CHAPTER

6

Interest Rates and Bond Valuation

LEARNING GOALS

LG1 Describe interest rate fundamentals, the term structure of interest rates, and risk premiums.

LG2 Review the legal aspects of bond financing and bond cost.

LG3 Discuss the general features, quotations, ratings, popular types, and international issues of corporate bonds.

LG4 Understand the key inputs and basic model used in the valuation process.

LG5 Apply the basic valuation model to bonds and describe the impact of required return and time to maturity on bond values.

LG6 Explain yield to maturity (YTM), its calculation, and the procedure used to value bonds that pay interest semiannually.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand interest rates and the various types of bonds in order to be able to account properly for amortization of bond premiums and discounts and for bond purchases and retirements.

Information systems: You need to understand the data that you will need to track in bond amortization schedules and bond valuation.

Management: You need to understand the behavior of interest rates and how they will affect the types of funds the firm can raise and the timing and cost of bond issues and retirements.

Marketing: You need to understand how the interest rate level and the firm's ability to issue bonds may affect the availability of financing for marketing research projects and new-product development.

Operations: You need to understand how the interest rate level may affect the firm's ability to raise funds to maintain and increase the firm's production capacity.

FORD

FORD CRUISES THE DEBT MARKETS

Ford and **Ford Motor Credit Co**. (FMCC), its finance unit, were frequent visitors to the corporate debt markets in 2001, selling over $22 billion in long-term notes and bonds. Despite the problems in the auto industry, investors nervous about stock market volatility were willing to accept the credit risk to get higher yields. The company's 2001 offerings had something for all types of investors, ranging from 2- to 10-year notes to 30-year bonds. Demand for Ford's debt was so high that in January the company increased the size of its issue from $5 billion to $7.8 billion, and October's plan to issue $3 billion turned into a $9.4 billion offering.

The world's second largest auto manufacturer joined other corporate bond issuers to take advantage of strengthening bond markets. Even though the Federal Reserve began cutting short-term rates, interest rates for the longer maturities remained attractively low for corporations. Unlike some other auto companies who limited the size of their debt offerings, FMCC decided to borrow as much as possible to lock in the very wide spread between its lower borrowing costs and what its auto loans yielded.

All this debt came at a price, however. Both major bond-rating agencies—Moody's Investors Service and Standard & Poor's (S&P)—downgraded Ford's debt quality ratings in October 2001. Moody's lowered Ford's long-term debt rating by one rating class but did not change FMCC's quality rating. Ford spokesman Todd Nissen was pleased that Moody's confirmed the FMCC ratings. "It will help us keep our costs of borrowing down, which benefits Ford Credit and ultimately Ford Motor," he said. S&P's outlook for Ford was more negative; the agency cut ratings on all Ford and FMCC debt one rating class. The lower ratings contributed to the higher yields on Ford's October debt. For example, in April FMCC's 10-year notes yielded 7.1 percent, about 2 points above U.S. Treasury bonds. In October, 10-year FMCC notes yielded 7.3 percent, or 2.7 points above U.S. Treasury bonds.

For corporations like Ford, deciding when to issue debt and selecting the best maturities requires knowledge of interest rate fundamentals, risk premiums, issuance costs, ratings, and similar features of corporate bonds. In this chapter you'll learn about these important topics and also become acquainted with techniques for valuing bonds.

LG1 6.1 Interest Rates and Required Returns

As noted in Chapter 1, financial institutions and markets create the mechanism through which funds flow between savers (funds suppliers) and investors (funds demanders). The level of funds flow between suppliers and demanders can significantly affect economic growth. Growth results from the interaction of a variety of economic factors (such as the money supply, trade balances, and economic policies) that affect the cost of money—the interest rate or required return. The interest rate level acts as a regulating device that controls the flow of funds between suppliers and demanders. The *Board of Governors of the Federal Reserve System* regularly assesses economic conditions and, when necessary, initiates actions to raise or lower interest rates to control inflation and economic growth. Generally, the lower the interest rate, the greater the funds flow and therefore the greater the economic growth; the higher the interest rate, the lower the funds flow and economic growth.

Interest Rate Fundamentals

The interest rate or required return represents the cost of money. It is the compensation that a demander of funds must pay a supplier. When funds are lent, the cost of borrowing the funds is the **interest rate.** When funds are obtained by selling an ownership interest—as in the sale of stock—the cost to the issuer (demander) is commonly called the **required return,** which reflects the funds supplier's level of expected return. In both cases the supplier is compensated for providing funds. Ignoring risk factors, the cost of funds results from the *real rate of interest* adjusted for inflationary expectations and **liquidity preferences**—general preferences of investors for shorter-term securities.

interest rate
The compensation paid by the borrower of funds to the lender; from the borrower's point of view, the cost of borrowing funds.

required return
The cost of funds obtained by selling an ownership interest; it reflects the funds supplier's level of expected return.

liquidity preferences
General preferences of investors for shorter-term securities.

real rate of interest
The rate that creates an equilibrium between the supply of savings and the demand for investment funds in a perfect world, without inflation, where funds suppliers and demanders are indifferent to the term of loans or investments and have no liquidity preference, and where all outcomes are certain.

The Real Rate of Interest

Assume a *perfect world* in which there is no inflation and in which funds suppliers and demanders are indifferent to the term of loans or investments because they have no liquidity preference and all outcomes are certain.[1] At any given point in time in that perfect world, there would be one cost of money—the **real rate of interest.** The real rate of interest creates an equilibrium between the supply of savings and the demand for investment funds. It represents the most basic cost of money. The real rate of interest in the United States is assumed to be stable and equal to around 1 percent.[2] This supply–demand relationship is shown in Figure 6.1 by the supply function (labeled S_0) and the demand function (labeled D). An equilibrium between the supply of funds and the demand for funds ($S_0 = D$) occurs at a rate of interest k_0^*, the real rate of interest.

Clearly, the real rate of interest changes with changing economic conditions, tastes, and preferences. A trade surplus could result in an increased supply of

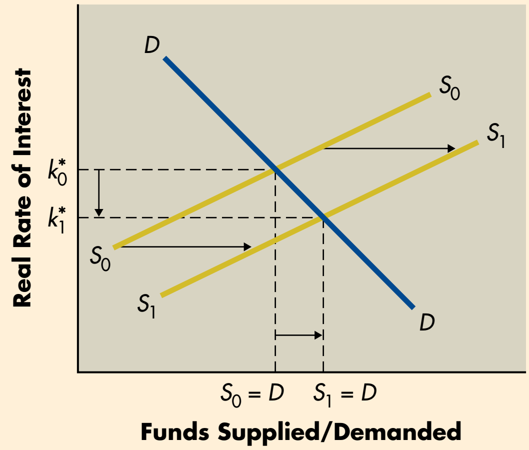
1. These assumptions are made to describe the most basic interest rate, the *real rate of interest.* Subsequent discussions relax these assumptions to develop the broader concept of the interest rate and required return.

2. Data in *Stocks, Bonds, Bills and Inflation, 2001 Yearbook* (Chicago: Ibbotson Associates, Inc., 2001), show that over the period 1926–2000, U.S. Treasury bills provided an average annual real rate of return of about 0.7 percent. Because of certain major economic events that occurred during the 1926–2000 period, many economists believe that the real rate of interest during recent years has been about 1 percent.

FIGURE 6.1

Supply–Demand Relationship

Supply of savings and demand for investment funds



funds, causing the supply function in Figure 6.1 to shift to, say, S_1. This could result in a lower real rate of interest, k_1^*, at equilibrium ($S_1 = D$). Likewise, a change in tax laws or other factors could affect the demand for funds, causing the real rate of interest to rise or fall to a new equilibrium level.

Nominal or Actual Rate of Interest (Return)

nominal rate of interest
The actual rate of interest charged by the supplier of funds and paid by the demander.

The **nominal rate of interest** is the actual rate of interest charged by the supplier of funds and paid by the demander. *Throughout this book, interest rates and required rates of return are nominal rates unless otherwise noted.* The nominal rate of interest differs from the real rate of interest, k^*, as a result of two factors: (1) inflationary expectations reflected in an inflation premium (IP), and (2) issuer and issue characteristics, such as default risk and contractual provisions, reflected in a risk premium (RP). When this notation is adopted, the nominal rate of interest for security 1, k_1, is given in Equation 6.1:

$$k_1 = \underbrace{k^* + IP}_{\text{risk-free rate, } R_F} + \underbrace{RP_1}_{\text{risk premium}} \quad (6.1)$$

As the horizontal braces below the equation indicate, the nominal rate, k_1, can be viewed as having two basic components: a risk-free rate of interest, R_F, and a risk premium, RP_1:

$$k_1 = R_F + RP_1 \quad (6.2)$$

To simplify the discussion, we will assume that the risk premium, RP_1, is equal to zero. By drawing from Equation 6.1,[3] the risk-free rate can (as earlier noted in Equation 5.9) be represented as

$$R_F = k^* + IP \quad (6.3)$$

3. This equation is commonly called the *Fisher equation*, named for the renowned economist Irving Fisher, who first presented this approximate relationship between nominal interest and the rate of inflation. See Irving Fisher, *The Theory of Interest* (New York: Macmillan, 1930).

Thus we concern ourselves only with the *risk-free rate of interest*, R_F, which was defined in Chapter 5 as the required return on a risk-free asset.[4] The risk-free rate (as shown in Equation 6.3) embodies the real rate of interest plus the inflationary expectation. Three-month *U.S. Treasury bills* (*T-bills*), which are (as noted in Chapter 5) short-term IOUs issued by the U.S. Treasury, are commonly considered the risk-free asset. *The real rate of interest can be estimated by subtracting the inflation premium from the nominal rate of interest.* For the risk-free asset in Equation 6.3, the real rate of interest, k^*, would equal $R_F - IP$. A simple example can demonstrate the practical distinction between nominal and real rates of interest.

EXAMPLE Marilyn Carbo has $10 that she can spend on candy costing $0.25 per piece. She could therefore buy 40 pieces of candy ($10.00/$0.25) today. The nominal rate of interest on a 1-year deposit is currently 7%, and the expected rate of inflation over the coming year is 4%. Instead of buying the 40 pieces of candy today, Marilyn could invest the $10 in a 1-year deposit account now. At the end of 1 year she would have $10.70 because she would have earned 7% interest—an additional $0.70 (0.07 × $10.00)—on her $10 deposit. The 4% inflation rate would over the 1-year period increase the cost of the candy by 4%—an additional $0.01 (0.04 × $0.25)—to $0.26 per piece. As a result, at the end of the 1-year period Marilyn would be able to buy about 41.2 pieces of candy ($10.70/$0.26), or roughly 3% more (41.2/40.0 = 1.03). The increase in the amount of money available to Marilyn at the end of 1 year is merely her nominal rate of return (7%), which must be reduced by the rate of inflation (4%) during the period to determine her real rate of return of 3%. Marilyn's increased buying power therefore equals her 3% real rate of return.

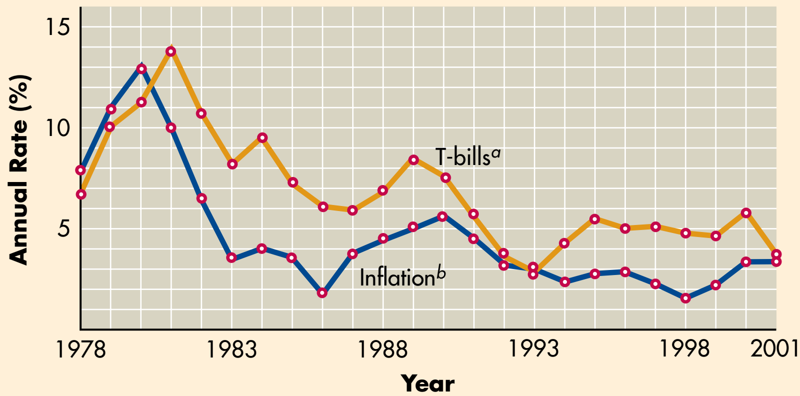
The premium for *inflationary expectations* in Equation 6.3 represents the average rate of *inflation* expected over the life of a loan or investment. It is *not* the rate of inflation experienced over the immediate past; rather, it reflects the forecasted rate. Take, for example, the risk-free asset. During the week ended March 15, 2002, 3-month T-bills earned a 1.81 percent rate of return. Assuming an approximate 1 percent real rate of interest, funds suppliers were forecasting a 0.81 percent (annual) rate of inflation (1.81% − 1.00%) over the next 3 months. This expectation was in striking contrast to the expected rate of inflation 17 years earlier in the week ending May 22, 1981. At that time the 3-month T-bill rate was 16.60 percent, which meant an expected (annual) inflation rate of 15.60 percent (16.60% − 1.00%). The inflationary expectation premium changes over time in response to many factors, including recent rates, government policies, and international events.

Figure 6.2 illustrates the movement of the rate of inflation and the risk-free rate of interest during the period 1978–2001. During this period the two rates tended to move in a similar fashion. Between 1978 and the early 1980s, inflation and interest rates were quite high, peaking at over 13 percent in 1980–1981. Since 1981 these rates have declined to levels generally below those in 1978. The data clearly illustrate the significant impact of inflation on the nominal rate of interest for the risk-free asset.

4. The risk premium and its effect on the nominal rate of interest are discussed and illustrated in a later part of this discussion.

FIGURE 6.2

Impact of Inflation
Relationship between annual rate of inflation and 3-month U.S. Treasury bill average annual returns, 1978–2001



[a] Average annual rate of return on 3-month U.S. Treasury bills.
[b] Annual pecentage change in the consumer price index.

