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.

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**LEARNING GOALS**

1. Describe interest rate fundamentals, the term structure of interest rates, and risk premiums.
2. Review the legal aspects of bond financing and bond cost.
3. Discuss the general features, quotations, ratings, popular types, and international issues of corporate bonds.
4. Understand the key inputs and basic model used in the valuation process.
5. Apply the basic valuation model to bonds and describe the impact of required return and time to maturity on bond values.
6. Explain yield to maturity (YTM), its calculation, and the procedure used to value bonds that pay interest semiannually.
The interactions of suppliers and demanders of funds in the financial markets affect interest rates. The interest rates (returns) required by suppliers of funds also depend on the perceived risk of an asset. In this chapter, we apply the concepts of risk and return in a process called valuation. This chapter discusses interest rates, describes the key aspects of corporate bonds, and demonstrates the valuation process for the easiest financial asset to value, bonds.

**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.

**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. 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

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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.
money. The real rate of interest in the United States is assumed to be stable and equal to around 1 percent. 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 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.

### Inflation and the Cost of Money

Ignoring risk factors, the cost of funds—the interest rate or required return—is closely tied to inflationary expectations. This can be demonstrated by using the risk-free rate of interest, $R_F$, which was defined in Chapter 5 as the required return on the risk-free asset. The risk-free asset is typically considered to be a 3-month U.S. Treasury bill ($T$-bill), which is a short-term IOU issued regularly by the U.S. Treasury. 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. The historical data clearly illustrate the significant impact of inflation on the actual rate of interest for the risk-free asset.

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.
CHAPTER 6 Interest Rates and Bond Valuation

Inverted Yield Curve
An 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.
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** 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.

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** 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.\(^3\)

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** 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-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 add the element of risk, in order to assess what effect it has on the cost of funds. The amount by which the interest rate or required return exceeds the risk-free rate of interest, \(R_F\), is a security’s risk premium. The risk premium varies with specific issuer and issue characteristics. It causes securities that have similar maturities to have differing rates of interest.

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\(^3\) 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.
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 191, and the purely debt-specific risks—default risk, maturity risk, and contractual provision risk, briefly defined in Table 6.1. In general, 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.

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
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<tbody>
<tr>
<td>Default risk</td>
<td>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.</td>
</tr>
</tbody>
</table>
| 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.  

*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 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 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 191, and the purely debt-specific risks—default risk, maturity risk, and contractual provision risk, briefly defined in Table 6.1. In general, 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 risk-free rate of interest for 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?
Corporate Bonds

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

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 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 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.

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 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**

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.

*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.

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.

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

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 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 (7.000/100.25 = 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.

**Table 6.2**

<table>
<thead>
<tr>
<th>Moody’s</th>
<th>Interpretation</th>
<th>Standard &amp; Poor’s</th>
<th>Interpretation</th>
</tr>
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<tbody>
<tr>
<td>Aaa</td>
<td>Prime quality</td>
<td>AAA</td>
<td>Bank investment quality</td>
</tr>
<tr>
<td>Aa</td>
<td>High grade</td>
<td>AA</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Upper medium grade</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Baa</td>
<td>Medium grade</td>
<td>BBB</td>
<td></td>
</tr>
<tr>
<td>Ba</td>
<td>Lower medium grade</td>
<td>BB</td>
<td>Speculative</td>
</tr>
<tr>
<td>or speculative</td>
<td></td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Speculative</td>
<td></td>
<td></td>
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<tr>
<td>Caa</td>
<td>From very speculative</td>
<td>CCC</td>
<td></td>
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<tr>
<td>Ca</td>
<td>to near or in default</td>
<td>CC</td>
<td></td>
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<tr>
<td>C</td>
<td>Lowest grade</td>
<td>C</td>
<td>Income bond</td>
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<tr>
<td>D</td>
<td>In default</td>
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</tbody>
</table>

