THE VALUATION AND CHARACTERISTICS OF BONDS

CHAPTER OUTLINE

Valuation is a systematic process through which we establish the price at which a security *should* sell. We can call that price the security's *intrinsic* value.

THE BASIS OF VALUE

Securities are pieces of paper, and unlike real assets they have no utility of their own. Real assets such as houses and cars have worth because they provide services like shelter and transportation. Paper assets must rely on something else to make them valuable. That something is the expectation of future income that goes along with owning securities. This is an important point. *Every* financial asset depends for its value on the future cash flows that come with it.

Since money expected in the future is worth its present (discounted) value today, *a security's value is equal to the present value of its expected future cash flows*. Further, the security should sell in financial markets for a price very close to that value.

There are often differences of opinion about what the price of a security should be. They arise because people make different assumptions about what the security's cash flows will turn out to be and about the appropriate interest rate to use in taking present values. The most arguable cash flows are associated with stocks, because future dividends are never guaranteed and the eventual selling price of a share is always speculative.

The idea of valuation is bound closely to the concept of return on investment. Because of the precise nature of the work we're about to undertake, we need to be very exact in our understanding of what the terms "investment" and "return" mean.

INVESTING

Securities are worth the **present value of the future cash income** associated with owning them.

Investing means using a resource in a way that generates *future benefits* rather than in a way that results in immediate satisfaction. We say an investor *forgoes current consumption* in order to improve his or her position in the future. In everyday language that means a person buys securities or puts money in the bank rather than spending it on a new car or going out to dinner.

In finance, investing means putting money to work to earn more money, generally by entrusting it to a person or an organization that uses it and pays the owner for its use. The two most common methods of entrusting money are lending and buying an ownership interest in a business. They are called debt and equity investments, respectively. The vehicle for a debt investment is generally a bond, while for an equity investment it's a share of stock.

Investing means using a resource to benefit the future rather than for current satisfaction.

RETURN

Returns on One-Year Investments

Return is what an investor receives for making an investment. It can be expressed as a dollar amount or as an annual percentage rate. For investments held for one year, the *rate of return is the money the investor receives divided by the amount he or she invests*.

For debt, that's simply the interest received divided by the amount loaned, which is the interest rate we've been calling k. Let's look at the idea a little more deeply in terms of the time value of money.

An amount PV loaned for one year at interest rate k earns interest of kPV. If the lender receives the principal plus the interest at the end of the year, these are the future cash flows that come from making the original investment of PV. Call these future cash flows FV_1 and write

$$FV_1 = PV + kPV$$

$$FV_1 = PV(1 + k)$$

We recognize this as equation 6.1 from our study of the time value of money.

Now solve for the original investment.

$$PV = \frac{FV_1}{(1 + k)}$$

Again we recognize this expression from our study of time value. It's the present value of a future amount due in one year, equation 6.5, with n = 1.

The rate of return on a security is the interest rate that **equates the present value of its expected future cash flows with its current price**.

In the context of valuing a security that represents a loan (usually a bond), think of PV as the *price* of the security that returns cash flows FV_1. Then the rate of return, k, can be thought of as the *interest rate that makes the present value of the future cash flows equal to the price*. This is a fundamental definition that applies to any investment held for any length of time.

The details are a bit more involved for equity (stock) investments than for debt, because the future cash flows are more complicated. Nevertheless, the basic rule is the same. We'll discuss the returns to equity investments in Chapter 8.

Returns on Longer-Term Investments

When the holding period is longer and there are a number of cash flows at different times, the concept remains the same. The return is still the discount rate that makes the present value of the future cash flows equal to the price.

For example, suppose someone offers to sell you an investment that will pay $200 one year from now and $250 two years from now for $363 paid today. If you accept the offer, the return on your investment will be the interest rate at which the present value of the two payments just equals the $363 "price" of the investment today. A time line for the arrangement looks like this.

As an exercise, show that the return on this hypothetical investment would be very close to 15%.

The term "yield" is synonymous with "rate of return." Its use is especially common with debt securities and traditional loans.

In the remainder of this chapter we'll look closely at the valuation of bonds and then at their institutional[1] characteristics. We'll turn our attention to stocks in Chapter 8.

> The terms **yield, return,** and **interest** mean essentially the same thing.

BOND VALUATION

Bonds represent a debt relationship in which the issuing company borrows and the buyer lends. A bond issue is an arrangement through which one company can borrow from many people at once. For example, suppose a large firm wants to borrow $10 million but can't find anyone willing to lend that much. Many people might be willing to lend smaller amounts, however, if the firm's credit reputation is good. If the company issues 10,000 bonds at $1,000 each, as many as 10,000 people could participate in the loan by buying one bond apiece. Bonds enable firms to raise large amounts by spreading a loan among a number of lenders.

> A **bond issue** allows an organization to borrow from many lenders at one time under a single agreement.

Before we get into the valuation of bonds, we need to learn a little about terminology and practice. We've introduced some of these ideas before, but will repeat them here for convenience.

BOND TERMINOLOGY AND PRACTICE

A bond represents a loan made by the buyer to the issuer for a period known as the *term*. The bond itself is a **promissory note** that serves as legal evidence of the debt. Bonds are said to *mature* on the last day of their terms. The word *term* means the bond's lifetime when it's first issued. Thereafter it means the time from the present until the maturity date. For example, a 20-year bond that's five years old has a term of 15 years. Every bond issued has a *par* or *face value*, which is printed on the face of the document. This is the amount the issuing company intends to borrow; in effect, it's the principal of the loan.

> A bond's **term** or **maturity** is the time from the present until the principal is to be returned.

---

1. The term "institutional" refers to the rules and practices according to which things are done in an organized society.

Bonds are *non-amortized* debt. That means no repayment of principal is made during the life of the bond. Rather, the face value is repaid in a lump sum on the maturity date. Interest is paid regularly, however, usually semiannually.

Any lender is said to extend *credit* to borrowers. Therefore, bondholders are called *creditors* of the company issuing the bonds. The term "creditor" also applies to banks that make loans to companies and vendors that sell products without receiving immediate payment.

Newly issued bonds are called *new issues*, as one might expect, while older bonds are commonly called **seasoned issues**.

The Coupon Rate

Most bonds pay interest at rates set at the time of issue called **coupon rates**. The coupon rate applied to the face value of a bond yields the dollar amount of interest paid, called the **coupon payment**. Coupon rates and payments are generally fixed throughout the life of a bond regardless of what happens to interest rates in financial markets.

The term "coupon" is outdated but is still in common use. Years ago, bonds were issued with a number of coupons attached that looked something like a sheet of postage stamps. When an interest payment was due, a bond owner would clip off a coupon and send it to the issuing company, which would return a check for the interest. Hence, the term "coupon" became associated with bond interest.

Coupons are rarely used today. Interest payments are now mailed directly to bondholders whose names and addresses are *registered* with the issuing company or its agent. Nevertheless, the term "coupon" is still associated with bond interest.

> A bond's **par** or **face value** is the amount the issuer intends to borrow at the **coupon rate** of interest.

BOND VALUATION—BASIC IDEAS

Now we have enough background to begin studying bond valuation. Keep in mind that valuation simply means determining the price a security should command in the financial market in which it is traded.

Adjusting to Interest Rate Changes

Let's put several facts from our earlier work together with what we've just learned about bonds. First recall from Chapter 5 that securities including bonds are sold in both primary and secondary markets. A primary market transaction refers to the original sale of the bond by the issuing company, and secondary market transactions are subsequent trades among investors. Second, recall from our discussion of financial markets in Chapter 5 that interest rates change all the time. Finally, we've just learned that most bonds pay interest at coupon rates that are fixed throughout their lives.

All this raises a question. How can a bond that pays a fixed rate be sold in the secondary market if interest rates have changed since it was originally issued? An example will make the idea clear.

Suppose Tom Benning, a typical investor, buys a newly issued 20-year bond directly from the Groton Company for its face value of $1,000. We'll assume that the bond pays interest at a coupon rate of 10%, which is the market rate for bonds of comparable risk at the time. From the discussion we've already had about valuation, we know that Tom has actually purchased a stream of future income. He'll receive interest payments of $100 a year (10% of $1,000) for 20 years and a payment of $1,000 returning principal along with the last interest payment.

Now imagine that a few days after Tom's purchase, interest rates rise to 12%. Also assume that coincidentally something occurs in Tom's financial situation that requires

him to get out of the bond investment. That is, he needs the cash he used to buy the bond for something else, perhaps an emergency.

Tom can't go back to Groton, the issuing company, and ask for a refund. The company borrowed the funds expecting to keep them for 20 years, and it would be unwilling to give up those terms. So to get his money back, Tom has to sell the bond to another investor in a secondary market transaction.

Let's suppose Tom approaches Sandra Fuentes, a friend who he knows is in the market for an investment, and asks if she'd like to buy his Groton Company bond. She says she might be interested and asks how much he wants. Tom answers that he bought it only a few days ago for $1,000 and would like to get about that much. What would Sandra's reaction be to Tom's asking price?

Unfortunately for Tom, Sandra wouldn't be willing to pay $1,000. That's because the increase in interest rates has given her better options. New bonds now being issued offer 12%, which means they'll pay $120 a year for 20 years plus the final $1,000. Sandra, as a rational investor, would have to refuse Tom's offer.

But suppose Tom is desperate and really has to sell his bond. What is he to do? Clearly the only way he'll interest a buyer is to lower the price. In fact, he'll have to lower the price until the return to the new buyer on his or her investment is just 12%. It turns out that he'd have to lower the price to exactly $849.51. We'll see how that figure is calculated later in the chapter. For now the important thing to understand is that the price of bonds on the secondary market *drops* in response to an increase in interest rates.

What would have happened if interest rates had fallen rather than having gone up? In that case, new issues would have offered less interest than Tom's bond, and he could have sold it for *more* than $1,000. In general, bond prices *rise* in response to a *drop* in interest rates.

Summarizing, we see that *bond prices and interest rates move in opposite directions.* This phenomenon is a fundamental and critically important law of finance and economics. When interest rates decline, the prices of debt securities go up; when rates increase, prices go down. The price changes are just enough to keep the yields (returns) on investments in seasoned issues equal to the yields on new issues of comparable risk and maturity. In other words, *bonds adjust to changing yields by changing their prices.*

As a result of all this, bonds don't generally sell for their face values. They trade for more or less, depending on where the current interest rate is in relation to their coupon rates. The terminology associated with this phenomenon is important. Bonds selling above their face values are said to be trading at a *premium*, while those selling below face value are said to trade at a *discount*. If at a point in time the market interest rate returns to a bond's coupon rate, the bond sells for its face value at that time. At such a time, we say the bond is trading at *par value*.