Source: Data from selected *Federal Reserve Bulletins.*

term structure of interest rates
The relationship between the interest rate or rate of return and the time to maturity.

yield to maturity
Annual rate of return earned on a debt security purchased on a given day and held to maturity.

yield curve
A graph of the relationship between the debt's remaining time to maturity (*x* axis) and its yield to maturity (*y* axis); it shows the pattern of annual returns on debts of equal quality and different maturities. Graphically depicts the *term structure of interest rates.*

inverted yield curve
A *downward-sloping* yield curve that indicates generally cheaper long-term borrowing costs than short-term borrowing costs.

normal yield curve
An *upward-sloping* yield curve that indicates generally cheaper short-term borrowing costs than long-term borrowing costs.

flat yield curve
A yield curve that reflects relatively similar borrowing costs for both short- and longer-term loans.

Term Structure of Interest Rates

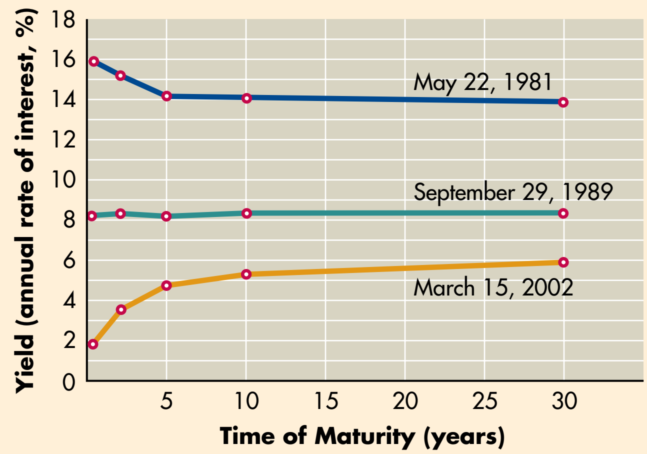
For any class of similar-risk securities, the **term structure of interest rates** relates the interest rate or rate of return to the time to maturity. For convenience we will use Treasury securities as an example, but other classes could include securities that have similar overall quality or risk. The riskless nature of Treasury securities also provides a laboratory in which to develop the term structure.

Yield Curves

A debt security's **yield to maturity** (discussed later in this chapter) represents the annual rate of return earned on a security purchased on a given day and held to maturity. At any point in time, the relationship between the debt's remaining time to maturity and its yield to maturity is represented by the **yield curve.** The yield curve shows the yield to maturity for debts of equal quality and different maturities; it is a graphical depiction of the *term structure of interest rates*. Figure 6.3 shows three yield curves for all U.S. Treasury securities: one at May 22, 1981, a second at September 29, 1989, and a third at March 15, 2002. Note that both the position and the shape of the yield curves change over time. The yield curve of May 22, 1981, indicates that short-term interest rates at that time were above longer-term rates. This curve is described as *downward-sloping,* reflecting long-term borrowing costs generally cheaper than short-term borrowing costs. Historically, the downward-sloping yield curve, which is often called an **inverted yield curve,** has been the exception. More frequently, yield curves similar to that of March 15, 2002, have existed. These *upward-sloping* or **normal yield curves** indicate that short-term borrowing costs are below long-term borrowing costs. Sometimes, a **flat yield curve,** similar to that of September 29, 1989, exists. It reflects relatively similar borrowing costs for both short- and longer-term loans.

FIGURE 6.3

Treasury Yield Curves
Yield curves for U.S. Treasury securities: May 22, 1981; September 29, 1989; and March 15, 2002



Sources: Data from *Federal Reserve Bulletins* (June 1981), p. A25 and (December 1989), p. A24; and *U.S. Financial Data,* Federal Reserve Bank of St. Louis (March 14, 2002), p. 7.

The shape of the yield curve may affect the firm's financing decisions. A financial manager who faces a downward-sloping yield curve is likely to rely more heavily on cheaper, long-term financing; when the yield curve is upward-sloping, the manager is more likely to use cheaper, short-term financing. Although a variety of other factors also influence the choice of loan maturity, the shape of the yield curve provides useful insights into future interest rate expectations.

Theories of Term Structure

Three theories are frequently cited to explain the general shape of the yield curve. They are the expectations theory, liquidity preference theory, and market segmentation theory.

expectations theory
The theory that the yield curve reflects investor expectations about future interest rates; an increasing inflation expectation results in an upward-sloping yield curve, and a decreasing inflation expectation results in a downward-sloping yield curve

Expectations Theory One theory of the term structure of interest rates, the **expectations theory,** suggests that the yield curve reflects investor expectations about future interest rates and inflation. Higher future rates of expected inflation will result in higher long-term interest rates; the opposite occurs with lower future rates. This widely accepted explanation of the term structure can be applied to the securities of any issuer. For example, take the case of U.S. Treasury securities. Thus far, we have concerned ourselves solely with the 3-month Treasury bill. In fact, all Treasury securities are *riskless* in terms of (1) the chance that the Treasury will default on the issue and (2) the ease with which they can be liquidated for cash without losing value. Because it is believed to be easier to forecast inflation over shorter periods of time, the shorter-term 3-month U.S. Treasury bill is considered the risk-free asset. Of course, differing inflation expectations associated with different maturities will cause nominal interest rates to vary. With the addition of a maturity subscript, t, Equation 6.3 can be rewritten as

$$R_{F_t} = k^* + IP_t \tag{6.4}$$

In Practice

FOCUS ON PRACTICE Watch Those Curves!

Why do financial institutions, individual investors, and corporations that need to issue debt pay close attention to the yield curve, looking for any changing patterns? Because the shape of the yield curve—a chart of the gap between short- and long-term interest rates—has been an excellent predictor of future economic growth in the United States. In general, sharp upward-sloping ("normal") yield curves signal a substantial rise in economic activity within a year. Downward-sloping ("inverted") yield curves have preceded every recession since 1955 (although recession did not follow an inverted curve in the mid-1960s).

The yield curve is based on the manner in which rates on different debt maturities are set. The marketplace determines long-term interest rates, which are tied to various economic factors, such as investors' views on the outlook for growth and for inflation. Because the Federal Reserve sets short-term rates, it can direct the pace of economic activity by managing the differences between the two ends of the interest rate spectrum. Most periods of flat or inverted yield curves occur when the Federal Reserve increases short-term rates, tightening monetary policy to control inflation. These higher rates curtail business growth because savers pull money out of long-term investments such as stocks and bonds and put it into lower-risk savings vehicles. When short-term rates are low, people switch money from liquid investments such as money market accounts into long-term investments, fueling economic growth.

This proved true in 2001. An inverted yield curve from July 2000 to early January 2001 triggered the slowdown in economic activity. In January the Federal Reserve cut the federal funds rate (the rate on loan transactions between commercial banks) to stimulate the economy but wasn't able to prevent the recession that began in March 2001. The Fed cut short-term rates 10 more times in 2001—a record for cuts in one year—to bring the "fed funds" rate from 6.5 percent to 1.75 percent, the lowest level since 1961. Long-term U.S. Treasury securities outperformed shorter maturities as institutional and individual investors shifted their portfolios to longer maturities, betting that the curve would return to its more normal upward slope as the Federal Reserve rate cuts took effect. By December 2001 the spread between long-term and short-term Treasury securities was about 2.5 points. As the yield curve turned strongly positive, economists predicted a short recession with a strong recovery in 2002.

Sources: Adapted from Peronet Despeignes, "Fed Cuts Rates by Quarter Point to 1.75%," *FT.com* (December 11, 2001), downloaded from *news.ft.com;* Michael Sivy, "Ahead of the Curve," *Money* (August 2001), p. 51; Michael Wallace, "The Fed Can't Get Ahead of the Curve," *Business Week Online* (November 5, 2001), downloaded from *www.businessweek.com;* Linda Wertheimer, "Analysis: Federal Reserve's Latest Interest Rate Cut," *All Things Considered (NPR)*, November 6, 2001, downloaded from Electric Library, *ask.elibrary.com.*

In other words, for U.S. Treasury securities the nominal, or risk-free, rate for a given maturity varies with the inflation expectation over the term of the security.[5]

EXAMPLE The nominal interest rate, R_F, for four maturities of U.S. Treasury securities on March 15, 2002, is given in column 1 of the following table. Assuming that the real rate of interest is 1%, as noted in column 2, the inflation expectation for each maturity in column 3 is found by solving Equation 6.4 for IP_t. Although a 0.81% rate of inflation was expected over the 3-month period beginning March 15, 2002, a 2.55% average rate of inflation was expected over the 2-year period, and so on. An analysis of the inflation expectations in column 3 for March 15, 2002, suggests that at that time a general expectation of increasing inflation existed. Simply stated, the March 15, 2002, yield curve for U.S. Treasury securities shown

5. Although U.S. Treasury securities have no risk of default or illiquidity, they do suffer from "maturity, or interest rate, risk"—the risk that interest rates will change in the future and thereby affect longer maturities more than shorter maturities. Therefore, the longer the maturity of a Treasury (or any other) security, the greater its interest rate risk. The impact of interest rate changes on bond values is discussed later in this chapter; here we ignore this effect.

in Figure 6.3 was upward-sloping as a result of the expectation that the rate of inflation would increase in the future.[6]

Maturity, t	Nominal interest rate, R_{F_t} (1)	Real interest rate, k^* (2)	Inflation expectation, IP_t [(1) − (2)] (3)
3 months	1.81%	1.00%	0.81%
2 years	3.55	1.00	2.55
5 years	4.74	1.00	3.74
30 years	5.90	1.00	4.90

Generally, under the expectations theory, an increasing inflation expectation results in an upward-sloping yield curve; a decreasing inflation expectation results in a downward-sloping yield curve; and a stable inflation expectation results in a flat yield curve. Although, as we'll see, other theories exist, the observed strong relationship between inflation and interest rates (see Figure 6.2) supports this widely accepted theory.

liquidity preference theory
Theory suggesting that for any given issuer, long-term interest rates tend to be higher than short-term rates because (1) lower liquidity and higher responsiveness to general interest rate movements of longer-term securities exists and (2) borrower willingness to pay a higher rate for long-term financing; causes the yield curve to be upward-sloping.

Liquidity Preference Theory The tendency for yield curves to be upward-sloping can be further explained by **liquidity preference theory.** This theory holds that for a given issuer, such as the U.S. Treasury, long-term rates tend to be higher than short-term rates. This belief is based on two behavioral facts:

1. Investors perceive less risk in short-term securities than in longer-term securities and are therefore willing to accept lower yields on them. The reason is that shorter-term securities are more liquid and less responsive to general interest rate movements.[7]
2. Borrowers are generally willing to pay a higher rate for long-term than for short-term financing. By locking in funds for a longer period of time, they can eliminate the potential adverse consequences of having to roll over short-term debt at unknown costs to obtain long-term financing.

Investors (lenders) tend to require a premium for tying up funds for longer periods, whereas borrowers are generally willing to pay a premium to obtain longer-term financing. These preferences of lenders and borrowers cause the yield curve to tend to be upward-sloping. Simply stated, longer maturities tend to have higher interest rates than shorter maturities.

market segmentation theory
Theory suggesting that the market for loans is segmented on the basis of maturity and that the supply of and demand for loans within each segment determine its prevailing interest rate; the slope of the yield curve is determined by the general relationship between the prevailing rates in each segment.

Market Segmentation Theory The **market segmentation theory** suggests that the market for loans is segmented on the basis of maturity and that the supply of and demand for loans within each segment determine its prevailing interest rate. In other words, the equilibrium between suppliers and demanders of short-term funds, such as seasonal business loans, would determine prevailing short-

6. It is interesting to note (in Figure 6.3) that the expectations reflected by the September 29, 1989, yield curve were not fully borne out by actual events. By March 2002, interest rates had fallen for all maturities, and the yield curve at that time had shifted downward and become upward-sloping, reflecting an expectation of increasing future interest rates and inflation rates.

7. Later in this chapter we demonstrate that debt instruments with longer maturities are more sensitive to changing market interest rates. For a given change in market rates, the price or value of longer-term debts will be more significantly changed (up or down) than the price or value of debts with shorter maturities.

Hint An upward-sloping yield curve will result if the supply outstrips the demand for short-term loans, thereby resulting in relatively low short-term rates at a time when long-term rates are high because the demand for long-term loans is far above their supply.

term interest rates, and the equilibrium between suppliers and demanders of long-term funds, such as real estate loans, would determine prevailing long-term interest rates. The slope of the yield curve would be determined by the general relationship between the prevailing rates in each market segment. Simply stated, low rates in the short-term segment and high rates in the long-term segment cause the yield curve to be upward-sloping. The opposite occurs for high short-term rates and low long-term rates.

All three theories of term structure have merit. From them we can conclude that at any time, the slope of the yield curve is affected by (1) inflationary expectations, (2) liquidity preferences, and (3) the comparative equilibrium of supply and demand in the short- and long-term market segments. Upward-sloping yield curves result from higher future inflation expectations, lender preferences for shorter-maturity loans, and greater supply of short-term loans than of long-term loans relative to demand. The opposite behaviors would result in a downward-sloping yield curve. At any time, the interaction of these three forces determines the prevailing slope of the yield curve.

Risk Premiums: Issuer and Issue Characteristics

So far we have considered only risk-free U.S. Treasury securities. We now reintroduce the risk premium and assess it in view of risky non-Treasury issues. Recall Equation 6.1:

$$k_1 = \underbrace{k^* + IP}_{\substack{\text{risk-free} \\ \text{rate, } R_F}} + \underbrace{RP_1}_{\substack{\text{risk} \\ \text{premium}}}$$

In words, the nominal rate of interest for security 1 (k_1) is equal to the risk-free rate, consisting of the real rate of interest (k^*) plus the inflation expectation premium (IP) plus the risk premium (RP_1). The *risk premium* varies with specific issuer and issue characteristics; it causes similar-maturity securities[8] to have differing nominal rates of interest.

EXAMPLE

The nominal interest rates on a number of classes of long-term securities on March 15, 2002, were as follows:[9]

Security	Nominal interest
U.S. Treasury bonds (average)	5.68%
Corporate bonds (by ratings):	
High quality (Aaa–Aa)	6.13
Medium quality (A–Baa)	7.14
Speculative (Ba–C)	8.11
Utility bonds (average rating)	6.99

8. To provide for the same risk-free rate of interest, $k^* + IP$, it is necessary to assume equal maturities. When we do so, the inflationary expectations premium, IP, and therefore R_F, will be held constant, and the issuer and issue characteristics premium, RP, becomes the key factor differentiating the nominal rates of interest on various securities.

