is critical in constructing and controlling the risk of a portfolio is the ability to quantify as many of these risks as possible. We will see this in later chapters, particularly in our coverage of factor models in Chapter 25.

Interest-Rate Risk

The price of a typical bond will change in the opposite direction from a change in interest rates: As interest rates rise, the price of a bond will fall; as interest rates fall, the price of a bond will rise. This property is illustrated in Chapter 2. If an investor has to sell a bond prior to the maturity date, an increase in interest rates will mean the realization of a capital loss (i.e., selling the bond below the purchase price). This risk is referred to as **interest-rate risk** or **market risk**.

As noted earlier, the actual degree of sensitivity of a bond's price to changes in market interest rates depends on various characteristics of the issue, such as coupon and maturity. It will also depend on any options embedded in the issue (e.g., call and put provisions), because, as we explain in later chapters, the value of these options is also affected by interest-rate movements.

Reinvestment Income or Reinvestment Risk

As explained in Chapter 3, calculation of the yield of a bond assumes that the cash flows received are reinvested. The additional income from such reinvestment, sometimes called **interest-on-interest**, depends on the prevailing interest-rate levels at the time of reinvestment, as well as on the reinvestment strategy. Variability in the reinvestment rate of a given strategy because of changes in market interest rates is called **reinvestment risk**. This risk is that the prevailing market interest rate at which interim cash flows can be reinvested will fall. Reinvestment risk is greater for longer holding periods, as well as for bonds with large, early cash flows, such as high-coupon bonds. This risk is analyzed in more detail in Chapter 3.

It should be noted that interest-rate risk and reinvestment risk have offsetting effects. That is, interest-rate risk is the risk that interest rates will rise, thereby reducing a bond's price. In contrast, reinvestment risk is the risk that interest rates will fall. A strategy based on these offsetting effects is called immunization, a topic covered in Chapter 27.

Call Risk

As explained earlier, bonds may include a provision that allows the issuer to retire or "call" all or part of the issue before the maturity date. The issuer usually retains this right in order to have flexibility to refinance the bond in the future if the market interest rate drops below the coupon rate.

From the investor's perspective, there are three disadvantages to call provisions. First, the cash flow pattern of a callable bond is not known with certainty. Second, because the issuer will call the bonds when interest rates have dropped, the investor is exposed to reinvestment risk (i.e., the investor will have to reinvest the proceeds when the bond is called at relatively lower interest rates). Finally, the capital appreciation potential of a bond will be reduced because the price of a callable bond may not rise much above the price at which the issuer will call the bond.[5]

Even though the investor is usually compensated for taking call risk by means of a lower price or a higher yield, it is not easy to determine if this compensation is sufficient. In any case the return or price performance of a bond with call risk can be dramatically different from those obtainable from an otherwise comparable noncallable bond. The magnitude of this risk depends on various parameters of the call provision, as well as on market conditions. Techniques for analyzing callable bonds are explained in Chapter 18.

Credit Risk

It is common to define **credit risk** as the risk that the issuer of a bond will fail to satisfy the terms of the obligation with respect to the timely payment of interest and repayment of the amount borrowed. This form of credit risk is called **default risk**. Market participants gauge the default risk of an issue by looking at the **credit rating** assigned to a bond issue by one of the three rating companies—Standard & Poor's, Moody's, and Fitch. We will discuss the rating systems used by these rating companies (also referred to as rating agencies) in Chapter 7 and the factors that they consider in assigning ratings in Chapter 22.

Risks are associated with investing in bonds other than default that are also components of credit risk. Even in the absence of default, an investor is concerned that the market value of a bond issue will decline in value and/or that the relative price performance of a bond issue will be worse than that of other bond issues, which the investor is compared against. The yield on a bond issue is made up of two components: (1) the yield on a similar maturity Treasury issue, and (2) a premium to compensate for the risks associated with the bond issue that do not exist in a Treasury issue—referred to as a spread. The part of the risk premium or spread attributable to default risk is called the **credit spread**. An entire chapter, Chapter 21, is devoted to the measurement of credit spread, and in Chapter 26 we explain how the measures can be used in portfolio management of corporate bond portfolios.

The price performance of a non-Treasury debt obligation and its return over some investment horizon will depend on how the credit spread of a bond issue changes. If the credit spread increases—investors say that the spread has "widened"—the market price of the bond issue will decline. The risk that a bond issue will decline due to an increase in the credit spread is called **credit spread risk**. This risk exists for an individual bond issue, bond issues in a particular industry or economic sector, and for all bond issues in the economy not issued by the U.S. Treasury.

Once a credit rating is assigned to a bond issue, a rating agency monitors the credit quality of the issuer and can change a credit rating. An improvement in the credit quality of an issue or issuer is rewarded with a better credit rating, referred to as an **upgrade**; a

[5] The reason for this is explained in Chapter 18.