DETERMINING THE PRICE OF A BOND

We made the point earlier that the value and hence the price of any security should be equal to the present value of the expected future cash flows associated with owning that security. In the case of bonds, those future cash flows are quite predictable, because they're specified by the bond agreement.

Bondholders receive interest payments periodically and a lump sum return of principal at the bond's maturity. Yearly interest is determined by applying the coupon rate to the face value of the bond, and the principal is simply the face value itself.

Let's illustrate the pattern of these payments by setting up a time line to display the cash flows coming from a $1,000 bond with a coupon rate of 10% whose maturity date

VIDEO >>

Bond **prices** respond to **changes** in the market rate of **interest** by moving in a direction **opposite** to the change.

Figure 7.1

Cash Flow Time Line for a Bond
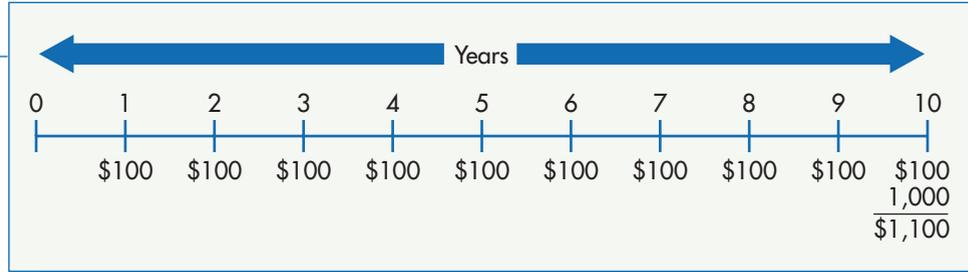
is 10 years off. Most bonds pay interest semiannually, but for illustrative purposes we'll assume this one pays annually. The time line of cash flows is illustrated in Figure 7.1.

Notice that the amount received in the 10th year is the sum of the last interest payment and the return of principal. Also notice that the interest payments are all the same and occur regularly in time.

It's important to realize that it doesn't matter whether the bond is new at time zero. The picture shown would be valid for a new 10-year bond, a 20-year bond that's currently 10 years old, or any other 10% $1,000 bond that has 10 years to go until maturity. Time zero is now, and the only thing that matters in today's valuation is *future* cash flows. Past cash flows are gone and irrelevant to today's buyer.

Having used Figure 7.1 to visualize bond cash flows in a simple numerical case, let's generalize the idea by showing a time to maturity of n periods, an interest payment represented as PMT, and a face value of FV. Recognize that each of these elements varies with different bonds. The general case is represented by the time line at the top of Figure 7.2.

In practice most bonds pay interest semiannually. That means the periods represented along the time line in Figure 7.2 are usually half years. Under those conditions, the interest payment, PMT, is calculated by applying the coupon rate to the face value and dividing by 2. For example, if the bond in Figure 7.2 had 10 years to go until maturity, had a face value of $1,000, and paid 10% interest semiannually, the time line would contain 20 periods, and each PMT would be $50.

Figure 7.2

Bond Cash Flow and Valuation Concepts
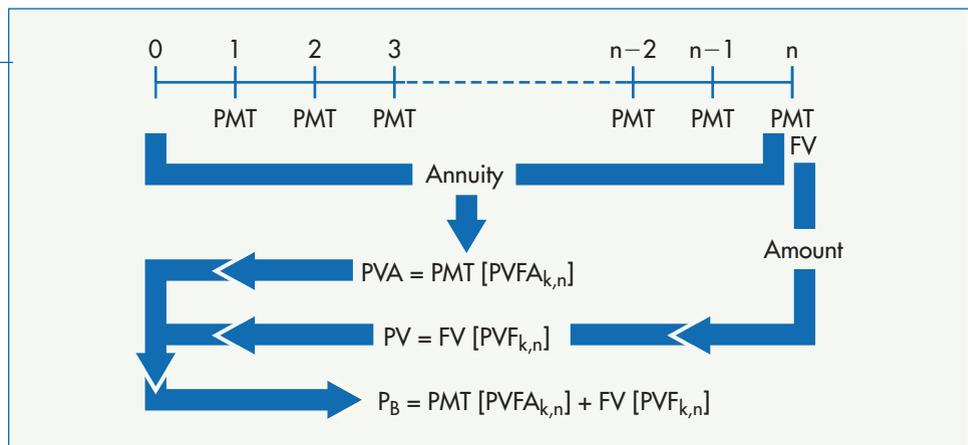
The Bond Valuation Formula

As we've been saying, a security's price should be equal to the present value of all the cash flows expected to come from owning it. In the case of a bond, the expected cash flows consist of a series of interest payments and a single payment returning principal at maturity. Hence, the price of a bond, which we'll write as P_B, is the present value of the stream of interest payments plus the present value of the principal repayment.

(7.1) $P_B = \text{PV(interest payments)} + \text{PV(principal repayment)}$

Because the interest payments are made regularly and are constant in amount, they can be treated as an annuity, and we can calculate their present value by using equation 6.19, the present value of an annuity formula. We'll rewrite that formula here for convenience.

(6.19) $\text{PVA} = \text{PMT}[\text{PVFA}_{k,n}]$

Applying this formula directly to the bond's interest, we can write

(7.2) $\text{PV(interest payments)} = \text{PMT}[\text{PVFA}_{k,n}]$

where PMT is the bond's regular interest payment, n is the number of interest-paying periods remaining in the bond's life, and k is the current market interest rate for comparable bonds for the interest-paying period.

A bond's principal is always equal to its face value, so the return of principal is an expected payment of that amount n periods in the future. Its present value can be calculated by using equation 6.7, the present value of an amount formula, which we'll repeat here.

(6.7) $\text{PV} = \text{FV}_n[\text{PVF}_{k,n}]$

We'll drop the subscript on FV_n and think of FV as face value rather than future value in this application. Then we can write

(7.3) $\text{PV(principal repayment)} = \text{FV}[\text{PVF}_{k,n}]$

Substituting equations 7.2 and 7.3 in 7.1, we get a convenient expression for calculating the price of a bond based on its future cash flows using our familiar time value techniques.

(7.4) $P_B = \text{PMT}[\text{PVFA}_{k,n}] + \text{FV}[\text{PVF}_{k,n}]$

The approach is illustrated graphically in Figure 7.2. In essence, pricing a bond involves doing an annuity problem and an amount problem together, and summing the results.

A bond's value is the sum of the present value of the **annuity of its interest payments** plus the present value of the **return of principal**, both taken at the current **market rate** of interest.

Two Interest Rates and One More

It's important to notice that two interest rates are associated with pricing a bond. The first is the coupon rate, which when applied to the face value determines the size of the interest payments made to bondholders. The second is k, the current market yield on comparable bonds at the time the price is being calculated. Don't confuse the two. The rate at which the present value of cash flows is taken is k. The only thing you do with the coupon rate is calculate the interest payment.

The return or yield on the bond investment to the bondholder is k. It is the interest rate that makes the present value of all the payments represented in Figure 7.2

equal to the price of the bond. Because this return considers all payments until the bond's maturity, it's called the **yield to maturity**, abbreviated **YTM**. When people refer to a bond's yield, they generally mean the YTM.

The third yield associated with a bond is called the *current yield.* This is a summary piece of information used in financial quotations and is not associated with the pricing process. The current yield is the annual interest payment divided by the bond's current price.

Solving Bond Problems with a Financial Calculator

In Chapter 6 we noted that financial calculators have five time value keys. When doing amount or annuity problems we used four of the five keys and zeroed the fifth.

In bond problems we use all five keys. The calculator is programmed to recognize the five inputs as two problems and add the results together. In a bond problem the keys have the following meanings.

n—Number of periods until maturity

I/Y—Market interest rate

PV—Price of the bond—that is, the present value of all the cash flows

FV—Face value of the bond

PMT—Coupon interest payment per period

The unknown is either the price of the bond (PV) or the market interest rate (I/Y), which is equal to the bond's yield to an investor buying at the current price. To solve a problem, we enter the four known variables first, press the compute key, and then press the key for the unknown variable.

If your calculator uses a sign convention, cash flows to and from the bondholder must be of opposite signs. That means PMT and FV, flows to the bondholder, will be of one sign while PV, the price coming from the bondholder, will be of the other sign.

Sophisticated calculators have a "bond mode" that allows you to input exact calendar dates for the present and the bond's maturity as well as some additional details about the payment of principal and interest. This facilitates the exact pricing of bonds sold in the middle of the month and issues with unusual provisions. Traders operating in fast-moving bond markets use such calculating options all the time. The time value keys are sufficient for our purposes, since our goal is simply to gain a broad understanding of bond operations.

Example 7.1

The Emory Corporation issued an 8%, 25-year bond 15 years ago. At the time of issue it sold for its par (face) value of $1,000. Comparable bonds are yielding 10% today. What must Emory's bond sell for in today's market to yield 10% (YTM) to the buyer? Assume the bond pays interest semiannually. Also calculate the bond's current yield.

SOLUTION: This is the typical bond problem. We're given a bond's face value, coupon rate, and remaining term, and are asked to find the price at which it must sell to achieve a particular return. Since the return is the market interest rate, we're being asked to find the market price of the bond. The question is equivalent to asking for the present value of the bond's expected cash flows at today's interest rate.

To solve the problem, we first write equation 7.4, the bond valuation formula.

$$P_B = PMT[PVFA_{k,n}] + FV[PFV_{k,n}]$$

Then we put the information given in the proper form for substitution into the equation.

The interest payment is found by applying the coupon rate to the face value and dividing by two, because payments are semiannual.

$$PMT = [\text{coupon rate} \times \text{face value}]/2$$

$$= (.08 \times \$1,000)/2$$

$$= \$40.00$$

Next we need n, the number of interest-paying periods from now until the end of the bond's term. This bond, like most, pays interest semiannually, so we multiply the number of years until maturity by 2 to get n. Notice that n represents the time from now until maturity. It doesn't matter how long the bond has been in existence previously. In this case,

$$n = 10 \text{ years} \times 2 = 20$$

Next we need k, the current market interest rate. Recall that when using time value formulas for non-annual compounding, we have to state n and k consistently for the compounding period. Here, n represents a number of semiannual periods, so k must be stated for semiannual compounding. That just means dividing the nominal rate by 2,

$$k = 10\%/2 = 5\%$$

Calculator Solution

Finally, the face value is given directly as $1,000, so

$$FV = \$1,000$$

Key	Input
n	20
I/Y	5
FV	1,000
PMT	40
Answer	
PV	875.38

Substitute these values into the bond equation,

$$P_B = \$40[PVFA_{5,20}] + \$1,000[PVF_{5,20}]$$

and use Appendix A for the factors. A-4 gives

$$PVFA_{5,20} = 12.4622$$

while A-2 yields

$$PVF_{5,20} = .3769$$

Substituting, we get

$$P_B = \$40[12.4622] + \$1,000[.3769]$$

$$= \$498.49 + \$376.90$$

$$= \$875.39$$

This is the price at which the Emory bond must sell to yield 10%. It won't be competitive with other bonds at any higher price. Notice that it's selling at a discount, a price below its face value, because the current interest rate is above the coupon rate.