9. These yields were obtained from Mr. Mike Steelman at UBS PaineWebber, La Jolla, CA (March 25, 2002). Note that bond ratings are explained later in this chapter, on page 278.

Because the U.S. Treasury bond would represent the risk-free, long-term security, we can calculate the risk premium of the other securities by subtracting the risk-free rate, 5.68%, from each nominal rate (yield):

Security	Risk premium
Corporate bonds (by ratings):	
High quality (Aaa–Aa)	6.13% − 5.68% = 0.45%
Medium quality (A–Baa)	7.14 − 5.68 = 1.46
Speculative (Ba–C)	8.11 − 5.68 = 2.43
Utility bonds (average rating)	6.99 − 5.68 = 1.31

These risk premiums reflect differing issuer and issue risks. The lower-rated corporate issues (speculative) have a higher risk premium than that of the higher-rated corporates (high quality and medium quality), and the utility issue has a risk premium near that of the medium-quality corporates.

The risk premium consists of a number of issuer- and issue-related components, including interest rate risk, liquidity risk, and tax risk, which were defined in Table 5.1 on page 215, and the purely debt-specific risks—default risk, maturity risk, and contractual provision risk, briefly defined in Table 6.1. In general,

TABLE 6.1 Debt-Specific Issuer- and Issue-Related Risk Premium Components

Component	Description
Default risk	The possibility that the issuer of debt will not pay the contractual interest or principal as scheduled. The greater the uncertainty as to the borrower's ability to meet these payments, the greater the risk premium. High bond ratings reflect low default risk, and low bond ratings reflect high default risk.
Maturity risk	The fact that the longer the maturity, the more the value of a security will change in response to a given change in interest rates. If interest rates on otherwise similar-risk securities suddenly rise as a result of a change in the money supply, the prices of long-term bonds will decline by more than the prices of short-term bonds, and vice versa.[a]
Contractual provision risk	Conditions that are often included in a debt agreement or a stock issue. Some of these reduce risk, whereas others may increase risk. For example, a provision allowing a bond issuer to retire its bonds prior to their maturity under favorable terms increases the bond's risk.

[a]A detailed discussion of the effects of interest rates on the price or value of bonds and other fixed-income securities is presented later in this chapter.

the highest risk premiums and therefore the highest returns result from securities issued by firms with a high risk of default and from long-term maturities that have unfavorable contractual provisions.

Review Questions

6–1 What is the *real rate of interest*? Differentiate it from the *nominal rate of interest* for the risk-free asset, a 3-month U.S. Treasury bill.

6–2 What is the *term structure of interest rates,* and how is it related to the *yield curve?*

6–3 For a given class of similar-risk securities, what does each of the following yield curves reflect about interest rates: (**a**) downward-sloping; (**b**) upward-sloping; and (**c**) flat? Which form has been historically dominant?

6–4 Briefly describe the following theories of the general shape of the yield curve: (**a**) expectations theory; (**b**) liquidity preference theory; and (**c**) market segmentation theory.

6–5 List and briefly describe the potential issuer- and issue-related risk components that are embodied in the risk premium. Which are the purely debt-specific risks?

LG2 LG3 6.2 Corporate Bonds

corporate bond
A long-term debt instrument indicating that a corporation has borrowed a certain amount of money and promises to repay it in the future under clearly defined terms.

coupon interest rate
The percentage of a bond's par value that will be paid annually, typically in two equal semiannual payments, as interest.

A **corporate bond** is a long-term debt instrument indicating that a corporation has borrowed a certain amount of money and promises to repay it in the future under clearly defined terms. Most bonds are issued with maturities of 10 to 30 years and with a par value, or face value, of $1,000. The **coupon interest rate** on a bond represents the percentage of the bond's par value that will be paid annually, typically in two equal semiannual payments, as interest. The bondholders, who are the lenders, are promised the semiannual interest payments and, at maturity, repayment of the principal amount.

Legal Aspects of Corporate Bonds

Certain legal arrangements are required to protect purchasers of bonds. Bondholders are protected primarily through the indenture and the trustee.

Bond Indenture

bond indenture
A legal document that specifies both the rights of the bondholders and the duties of the issuing corporation.

A **bond indenture** is a legal document that specifies both the rights of the bondholders and the duties of the issuing corporation. Included in the indenture are descriptions of the amount and timing of all interest and principal payments, various standard and restrictive provisions, and, frequently, sinking-fund requirements and security interest provisions.

standard debt provisions
Provisions in a *bond indenture* specifying certain record-keeping and general business practices that the bond issuer must follow; normally, they do not place a burden on a financially sound business.

Standard Provisions The **standard debt provisions** in the bond indenture specify certain record-keeping and general business practices that the bond issuer must follow. Standard debt provisions do not normally place a burden on a financially sound business.

The borrower commonly must (1) *maintain satisfactory accounting records* in accordance with generally accepted accounting principles (GAAP); (2) periodically *supply audited financial statements;* (3) *pay taxes and other liabilities when due;* and (4) *maintain all facilities in good working order.*

restrictive covenants
Provisions in a *bond indenture* that place operating and financial constraints on the borrower.

Restrictive Provisions Bond indentures also normally include certain **restrictive covenants,** which place operating and financial constraints on the borrower. These provisions help protect the bondholder against increases in borrower risk. Without them, the borrower could increase the firm's risk but not have to pay increased interest to compensate for the increased risk.

The most common restrictive covenants do the following:

1. Require a *minimum level of liquidity,* to ensure against loan default.
2. *Prohibit the sale of accounts receivable* to generate cash. Selling receivables could cause a long-run cash shortage if proceeds were used to meet current obligations.
3. Impose *fixed-asset restrictions.* The borrower must maintain a specified level of fixed assets to guarantee its ability to repay the bonds.
4. *Constrain subsequent borrowing.* Additional long-term debt may be prohibited, or additional borrowing may be *subordinated* to the original loan. **Subordination** means that subsequent creditors agree to wait until all claims of the *senior debt* are satisfied.
5. *Limit the firm's annual cash dividend payments* to a specified percentage or amount.

subordination
In a bond indenture, the stipulation that subsequent creditors agree to wait until all claims of the *senior debt* are satisfied.

Other restrictive covenants are sometimes included in bond indentures.

The violation of any standard or restrictive provision by the borrower gives the bondholders the right to demand immediate repayment of the debt. Generally, bondholders evaluate any violation to determine whether it jeopardizes the loan. They may then decide to demand immediate repayment, continue the loan, or alter the terms of the bond indenture.

sinking-fund requirement
A restrictive provision often included in a bond indenture, providing for the systematic retirement of bonds prior to their maturity.

Sinking-Fund Requirements Another common restrictive provision is a **sinking-fund requirement.** Its objective is to provide for the systematic retirement of bonds prior to their maturity. To carry out this requirement, the corporation makes semiannual or annual payments that are used to retire bonds by purchasing them in the marketplace.

Security Interest The bond indenture identifies any collateral pledged against the bond and specifies how it is to be maintained. The protection of bond collateral is crucial to guarantee the safety of a bond issue.

Trustee

trustee
A paid individual, corporation, or commercial bank trust department that acts as the third party to a bond indenture and can take specified actions on behalf of the bondholders if the terms of the indenture are violated.

A **trustee** is a third party to a bond indenture. The trustee can be an individual, a corporation, or (most often) a commercial bank trust department. The trustee is paid to act as a "watchdog" on behalf of the bondholders and can take specified actions on behalf of the bondholders if the terms of the indenture are violated.

Cost of Bonds to the Issuer

The cost of bond financing is generally greater than the issuer would have to pay for short-term borrowing. The major factors that affect the cost, which is the rate of interest paid by the bond issuer, are the bond's maturity, the size of the offering, the issuer's risk, and the basic cost of money.

Impact of Bond Maturity on Bond Cost

Generally, as we noted earlier, long-term debt pays higher interest rates than short-term debt. In a practical sense, the longer the maturity of a bond, the less accuracy there is in predicting future interest rates, and therefore the greater the bondholders' risk of giving up an opportunity to lend money at a higher rate. In addition, the longer the term, the greater the chance that the issuer might default.

Impact of Offering Size on Bond Cost

The size of the bond offering also affects the interest cost of borrowing, but in an inverse manner: Bond flotation and administration costs per dollar borrowed are likely to decrease with increasing offering size. On the other hand, the risk to the bondholders may increase, because larger offerings result in greater risk of default.

Impact of Issuer's Risk

The greater the issuer's *default risk*, the higher the interest rate. Some of this risk can be reduced through inclusion of appropriate restrictive provisions in the bond indenture. Clearly, bondholders must be compensated with higher returns for taking greater risk. Frequently, bond buyers rely on bond ratings (discussed later) to determine the issuer's overall risk.

Impact of the Cost of Money

The cost of money in the capital market is the basis for determining a bond's coupon interest rate. Generally, the rate on U.S. Treasury securities of equal maturity is used as the lowest-risk cost of money. To that basic rate is added a *risk premium* (as described earlier in this chapter) that reflects the factors mentioned above (maturity, offering size, and issuer's risk).

General Features of a Bond Issue

Three features sometimes included in a corporate bond issue are a conversion feature, a call feature, and stock purchase warrants. These features provide the issuer or the purchaser with certain opportunities for replacing or retiring the bond or supplementing it with some type of equity issue.

conversion feature
A feature of *convertible bonds* that allows bondholders to change each bond into a stated number of shares of common stock.

Convertible bonds offer a **conversion feature** that allows bondholders to change each bond into a stated number of shares of common stock. Bondholders convert their bonds into stock only when the market price of the stock is such that conversion will provide a profit for the bondholder. Inclusion of the conversion feature by the issuer lowers the interest cost and provides for automatic conversion of the bonds to stock if future stock prices appreciate noticeably.

call feature
A feature included in nearly all corporate bond issues that gives the issuer the opportunity to repurchase bonds at a stated *call price* prior to maturity.

call price
The stated price at which a bond may be repurchased, by use of a *call feature,* prior to maturity.

call premium
The amount by which a bond's *call price* exceeds its par value.

The **call feature** is included in nearly all corporate bond issues. It gives the issuer the opportunity to repurchase bonds prior to maturity. The **call price** is the stated price at which bonds may be repurchased prior to maturity. Sometimes the call feature can be exercised only during a certain period. As a rule, the call price exceeds the par value of a bond by an amount equal to 1 year's interest. For example, a \$1,000 bond with a 10 percent coupon interest rate would be callable for around \$1,100 [$\$1{,}000 + (10\% \times \$1{,}000)$]. The amount by which the call price exceeds the bond's par value is commonly referred to as the **call premium.** This premium compensates bondholders for having the bond called away from them; to the issuer, it is the cost of calling the bonds.

The call feature enables an issuer to call an outstanding bond when interest rates fall and issue a new bond at a lower interest rate. When interest rates rise, the call privilege will not be exercised, except possibly to meet sinking-fund requirements. Of course, to sell a callable bond in the first place, the issuer must pay a higher interest rate than on noncallable bonds of equal risk, to compensate bondholders for the risk of having the bonds called away from them.

stock purchase warrants
Instruments that give their holders the right to purchase a certain number of shares of the issuer's common stock at a specified price over a certain period of time.

Bonds occasionally have stock purchase warrants attached as "sweeteners" to make them more attractive to prospective buyers. **Stock purchase warrants** are instruments that give their holders the right to purchase a certain number of shares of the issuer's common stock at a specified price over a certain period of time. Their inclusion typically enables the issuer to pay a slightly lower coupon interest rate than would otherwise be required.

Interpreting Bond Quotations

quotations
Information on bonds, stocks, and other securities, including current price data and statistics on recent price behavior.

The financial manager needs to stay abreast of the market values of the firm's outstanding securities, whether they are traded on an organized exchange, over the counter, or in international markets. Similarly, existing and prospective investors in the firm's securities need to monitor the prices of the securities they own because these prices represent the current value of their investment. Information on bonds, stocks, and other securities is contained in **quotations,** which include current price data along with statistics on recent price behavior. Security price quotations are readily available for actively traded bonds and stocks. The most up-to-date "quotes" can be obtained electronically, via a personal computer. Price information is available from stockbrokers and is widely published in news media. Popular sources of daily security price quotations include financial newspapers, such as the *Wall Street Journal* and *Investor's Business Daily,* and the business sections of daily general newspapers. Here we focus on bond quotations; stock quotations are reviewed in Chapter 7.

FIGURE 6.4

Bond Quotations

Selected bond quotations for April 22, 2002

BONDS	CUR YLD	VOL	CLOSE	NET CHG
HuntPly 11¾04f	...	22	20.13	−0.88
IBM 7¼02	7.1	15	101.75	−0.38
IBM 5⅜09	5.6	50	96.63	0.25
IBM 8⅜19	...	20	114.25	0.38
IBM 7s25	7.0	10	100.25	−1.75
IPap dc5⅛12	5.9	20	86.50	1.88
IntShip 9s03	9.0	3	100	...
JPMChse 7½03	7.3	10	103	−0.25
JPMChse 6⅛08	6.1	25	100.88	0.63
JPMChse 6½09	6.5	40	100.13	...
JCPL 6⅜03	6.3	4	101	−0.75
KCS En 8⅞06	11.5	30	76.88	...
K&B Hm 7¾04	7.6	36	102	...
K&B Hm 9⅝06	9.2	65	104.38	−0.25
Koppers 8½04	8.6	16	99	...
Leucadia 7¾13	7.6	25	101.25	0.25
LionCT 6⅜03	6.3	15	101	−4.00
LglsLt 9s22	8.6	40	104.50	−0.50
Lucent 7¼06	8.9	585	81.63	−0.50
Lucent 5½08	7.8	240	70.75	−0.88
Lucent 6½28	10.5	89	62	0.25
Lucent 6.45s29	10.4	145	62.13	−0.38
MBNA 8.28s26	8.7	121	95.50	−0.50
MailWell 5s02	cv	30	98.75	0.25
Malan 9½04	cv	41	92.88	0.88
McDnl 6⅝05	6.5	87	102.13	0.38
Motrla zr13	...	10	73.25	−0.50
NRurU 6.55s18	7.0	50	94	−2.63
NYTel 6¼04	6.1	25	102	−0.25
NYTel 7⅝23	7.6	50	100.63	−1.25
NYTel 6.70s23	7.0	5	95	−1.75
NYTel 7s25	7.2	20	97	−0.63
NYTel 7s33	7.1	7	98.38	0.63
OcciP 10⅛09	8.4	5	121	0.13
OffDep zr07	...	30	90	−2.50

IBM

Source: Wall Street Journal, April 23, 2002, p. C14.