*aSome 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

<table>
<thead>
<tr>
<th>Bond type</th>
<th>Characteristics</th>
<th>Priority of lender’s claim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsecured Bonds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debentures</td>
<td>Unsecured bonds that only creditworthy firms can issue. Convertible bonds are</td>
<td>Claims are the same as those of any general creditor. May have other unsecured bonds</td>
</tr>
<tr>
<td></td>
<td>normally debentures.</td>
<td>subordinated to them.</td>
</tr>
<tr>
<td>Subordinated</td>
<td>Claims are not satisfied until those of the creditors holding certain (senior)</td>
<td>Claim is that of a general creditor but not as good as a senior debt claim.</td>
</tr>
<tr>
<td>debentures</td>
<td>debts have been fully satisfied.</td>
<td></td>
</tr>
<tr>
<td>Income bonds</td>
<td>Payment of interest is required only when earnings are available. Commonly</td>
<td>Claim is that of a general creditor. Are not in default when interest payments are missed,</td>
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<td></td>
<td>issued in reorganization of a failing firm.</td>
<td>because they are contingent only on earnings being available.</td>
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<td>Secured Bonds</td>
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<tr>
<td>Mortgage bonds</td>
<td>Secured by real estate or buildings.</td>
<td>Claim is on proceeds from sale of mortgaged assets; if not fully satisfied, the lender</td>
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<td></td>
<td></td>
<td>becomes a general creditor. The first-mortgage claim must be fully satisfied before</td>
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<tr>
<td></td>
<td></td>
<td>distribution of proceeds to second-mortgage holders, and so on. A number of mortgages</td>
</tr>
<tr>
<td></td>
<td></td>
<td>can be issued against the same collateral.</td>
</tr>
<tr>
<td>Collateral trust</td>
<td>Secured by stock and (or) bonds that are owned by the issuer. Collateral value</td>
<td>Claim is on proceeds from stock and (or) bond collateral; if not fully satisfied, the</td>
</tr>
<tr>
<td>bonds</td>
<td>is generally 25% to 35% greater than bond value.</td>
<td>lender becomes a general creditor.</td>
</tr>
<tr>
<td>Equipment trust</td>
<td>Used to finance “rolling stock”—airplanes, trucks, boats, railroad cars. A</td>
<td>Claim is on proceeds from the sale of the asset; if proceeds do not satisfy outstanding</td>
</tr>
<tr>
<td>certificates</td>
<td>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.</td>
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</tr>
</tbody>
</table>

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 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.

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.

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.
CHAPTER 6  Interest Rates and Bond Valuation

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.

Valuation Fundamentals

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. 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

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

---

4. 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.
\[ V_0 = \frac{CF_1}{(1 + k)^1} + \frac{CF_2}{(1 + k)^2} + \cdots + \frac{CF_n}{(1 + k)^n} \] (6.1)

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 6.1 can be rewritten as

\[ V_0 = [CF_1 \times (PVIF_{k,1})] + [CF_2 \times (PVIF_{k,2})] + \cdots + [CF_n \times (PVIF_{k,n})] \] (6.2)

We can use Equation 6.2 to determine the value of any asset.

**EXAMPLE**

Celia Sargent used Equation 6.2 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.

<table>
<thead>
<tr>
<th>Asset</th>
<th>Cash flow, CF</th>
<th>Appropriate required return</th>
<th>Valuationa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michaels Enterprises stockb</td>
<td>$300/year indefinitely</td>
<td>12%</td>
<td>[ V_0 = 300 \times \frac{1}{0.12} = $2,500 ]</td>
</tr>
<tr>
<td>Oil wellc</td>
<td>Year (t)</td>
<td>CFt</td>
<td>20%</td>
</tr>
<tr>
<td>1</td>
<td>2,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>10,000</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Original paintingd</td>
<td>$85,000 at end of year 5</td>
<td>15%</td>
<td>[ V_0 = 85,000 \times (PVIF_{15%,5}) ]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[ = 85,000 \times (0.497) ]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[ = $42,245 ]</td>
</tr>
</tbody>
</table>

*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.

bThis is a perpetuity (infinite-lived annuity), and therefore the present value interest factor given in Equation 4.19 is applied.

cThis is a mixed stream of cash flows and therefore requires a number of PVIFs, as noted.

dThis is a single-amount cash flow and therefore requires a single PVIF.
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, \( V_0 \).

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

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.

**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 \( \times \$1,000 \) par value) distributed as $50 (1/2 \( \times \$100 \)) 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 6.3:

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

\[
= I \times (PVIFA_{k_d,n}) + M \times (PVIF_{k_d,n})
\]  

(6.3)

(6.3a)
where

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

We can calculate bond value using Equation 6.3a 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.

**Table Use**

Substituting the values noted above into Equation 6.3a yields

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

The bond therefore has a value of approximately $1,000.6

5. 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.
6. Note that a slight rounding error ($0.50) results here from the use of the table factors, which are rounded to the nearest thousandth.
PART 2 Important Financial Concepts

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.

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.

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 \( B_0 - M \).