The bond's current yield is calculated as follows.

$$\text{current yield} = \frac{\text{annual interest}}{\text{price}} = \frac{\$80}{\$875.39} = 9.14\%$$

Although using the bond valuation formula is easy once you get used to it, students often have trouble knowing where to put what at first. Here's a self-test example using the method we've just illustrated. It will help your understanding a great deal if you work it yourself *before* looking at the solution.

Example 7.2
Self-Test

Carstairs Inc. issued a $1,000, 25-year bond 5 years ago at 11% interest. Comparable bonds yield 8% today. What should Carstairs's bond sell for now?

SOLUTION: The variables are as follows (as usual, assume semiannual interest).

$$PMT = (.11 \times \$1,000)/2 = \$55$$

$$n = 20 \times 2 = 40$$

$$k = 8\%/2 = 4\% \text{ and}$$

$$FV = \$1,000$$

Calculator Solution

Then, using equation 7.4,

Key	Input
n	40
I/Y	4
FV	1,000
PMT	55
Answer	
PV	1,296.89

$$P_B = PMT[PVFA_{k,n}] + FV[PVF_{k,n}]$$

$$= \$55[PVFA_{4,40}] + \$1,000[PVF_{4,40}]$$

$$= \$55(19.7928) + \$1,000(.2083)$$

$$= \$1,088.60 + \$208.30$$

$$= \$1,296.90$$

The current yield is $\text{current yield} = \$110/\$1,296.90 = 8.48\%$

Estimating the Answer First

If we think of the bond as having been issued at a time when the market rate was equal to the coupon rate, we can make a rough estimate of the current price before starting the problem. That provides a good reasonableness check on the solution we come up with. We base the estimate on the fact that bond prices and interest rates move in opposite directions.

In Example 7.1, we knew the current price of the bond had to be *below* the face value of $1,000. That's because the market interest rate had *risen* from 8% at the time of the bond's issue to its current value of 10%. Further, the increase was fairly substantial, so we were looking for a significant drop in price, which is what we found.

It doesn't matter whether the interest rate fluctuated up and down past 8% after the bond was issued or moved directly to 10%. The only rates that count for today's price are the original coupon rate and the current rate.[2]

Before starting a bond problem, you should always decide whether the new price will represent a premium or a discount from the face value.

In general, price changes due to a given interest rate change will be larger the more time there is remaining until maturity. We'll see that more clearly in the next section.

---

2. Bonds aren't always issued at coupon rates equal to the current market interest rate, but it helps to understand the pricing process if we imagine that they are. In practice, coupon rates are usually targeted at or near the current market rate. However, the mechanics of printing and issuing cause a delay between the time the rate is chosen and the time the bond actually hits the market. As a result there's usually a slight difference between coupon rates and current market rates. Bonds issued above or below market rates simply sell at premiums or discounts, respectively, when offered on the primary market. Because market rates change constantly some discount or premium is almost always associated with a new issue.

MATURITY RISK REVISITED

In Chapter 5 we developed an interest rate model in which rates generally consist of a base rate plus premiums for various risks borne by lenders. In particular, the model recognizes *maturity risk*, which is related to the term of the debt. We're now in a position to fully understand this important idea.

The risk arises from the fact that bond prices vary (inversely) with interest rates. When an investor buys a bond, the only way to recover the invested cash before maturity is to sell it to someone else. If interest rates rise and prices fall while the investor is holding the bond, the sale to someone else will be at a loss. (Review page 200 if necessary.)

This is exactly what happened to Tom Benning in our illustration of price adjustments to interest rate changes. The possibility of such a loss viewed at the time of purchase is the risk we're talking about.

Maturity risk has two other names, *price risk* and *interest rate risk*. These terms reflect the fact that bond *prices* move up and down with changes in *interest rates*.

The expression *maturity risk* emphasizes the fact that the *degree* of risk is related to the maturity (term) of the bond. The longer the term (time until maturity), the greater the maturity (price, interest rate) risk. The reason is that the prices of longer-term bonds change more in response to interest rate movements than do the prices of shorter-term bonds.

To see that, let's look again at the bond in Example 7.1. It was issued at 8% and had 10 years to go until maturity. Interest rates rose to 10%, and the price dropped to $875.39. Let's calculate what the price would have become under varying assumptions about the remaining term to maturity without changing anything else in the problem.

Table 7.1 gives the bond's price and the price drop from $1,000 at terms of 2, 5, 10, and 20 years. You might want to verify that these figures are correct as an exercise. Each of the price changes in Table 7.1 is the result of the same increase in interest rates, from 8% to 10%. Notice how much larger the price drop becomes as the term of the bond increases. This is the essence of maturity risk. The possible loss on debt investments due to interest-rate-induced price changes increases with the term of the debt.

> **Maturity risk**
> exists because the prices of **longer-term** bonds **fluctuate** more in response to **interest rate** changes than the prices of shorter-term bonds.

Table 7.1			
Price Changes at Different Terms due to an Interest Rate Increase from 8% to 10%	**Time to Maturity**	**Price**	**Drop from $1,000**
	2 years	$964.54	$ 35.46
	5	922.77	77.23
	10	875.39	124.61
	20	828.36	171.64

Realizing this fact, investors demand a premium to compensate for the additional risk they bear with longer issues. This is the *maturity risk premium*.

As Time Goes By

Let's consider the original Emory Corporation bond in Example 7.1 again. Recall that the interest rate rose from 8% to 10%, and the price fell from $1,000 to $875.39 with 10 years of term to go.

Let's imagine a very unlikely event just to enhance our understanding of the processes involved in bond pricing.

What would happen to the price of the Emory bond as time goes by *if interest rates didn't change again* for the remainder of the bond's life (a practical impossibility)? Would the price remain at $875.39, or move to something else? Test your understanding by answering the question before reading on.

In fact, the bond's price would slowly rise to $1,000 as maturity approached. If you have trouble seeing that, think of what it would be worth on the day before maturity. Someone buying at that time would be getting virtually no interest, because the last interest payment would be prorated almost entirely to the person who owned the bond during most of the last period. A buyer on the day before maturity would be buying a payment of $1,000 to be made the next day. That would be worth very nearly $1,000. This logic tells us that as we get closer to maturity, the price has to approach the bond's face value of $1,000.

We've already calculated what the price would be at two points along the way to maturity in our hypothetical example. Table 7.1 tells us that with five years to go the price will be $922.77 and when just two years remain it will be $964.54. Graphically, the progression in prices is shown in Figure 7.3.

Figure 7.3

Price Progression with Constant Interest Rate
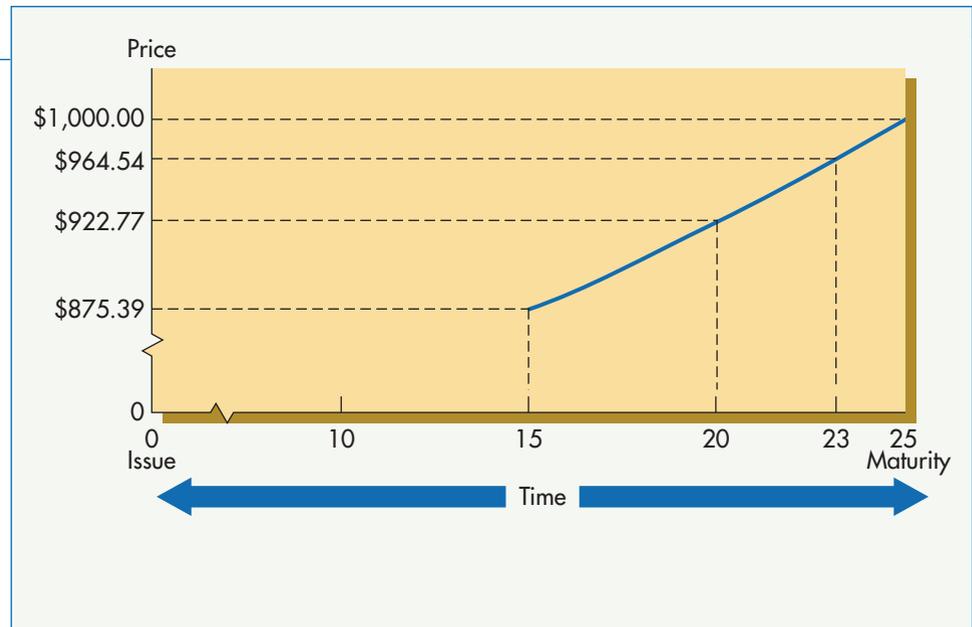
FINDING THE YIELD AT A GIVEN PRICE

Basically only two questions are asked about the dollars and cents of bonds. We've just explored the first, finding the price at which a bond achieves a specified yield. The second question is the reverse of the first. It asks for the yield on a bond investment if the security sells at a particular price. In the bond valuation formula, equation 7.4, this question asks us to find the market interest rate, k, given a value for P_B.

Let's rewrite equation 7.4 for convenient reference.

$$\text{(7.4)} \qquad P_B = PMT[PVFA_{k,n}] + FV[PVF_{k,n}]$$

Recall that finding P_B when the market yield is known simply involves doing two time value problems and adding the results together. We do a present value of an

annuity problem for the interest payments and a present value of an amount problem for the return of the face value. Finding k when P_B is known is conceptually the same but much more difficult.

Recall the time value problems we studied in Chapter 6. In both amount and annuity problems we were able to solve for an unknown k quite easily. We did so by solving one of the time value formulas for a factor, and then finding the factor in the table.

Even though the bond formula utilizes present value factors and the same tables we used in Chapter 6, this approach doesn't work. It fails because equation 7.4 uses two time value factors at the same time. As we have only one equation, we can't solve for both, and therefore can't find the right column and row in each table simultaneously.

This mathematically unfortunate state of affairs means we have to resort to a rather tedious approach to solving the problem, trial and error. We begin by guessing at a solution for k. Then we value the bond at that return by using equation 7.4 and whatever other information we have. That process results in a price we can compare with the price given by the problem. If they're significantly different, we have to guess at the return again and reevaluate for another price. We keep doing that until we get a price that's very close to the one we're looking for.

The trial and error approach isn't as haphazard as it may seem. By applying a little logic, we can usually get close to the answer in a few tries. An example will make the process clear.

Example 7.3

The Benson Steel Company issued a 30-year bond 14 years ago with a face value of $1,000 and a coupon rate of 8%. The bond is currently selling for $718. What is the yield to an investor who buys it today at that price? (Assume semiannual compounding.)