Figure 6.4 includes an excerpt from the New York Stock Exchange (NYSE) bond quotations reported in the April 23, 2002, *Wall Street Journal* for transactions through the close of trading on Monday, April 22, 2002. We'll look at the corporate bond quotation for IBM, which is highlighted in Figure 6.4. The numbers following the company name—IBM—represent the bond's *coupon interest rate* and the year it matures: "7s25" means that the bond has a stated coupon interest rate of 7 percent and matures sometime in the year 2025. This information allows investors to differentiate between the various bonds issued by the corporation. Note that on the day of this quote, IBM had four bonds listed. The next column, labeled "Cur Yld.," gives the bond's *current yield,* which is found by dividing its annual coupon (7%, or 7.000%) by its closing price (100.25), which in this case turns out to be 7.0 percent ($7.000 \div 100.25 = 0.0698 = 7.0\%$).

The "Vol" column indicates the actual number of bonds that traded on the given day; 10 IBM bonds traded on Monday, April 22, 2002. The final two columns include price information—the closing price and the net change in closing price from the prior trading day. Although most corporate bonds are issued with a *par,* or *face, value* of $1,000, *all bonds are quoted as a percentage of par.* A $1,000-par-value bond quoted at 110.38 is priced at $1,103.80 (110.38% × $1,000). Corporate bonds are quoted in dollars and cents. Thus IBM's closing price of 100.25 for the day was $1,002.50—that is, 100.25% × $1,000. Because a "Net Chg." of −1.75 is given in the final column, the bond must have closed at 102 or $1,020 (102.00% × $1,000) on the prior day. Its price decreased by 1.75, or $17.50 (1.75% × $1,000), on Tuesday, April 22, 2002. Additional information may be included in a bond quotation, but these are the basic elements.

Bond Ratings

Independent agencies such as Moody's and Standard & Poor's assess the riskiness of publicly traded bond issues. These agencies derive the ratings by using financial ratio and cash flow analyses to assess the likely payment of bond interest and principal. Table 6.2 summarizes these ratings. Normally an inverse relationship exists between the quality of a bond and the rate of return that it must provide bondholders: High-quality (high-rated) bonds provide lower returns than lower-quality (low-rated) bonds. This reflects the lender's risk-return trade-off. When considering bond financing, the financial manager must be concerned with the expected ratings of the bond issue, because these ratings affect salability and cost.

Popular Types of Bonds

Bonds can be classified in a variety of ways. Here we break them into traditional bonds (the basic types that have been around for years) and contemporary bonds (newer, more innovative types). The traditional types of bonds are summarized in terms of their key characteristics and priority of lender's claim in Table 6.3. Note

Hint Note that Moody's has 9 major ratings; Standard & Poor's has 10.

TABLE 6.2 Moody's and Standard & Poor's Bond Ratings[a]

Moody's	Interpretation	Standard & Poor's	Interpretation
Aaa	Prime quality	AAA	Bank investment quality
Aa	High grade	AA	
A	Upper medium grade	A	
Baa	Medium grade	BBB	
Ba	Lower medium grade or speculative	BB	Speculative
		B	
B	Speculative		
Caa	From very speculative	CCC	
Ca	to near or in default	CC	
C	Lowest grade	C	Income bond
		D	In default

[a]Some ratings may be modified to show relative standing within a major rating category; for example, Moody's uses numerical modifiers (1, 2, 3), whereas Standard & Poor's uses plus (+) and minus (−) signs.

Sources: Moody's Investors Service, Inc. and Standard & Poor's Corporation.

TABLE 6.3 Characteristics and Priority of Lender's Claim of Traditional Types of Bonds

Bond type	Characteristics	Priority of lender's claim
Unsecured Bonds		
Debentures	Unsecured bonds that only creditworthy firms can issue. Convertible bonds are normally debentures.	Claims are the same as those of any general creditor. May have other unsecured bonds subordinated to them.
Subordinated debentures	Claims are not satisfied until those of the creditors holding certain (senior) debts have been fully satisfied.	Claim is that of a general creditor but not as good as a senior debt claim.
Income bonds	Payment of interest is required only when earnings are available. Commonly issued in reorganization of a failing firm.	Claim is that of a general creditor. Are not in default when interest payments are missed, because they are contingent only on earnings being available.
Secured Bonds		
Mortgage bonds	Secured by real estate or buildings.	Claim is on proceeds from sale of mortgaged assets; if not fully satisfied, the lender becomes a general creditor.The *first-mortgage* claim must be fully satisfied before distribution of proceeds to *second-mortgage* holders, and so on. A number of mortgages can be issued against the same collateral.
Collateral trust bonds	Secured by stock and (or) bonds that are owned by the issuer. Collateral value is generally 25% to 35% greater than bond value.	Claim is on proceeds from stock and (or) bond collateral; if not fully satisfied, the lender becomes a general creditor.
Equipment trust certificates	Used to finance "rolling stock"—airplanes, trucks, boats, railroad cars. A trustee buys such an asset with funds raised through the sale of trust certificates and then leases it to the firm, which, after making the final scheduled lease payment, receives title to the asset. A type of leasing.	Claim is on proceeds from the sale of the asset; if proceeds do not satisfy outstanding debt, trust certificate lenders become general creditors.

debentures
subordinated debentures
income bonds
mortgage bonds
collateral trust bonds
equipment trust certificates
See Table 6.3

zero- (or low-) coupon bonds
junk bonds
floating-rate bonds
extendible notes
putable bonds
See Table 6.4

that the first three types—**debentures, subordinated debentures,** and **income bonds**—are unsecured, whereas the last three—**mortgage bonds, collateral trust bonds,** and **equipment trust certificates**—are secured.

Table 6.4 describes the key characteristics of five contemporary types of bonds: **zero-coupon or low-coupon bonds, junk bonds, floating-rate bonds, extendible notes,** and **putable bonds.** These bonds can be either unsecured or secured. Changing capital market conditions and investor preferences have spurred further innovations in bond financing in recent years and will probably continue to do so.

International Bond Issues

Companies and governments borrow internationally by issuing bonds in two principal financial markets: the Eurobond market and the foreign bond market. Both give borrowers the opportunity to obtain large amounts of long-term debt financing quickly, in the currency of their choice and with flexible repayment terms.

TABLE 6.4 Characteristics of Contemporary Types of Bonds

Bond type	Characteristics[a]
Zero- (or low-) coupon bonds	Issued with no (zero) or a very low coupon (stated interest) rate and sold at a large discount from par. A significant portion (or all) of the investor's return comes from gain in value (i.e., par value minus purchase price). Generally callable at par value. Because the issuer can annually deduct the current year's interest accrual without having to pay the interest until the bond matures (or is called), its cash flow each year is increased by the amount of the tax shield provided by the interest deduction.
Junk bonds	Debt rated Ba or lower by Moody's or BB or lower by Standard & Poor's. Commonly used during the 1980s by rapidly growing firms to obtain growth capital, most often as a way to finance mergers and takeovers. High-risk bonds with high yields—often yielding 2% to 3% more than the best-quality corporate debt.
Floating-rate bonds	Stated interest rate is adjusted periodically within stated limits in response to changes in specified money market or capital market rates. Popular when future inflation and interest rates are uncertain. Tend to sell at close to par because of the automatic adjustment to changing market conditions. Some issues provide for annual redemption at par at the option of the bondholder.
Extendible notes	Short maturities, typically 1 to 5 years, that can be renewed for a similar period at the option of holders. Similar to a floating-rate bond. An issue might be a series of 3-year renewable notes over a period of 15 years; every 3 years, the notes could be extended for another 3 years, at a new rate competitive with market interest rates at the time of renewal.
Putable bonds	Bonds that can be redeemed at par (typically, $1,000) at the option of their holder either at specific dates after the date of issue and every 1 to 5 years thereafter or when and if the firm takes specified actions, such as being acquired, acquiring another company, or issuing a large amount of additional debt. In return for its conferring the right to "put the bond" at specified times or when the firm takes certain actions, the bond's yield is lower than that of a nonputable bond.

[a]The claims of lenders (i.e., bondholders) against issuers of each of these types of bonds vary, depending on the bonds' other features. Each of these bonds can be unsecured or secured.

Eurobond
A bond issued by an international borrower and sold to investors in countries with currencies other than the currency in which the bond is denominated.

A **Eurobond** is issued by an international borrower and sold to investors in countries with currencies other than the currency in which the bond is denominated. An example is a dollar-denominated bond issued by a U.S. corporation and sold to Belgian investors. From the founding of the Eurobond market in the 1960s until the mid-1980s, "blue chip" U.S. corporations were the largest single class of Eurobond issuers. Some of these companies were able to borrow in this market at interest rates below those the U.S. government paid on Treasury bonds. As the market matured, issuers became able to choose the currency in which they borrowed, and European and Japanese borrowers rose to prominence. In more recent years, the Eurobond market has become much more balanced in terms of the mix of borrowers, total issue volume, and currency of denomination.

foreign bond
A bond issued in a host country's financial market, in the host country's currency, by a foreign borrower.

In contrast, a **foreign bond** is issued in a host country's financial market, in the host country's currency, by a foreign borrower. A Swiss-franc–denominated bond issued in Switzerland by a U.S. company is an example of a foreign bond. The three largest foreign-bond markets are Japan, Switzerland, and the United States.

Review Questions

6–6 What are typical maturities, denominations, and interest payments of a corporate bond? What mechanisms protect bondholders?

6–7 Differentiate between *standard debt provisions* and *restrictive covenants* included in a bond indenture. What are the consequences of violation of them by the bond issuer?

6–8 How is the cost of bond financing typically related to the cost of short-term borrowing? In addition to a bond's maturity, what other major factors affect its cost to the issuer?

6–9 What is a *conversion feature?* A *call feature? Stock purchase warrants?*

6–10 What information is found in a bond *quotation?* How are bonds rated, and why?

6–11 Compare the basic characteristics of *Eurobonds* and *foreign bonds.*

LG4 6.3 Valuation Fundamentals

valuation
The process that links risk and return to determine the worth of an asset.

Valuation is the process that links risk and return to determine the worth of an asset. It is a relatively simple process that can be applied to *expected* streams of benefits from bonds, stocks, income properties, oil wells, and so on. To determine an asset's worth at a given point in time, a financial manager uses the time-value-of-money techniques presented in Chapter 4 and the concepts of risk and return developed in Chapter 5.

Key Inputs

There are three key inputs to the valuation process: (1) cash flows (returns), (2) timing, and (3) a measure of risk, which determines the required return. Each is described below.

Cash Flows (Returns)

The value of any asset depends on the cash flow(s) it is *expected* to provide over the ownership period. To have value, an asset does not have to provide an annual cash flow; it can provide an intermittent cash flow or even a single cash flow over the period.

EXAMPLE

Celia Sargent, financial analyst for Groton Corporation, a diversified holding company, wishes to estimate the value of three of its assets: common stock in Michaels Enterprises, an interest in an oil well, and an original painting by a well-known artist. Her cash flow estimates for each are as follows:

Stock in Michaels Enterprises *Expect* to receive cash dividends of $300 per year indefinitely.

Oil well *Expect* to receive cash flow of $2,000 at the end of year 1, $4,000 at the end of year 2, and $10,000 at the end of year 4, when the well is to be sold.

Original painting *Expect* to be able to sell the painting in 5 years for $85,000.

With these cash flow estimates, Celia has taken the first step toward placing a value on each of the assets.

Timing

In addition to making cash flow estimates, we must know the timing of the cash flows.[10] For example, Celia expects the cash flows of $2,000, $4,000, and $10,000 for the oil well to occur at the ends of years 1, 2, and 4, respectively. The combination of the cash flow and its timing fully defines the return expected from the asset.

Risk and Required Return

Hint The required rate of return is the result of investors being risk-averse. In order for the risk-averse investor to purchase a given asset, the investor ***must expect*** at least enough return to compensate for the asset's perceived risk.

The level of risk associated with a given cash flow can significantly affect its value. In general, the greater the risk of (or the less certain) a cash flow, the lower its value. Greater risk can be incorporated into a valuation analysis by using a higher required return or discount rate. As in the previous chapter, the higher the risk, the greater the required return, and the lower the risk, the less the required return.

EXAMPLE

Let's return to Celia Sargent's task of placing a value on Groton Corporation's original painting and consider two scenarios.

Scenario 1—Certainty A major art gallery has contracted to buy the painting for $85,000 at the end of 5 years. Because this is considered a certain situation, Celia views this asset as "money in the bank." She thus would use the prevailing risk-free rate of 9% as the required return when calculating the value of the painting.

Scenario 2—High Risk The values of original paintings by this artist have fluctuated widely over the past 10 years. Although Celia expects to be able to get $85,000 for the painting, she realizes that its sale price in 5 years could range between $30,000 and $140,000. Because of the high uncertainty surrounding the painting's value, Celia believes that a 15% required return is appropriate.

These two estimates of the appropriate required return illustrate how this rate captures risk. The often subjective nature of such estimates is also clear.