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 6.3a):

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

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

Example

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

discount

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

premium

Table Use

Required Return = 12%  
\[
B_0 = 100 \times (PVIFA_{12\%,10yrs}) + 1,000 \times (PVIF_{12\%,10yrs}) = 887.00
\]

Required Return = 8%  
\[
B_0 = 100 \times (PVIFA_{8\%,10yrs}) + 1,000 \times (PVIF_{8\%,10yrs}) = 1,134.00
\]

Calculator Use  Using the inputs shown on the next page 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.
**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.

*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 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)**

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 6.3 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 × $1,000), $M = $1,000, and $n = 10$ years, substituting into Equation 6.3a yields

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

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

$$100 \times (PVIFA_{9\%,10yrs}) + 1,000 \times (PVIF_{9\%,10yrs})$$

$$= 100 \times (6.418) + 1,000 \times (0.422)$$

$$= 641.80 + 422.00$$

$$= 1,063.80$$
Because the 9% rate is not quite low enough to bring the value up to $1,080, we next try 8% and get

\[ 100 \times (PVIFA_{8\%, 10yrs}) + 1,000 \times (PVIF_{8\%, 10yrs}) = 100 \times (6.710) + 1,000 \times (0.463) = 671.00 + 463.00 = 1,134.00 \]

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%.)

**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) 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 6.3 yields

\[
B_0 = \frac{I}{2} \times \left[ \sum_{t=1}^{2n} 1 \left( 1 + \frac{k_d}{2} \right)^{-t} \right] + M \times \left[ \frac{1}{\left(1 + \frac{k_d}{2}\right)^{2n}} \right] \\
= \frac{I}{2} \times (PVIFA_{k_d/2,2n}) + M \times (PVIF_{k_d/2,2n})
\]

**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 6.4a yields

\[
B_0 = \frac{100}{2} \times (PVIFA_{12\%/2,2 \times 10yrs}) + 1,000 \times (PVIF_{12\%/2,2 \times 10yrs})
\]
Table Use

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

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 \times 10 \text{ years}), a required return of 6\% (12\% \div 2), and an interest payment of $50 ($100 \div 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 known with certainty. The financial manager needs to understand how to apply valuation techniques to bonds in order to make decisions that are consistent with the firm’s share price maximization goal.

**REVIEW OF LEARNING GOALS**

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. 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.

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.

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.

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.

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.
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:

$$V_0 = \frac{CF_1}{(1 + k)^1} + \frac{CF_2}{(1 + k)^2} + \cdots + \frac{CF_n}{(1 + k)^n}$$  \[Eq. 6.1\]

$$= [CF_1 \times (PVIFk,1)] + [CF_2 \times (PVIFk,2)] + \cdots + [CF_n \times (PVIFk,n)]$$  \[Eq. 6.2\]

Bond value:

$$B_0 = I \times \left[ \sum_{t=1}^{n} \frac{1}{(1 + k_d)^t} \right] + M \times \left[ \frac{1}{(1 + k_d)^n} \right]$$  \[Eq. 6.3\]

$$= I \times (PVIFA_{k_d,n}) + M \times (PVIF_{k_d,n})$$  \[Eq. 6.3a\]

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)**

**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.
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.

PROBLEMS

6–1  **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.

<table>
<thead>
<tr>
<th>U.S. Treasury security</th>
<th>Time to maturity</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1 year</td>
<td>12.6%</td>
</tr>
<tr>
<td>B</td>
<td>10 years</td>
<td>11.2</td>
</tr>
<tr>
<td>C</td>
<td>6 months</td>
<td>13.0</td>
</tr>
<tr>
<td>D</td>
<td>20 years</td>
<td>11.0</td>
</tr>
<tr>
<td>E</td>
<td>5 years</td>
<td>11.4</td>
</tr>
</tbody>
</table>

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.

6–2  **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.

<table>
<thead>
<tr>
<th>Time to maturity (years)</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 years ago</td>
</tr>
<tr>
<td>1</td>
<td>9.1%</td>
</tr>
<tr>
<td>3</td>
<td>9.2</td>
</tr>
<tr>
<td>5</td>
<td>9.3</td>
</tr>
<tr>
<td>10</td>
<td>9.5</td>
</tr>
<tr>
<td>15</td>
<td>9.4</td>
</tr>
<tr>
<td>20</td>
<td>9.3</td>
</tr>
<tr>
<td>30</td>
<td>9.4</td>
</tr>
</tbody>
</table>

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.