SOLUTION: First we make an educated guess at the answer on the basis of our knowledge that interest rates and bond prices move in opposite directions. In this case the $718 price is substantially below the face value of $1,000, so we know the bond's yield must be quite a bit above the coupon rate. Let's make a first guess at 10%. Evaluating at 10%, we have the following variables.

$$PMT = (.08 \times \$1,000)/2 = \$40$$

$$n = 16 \times 2 = 32$$

$$k = 10\%/2 = 5\%$$

$$FV = \$1,000$$

Then, using equation 7.4, we have

$$P_B = PMT[PVFA_{k,n}] + FV[PVF_{k,n}]$$

$$= \$40[PVFA_{5,32}] + \$1,000[PVF_{5,32}]$$

$$= \$40(15.8027) + \$1,000(.2099)$$

$$= \$632.11 + \$209.90$$

$$= \$842.01$$

Clearly 10% isn't the solution, because we're looking for the rate that yields a price of $718. Our choice has brought the price down from $1,000, but not far enough. That means we have to bring the rate up quite a bit more. For illustrative purposes, let's jump all the way to 14%

(we probably wouldn't go that far if we weren't trying to make a point). The only input that changes from our last try is k, which is now

$$k = 14\%/2 = 7\%$$

Substitute into equation 7.4 and verify that the calculation leads to

$$P_B = \$620.56$$

This figure is substantially below the target of $718, so we've pushed our interest rate too high. Now we know the answer has to be between 10% and 14%. Let's try a figure right in the middle. Evaluate the bond at 12% to verify that the resulting price is

$$P_B = \$718.36$$

This is just a shade higher than the actual selling price, so the true yield is just below 12%. For most purposes, declaring 12% the solution would be close enough.

Financial calculators are programmed to solve bond programs, including finding yields. The internal workings of such calculators do exactly what we've just done, find the solution by trial and error.

CALL PROVISIONS

Circumstances sometimes arise in which bond issuers want to pay off their indebtedness early. This commonly occurs when interest rates drop a great deal after bonds are issued.

For example, suppose a company issues a 30-year bond with a 15% coupon rate when interest rates are at about that level. Some years later, suppose rates drop to 7%. The firm will be stuck paying above-market rates on the bond's principal until maturity unless it can somehow get out of the loan arrangement with the bondholders.

Companies that issue bonds anticipate this sort of thing, and like to include call provisions in bond agreements to protect themselves. A **call provision** is a clause that gives the issuing organization the right to pay off the bond prior to maturity. In our illustration, the company would like to borrow money at the new lower interest rate of 7%, and use it to retire the old bond that pays 15%. The process is called *refunding* the debt.

Investors who buy bonds don't like call provisions because they feel the clauses give firms the opportunity to renege on interest rate obligations. In the example we've just described, the bondholders were getting a 15% return on funds in a market that currently offered only 7%. If the bond is paid off early, they'll lose that 15% and will have to reinvest at 7%.

These conflicting interests are reconciled with a two- or three-part compromise. First, call provisions are generally written to include a *call premium* that must be paid to bondholders if the feature is exercised. This means that if the company chooses to pay a bond off early, it must pay lenders (bondholders) some extra money as compensation for their loss of the original deal. The premium is usually stated in terms of extra interest at the coupon rate, and diminishes as the bond's maturity approaches.

Second, issuers usually agree that the bond won't be called for a certain number of years at the beginning of its life. This initial time is the period of *call protection*. Finally, to attract buyers, a bond with a call provision may require a somewhat higher interest rate than similar bonds without call provisions.

Call provisions are also sometimes exercised to free companies of restrictions imposed by certain agreements associated with bond contracts called *indentures*. We'll discuss indentures later in the chapter.

Call provisions allow bond issuers to **retire** bonds **before maturity** by paying a premium (penalty) to bondholders.

Figure 7.4

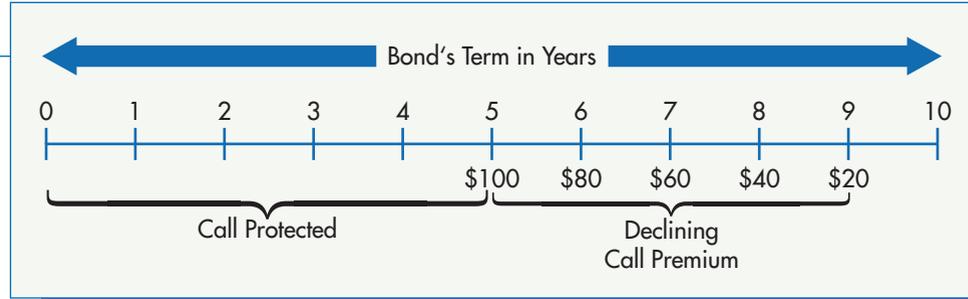**The Call-Protected Period and a Declining Call Premium**

Figure 7.4 portrays a declining call premium starting at one year's interest on a 10%, $1,000 bond with a term of 10 years and a call-protected period of 5 years. Although call premiums often decline, we'll assume they're constant to keep our computations simple.

The call premium is also known as a *call penalty*. This apparent conflict is easily explained by point of view. The payment is a premium to the investor who receives it but a penalty to the company that pays it. Call provisions are also called *call features*.

The Effect of a Call Provision on Price

A special situation arises when a bond with a call provision is in its protected period, but appears certain to be called as soon as that period is over. In such a case the traditional bond valuation procedure doesn't work because it includes cash flows projected

---

INSIGHTS

PRACTICAL **FINANCE**

Can a Bond Be a Bond Without Paying Interest?

The answer to that mysterious question is yes; they're called **zero coupon bonds**.

To understand the idea, think about a bond issued at a very low coupon rate—say, half the market rate. It would sell at a deep discount because the interest payments would be less than investors could get elsewhere. But offsetting the low interest payments, investors would receive the bond's face value at maturity, which would be more than they paid for it. In other words, investors who chose the bond would be trading some current income for a capital gain later on. But that capital gain would be unusual in that it wouldn't come from changing market values. It would actually be interest earned on the debt all along but not paid until maturity.

If we take this idea to the extreme making the coupon interest smaller and smaller until it's gone, we've got a zero coupon bond. Essentially it's just a promise to pay a face amount in the future that sells for the present value of that amount today.

The "zero" has some interesting tax implications. You'd think the investor would pay no tax until maturity because no money is received until then. But that isn't the case. The IRS *imputes* interest during the bond's life and demands tax on the phantom income.

We're all familiar with zeros under another name, U.S. savings bonds. They operate in exactly the same way. We buy a bond for the present value of its face at maturity. They're a popular gift because a $100 bond only costs about $60. There is one big difference, however. The government gives buyers of its own "zeros" a break by not taxing the interest until maturity.

A **zero coupon bond** pays no interest during its life, but imputed interest is still taxable.

Figure 7.5

Valuation of a Bond Subject to Call
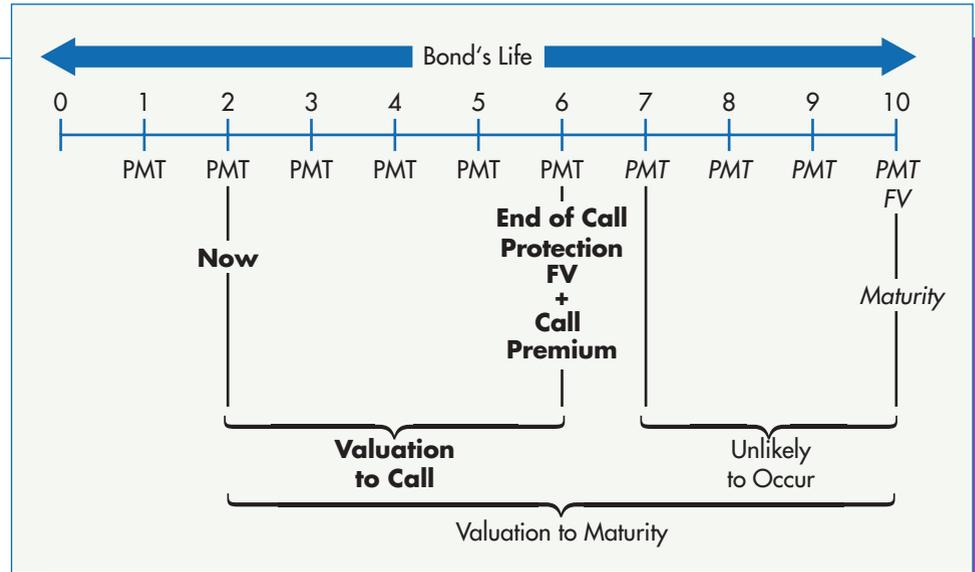
to occur after the protected period. These cash flows aren't likely to be forthcoming because the bond will probably be paid off exactly at the end of the protected period. In such cases, bondholders will actually receive normal interest payments up until call, at which time they'll receive the bond's face value plus the call premium. The situation is illustrated graphically in Figure 7.5.

Examine the diagram carefully. It shows the entire life of a bond that was originally intended to pay interest for 10 semiannual periods. This would normally be a five-year bond. The first three years are call protected in this example. We're assuming the first year has passed, so the present is indicated by "**Now**" at the end of period 2.

We assume the interest rate has dropped substantially, so the bond is very likely to be called at the end of the third year, period 6. Cash flows planned after that time probably won't happen. These are shown in italics.

We'd normally value this bond by taking the present value of all the payments from **Now** until maturity, including the return of the face value at maturity. This would mean that in the bond valuation formula we would use n = 8 and substitute the face value for FV.

What's actually going to happen, however, is a shorter series of interest payments ending with the sixth, and a final payment equal to FV *plus* the call premium.

Valuing the Sure to Be Called Bond

We can value this bond with the same formula we've used up until now by making two simple modifications to our inputs. All we have to do to realistically represent what is likely to happen is let n equal the time to call instead of the time to maturity, and add the call premium to the face value when we portray the final payment. The sum of the face value and the call premium is known as the *call price*.

We can express these ideas in a modification of the bond formula as follows.

(7.5) $$P_B(\text{call}) = PMT[PVFA_{k,m}] + CP[PVF_{k,m}]$$

where   m = number of periods to call

CP = call price = face value + call premium

PMT and k are computationally the same as in the problem without a call. However, k is known as the yield to call, abbreviated YTC, because it's used in taking the present value of cash flows only until the call is likely to occur.

Example 7.4

The Northern Timber Co. issued a $1,000, 25-year bond 5 years ago. The bond has a call provision that allows it to be retired any time after the first 10 years with the payment of an additional year's interest at the coupon rate. Interest rates were especially high when the bond was issued, and its coupon rate is 18%. Interest rates on bonds of comparable risk are now 8%. What is the bond worth today? What would it be worth if it didn't have the call feature? Assume interest payments are semiannual.