The Basic Valuation Model

Simply stated, the value of any asset is *the present value of all future cash flows it is expected to provide over the relevant time period.* The time period can be any length, even infinity. The value of an asset is therefore determined by discounting the expected cash flows back to their present value, using the required return commensurate with the asset's risk as the appropriate discount rate. Utilizing the present value techniques explained in Chapter 4, we can express the value of any asset at time zero, V_0, as

$$V_0 = \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k^2)} + \cdots + \frac{CF_n}{(1+k)^n} \tag{6.5}$$

10. Although cash flows can occur at any time during a year, for computational convenience as well as custom, we will assume they occur at the *end of the year* unless otherwise noted.

TABLE 6.5 Valuation of Groton Corporation's Assets by Celia Sargent

Asset	Cash flow, *CF*	Appropriate required return	Valuation[a]
Michaels Enterprises stock[b]	\$300/year indefinitely	12%	$V_0 = \$300 \times (PVIFA_{12\%,\infty})$ $= \$300 \times \frac{1}{0.12} = \underline{\underline{\$2,500}}$
Oil well[c]	**Year (*t*)** / **CF_t** 1 / \$ 2,000 2 / 4,000 3 / 0 4 / 10,000	20%	$V_0 = [\$2,000 \times (PVIF_{20\%,1})]$ $+ [\$4,000 \times (PVIF_{20\%,2})]$ $+ [\$0 \times (PVIF_{20\%,3})]$ $+ [\$10,000 \times (PVIF_{20\%,4})]$ $= [\$2,000 \times (0.833)]$ $+ [\$4,000 \times (0.694)]$ $+ [\$0 \times (0.579)]$ $+ [\$10,000 \times (0.482)]$ $= \$1,666 + \$2,776$ $+ \$0 + \$4,820$ $= \underline{\underline{\$9,262}}$
Original painting[d]	\$85,000 at end of year 5	15%	$V_0 = \$85,000 \times (PVIF_{15\%,5})$ $= \$85,000 \times (0.497)$ $= \underline{\underline{\$42,245}}$

[a]Based on *PVIF* interest factors from Table A–2. If calculated using a calculator, the values of the oil well and original painting would have been \$9,266.98 and \$42,260.03, respectively.
[b]This is a perpetuity (infinite-lived annuity), and therefore the present value interest factor given in Equation 4.19 is applied.
[c]This is a mixed stream of cash flows and therefore requires a number of *PVIF*s, as noted.
[d]This is a single-amount cash flow and therefore requires a single *PVIF*.

where

V_0 = value of the asset at time zero
CF_t = cash flow *expected* at the end of year t
k = appropriate required return (discount rate)
n = relevant time period

Using present value interest factor notation, $PVIF_{k,n}$ from Chapter 4, Equation 6.5 can be rewritten as

$$V_0 = [CF_1 \times (PVIF_{k,1})] + [CF_2 \times (PVIF_{k,2})] + \cdots + [CF_n \times (PVIF_{k,n})] \quad (6.6)$$

We can use Equation 6.6 to determine the value of any asset.

EXAMPLE Celia Sargent used Equation 6.6 to calculate the value of each asset (using present value interest factors from Table A–2), as shown in Table 6.5. Michaels Enterprises stock has a value of \$2,500, the oil well's value is \$9,262, and the original painting has a value of \$42,245. Note that regardless of the pattern of the expected cash flow from an asset, the basic valuation equation can be used to determine its value.

Review Questions

6–12 Why is it important for financial managers to understand the valuation process?

6–13 What are the three key inputs to the valuation process?

6–14 Does the valuation process apply only to assets that provide an annual cash flow? Explain.

6–15 Define and specify the general equation for the value of any asset, V_0.

LG5 LG6 6.4 Bond Valuation

The basic valuation equation can be customized for use in valuing specific securities: bonds, common stock, and preferred stock. Bond valuation is described in this chapter, and valuation of common stock and preferred stock is discussed in Chapter 7.

Bond Fundamentals

Hint A bondholder receives two cash flows from a bond if it is held to maturity—interest and the bond's face value. For valuation purposes, the interest is an annuity and the face value is a single payment received at a specified future date.

As noted earlier in this chapter, *bonds* are long-term debt instruments used by business and government to raise large sums of money, typically from a diverse group of lenders. Most corporate bonds pay interest *semiannually* (every 6 months) at a stated *coupon interest rate,* have an initial *maturity* of 10 to 30 years, and have a *par value,* or *face value,* of $1,000 that must be repaid at maturity.[11]

EXAMPLE Mills Company, a large defense contractor, on January 1, 2004, issued a 10% coupon interest rate, 10-year bond with a $1,000 par value that pays interest semiannually. Investors who buy this bond receive the contractual right to two cash flows: (1) $100 annual interest (10% coupon interest rate × $1,000 par value) distributed as $50 (1/2 × $100) at the end of each 6 months, and (2) the $1,000 par value at the end of the tenth year.

We will use data for Mills's bond issue to look at basic bond valuation.

Basic Bond Valuation

The value of a bond is the present value of the payments its issuer is contractually obligated to make, from the current time until it matures. The basic model for the value, B_0, of a bond is given by Equation 6.7:

$$B_0 = I \times \left[\sum_{t=1}^{n} \frac{1}{(1+k_d)^t}\right] + M \times \left[\frac{1}{(1+k_d)^n}\right] \tag{6.7}$$

$$= I \times (PVIFA_{k_d,n}) + M \times (PVIF_{k_d,n}) \tag{6.7a}$$

11. Bonds often have features that allow them to be retired by the issuer prior to maturity; these *conversion* and *call* features were presented earlier in this chapter. For the purpose of the current discussion, these features are ignored.

where

B_0 = value of the bond at time zero
I = *annual* interest paid in dollars[12]
n = number of years to maturity
M = par value in dollars
k_d = required return on a bond

We can calculate bond value using Equation 6.7a and the appropriate financial tables (A–2 and A–4) or by using a financial calculator.

EXAMPLE

Assuming that interest on the Mills Company bond issue is paid annually and that the required return is equal to the bond's coupon interest rate, $I = \$100$, $k_d = 10\%$, $M = \$1{,}000$, and $n = 10$ years.

The computations involved in finding the bond value are depicted graphically on the following time line.

Time line for bond valuation (Mills Company's 10% coupon interest rate, 10-year maturity, $1,000 par, January 1, 2004, issue paying annual interest; required return = 10%)

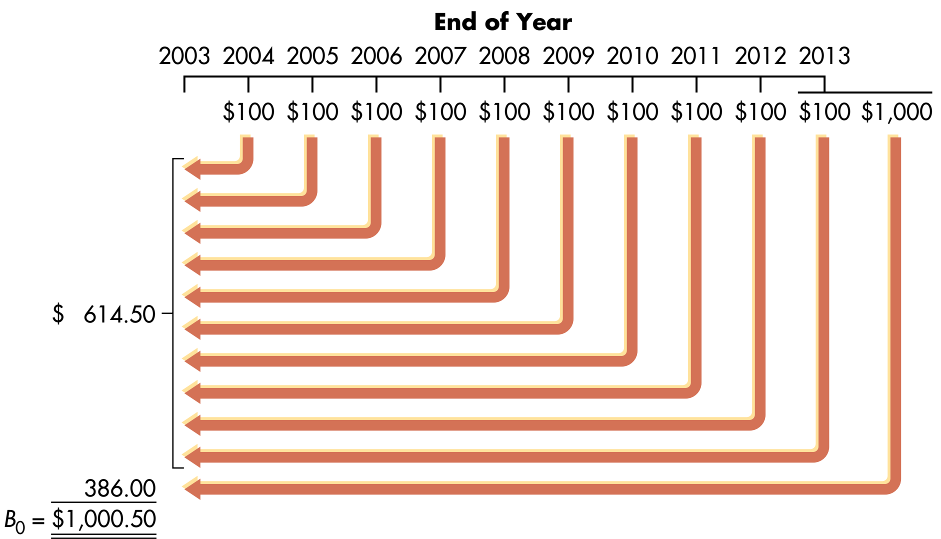


Table Use Substituting the values noted above into Equation 6.7a yields

$$B_0 = \$100 \times (PVIFA_{10\%,10\text{yrs}}) + \$1{,}000 \times (PVIF_{10\%,10\text{yrs}})$$
$$= \$100 \times (6.145) + \$1{,}000 \times (0.386)$$
$$= \$614.50 + \$386.00 = \underline{\underline{\$1{,}000.50}}$$

The bond therefore has a value of approximately $1,000.[13]

12. The payment of annual rather than semiannual bond interest is assumed throughout the following discussion. This assumption simplifies the calculations involved, while maintaining the conceptual accuracy of the valuation procedures presented.

13. Note that a slight rounding error ($0.50) results here from the use of the table factors, which are rounded to the nearest thousandth.

Input	Function
10	N
10	I
100	PMT
1000	FV
	CPT
	PV

Solution
1000

Calculator Use Using the Mills Company's inputs shown at the left, you should find the bond value to be exactly $1,000. Note that *the calculated bond value is equal to its par value; this will always be the case when the required return is equal to the coupon interest rate.*[14]

Bond Value Behavior

In practice, the value of a bond in the marketplace is rarely equal to its par value. In bond quotations (see Figure 6.4), the closing prices of bonds often differ from their par values of 100 (100 percent of par). Some bonds are valued below par (quoted below 100), and others are valued above par (quoted above 100). A variety of forces in the economy, as well as the passage of time, tend to affect value. Although these external forces are in no way controlled by bond issuers or investors, it is useful to understand the impact that required return and time to maturity have on bond value.

Required Returns and Bond Values

Whenever the required return on a bond differs from the bond's coupon interest rate, the bond's value will differ from its par value. The required return is likely to differ from the coupon interest rate because either (1) economic conditions have changed, causing a shift in the basic cost of long-term funds, or (2) the firm's risk has changed. Increases in the basic cost of long-term funds or in risk will raise the required return; decreases in the cost of funds or in risk will lower the required return.

discount
The amount by which a bond sells at a value that is less than its par value.

premium
The amount by which a bond sells at a value that is greater than its par value.

Regardless of the exact cause, what is important is the relationship between the required return and the coupon interest rate: When the required return is greater than the coupon interest rate, the bond value, B_0, will be less than its par value, M. In this case, the bond is said to sell at a **discount,** which will equal $M - B_0$. When the required return falls below the coupon interest rate, the bond value will be greater than par. In this situation, the bond is said to sell at a **premium,** which will equal $B_0 - M$.

EXAMPLE The preceding example showed that when the required return equaled the coupon interest rate, the bond's value equaled its $1,000 par value. If for the same bond the required return were to rise or fall, its value would be found as follows (using Equation 6.7a):

Table Use

Required Return = 12%

$$B_0 = \$100 \times (PVIFA_{12\%,10\text{yrs}}) + \$1{,}000 \times (PVIF_{12\%,10\text{yrs}}) = \underline{\underline{\$887.00}}$$

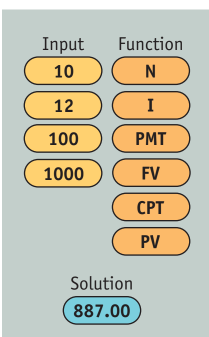
Required Return = 8%

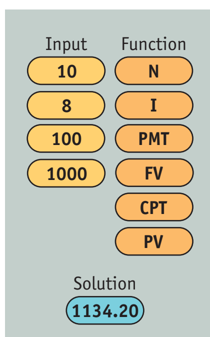
$$B_0 = \$100 \times (PVIFA_{8\%,10\text{yrs}}) + \$1{,}000 \times (PVIF_{8\%,10\text{yrs}}) = \underline{\underline{\$1{,}134.00}}$$

14. Note that because bonds pay interest in arrears, the prices at which they are quoted and traded reflect their value *plus* any accrued interest. For example, a $1,000 par value, 10% coupon bond paying interest semiannually and having a calculated value of $900 would pay interest of $50 at the end of each 6-month period. If it is now 3 months since the beginning of the interest period, three-sixths of the $50 interest, or $25 (i.e., 3/6 × $50), would be accrued. The bond would therefore be quoted at $925—its $900 value plus the $25 in accrued interest. For convenience, *throughout this book, bond values will always be assumed to be calculated at the beginning of the interest period,* thereby avoiding the need to consider accrued interest.

TABLE 6.6 Bond Values for Various Required Returns (Mills Company's 10% Coupon Interest Rate, 10-Year Maturity, $1,000 Par, January 1, 2004, Issue Paying Annual Interest)

Required return, k_d	Bond value, B_0	Status
12%	$ 887.00	Discount
10	1,000.00	Par value
8	1,134.00	Premium



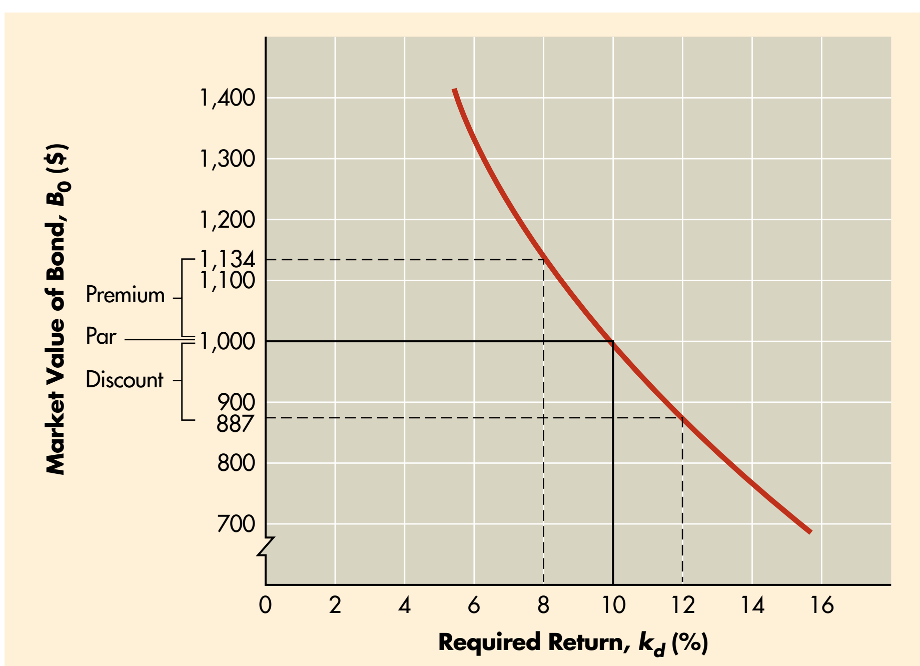


Calculator Use Using the inputs shown at the left for the two different required returns, you will find the value of the bond to be below or above par. At a 12% required return, the bond would sell at a *discount* of $113.00 ($1,000 par value − $887.00 value). At the 8% required return, the bond would sell for a *premium* of about $134.00 ($1,134.00 value − $1,000 par value). The results of this and earlier calculations for Mills Company's bond values are summarized in Table 6.6 and graphically depicted in Figure 6.5. The inverse relationship between bond value and required return is clearly shown in the figure.