6–3  **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.
CHAPTER 6 Interest Rates and Bond Valuation

6–4 Risk premiums Eleanor Burns is attempting to find the actual 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:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Security A</th>
<th>Security B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to maturity</td>
<td>3 years</td>
<td>15 years</td>
</tr>
<tr>
<td>Inflation expectation premium</td>
<td>9.0%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Risk premium for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquidity risk</td>
<td>1.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Default risk</td>
<td>1.0%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Maturity risk</td>
<td>0.5%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Other risk</td>
<td>0.5%</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

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 actual rate of interest for each security. Compare and discuss your findings.

6–5 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?

6–6 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?

6–7 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.

6–8 Valuation of assets Using the information provided in the following table, find the value of each asset.

<table>
<thead>
<tr>
<th>Asset</th>
<th>Cash flow</th>
<th>End of year</th>
<th>Amount</th>
<th>Appropriate required return</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>1</td>
<td>$5,000</td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>5,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>5,000</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>1 through ∞</td>
<td>$300</td>
<td>15%</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>1</td>
<td>$0</td>
<td>16%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>35,000</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>1 through 5</td>
<td>$1,500</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>8,500</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td>1</td>
<td>$2,000</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>3,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>5,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>7,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>4,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>1,000</td>
<td></td>
</tr>
</tbody>
</table>
6–9 **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.

6–10 **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.

6–11 **Bond valuation—Annual interest** Calculate the value of each of the bonds shown in the following table, all of which pay interest *annually*.

<table>
<thead>
<tr>
<th>Bond</th>
<th>Par value</th>
<th>Coupon interest rate</th>
<th>Years to maturity</th>
<th>Required return</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$1,000</td>
<td>14%</td>
<td>20</td>
<td>12%</td>
</tr>
<tr>
<td>B</td>
<td>1,000</td>
<td>8</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>C</td>
<td>100</td>
<td>10</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>D</td>
<td>500</td>
<td>16</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>E</td>
<td>1,000</td>
<td>12</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

6–12 **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?
6–13 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.

6–14 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.

<table>
<thead>
<tr>
<th>Required return</th>
<th>Value of bond A</th>
<th>Value of bond B</th>
</tr>
</thead>
<tbody>
<tr>
<td>8%</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>11%</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>14%</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

6–15 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.

<table>
<thead>
<tr>
<th>Bond</th>
<th>Coupon interest rate</th>
<th>Yield to maturity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6%</td>
<td>10%</td>
<td>______</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>8</td>
<td>______</td>
</tr>
<tr>
<td>C</td>
<td>9</td>
<td>7</td>
<td>______</td>
</tr>
<tr>
<td>D</td>
<td>7</td>
<td>9</td>
<td>______</td>
</tr>
<tr>
<td>E</td>
<td>12</td>
<td>10</td>
<td>______</td>
</tr>
</tbody>
</table>
6–16 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.

6–17 Yield to maturity  Each of the bonds shown in the following table pays interest annually.

<table>
<thead>
<tr>
<th>Bond</th>
<th>Par value</th>
<th>Coupon interest rate</th>
<th>Years to maturity</th>
<th>Current value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$1,000</td>
<td>9%</td>
<td>8</td>
<td>$ 820</td>
</tr>
<tr>
<td>B</td>
<td>1,000</td>
<td>12</td>
<td>16</td>
<td>1,000</td>
</tr>
<tr>
<td>C</td>
<td>500</td>
<td>12</td>
<td>12</td>
<td>560</td>
</tr>
<tr>
<td>D</td>
<td>1,000</td>
<td>15</td>
<td>10</td>
<td>1,120</td>
</tr>
<tr>
<td>E</td>
<td>1,000</td>
<td>5</td>
<td>3</td>
<td>900</td>
</tr>
</tbody>
</table>

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.

6–18 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).

6–19 Bond valuation—Semiannual interest  Calculate the value of each of the bonds shown in the following table, all of which pay interest semiannually.

<table>
<thead>
<tr>
<th>Bond</th>
<th>Par value</th>
<th>Coupon interest rate</th>
<th>Years to maturity</th>
<th>Required stated annual return</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$1,000</td>
<td>10%</td>
<td>12</td>
<td>8%</td>
</tr>
<tr>
<td>B</td>
<td>1,000</td>
<td>12</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>C</td>
<td>500</td>
<td>12</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>D</td>
<td>1,000</td>
<td>14</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>E</td>
<td>100</td>
<td>6</td>
<td>4</td>
<td>14</td>
</tr>
</tbody>
</table>

6–20 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 the price of 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.