SOLUTION: This problem asks us to evaluate the price of the bond, first assuming the call feature will be exercised (which is very likely) and then in the normal way. The basic assumption is that the bond must *yield* the current rate of interest in either case. That is, even if the bond is going to be called, the price will adjust to bring the yield to the market rate of 8%. A graphic depiction of the problem follows (the interest payments are omitted).

Notice that the time line shows semiannual periods rather than years. The call premium is 18% of $1,000 or $180, so the call price is ($1,000 + $180 =) $1,180.
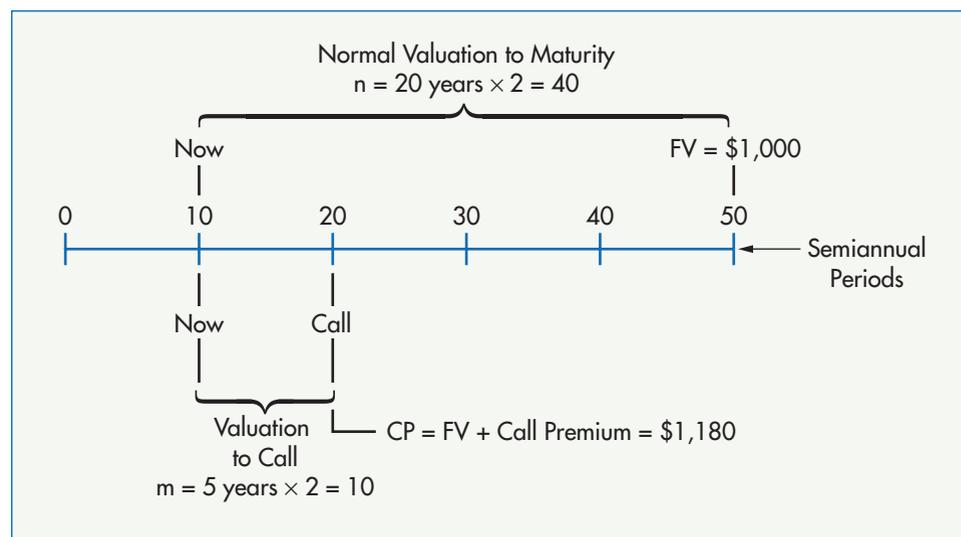
At the top of the diagram, above the time line, we show the period over which the bond would normally be evaluated and the face value to be returned of $1,000. At the bottom we show the relevant period for a likely call and a call price of $1,180.

First we'll evaluate to maturity using equation 7.4.

$$P_B = PMT[PVFA_{k,n}] + FV[PVF_{k,n}]$$

The variables follow.

$$PMT = (.18 \times \$1,000)/2 = \$90$$
$$n = 20 \times 2 = 40$$
$$k = 8\%/2 = 4\%$$
$$FV = \$1,000$$

Calculator Solution

Key	Input
n	40
I/Y	4
FV	1,000
PMT	90
Answer	
PV	1,989.64

Substituting, we have

$$P_B = \$90[PVFA_{4,40}] + \$1,000[PVF_{4,40}]$$

$$= \$90[19.7928] + \$1,000[.2083]$$

$$= \$1,781.35 + \$208.30$$

$$= \$1,989.65$$

Notice how much the price has risen, almost doubling the original $1,000. That's because the drop in the interest rate was very substantial *and* the bond has a long time to go until maturity. This price represents the present value of Northern Timber's (the bond issuer) cash flow commitment if the bond isn't called.

Next we'll evaluate to call using equation 7.5.

$$P_B(call) = PMT[PVFA_{k,m}] + CP[PVF_{k,m}]$$

The variables follow.

$$PMT = (.18 \times \$1,000)/2 = \$90$$

$$m = 5 \times 2 = 10$$

$$k = 8\%/2 = 4\%$$

$$CP = \$1,000 + .18(\$1,000) = \$1,180$$

Substituting,

$$P_B(call) = \$90[PVFA_{4,10}] + \$1,180[PVF_{4,10}]$$

$$= \$90[8.1109] + \$1,180[.6756]$$

$$= \$729.98 + \$797.21$$

$$= \$1,527.19$$

Calculator Solution

Key	Input
n	10
I/Y	4
FV	1,180
PMT	90
Answer	
PV	1,527.15

Notice that the price is substantially above $1,000 but is much less than the price without a call. From the point of view of a bond buyer, the only relevant price is $1,527.19, because the likelihood of call is very high. This price represents the value of Northern Timber's cash flow commitment if the bond is called. Notice how much Northern will save if it calls the bond.

The Refunding Decision

Whenever the current interest rate is substantially below a bond's coupon rate and the issue has a call feature, the issuing company has to decide whether or not to exercise the call. The company has to compare the interest savings from calling the bond with the cost of making the call and issuing a new bond to raise the money required to pay the old one off.

The difference in bond prices in the last example shows the interest savings associated with a call and includes a major cost item, the call premium. However, the figure does not include administrative expenses or the cost of issuing a new bond.

The costs incurred in issuing new bonds are known as *flotation costs* and can be rather substantial. They're primarily brokerage fees paid to investment bankers, but they also include administrative expenses and the costs of printing and engraving.

As a result of these costs, interest rates have to drop a lot before it's advisable for a company to refund by calling in one bond issue and floating another.

from the **CFO**

Dangerous Bonds with Surprising Calls

Bonds can occasionally have obscure call features buried in their contract terms that can cause unwary investors real grief. These generally take the form of a clause that says if some particular event occurs the bond will be called at face value.

The most common of these clauses involves *sinking fund* provisions. Recall that in Chapter 6 we described a sinking fund as a way lenders guarantee that borrowers will have enough money put aside to pay off a bond's principal when it comes due. (Review pages 235–236 if necessary.) There we said that borrowing firms can make deposits in a separate account whose future value will be the amount of the bond's principal.

Another way to provide for an orderly payoff of principal is to require that the individual bonds of an issue be called in and paid off over a series of years rather than all at once. For example, suppose a company borrowed a million dollars for 25 years by issuing 1,000 25-year bonds, each with a face value of $1,000. Repayment could be made a lot more secure if, instead of paying off all the bonds at the maturity date, the company called and retired a few each year during the last five years of the issue's life.

Sinking fund provisions often require companies to do just that, call in and retire a fixed percentage of the issue each year toward the end of the term. Since this procedure is for the benefit of the bondholders (to increase their security), the agreements don't generally include a call premium. The bonds called are usually determined by a *lottery*, so no one knows which bonds will be called early and which will continue to maturity.

Now, suppose a particular bond that's subject to sinking fund provisions like these happens to be selling at a premium because of interest rate changes. An unlucky investor might buy a $1,000 face value bond for, say, $1,100, and in short order receive a call at $1,000 that results in an immediate loss of $100! This does happen, even though bond investments are supposed to be relatively safe.

Here's another example. Government agencies issue bonds that are backed by mortgages on residential real estate. If the mortgages underlying the bonds are held to maturity, the bonds pay interest until maturity. But if the mortgages are paid off early, the funds are used to retire the bonds at face value. Because no one knows how fast people will pay off their home mortgages, you can never be sure the mortgage-backed bonds won't be called early.

Needless to say, it's wise to check the details of bond agreements before investing.

RISKY ISSUES

Sometimes bonds sell for prices far below those indicated by the valuation techniques we've described so far in this chapter. For example, suppose we applied equation 7.4 to a particular $1,000 face value bond and came up with a value of $950. However, suppose we checked the financial pages of a newspaper and found the bond to be trading at $500.

from the **CFO**

This would usually mean the company that issued the bond is in financial trouble, and there is some question about its ability to honor the obligations of the bond agreement. In other words, analysts feel it might default on the payment of interest and/or principal. Obviously such a risk will cause investors to lower their estimates of what any security is worth.

Financial purists argue that in such a situation equation 7.4 still gives the right answer if we properly select the interest rate k. The argument is that the increased risk should be reflected in a higher expected return to the investor. Using a higher k results in a lower calculated price. In other words, the bond has slipped into a lower quality class, which should be reflected by the requirement of a higher yield to

compensate for the chance that the investor may lose everything if things go poorly for the company.

However you look at it, a major deterioration in a bond-issuing company's financial performance will substantially depress the price of its securities, including bonds.

CONVERTIBLE BONDS

A **convertible bond** is exchangeable for a fixed number of shares of the issuing company's stock at the bondholder's discretion. The number of shares exchanged for the bond is determined by a **conversion ratio** that's set at the time the bond is issued. For example, a $1,000 par (face) value *convertible* with a 50-to-1 conversion ratio would exchange for 50 shares of stock. Notice that stating the conversion ratio along with the bond's par value implies a **conversion price**. In this case the bond converts at a stock price of $1,000/50 = $20. In general,

Convertible bonds are exchangeable for stock at a **conversion price**.

$$(7.6) \qquad \text{conversion ratio} = \frac{\text{bond's par value}}{\text{conversion price}} = \text{shares exchanged}^{[3]}$$

Ordinary bonds are generally safer investments than stock in the same company, but don't offer stock's potential for price appreciation. A *convertible feature* allows bondholders to enjoy some of that price appreciation if the firm is successful.

Conversion prices are usually set 15% to 30% *above* the stock's market price at the time the convertible is issued. Then if stock prices rise above conversion prices, convertible owners make money by converting and selling their shares at the appreciated market price.

Convertibles let **bondholders** participate in **stock price appreciation**.

In exchange for this potential, investors are generally willing to accept lower yields on convertibles than on ordinary bonds. That means they can be issued at lower coupon rates and cost borrowers less in interest expense.

Example 7.5   Harry Jenson purchased one of Algo Corp.'s 9%, 25-year convertible bonds at its $1,000 par value a year ago when the company's common stock was selling for $20. Similar bonds without a conversion feature returned 12% at the time. The bond is convertible into stock at a price of $25. The stock is now selling for $29. Algo pays no dividends. (Notice that this bond's coupon rate is below the market rate for nonconvertible issues.)

    a. Harry exercised the conversion feature today and immediately sold the stock he received. Calculate the total return on his investment.

    b. What would Harry's return have been if he had invested $1,000 in Algo's stock instead of the bond?

    c. Comment on the difference between the returns in parts (a) and (b) and from investing in a nonconvertible bond.

    d. Would the convertible have been a good investment if the stock's price had fallen?

---

3. Convertibles are always *debentures*, unsecured bonds. We'll discuss types of bonds later in the chapter. It is common practice to refer to the face value of a convertible as its **par** value.