FIGURE 6.5

Bond Values and Required Returns

Bond values and required returns (Mills Company's 10% coupon interest rate, 10-year maturity, $1,000 par, January 1, 2004, issue paying annual interest)



Time to Maturity and Bond Values

Whenever the required return is different from the coupon interest rate, the amount of time to maturity affects bond value. An additional factor is whether required returns are constant or changing over the life of the bond.

Constant Required Returns When the required return is different from the coupon interest rate and is assumed to be *constant until maturity,* the value of the bond will approach its par value as the passage of time moves the bond's value closer to maturity. (Of course, when the required return *equals* the coupon interest rate, the bond's value will remain at par until it matures.)

EXAMPLE

Figure 6.6 depicts the behavior of the bond values calculated earlier and presented in Table 6.6 for Mills Company's 10% coupon interest rate bond paying annual interest and having 10 years to maturity. Each of the three required returns—12%, 10%, and 8%—is assumed to remain constant over the 10 years to the bond's maturity. The bond's value at both 12% and 8% approaches and ultimately equals the bond's $1,000 par value at its maturity, as the discount (at 12%) or premium (at 8%) declines with the passage of time.

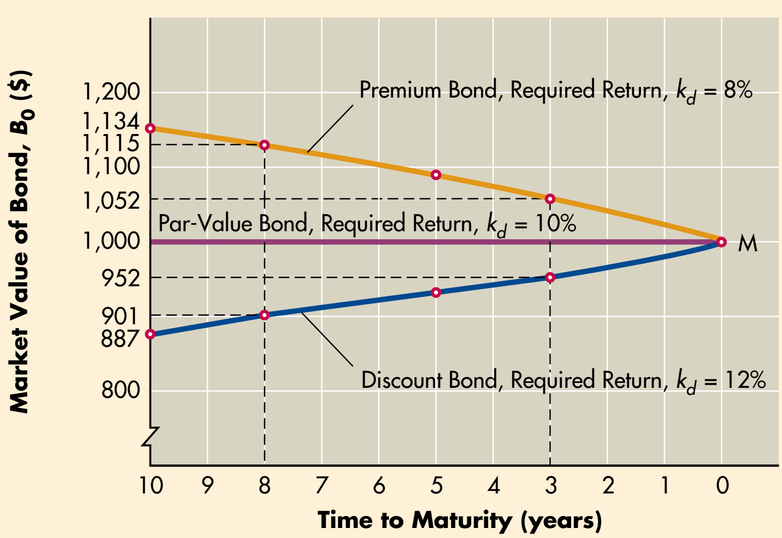
interest rate risk
The chance that interest rates will change and thereby change the required return and bond value. Rising rates, which result in decreasing bond values, are of greatest concern.

Changing Required Returns The chance that interest rates will change and thereby change the required return and bond value is called **interest rate risk.** (This was described as a shareholder-specific risk in Chapter 5, Table 5.1.) Bondholders are typically more concerned with rising interest rates because a rise in interest rates, and therefore in the required return, causes a decrease in bond value. The shorter the amount of time until a bond's maturity, the less responsive

FIGURE 6.6

Time to Maturity and Bond Values

Relationship among time to maturity, required returns, and bond values (Mills Company's 10% coupon interest rate, 10-year maturity, $1,000 par, January 1, 2004, issue paying annual interest)



In Practice

FOCUS ON PRACTICE The Value of a Zero

Many investors buy bonds to get a steady stream of interest payments. So why would anyone buy a zero-coupon bond, which doesn't offer that stream of cash flows? One reason is the cost of "zeros." Because they pay no interest, zeros sell at a deep discount from par value: A $1,000, 30-year government agency zero-coupon bond might cost about $175. At maturity, the investor receives the $1,000 par value. The difference between the price of the bond and its par value is the return to the investor. Stated as an annual yield, the return reflects the compounding of interest, just as though the issuer had paid interest during bond term. In this example, the bond yields 6 percent.

Even though a corporate issuer of a zero-coupon bond makes no cash interest payments, for tax purposes it can take an interest deduction. To calculate the annual implicit interest expense, the issuer must first determine the bond's value at the beginning of each year by using the formula $M/(1 + k_d)^n$, where M = the par value in dollars, k_d = the required return, and n = the number of years to maturity. The difference in the bond's value from year to year is the implicit interest.

Assume that a corporation issues a 5-year zero-coupon bond with a $1,000 par value and a required yield of 6.5 percent. Applying the above formula, we discover that the initial price of this bond is $729.88 [$1,000/(1 + 0.065)^5 = $1,000/1.3700867]. Total implicit interest over the 5 years is $270.12 ($1,000 – $729.88). The following table uses the formula to calculate the bond's value at the end of each year and the implicit interest expense that the corporation can deduct each year.

Sources: Adapted from Hope Hamashige, "More than Zero," *Los Angeles Times* (September 16, 1997), p. D-6; Donald Jay Korn, "Getting Something for Nothing," *Black Enterprise* (April 2000), downloaded from *www.findarticles.com;* "Putting Compound Interest to Work Through Zero Coupon Bonds," The Bond Market Association, PR Newswire (June 24, 1998), downloaded from *www.ask.elibrary.com*.

Year	Beginning value	Ending value	Implicit Interest Expense
1	$729.88	$ 777.32	$ 47.44
2	777.32	827.84	50.52
3	827.84	881.66	53.82
4	881.66	938.97	57.31
5	938.97	1,000.00	61.03
		Total	$270.12

is its market value to a given change in the required return. In other words, short maturities have less interest rate risk than long maturities when all other features (coupon interest rate, par value, and interest payment frequency) are the same. This is because of the mathematics of time value; the present values of short-term cash flows change far less than the present values of longer-term cash flows in response to a given change in the discount rate (required return).

EXAMPLE The effect of changing required returns on bonds of differing maturity can be illustrated by using Mills Company's bond and Figure 6.6. If the required return rises from 10% to 12% (see the dashed line at 8 years), the bond's value decreases from $1,000 to $901—a 9.9% decrease. If the same change in required return had occurred with only 3 years to maturity (see the dashed line at 3 years), the bond's value would have dropped to just $952—only a 4.8% decrease. Similar types of responses can be seen for the change in bond value associated with decreases in required returns. The shorter the time to maturity, the less the impact on bond value caused by a given change in the required return.

Yield to Maturity (YTM)

yield to maturity (YTM)
The rate of return that investors earn if they buy a bond at a specific price and hold it until maturity. (Assumes that the issuer makes all scheduled interest and principal payments as promised.)

When investors evaluate bonds, they commonly consider **yield to maturity (YTM).** This is the rate of return that investors earn if they buy the bond at a specific price and hold it until maturity. (The measure assumes, of course, that the issuer makes all scheduled interest and principal payments as promised.) The yield to maturity on a bond with a current price equal to its par value (that is, $B_0 = M$) will always equal the coupon interest rate. When the bond value differs from par, the yield to maturity will differ from the coupon interest rate.

Assuming that interest is paid annually, the yield to maturity on a bond can be found by solving Equation 6.7 for k_d. In other words, the current value, the annual interest, the par value, and the years to maturity are known, and the required return must be found. The required return is the bond's yield to maturity. The YTM can be found by trial and error or by use of a financial calculator. The calculator provides accurate YTM values with minimum effort.

EXAMPLE

The Mills Company bond, which currently sells for $1,080, has a 10% coupon interest rate and $1,000 par value, pays interest annually, and has 10 years to maturity. Because $B_0 = \$1{,}080$, $I = \$100$ $(0.10 \times \$1{,}000)$, $M = \$1{,}000$, and $n = 10$ years, substituting into Equation 6.7a yields

$$\$1{,}080 = \$100 \times (PVIFA_{k_d,10\text{yrs}}) + \$1{,}000 \times (PVIF_{k_d,10\text{yrs}})$$

Our objective is to solve the equation for k_d, the YTM.

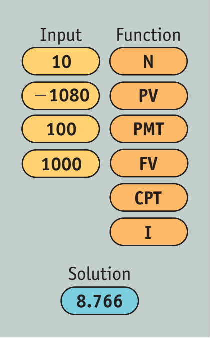
Trial and Error Because we know that a required return, k_d, of 10% (which equals the bond's 10% coupon interest rate) would result in a value of $1,000, the discount rate that would result in $1,080 must be less than 10%. (Remember that the lower the discount rate, the higher the present value, and the higher the discount rate, the lower the present value.) Trying 9%, we get

$$\begin{aligned}
&\$100 \times (PVIFA_{9\%,10\text{yrs}}) + \$1{,}000 \times (PVIF_{9\%,10\text{yrs}}) \\
&= \$100 \times (6.418) + \$1{,}000 \times (0.422) \\
&= \$641.80 + \$422.00 \\
&= \$1{,}063.80
\end{aligned}$$

Because the 9% rate is not quite low enough to bring the value up to $1,080, we next try 8% and get

$$\begin{aligned}
&\$100 \times (PVIFA_{8\%,10\text{yrs}}) + \$1{,}000 \times (PVIF_{8\%,10\text{yrs}}) \\
&= \$100 \times (6.710) + \$1{,}000 \times (0.463) \\
&= \$671.00 + \$463.00 \\
&= \$1{,}134.00
\end{aligned}$$

Because the value at the 8% rate is higher than $1,080 and the value at the 9% rate is lower than $1,080, the bond's yield to maturity must be between 8% and



9%. Because the \$1,063.80 is closer to \$1,080, the YTM to the nearest whole percent is 9%. (By using *interpolation,* we could eventually find the more precise YTM value to be 8.77%.)[15]

Calculator Use [*Note:* Most calculators require *either* the present value (B_0 in this case) or the future values (I and M in this case) to be input as negative numbers to calculate yield to maturity. That approach is employed here.] Using the inputs shown at the left, you should find the YTM to be 8.766%.

Semiannual Interest and Bond Values

The procedure used to value bonds paying interest semiannually is similar to that shown in Chapter 4 for compounding interest more frequently than annually, except that here we need to find present value instead of future value. It involves

1. Converting annual interest, I, to semiannual interest by dividing I by 2.
2. Converting the number of years to maturity, n, to the number of 6-month periods to maturity by multiplying n by 2.
3. Converting the required stated (rather than effective)[16] annual return for similar-risk bonds that also pay semiannual interest from an annual rate, k_d, to a semiannual rate by dividing k_d by 2.

Substituting these three changes into Equation 6.7 yields

$$B_0 = \frac{I}{2} \times \left[\sum_{i=1}^{2n} \frac{1}{\left(1 + \frac{k_d}{2}\right)^t} \right] + M \times \left[\frac{1}{\left(1 + \frac{k_d}{2}\right)^{2n}} \right] \qquad (6.8)^{17}$$

15. For information on how to interpolate to get a more precise answer, see the book's home page at www.aw.com/gitman

16. As we noted in Chapter 4, the effective annual rate of interest, EAR, for stated interest rate i, when interest is paid semiannually ($m = 2$), can be found by using Equation 4.23:

$$\text{EAR} = \left(1 + \frac{i}{2}\right)^2 - 1$$

For example, a bond with a 12% required stated return, k_d, that pays semiannual interest would have an effective annual rate of

$$\text{EAR} = \left(1 + \frac{0.12}{2}\right)^2 - 1 = (1.06)^2 - 1 = 1.1236 - 1 = 0.1236 = \underline{\underline{12.36}}\%$$

Because most bonds pay semiannual interest at semiannual rates equal to 50% of the stated annual rate, their effective annual rates are generally higher than their stated annual rates.

17. Although it may appear inappropriate to use the semiannual discounting procedure on the maturity value, M, this technique is necessary to find the correct bond value. One way to confirm the accuracy of this approach is to calculate the bond value for the case where the required stated annual return and coupon interest rate are equal; for B_0 to equal M, as would be expected in such a case, the maturity value must be discounted on a semiannual basis.

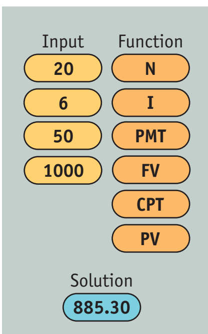
$$= \frac{I}{2} \times (PVIFA_{k_d/2,2n}) + M \times (PVIF_{k_d/2,2n}) \quad (6.8a)$$

EXAMPLE Assuming that the Mills Company bond pays interest semiannually and that the required stated annual return, k_d, is 12% for similar-risk bonds that also pay semiannual interest, substituting these values into Equation 6.8a yields

$$B_0 = \frac{\$100}{2} \times (PVIFA_{12\%/2,2\times10\text{yrs}}) + \$1{,}000 \times (PVIF_{12\%/2,2\times10\text{yrs}})$$

Table Use

$$B_0 = \$50 \times (PVIFA_{6\%,20\text{periods}}) + \$1{,}000 \times (PVIF_{6\%,20\text{periods}})$$
$$= \$50 \times (11.470) + \$1{,}000 \times (0.312) = \underline{\underline{\$885.50}}$$



Calculator Use In using a calculator to find bond value when interest is paid semiannually, we must double the number of periods and divide both the required stated annual return and the annual interest by 2. For the Mills Company bond, we would use 20 periods (2 × 10 years), a required return of 6% (12% ÷ 2), and an interest payment of \$50 (\$100 ÷ 2). Using these inputs, you should find the bond value with semiannual interest to be \$885.30, as shown at the left. Note that this value is more precise than the value calculated using the rounded financial-table factors.