SOLUTION:

a. Use equation 7.6 to calculate the number of shares exchanged for the bond.

$$\text{shares exchanged} = \frac{\text{par value}}{\text{conversion price}}$$

$$= \frac{\$1,000}{\$25}$$

$$= 40 \text{ shares}$$

The proceeds from selling those shares at the current market price were

$$40 \times \$29 = \$1,160$$

In addition, the bond paid interest during the year of

$$\$1,000 \times .09 = \$90$$

So total receipts from the bond investment were

$$\$1,160 + \$90 = \$1,250$$

The bond cost Harry $1,000, so his gain is

$$\$1,250 - \$1,000 = \$250$$

for a return on the invested cost of

$$\frac{\$250}{\$1,000} = 25\%$$

b. If Harry had invested $1,000 in Algo's stock, he would have purchased

$$\frac{\$1,000}{\$20} = 50 \text{ shares}$$

each of which would have increased in value by

$$\$29 - \$20 = \$9$$

for a total gain of

$$50 \times \$9 = \$450$$

His return would have been

$$\frac{\$450}{\$1,000} = 45\%$$

c. Investing in Algo's ordinary debt would have returned 12%. Investing in its stock returned 45%. The convertible, at 25%, allowed bond investors to participate in some, but not all, of the unusually high return enjoyed by stock investors this year.

d. Convertibles limit risk relative to investing in stock. Had Algo's stock price fallen, an investment in it would have generated a negative return. But Harry's return would have been the convertible's 9% coupon rate unaffected by the stock's poor performance. That's less than the 12% offered by ordinary debt, but substantially better than a loss.

Convertibles are **less risky** than stock.

The Effect of Conversion on the Financial Statements and Cash Flow

When conversion occurs, an accounting entry is made that takes the par value of converted bonds out of long-term debt, and places it in the equity accounts as if new shares had been sold at the conversion price. (See page 39 for equity accounting.)

Conversion has **no immediate cash flow** impact, but affects **ongoing** cash flow.

It's important to notice that there is no *immediate* cash flow impact from a conversion; the transaction is strictly on the company's books. However, conversion has important ongoing cash flow implications. The original debt is gone, so interest payments stop immediately, but the newly created shares are entitled to dividends if any are paid. But, since many companies that issue convertibles don't pay dividends, conversion usually implies a decrease in cash outflow.

Conversion also strengthens the balance sheet by removing debt and adding equity, which improves all debt management ratios (page 87–88).

Convertibles as Deferred Stock Purchases

Convertibles can be **deferred stock purchases**.

Notice that it's possible to look at an investment in a convertible as a deferred purchase of equity (stock). If a substantial increase in stock price is very likely, eventual conversion is virtually assured. That means the bond and associated interest payments can be viewed as temporary, and the long-term effect of the transaction is a sale of stock.

ADVANTAGES OF CONVERTIBLE BONDS

Several advantages can make convertibles attractive to issuing companies and investors.

Advantages to Issuing Companies

Issuing companies may experience these advantages.

Convertibles:
Offer **lower** interest rates.
May sell stock at **above market** prices.
Have **few restrictions**.

1. Convertible debt tends to be offered by risky companies that have problems with conventional borrowing. Risky businesses always pay higher interest rates than more stable firms and sometimes are completely unable to borrow. For these firms, convertible features are *sweeteners* that can induce lenders to accept lower rates or lend where they ordinarily would not.

2. A convertible can be viewed as a way to sell equity at a price above market. In Example 7.5, if Algo's management was sure the firm's stock was undervalued when the convertible was issued, and that it would eventually be converted, they were essentially selling stock at the conversion price of $25 when the market price was $20.

3. We'll learn later in this chapter that lenders generally insist on reducing their risk with contracts called bond indentures that limit the activities of borrowers while debt is outstanding. When debt is convertible, lenders view themselves as purchasing equity, so they're less concerned about restrictions. As a result, convertible bonds usually have mild indentures or none at all.

Advantages to Buyers

Convertible bond buyers may see the following advantages.

1. Convertibles offer buyers the chance to participate in the stock price appreciation offered by risky equity investments.

2. At the same time, convertibles offer a way to limit the risk associated with stock investments which can result in big losses as well as big gains.

FORCED CONVERSION

Reconsider Example 7.5 and imagine that after Algo's stock has risen to $29, Harry decides to indefinitely delay exercising his bond's conversion feature. He might do that because he expects the stock price to remain at or above $29 and he can collect interest on his investment until he's ready to close out his position in Algo altogether. This is better than converting and holding the stock, because Algo doesn't pay dividends.

Algo's management wants its bond converted for two reasons. They'd like to avoid paying further interest, but also want to exchange debt for equity to strengthen the balance sheet. For these reasons, convertibles are virtually always issued with call features that can be used to force conversion. Typically, convertible call features have call premiums of one year's coupon interest. (See page 283 for call features.)

Conversion can be forced by a **call feature**.

For example, suppose in our continuation of Example 7.5, Algo calls the bond to force conversion. Harry is then faced with a choice. He can either accept the call price of $1,090[4] or convert and sell his shares for a total of $1,160 as calculated in the example. Clearly, a rational investor will do the latter.

Issuers generally call convertibles when stock prices have risen to levels that are 10% to 15% above conversion prices.

Overhanging Issues

Recall that the purpose of issuing convertibles may not be to borrow money, but may be to sell equity at a price above market. In those cases, convertibles become problems if stock prices don't increase enough to make the bonds' conversion values more than their call prices (i.e., calls won't force conversion).

When **stock prices don't rise**, convertibles become **overhanging issues**.

For example, suppose in Example 7.5, Algo's stock price rises to $27 and stops. Conversion at that price yields

$$40 \times \$27 = \$1,080$$

which is less than the call price of $1,090, so investors will accept a call rather than convert. Essentially, an overhanging issue means Algo is stuck with debt it doesn't want.[5]

VALUING (PRICING) CONVERTIBLES

Valuing a convertible is somewhat complicated because the security's value (price) can depend on *either* its value as a traditional bond *or* the market value of the stock into which it can be converted. Let's look at a diagram to illustrate this idea before examining a numerical example. Figure 7.6 graphs the value (price) of a convertible against the underlying stock's price.

We'll assume market interest rates are such that an otherwise identical bond without a conversion feature would sell for its par value of $1,000. *This is the convertible's value as a bond.* On the diagram, it is the horizontal line that intersects the vertical price axis at $1,000. We'll assume interest rates don't change so this figure remains constant throughout the illustration. It's important to realize that the convertible's value as a bond doesn't have to be par. It depends on the interest rate and can be any figure calculated using the bond equation. We'll demonstrate this in an example shortly.
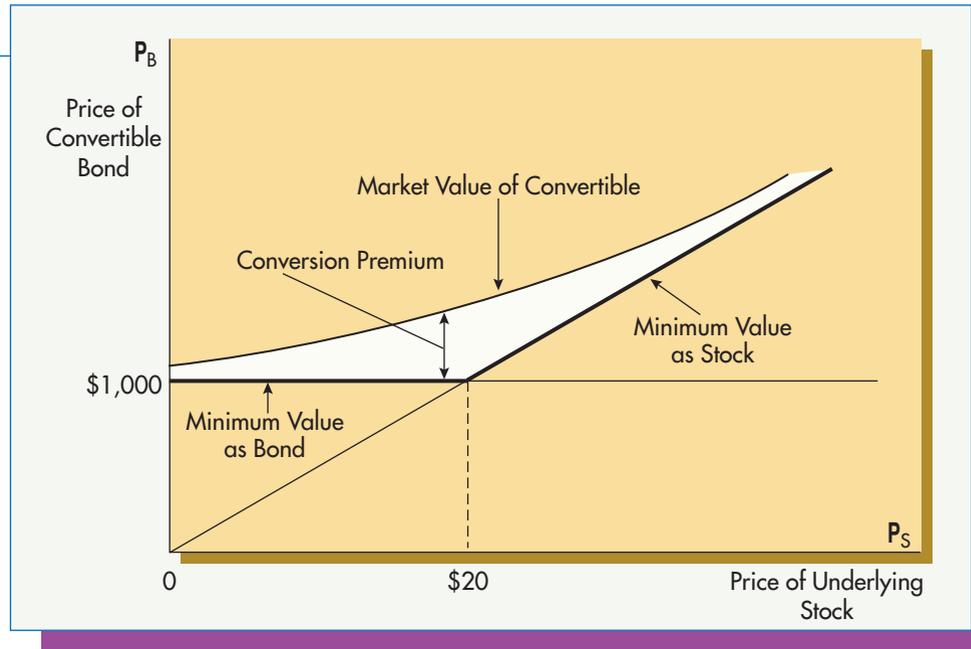
---

4. $1,000 plus one year's interest at 9%.
5. Algo would rather have equity to avoid paying interest and to make its balance sheet stronger.

Figure 7.6

Value of a Convertible Bond

The diagonal line from the origin represents the convertible's value as stock. It is simply the number of shares exchanged (the conversion ratio) multiplied by the current stock price. Let's assume that this particular bond is convertible into 50 shares of stock, so the equation of the diagonal line is

$$P_B = 50P_S$$

where P_B and P_S are the prices of the bond and the stock, respectively.

Notice that at low stock prices the convertible's value as a bond is higher than its value as stock. At higher prices, it's worth more as stock.

At any stock price, the convertible is worth *at least the larger* of its value as a bond or as stock. That means the higher of the stock and bond value lines represents minimum values of the convertible as a function of stock price. In the diagram, this minimum value path is represented by the boldfaced line running along the horizontal from $1,000 and breaking upward along the value as stock line.

The market value of a convertible lies above the minimum line, because there's always a possibility that the stock's price will go up and improve the return of the bond's owner still further. That possibility gives the convertible a little extra value. In the diagram, market value is shown as a curved line above the bent minimum value line. The difference between market value and the appropriate minimum is the conversion premium, indicated in the diagram.

The minimum values as stock and as a bond are equal at the intersection of the two minimum value lines. That point can be found by substituting the value as a bond into the equation of the diagonal value as stock line. In this illustration we have:

$$P_B = 50P_S$$
$$\$1,000 = 50P_S$$
$$P_S = \$1,000/50$$
$$= \$20$$

A convertible is worth at **least** the **larger** of its value **as stock** or **as a bond**.

The **conversion premium** is the **excess** of a convertible's **market value** over its **value as stock or a bond**.

Example 7.6

What was the conversion premium of the Algo convertible in Example 7.5 at the time it was issued?

SOLUTION: A diagram for this problem is shown below. Find the results of the following calculations on it as we move through the solution. Summarizing from Example 7.5, Algo's convertible bond was issued for 25 years at a coupon rate of 9%. The market rate was 12%, and the bond was exchangeable into 40 shares of stock.

To solve this problem we have to find the breakpoint on the minimum value line and decide whether the stock price was to the right or left of it when the convertible was issued. That will tell us which minimum value formulation to use in calculating the conversion premium.

First we'll calculate the minimum value of the convertible as a bond by writing equation 7.4 and substituting the following from the problem.

$$PMT = (.09 \times \$1{,}000)/2 = \$45$$
$$n = 25 \times 2 = 50$$
$$k = 12\%/2 = 6\%$$
$$FV = \$1{,}000$$
$$P_B = PMT[PVFA_{k,n}] + FV[PVF_{k,n}]$$
$$= \$45[PVFA_{6,50}] + \$1{,}000[PVF_{6,50}]$$
$$= \$45(15.7619) + \$1{,}000(.0543)$$
$$= \$709.29 + \$54.30$$
$$= \$763.59$$

Calculator Solution

Key	Input
n	50
I/Y	6
FV	1,000
PMT	45
Answer	
PV	763.57

Next find the stock price that makes the bond's value as stock just equal to this amount. We do that by noting that the conversion ratio is ($1,000/$25=) 40, so the equation of the value as stock line is

$$P_B = 40P_S$$

Then we find the stock price at the break in the minimum value path by substituting $P_B = \$763.59$ into the equation of the value as stock line and solving for P_S.

$$P_B = 40P_S$$
$$\$763.59 = 40P_S$$
$$P_S = \$19.09$$
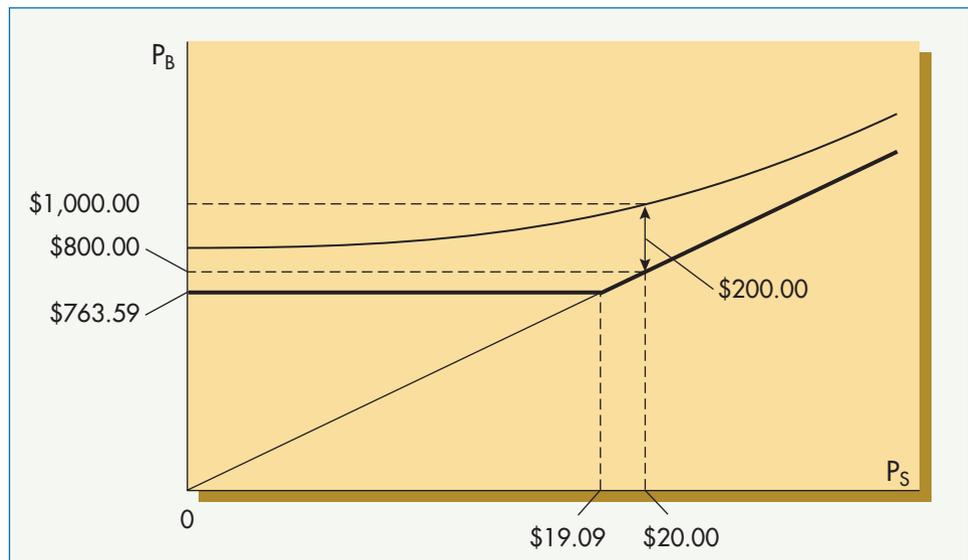
When the convertible was issued, the market price of the stock was $20, which is to the right of the breakpoint in the diagram. That means the convertible's value as stock is the appropriate minimum. Calculate the bond's minimum value as stock at a stock price of $20 by substituting into the equation for the value as stock line.

$$P_B = 40P_S$$
$$= 40 \times \$20$$
$$= \$800$$

Harry bought the convertible for a market price of $1,000, so our solution is

$$\text{conversion premium} = \text{market price} - \text{minimum}$$
$$= \$1,000 - \$800$$
$$= \$200$$

EFFECT ON EARNINGS PER SHARE—DILUTED EPS

Earnings per share (EPS) is net income (earnings after tax) divided by the number of shares of stock outstanding. Essentially, EPS is a firm's money-making power stated on a per-share basis. We mentioned this idea briefly in Chapter 3 (page 91), and we'll study it again in Chapter 8.

In everyday finance, EPS is a key factor in determining the value of stocks. Investors decide how much they're willing to pay for shares based in large part on the issuing companies' EPS. A growing EPS is a very positive sign, while one that's stagnant or declining can lead to a depressed stock price. Indeed, EPS is so important that it and the related price earnings ratio (P/E ratio, see page 91) are the first things investors look at when studying potential investments.

Convertible securities have an important impact on EPS, but before we can appreciate it we have to understand the idea of dilution.

EPS is a **key** factor in **pricing stocks**.

Dilution

Suppose a company with 1,000 shares of stock outstanding has a total value of $100,000, so each share is worth $100. Now suppose the company sells 100 new shares to new investors at $100 each for a total of $10,000. Would the old stockholders object to the sale?

The answer is no because the additional equity contributed by the new investors would increase the value of the company just enough to keep the value of the old shares constant. After the purchase, there would be 1,100 shares, but the firm would be worth an extra $10,000 and each share would still be worth ($110,000/1,100=) $100.

But suppose the new shares were priced at only $50 for a total of $5,000. The equity contribution would increase the firm's value to only $105,000, but there would still be 1,100 shares outstanding. So the value of each share, new and old, would be ($105,000/1,100=) $95.45.

Notice that the new shareholders get a big gain because their investment of $50 per share is suddenly worth $95.45. But that gain is at the expense of the old shareholders who see a drop of ($100 − $95.45=) $4.55 in their per-share value. In a situation like this, we would say the old stockholders' interests were **diluted** by the sale of new shares at a price below that of the old ones.

Earnings dilution is an easy extension of the same idea. Suppose the firm earns 10% on the value figures above. Then before the stock sale, EPS is

Earnings dilution is a drop in **EPS** caused by a sale **of stock** at a **below market** price.

$$\text{EPS} = \text{earnings/shares} = (\$100,000 \times .10)/1,000 = \$10$$

The stock sale at $100 per share results in

$$EPS = earnings/shares = (\$110{,}000 \times .10)/1{,}100 = \$10$$

But the sale at $50 per share yields

$$EPS = earnings/shares = (\$105{,}000 \times .10)/1{,}100 = \$9.55$$

Here we'd say the existing stockholders had suffered an earnings dilution in that their EPS diminished. Since a drop in EPS generally leads to a drop in stock price, shareholders are very concerned about dilution or potential dilution in earnings.

Convertibles and Dilution

Convertible securities cause dilution. Consider the Algo convertible in Example 7.5. Recall that the bond was convertible into stock at a price of $25 and was exercised when the stock's market price was $29. That means Harry, the convertible owner, received $29 per share when he sold his converted stock, but Algo received an equity injection of only $25 per share in the form of a shift of debt into equity. This has the same dilutive effect as a sale of new stock at $25 when its market value is $29.

In other words, dilution just about always happens when a company's stock price rises after a convertible is issued. Because of this phenomenon, the existence of unexercised convertibles always represents a *potential* dilution in a firm's EPS.

Unexercised **convertibles** represent **potential** dilution.

Disclosure of the Dilutive Potential of Convertibles

Investors use EPS to help determine the price they're willing to pay for stock. But if there are unexercised convertibles, future EPS may be smaller than expected simply because of their dilutive effect. That's a problem because it could result in investors being misled into paying too much for the stock.

In response to the problem, the accounting profession, acting through the Financial Accounting Standards Board (FASB), created rules requiring that companies report potential dilution from convertible and certain other securities in their financial statements. The rules have been modified several times since they first appeared in 1969. The latest version is reflected in *Statement of Accounting Standards No. 128*, issued in 1997. FASB 128, as it is called, requires that companies report two EPS figures, **basic EPS** and **diluted EPS**.

FASB 128 **requires** reporting **basic and diluted EPS**.

Basic EPS is what you would expect, earnings after tax divided by the number of shares outstanding during the year. If the number of shares isn't constant during the year, an average over time is used.

Diluted EPS is calculated assuming all existing convertibles are exercised creating new shares as of the beginning of the year. Essentially, it shows the worst case scenario for dilution.

Diluted EPS assumes **all convertibles** are **exercised** as of the **beginning** of the year.

EPS calculations sound simple but can be complicated because of midyear changes in the number of shares outstanding and the effects of the assumed conversions on income. Example 7.7 illustrates the latter complication.

Example 7.7

Montgomery Inc. is a small manufacturer of men's clothing with operations in southern California. It issued 2,000 convertible bonds in 1999 at a coupon rate of 8% and a par value of $1,000. Each bond is convertible into Montgomery's common stock at $40 per share.

Management expected the stock price to rise rapidly after the convertible was issued and to lead to a quick conversion of the bond debt into equity. However, a recessionary climate has prevented that from happening, and the bonds are still outstanding.

In 2003, Montgomery had net income of $3 million. One million shares of its stock were outstanding for the entire year, and its marginal tax rate was 40%. Calculate Montgomery's basic and diluted EPS for the year.

SOLUTION:
Basic EPS

The basic EPS calculation is very simple because the number of shares outstanding was constant for the entire year.

$$\text{basic EPS} = \frac{\text{net income}}{\text{shares outstanding}} = \frac{\$3,000,000}{1,000,000} = \$3.00$$

Diluted EPS

Calculating **diluted EPS** requires **adjusting** the **number of shares** and net income to reflect less **interest expense**.

Diluted EPS assumes all convertibles are exercised at the beginning of the year. Two adjustments have to be made to the EPS calculation above. The first adds newly converted shares to the denominator, while the second adjusts net income in the numerator for the after-tax effect of the interest saved when the bond debt is eliminated.

Use equation 7.6 to calculate the number of new shares issued for each bond converted as

$$\text{shares exchanged} = \frac{\text{bond's par value}}{\text{conversion price}} = \frac{\$1,000}{\$25} = 40$$

Then multiply by 2,000 bonds for the total number of new shares issued, and add that to the original number of shares outstanding.

$$\text{shares from conversion} = 2,000 \times 40 = 80,000$$
$$\text{new shares outstanding} = 1,000,000 + 80,000 = 1,080,000$$

The 2,000 bonds pay interest at 8% on a $1,000 par value. Hence, the interest saved by their conversion into equity is

$$\text{interest saved} = .08 \times \$1,000 \times 2,000 = \$160,000$$

But since interest is tax deductible at 40%, paying it saved taxes of

$$\$160,000 \times .40 = \$64,000$$

so the improvement in net income from eliminating the interest is

$$\$160,000 - \$64,000 = \$96,000$$

And net income for calculating diluted EPS is

$$\$3,000,000 + \$96,000 = \$3,096,000$$

Then

$$\text{diluted EPS} = \frac{\$3,096,000}{1,080,000} = \$2.87$$

OTHER CONVERTIBLE SECURITIES

Convertible features can be associated with certain other securities. The most common is preferred stock. We introduced preferred stock briefly in Example 6.14 (page 253) and will study it in detail in Chapter 8. Convertible preferred shares are similar to convertible bonds in that both are potentially dilutive. They're treated similarly in the calculation of diluted EPS.