Comparing this result with the \$887.00 value found earlier for annual compounding (see Table 6.6), we can see that the bond's value is lower when semiannual interest is paid. *This will always occur when the bond sells at a discount.* For bonds selling at a premium, the opposite will occur: The value with semiannual interest will be greater than with annual interest.

Review Questions

6–16 What basic procedure is used to value a bond that pays annual interest? Semiannual interest?

6–17 What relationship between the required return and the coupon interest rate will cause a bond to sell at a *discount?* At a *premium?* At its *par value?*

6–18 If the required return on a bond differs from its coupon interest rate, describe the behavior of the bond value over time as the bond moves toward maturity.

6–19 As a risk-averse investor, would you prefer bonds with short or long periods until maturity? Why?

6–20 What is a bond's *yield to maturity (YTM)?* Briefly describe both the trial-and-error approach and the use of a financial calculator for finding YTM.

Summary

FOCUS ON VALUE

Interest rates and required returns embody the real cost of money, inflationary expectations, and issuer and issue risk. They reflect the level of return required by market participants as compensation for the risk perceived in a specific security or asset investment. Because these returns are affected by economic expectations, they vary as a function of time, typically rising for longer-term maturities or transactions. The yield curve reflects such market expectations at any point in time.

The value of an asset can be found by calculating the present value of its expected cash flows, using the required return as the discount rate. Bonds are the easiest financial assets to value, because both the amounts and the timing of their cash flows are contractual and therefore known with certainty. The financial manager needs to understand how to apply valuation techniques to bonds, stocks, and tangible assets (as will be demonstrated in the following chapters) in order to make decisions that are consistent with the firm's **share price maximization goal.**

REVIEW OF LEARNING GOALS

LG1 **Describe interest rate fundamentals, the term structure of interest rates, and risk premiums.** The flow of funds between savers (suppliers) and investors (demanders) is regulated by the interest rate or required return. In a perfect, inflation-free, certain world there would be one cost of money—the real rate of interest. The nominal or actual interest rate is the sum of the risk-free rate, which is the sum of the real rate of interest and the inflationary expectation premium, and a risk premium reflecting issuer and issue characteristics. For any class of similar-risk securities, the term structure of interest rates reflects the relationship between the interest rate, or rate of return, and the time to maturity. Yield curves can be downward-sloping (inverted), upward-sloping (normal), or flat. Three theories—expectations theory, liquidity preference theory, and market segmentation theory—are cited to explain the general shape of the yield curve. Risk premiums for non-Treasury debt issues result from interest rate risk, liquidity risk, tax risk, default risk, maturity risk, and contractual provision risk.

LG2 **Review the legal aspects of bond financing and bond cost.** Corporate bonds are long-term debt instruments indicating that a corporation has borrowed an amount that it promises to repay in the future under clearly defined terms. Most bonds are issued with maturities of 10 to 30 years and a par value of $1,000. The bond indenture, enforced by a trustee, states all conditions of the bond issue. It contains both standard debt provisions and restrictive covenants, which may include a sinking-fund requirement and/or a security interest. The cost of bonds to an issuer depends on its maturity, offering size, and issuer risk and on the basic cost of money.

LG3 **Discuss the general features, quotations, ratings, popular types, and international issues of corporate bonds.** A bond issue may include a conversion feature, a call feature, or stock purchase warrants. Bond quotations, published regularly in the financial press, provide information on bonds, including current price data and statistics on recent price behavior. Bond ratings by independent agencies indicate the risk of a bond issue. Various types of traditional and contemporary bonds are available. Eurobonds and foreign bonds enable established creditworthy companies and governments to borrow large amounts internationally.

LG4 **Understand the key inputs and basic model used in the valuation process.** Key inputs to the valuation process include cash flows (returns), timing, and risk and the required return. The value of any asset is equal to the present value of all future cash flows it is *expected* to provide over the relevant time period. The basic valuation formula for any asset is summarized in Table 6.7.

LG5 **Apply the basic valuation model to bonds and describe the impact of required return and time to maturity on bond values.** The value of a bond is the present value of its interest payments plus the present value of its par value. The basic valuation model for a bond is summarized in Table 6.7. The discount rate used to determine bond value is the required return, which may differ from the bond's coupon interest rate. A bond can sell at a discount, at par, or at a premium, depending on whether the required return is greater than, equal to, or less than its coupon interest rate. The amount of time to maturity affects bond values. Even if the required return remains constant, the value of a bond will approach its par value as the bond moves closer to maturity. The chance that interest rates will change and thereby change the required return and bond value is called interest rate risk. The shorter the amount of time until a bond's maturity, the less responsive is its market value to a given change in the required return.

LG6 **Explain yield to maturity (YTM), its calculation, and the procedure used to value bonds that pay interest semiannually.** Yield to maturity (YTM) is the rate of return investors earn if they buy a bond at a specific price and hold it until maturity. YTM can be calculated by trial and error or financial calculator. Bonds that pay interest semiannually are valued by using the same procedure used to value bonds paying annual interest, except that the interest payments are one-half of the annual interest payments, the number of periods is twice the number of years to maturity, and the required return is one-half of the stated annual required return on similar-risk bonds.

SELF-TEST PROBLEMS (Solutions in Appendix B)

LG5 LG6

ST 6–1 Bond valuation Lahey Industries has outstanding a $1,000 par-value bond with an 8% coupon interest rate. The bond has 12 years remaining to its maturity date.

a. If interest is paid *annually,* find the value of the bond when the required return is (1) 7%, (2) 8%, and (3) 10%?

b. Indicate for each case in part **a** whether the bond is selling at a discount, at a premium, or at its par value.

c. Using the 10% required return, find the bond's value when interest is paid *semiannually.*

LG6

ST 6–2 Yield to maturity Elliot Enterprises' bonds currently sell for $1,150, have an 11% coupon interest rate and a $1,000 par value, pay interest *annually,* and have 18 years to maturity.

a. Calculate the bonds' yield to maturity (YTM).

b. Compare the YTM calculated in part **a** to the bonds' coupon interest rate, and use a comparison of the bonds' current price and their par value to explain this difference.

TABLE 6.7 Summary of Key Valuation Definitions and Formulas for Any Asset and for Bonds

Definitions of variables

B_0 = bond value
CF_t = cash flow *expected* at the end of year t
I = annual interest on a bond
k = appropriate required return (discount rate)
k_d = required return on a bond
M = par, or face, value of a bond
n = relevant time period, or number of years to maturity
V_0 = value of the asset at time zero

Valuation formulas

Value of any asset:

$$V_0 = \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \cdots + \frac{CF_n}{(1+k)^n} \qquad \text{[Eq. 6.5]}$$

$$= [CF_1 \times (PVIF_{k,1})] + [CF_2 \times (PVIF_{k,2})] + \cdots + [CF_n \times (PVIF_{k,n})] \qquad \text{[Eq. 6.6]}$$

Bond value:

$$B_0 = I \times \left[\sum_{t=1}^{n} \frac{1}{(1+k_d)^t}\right] + M \times \left[\frac{1}{(1+k_d)^n}\right] \qquad \text{[Eq. 6.7]}$$

$$= I \times (PVIFA_{k_d,n}) + M \times (PVIF_{k_d,n}) \qquad \text{[Eq. 6.7a]}$$

PROBLEMS

LG1 **6–1 Interest rate fundamentals: The real rate of return** Carl Foster, a trainee at an investment banking firm, is trying to get an idea of what real rate of return investors are expecting in today's marketplace. He has looked up the rate paid on 3-month U.S. Treasury bills and found it to be 5.5%. He has decided to use the rate of change in the Consumer Price Index as a proxy for the inflationary expectations of investors. That annualized rate now stands at 3%. On the basis of the information that Carl has collected, what estimate can he make of the real rate of return?

LG1 **6–2 Real rate of interest** To estimate the real rate of interest, the economics division of Mountain Banks—a major bank holding company—has gathered the data summarized in the following table. Because there is a high likelihood that new tax legislation will be passed in the near future, current data as well as data reflecting the probable impact of passage of the legislation on the demand for funds are also included in the table. (*Note:* The proposed legislation will not have any impact on the supply schedule of funds. Assume a perfect world in which inflation is expected to be zero, funds suppliers and demanders have no liquidity preference, and all outcomes are certain.)

	Currently		With passage of tax legislation
Amount of funds supplied/demanded ($ billion)	Interest rate required by funds suppliers	Interest rate required by funds demanders	Interest rate required by funds demanders
$ 1	2%	7%	9%
5	3	6	8
10	4	4	7
20	6	3	6
50	7	2	4
100	9	1	3

a. Draw the supply curve and the demand curve for funds using the current data. (*Note:* Unlike the functions in Figure 6.1, the functions here will not appear as straight lines.)
b. Using your graph, label and note the real rate of interest using current data.
c. Add to the graph drawn in part **a** the new demand curve expected in the event that the proposed tax legislation becomes effective.
d. What is the new real rate of interest? Compare and analyze this finding in light of your analysis in part **b.**

LG1 **6–3 Real and nominal rates interest** Zane Perelli currently has $100 that he can spend today on polo shirts costing $25 each. Instead he could invest the $100 in a risk-free U.S. Treasury security that is expected to earn a 9% nominal rate of interest. The consensus forecast of leading economists is a 5% rate of inflation over the coming year.
a. How many polo shirts can Zane purchase today?
b. How much money will Zane have at the end of 1 year if he forgoes purchasing the polo shirts today?
c. How much would you expect the polo shirts to cost at the end of 1 year in light of the expected inflation?
d. Use your findings in parts **b** and **c** to determine how many polo shirts (fractions are OK) Zane can purchase at the end of 1 year. In percentage terms, how many more or fewer polo shirts can Zane buy at the end of 1 year?
e. What is Zane's real rate of return over the year? How is it related to the percentage change in Zane's buying power found in part **d**? Explain.

LG1 **6–4 Yield curve** A firm wishing to evaluate interest rate behavior has gathered yield data on five U.S. Treasury securities, each having a different maturity and all measured at the same point in time. The summarized data follow.

U.S. Treasury security	Time to maturity	Yield
A	1 year	12.6%
B	10 years	11.2
C	6 months	13.0
D	20 years	11.0
E	5 years	11.4

a. Draw the yield curve associated with these data.
b. Describe the resulting yield curve in part **a,** and explain the general expectations embodied in it.

LG1 **6–5 Nominal interest rates and yield curves** A recent study of inflationary expectations has revealed that the consensus among economic forecasters yields the following average annual rates of inflation expected over the periods noted. (*Note:* Assume that the risk that future interest rate movements will affect longer maturities more than shorter maturities is zero; that is, there is no *maturity risk*.)

Period	Average annual rate of inflation
3 months	5%
2 years	6
5 years	8
10 years	8.5
20 years	9

a. If the real rate of interest is currently 2.5%, find the nominal interest rate on each of the following U.S. Treasury issues: 20-year bond, 3-month bill, 2-year note, and 5-year bond.
b. If the real rate of interest suddenly dropped to 2% without any change in inflationary expectations, what effect, if any, would this have on your answers in part **a?** Explain.
c. Using your findings in part **a,** draw a yield curve for U.S. Treasury securities. Describe the general shape and expectations reflected by the curve.
d. What would a follower of the *liquidity preference theory* say about how the preferences of lenders and borrowers tend to affect the shape of the yield curve drawn in part **c?** Illustrate that effect by placing on your graph a dotted line that approximates the yield curve without the effect of liquidity preference.
e. What would a follower of the *market segmentation theory* say about the supply and demand for long-term loans versus the supply and demand for short-term loans given the yield curve constructed for part **c** of this problem?

LG1 **6–6 Nominal and real rates and yield curves** A firm wishing to evaluate interest rate behavior has gathered data on nominal rate of interest and on inflationary expectation for five U.S. Treasury securities, each having a different maturity and each measured at a different point in time during the year just ended. (*Note:* Assume that the risk that future interest rate movements will affect longer maturities more than shorter maturities is zero; that is, there is no *maturity risk*.) These data are summarized in the following table.

U.S. Treasury security	Point in time	Maturity	Nominal rate of interest	Inflationary expectation
A	Jan. 7	2 years	12.6%	9.5%
B	Mar. 12	10 years	11.2	8.2
C	May 30	6 months	13.0	10.0
D	Aug. 15	20 years	11.0	8.1
E	Dec. 30	5 years	11.4	8.3

a. Using the preceding data, find the real rate of interest at each point in time.
b. Describe the behavior of the real rate of interest over the year. What forces might be responsible for such behavior?
c. Draw the yield curve associated with these data, assuming that the nominal rates were measured at the same point in time.
d. Describe the resulting yield curve in part **c**, and explain the general expectations embodied in it.

LG1 **6–7 Term structure of interest rates** The following yield data for a number of highest quality corporate bonds existed at each of the three points in time noted.

	Yield		
Time to maturity (years)	5 years ago	2 years ago	Today
1	9.1%	14.6%	9.3%
3	9.2	12.8	9.8
5	9.3	12.2	10.9
10	9.5	10.9	12.6
15	9.4	10.7	12.7
20	9.3	10.5	12.9
30	9.4	10.5	13.5

a. On the same set of axes, draw the yield curve at each of the three given times.
b. Label each curve in part **a** with its general shape (downward-sloping, upward-sloping, flat).
c. Describe the general inflationary and interest rate expectation existing at each of the three times.

LG1 **6–8 Risk-free rate and risk premiums** The real rate of interest is currently 3%; the inflation expectation and risk premiums for a number of securities follow.

Security	Inflation expectation premium	Risk premium
A	6%	3%
B	9	2
C	8	2
D	5	4
E	11	1

a. Find the risk-free rate of interest, R_F, that is applicable to each security.
b. Although not noted, what factor must be the cause of the differing risk-free rates found in part **a?**
c. Find the nominal rate of interest for each security.

LG1 **6–9 Risk premiums** Eleanor Burns is attempting to find the nominal rate of interest for each of two securities—A and B—issued by different firms at the same point in time. She has gathered the following data:

Characteristic	Security A	Security B
Time to maturity	3 years	15 years
Inflation expectation premium	9.0%	7.0%
Risk premium for:		
Liquidity risk	1.0%	1.0%
Default risk	1.0%	2.0%
Maturity risk	0.5%	1.5%
Other risk	0.5%	1.5%

a. If the real rate of interest is currently 2%, find the risk-free rate of interest applicable to each security.
b. Find the total risk premium attributable to each security's issuer and issue characteristics.
c. Calculate the nominal rate of interest for each security. Compare and discuss your findings.

LG2 **6–10 Bond interest payments before and after taxes** Charter Corp. has issued 2,500 debentures with a total principal value of $2,500,000. The bonds have a coupon interest rate of 7%.
a. What dollar amount of interest per bond can an investor expect to receive each year from Charter Corp.?
b. What is Charter's total interest expense per year associated with this bond issue?
c. Assuming that Charter is in a 35% corporate tax bracket, what is the company's net after-tax interest cost associated with this bond issue?

LG3 **6–11 Bond quotation** Assume that the following quote for the Financial Management Corporation's $1,000-par-value bond was found in the Wednesday, November 8, issue of the *Wall Street Journal.*

Fin Mgmt 8.75 05 8.7 558 100.25 −0.63

Given this information, answer the following questions.
a. On what day did the trading activity occur?
b. At what price did the bond close at the end of the day on November 7?
c. In what year does the bond mature?
d. How many bonds were traded on the day quoted?
e. What is the bond's coupon interest rate?
f. What is the bond's *current yield?* Explain how this value was calculated.
g. How much of a change, if any, in the bond's closing price took place between the day quoted and the day before? At what price did the bond close on the day before?

LG4 **6–12 Valuation fundamentals** Imagine that you are trying to evaluate the economics of purchasing an automobile. You expect the car to provide annual after-tax cash benefits of $1,200 at the end of each year, and assume that you can sell the car for after-tax proceeds of $5,000 at the end of the planned 5-year ownership period. All funds for purchasing the car will be drawn from your savings, which are currently earning 6% after taxes.

a. Identify the cash flows, their timing, and the required return applicable to valuing the car.
b. What is the maximum price you would be willing to pay to acquire the car? Explain.

LG4 **6–13 Valuation of assets** Using the information provided in the following table, find the value of each asset.

	Cash flow		
Asset	End of year	Amount	Appropriate required return
A	1	$ 5,000	18%
	2	5,000	
	3	5,000	
B	1 through ∞	$ 300	15%
C	1	$ 0	16%
	2	0	
	3	0	
	4	0	
	5	35,000	
D	1 through 5	$ 1,500	12%
	6	8,500	
E	1	$ 2,000	14%
	2	3,000	
	3	5,000	
	4	7,000	
	5	4,000	
	6	1,000	

LG4 **6–14 Asset valuation and risk** Laura Drake wishes to estimate the value of an asset expected to provide cash inflows of $3,000 per year at the end of years 1 through 4 and $15,000 at the end of year 5. Her research indicates that she must earn 10% on low-risk assets, 15% on average-risk assets, and 22% on high-risk assets.
a. Determine what is the most Laura should pay for the asset if it is classified as (1) low-risk, (2) average-risk, and (3) high-risk.
b. Say Laura is unable to assess the risk of the asset and wants to be certain she's making a good deal. On the basis of your findings in part **a,** what is the most she should pay? Why?
c. All else being the same, what effect does increasing risk have on the value of an asset? Explain in light of your findings in part **a.**

LG5 **6–15 Basic bond valuation** Complex Systems has an outstanding issue of $1,000-par-value bonds with a 12% coupon interest rate. The issue pays interest *annually* and has 16 years remaining to its maturity date.
a. If bonds of similar risk are currently earning a 10% rate of return, how much should the Complex Systems bond sell for today?

b. Describe the *two* possible reasons why similar-risk bonds are currently earning a return below the coupon interest rate on the Complex Systems bond.
c. If the required return were at 12% instead of 10%, what would the current value of Complex Systems' bond be? Contrast this finding with your findings in part **a** and discuss.

LG5 **6–16 Bond valuation—Annual interest** Calculate the value of each of the bonds shown in the following table, all of which pay interest *annually*.

Bond	Par value	Coupon interest rate	Years to maturity	Required return
A	$1,000	14%	20	12%
B	1,000	8	16	8
C	100	10	8	13
D	500	16	13	18
E	1,000	12	10	10

LG5 **6–17 Bond value and changing required returns** Midland Utilities has outstanding a bond issue that will mature to its $1,000 par value in 12 years. The bond has a coupon interest rate of 11% and pays interest *annually*.
a. Find the value of the bond if the required return is (1) 11%, (2) 15%, and (3) 8%.
b. Plot your findings in part **a** on a set of "required return (x axis)–market value of bond (*y* axis)" axes.
c. Use your findings in parts **a** and **b** to discuss the relationship between the coupon interest rate on a bond and the required return and the market value of the bond relative to its par value.
d. What *two* possible reasons could cause the required return to differ from the coupon interest rate?

LG5 **6–18 Bond value and time—Constant required returns** Pecos Manufacturing has just issued a 15-year, 12% coupon interest rate, $1,000-par bond that pays interest *annually*. The required return is currently 14%, and the company is certain it will remain at 14% until the bond matures in 15 years.
a. Assuming that the required return does remain at 14% until maturity, find the value of the bond with (1) 15 years, (2) 12 years, (3) 9 years, (4) 6 years, (5) 3 years, and (6) 1 year to maturity.
b. Plot your findings on a set of "time to maturity (*x* axis)–market value of bond (*y* axis)" axes constructed similarly to Figure 6.6.
c. All else remaining the same, when the required return differs from the coupon interest rate and is assumed to be constant to maturity, what happens to the bond value as time moves toward maturity? Explain in light of the graph in part **b**.

LG5 **6–19 Bond value and time—Changing required returns** Lynn Parsons is considering investing in either of two outstanding bonds. The bonds both have $1,000 par values and 11% coupon interest rates and pay *annual* interest. Bond A has exactly 5 years to maturity, and bond B has 15 years to maturity.

a. Calculate the value of bond A if the required return is (1) 8%, (2) 11%, and (3) 14%.

b. Calculate the value of bond B if the required return is (1) 8%, (2) 11%, and (3) 14%.

c. From your findings in parts **a** and **b,** complete the following table, and discuss the relationship between time to maturity and changing required returns.

Required return	Value of bond A	Value of bond B
8%	?	?
11	?	?
14	?	?

d. If Lynn wanted to minimize *interest rate risk,* which bond should she purchase? Why?

LG6 **6–20 Yield to maturity** The relationship between a bond's yield to maturity and coupon interest rate can be used to predict its pricing level. For each of the bonds listed, state whether the price of the bond will be at a premium to par, at par, or at a discount to par.

Bond	Coupon interest rate	Yield to maturity	Price
A	6%	10%	________
B	8	8	________
C	9	7	________
D	7	9	________
E	12	10	________

LG6 **6–21 Yield to maturity** The Salem Company bond currently sells for $955, has a 12% coupon interest rate and a $1,000 par value, pays interest *annually,* and has 15 years to maturity.

a. Calculate the *yield to maturity* (*YTM*) on this bond.

b. Explain the relationship that exists between the coupon interest rate and yield to maturity and the par value and market value of a bond.

LG6 **6–22 Yield to maturity** Each of the bonds shown in the following table pays interest *annually*.

Bond	Par value	Coupon interest rate	Years to maturity	Current value
A	$1,000	9%	8	$ 820
B	1,000	12	16	1,000
C	500	12	12	560
D	1,000	15	10	1,120
E	1,000	5	3	900

a. Calculate the *yield to maturity* (*YTM*) for each bond.
b. What relationship exists between the coupon interest rate and yield to maturity and the par value and market value of a bond? Explain.

LG2 LG5 LG6

6–23 **Bond valuation and yield to maturity** Mark Goldsmith's broker has shown him two bonds. Each has a maturity of 5 years, a par value of $1,000, and a yield to maturity of 12%. Bond A has a coupon interest rate of 6% paid annually. Bond B has a coupon interest rate of 14% paid annually.
a. Calculate the selling price for each of the bonds.
b. Mark has $20,000 to invest. Judging on the basis of the price of the bonds, how many of either one could Mark purchase if he were to choose it over the other? (Mark cannot really purchase a fraction of a bond, but for purposes of this question, pretend that he can.)
c. Calculate the yearly interest income of each bond on the basis of its coupon rate and the number of bonds that Mark could buy with his $20,000.
d. Assume that Mark will reinvest the interest payments as they are paid (at the end of each year) and that his rate of return on the reinvestment is only 10%. For each bond, calculate the value of the principal payment plus the value of Mark's reinvestment account at the end of the 5 years.
e. Why are the two values calculated in part **d** different? If Mark were worried that he would earn less than the 12% yield to maturity on the reinvested interest payments, which of these two bonds would be a better choice?

LG6

6–24 **Bond valuation—Semiannual interest** Find the value of a bond maturing in 6 years, with a $1,000 par value and a coupon interest rate of 10% (5% paid semiannually) if the required return on similar-risk bonds is 14% annual interest (7% paid semiannually).

LG6

6–25 **Bond valuation—Semiannual interest** Calculate the value of each of the bonds shown in the following table, all of which pay interest *semiannually*.

Bond	Par value	Coupon interest rate	Years to maturity	Required stated annual return
A	$1,000	10%	12	8%
B	1,000	12	20	12
C	500	12	5	14
D	1,000	14	10	10
E	100	6	4	14

LG6

6–26 **Bond valuation—Quarterly interest** Calculate the value of a $5,000-par-value bond paying quarterly interest at an annual coupon interest rate of 10% and having 10 years until maturity if the required return on similar-risk bonds is currently a 12% annual rate paid *quarterly*.

CHAPTER 6 CASE Evaluating Annie Hegg's Proposed Investment in Atilier Industries Bonds

Annie Hegg has been considering investing in the bonds of Atilier Industries. The bonds were issued 5 years ago at their $1,000 par value and have exactly 25 years remaining until they mature. They have an 8% coupon interest rate, are convertible into 50 shares of common stock, and can be called any time at $1,080. The bond is rated Aa by Moody's. Atilier Industries, a manufacturer of sporting goods, recently acquired a small athletic-wear company that was in financial distress. As a result of the acquisition, Moody's and other rating agencies are considering a rating change for Atilier bonds. Recent economic data suggest that inflation, currently at 5% annually, is likely to increase to a 6% annual rate.

Annie remains interested in the Atilier bond but is concerned about inflation, a potential rating change, and maturity risk. In order to get a feel for the potential impact of these factors on the bond value, she decided to apply the valuation techniques she learned in her finance course.

Required

a. If price of the the common stock into which the bond is convertible rises to $30 per share after 5 years and the issuer calls the bonds at $1,080, should Annie let the bond be called away from her or should she convert it into common stock?

b. For each of the following required returns, calculate the bond's value, assuming annual interest. Indicate whether the bond will sell at a discount, at a premium, or at par value.
(1) Required return is 6%.
(2) Required return is 8%.
(3) Required return is 10%.

c. Repeat the calculations in part **b**, assuming that interest is paid *semiannually* and that the semiannual required returns are one-half of those shown. Compare and discuss differences between the bond values for each required return calculated here and in part **b** under the annual versus semiannual payment assumptions.

d. If Annie strongly believes that inflation will rise by 1% during the next 6 months, what is the most she should pay for the bond, assuming annual interest?

e. If the Atilier bonds are downrated by Moody's from Aa to A, and if such a rating change will result in an increase in the required return from 8% to 8.75%, what impact will this have on the bond value, assuming annual interest?

f. If Annie buys the bond today at its $1,000 par value and holds it for exactly 3 years, at which time the required return is 7%, how much of a gain or loss will she experience in the value of the bond (ignoring interest already received and assuming annual interest)?

g. Rework part **f,** assuming that Annie holds the bond for 10 years and sells it when the required return is 7%. Compare your finding to that in part **f,** and comment on the bond's *maturity risk*.

h. Assume that Annie buys the bond at its current closing price of 98.38 and holds it until maturity. What will her *yield to maturity* (*YTM*) be, assuming annual interest?

i. After evaluating all of the issues raised above, what recommendation would you give Annie with regard to her proposed investment in the Atilier Industries bonds?

WEB EXERCISE

Go to the Web site *www.smartmoney.com*. Click on **Economy & Bonds**. Then click on **Bond Calculator**, which is located down the page under the column **Bond Tools**. Read the instructions on how to use the bond calculator. Using the bond calculator:

1. Calculate the *yield to maturity* (*YTM*) for a bond whose coupon rate is 7.5% with maturity date of July 31, 2030, which you bought for 95.
2. What is the YTM of the above bond if you bought it for 105? For 100?
3. Change the yield % box to 8.5. What would be the price of this bond?
4. Change the yield % box to 9.5. What is this bond's price?
5. Change the maturity date to 2006 and reset yield % to 6.5. What is the price of this bond?
6. Why is the price of the bond in Question 5 higher than the price of the bond in Question 4?
7. Explore the other bond-related resources at the site. Using **Bond Market Update**, comment on current interest rate levels and the yield curve.

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.