Certain securities that are not convertibles can also result in issuing new stock at prices below market. Until exercised they too represent potential dilution, and the calculation of diluted EPS must be adjusted for them. The most common example is a *warrant*, which gives its owner the right to buy a limited amount of new stock at a fixed price during a specified period. We'll discuss warrants in Chapter 8.

INSTITUTIONAL CHARACTERISTICS OF BONDS

In the remainder of this chapter we'll describe some of the more important features of bonds and bond agreements that aren't directly related to pricing. Keep the fundamental definition of a bond in mind as we go forward. A bond is a device that enables an organization (generally a corporation or a government unit) to borrow from a large number of people at the same time under one agreement.

REGISTRATION, TRANSFER AGENTS, AND OWNERS OF RECORD

Bonds are classified as either **bearer bonds** or **registered bonds**. Bearer bonds belong to whoever possesses them, a convention that makes them dangerously subject to loss and theft. Bearer bonds have coupons attached for the payment of interest as described earlier.

A record of owners of **registered securities** is kept by a **transfer agent**. Payments are sent to **owners of record** as of the dates the payments are made.

The owners of registered bonds are recorded with a **transfer agent**. This is an organization, usually a bank, that keeps track of the owners of stocks and bonds for issuing companies. When one investor sells a security to another, the agent *transfers* ownership in its records as of the date of the sale. On any given date, there is a particular *owner of record* on the transfer agent's books for every bond (and share of stock) outstanding. Interest payments are sent directly to the owners of record of registered bonds as of the date the interest is paid.

KINDS OF BONDS

Several distinguishing features, in addition to convertibility which we've already considered, divide bonds into different categories. We'll briefly discuss a few of the more important distinctions.

Secured Bonds and Mortgage Bonds

Secured bonds are backed by the value of specific assets owned by the issuing company. If the firm defaults, the secured bondholders can take possession of the assets and sell them to recover their claims on the company. The essence of the secured arrangement is that the assets tied to specific debt aren't available to other creditors until that debt is satisfied. When the securing assets are real estate, the bond is called a **mortgage bond**.

Debentures

Debentures are unsecured bonds. They rely on the general creditworthiness of the issuing company rather than the value of specific assets. Debentures are clearly more risky than the secured debt of the same company. Therefore, they must usually be issued to yield higher returns to investors.

Subordinated debt is **lower in priority** for payment of principal and interest than **senior debt**.

Subordinated Debentures and Senior Debt

The term "subordinated" means lower in rank or priority. In terms of debt, it means having lower priority than other debt for repayment in the event the issuing company fails. Debentures can be subordinated to specific issues or to all other debentures in general. The debt having priority over a *subordinated debenture* is known as *senior debt*.

Conceptually, subordination arises with the senior debt. For example, suppose a lender is considering making a loan but fears the borrower will take on more debt from other lenders in the future. Then if the borrower failed, whatever assets were available to satisfy unpaid loans would have to be shared among a large number of creditors. Some security is afforded to the first lender by writing a clause into the loan agreement requiring the subordination of all future debt.

Because **subordinated debt** is riskier than senior or unsubordinated debt, it generally requires a higher yield than those issues.

Junk Bonds

Junk bonds are issued by risky companies and pay high interest rates.

Junk bonds are issued by companies that are not in particularly sound financial condition or are considered risky for some other reason. They generally pay interest rates that are as much as 5% higher than the rates paid by the strongest companies. Hence, they're also called *high-yield* securities.

Before the mid-1970s it was virtually impossible for risky firms, especially new, small companies, to borrow by issuing unsecured bonds. Investors were simply unwilling to accept the risks associated with such firms at any promised rate of return. At that time, however, a concept of pooling risky bonds arose and seemed to make high-risk, high-yield issues viable in the sense of being reasonably safe investments. For a few years the volume of junk bonds exploded, growing until it represented 10% to 20% of the total domestic bond market.

In the late 1980s and early 1990s, the safety perceived in the pooling technique evaporated when the economy went into a sustained recession. As a result, the junk bond vehicle lost much of its popularity. We'll discuss junk bonds again in Chapter 17.

BOND RATINGS—ASSESSING DEFAULT RISK

Recall that in Chapter 5 we discussed several risks associated with bonds, including the risk of default (page 200). In practice, investors and the financial community go to great lengths to assess and control exposure to default risk in bonds.

Bond ratings gauge the probability that issuers will fail to meet their obligations.

Bonds are assigned quality ratings that reflect the probability of their going into default. Higher ratings mean lower default probabilities. The **bond ratings** are developed by *rating agencies* that make a business out of staying on top of the things that make bonds and the underlying firms more or less risky. The best known rating agencies are Moody's Corporation (known as Moody's) and Standard & Poor's Corporation (generally called S&P).

The agencies rate bonds by examining the financial and market condition of the issuing companies and the contractual provisions supporting individual bonds. It's important to realize that the analysis has these two parts. A bond's strength is fundamentally dependent on that of the issuing corporation, but some things can make one bond safer than another issued by the same company. For example, a mortgage bond backed by real estate will always be stronger than an unsecured debenture issued by the same company. Similarly, senior debt is always superior to subordinated debt.

The process of rating a bond begins with a financial (ratio) analysis of the issuing firm using the kinds of tools we developed in Chapter 3. To that the agencies add any knowledge they have about the company, its markets, and its other dealings. For example, suppose a firm has good financial results and a prosperous market outlook but is threatened by a major lawsuit. If the lawsuit is very serious, it can lower the rating of the firm's bonds.

Bond ratings are not precise in the sense of being the result of a mathematical formula. Although they do rely heavily on standard numerical (ratio) analyses, they also include qualitative judgments made by the rating agencies.

Table 7.2

Moody's and S&P Bond Ratings

Moody's	S&P	Implication
Aaa	AAA	Highest quality, extremely safe
Aa	AA	High quality
A	A	Good quality
Baa	BBB	"Investment grade," medium quality
Ba	BB	Poor quality
B	B	Low quality, risky
Caa	CCC	Low quality, possible default
Ca	CC	Low quality, default, recovery possible
C	C	Defaulted, recovery unlikely

Rating Symbols and Grades

Moody's and S&P use similar scales to describe the bonds they rate. It's important to be generally familiar with the meaning of the terms. Table 7.2 summarizes the symbols used by the two firms and their meanings. The distinction between bonds above and below the Baa/BBB is especially significant. Bonds at or above that level are said to be **investment grade**, while those below are considered substandard. The latter can be called *junk bonds*.

Why Ratings Are Important

Throughout our study, we've stressed the fact that risk and return are related, and that investors *require* higher returns on riskier investments. Ratings are the primary measure of the default risk associated with bonds. Therefore, they're an important determinant of the interest rates investors demand on the bonds of different companies.

In effect, the rating associated with a firm's bonds determines the rate at which the firm can borrow. A lower rating implies the company has to pay higher interest rates. That generally means it's more difficult for the company to do business and earn a profit, because it's burdened with a higher cost of debt financing. To be precise about what we've just said, the idea is laid out in Figure 7.7.

Figure 7.7

The Yield Differential between High- and Low-Quality Bonds

INSIGHTS
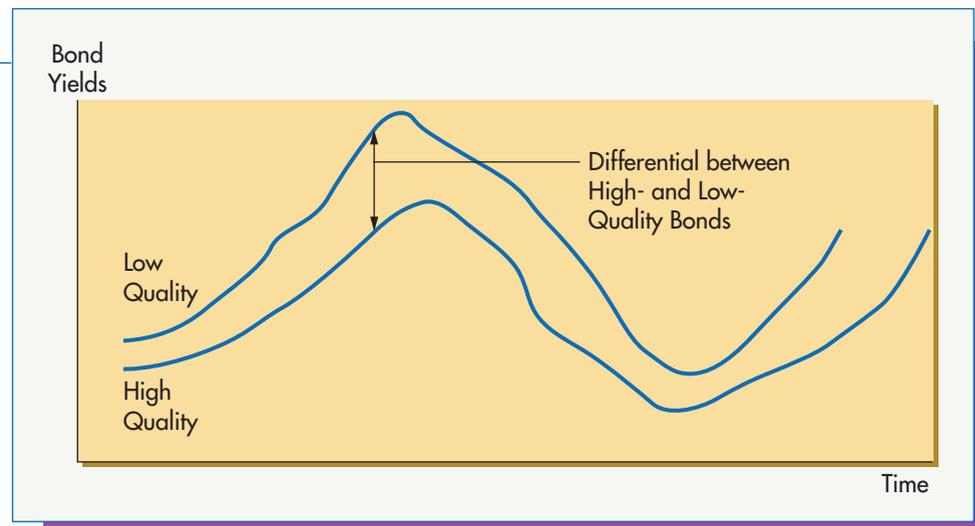
REAL **APPLICATIONS**

Even the Safest Companies Can Default on Bonds—The Perils of Utility Deregulation in California

Public utilities like water and power companies have traditionally issued some of the safest securities available. That's because until recently they were all "regulated monopolies." This means customers have to buy their water and electricity from the utilities, but prices are set by government commissions that ensure customers get a fair deal.

This generally makes investment in utility stocks and bonds safe but unexciting. Under normal conditions, regulated utilities just about can't lose money, but they can't make much either. As a result, returns on their securities are stable and relatively risk free. Utility bonds have always been particularly safe havens for investors concerned about risk, and traditionally received high grades from bond rating agencies.

However, in recent years there's been a general movement by state governments to deregulate utilities, that is, to take away their monopoly status and eliminate price controls. The rationale is that the pressure of competition will result in greater efficiency and lower prices for consumers. California moved toward an unregulated approach to the electric power business with laws passed in the late 1990s.

Electric power is provided in a two-step process. Suppliers generate electricity and sell it wholesale to electric utilities, who sell it to homes and businesses at retail prices. Traditionally both wholesale and retail transactions were regulated. In California, legislation was designed to phase in deregulation by introducing market pricing of the utilities' purchase of power from power suppliers first, and then to later introduce market pricing to the end consumer. It was believed this two-step procedure would prevent consumers from experiencing a big jolt at the start of deregulation.

Unfortunately, the convergence of unregulated wholesale prices and regulated retail prices had an unexpected outcome that put some of California's huge electric utilities in great peril. They were forced to buy their power in a market in which suppliers could raise prices at will, but they had to sell it in regulated markets in which they couldn't raise prices to match their costs.

In the early 2000s, companies like Southern California Edison ran up massive bills as wholesale electricity prices surged to unforeseen highs. With customer prices controlled, Southern California Edison was unable to pass on its higher cost and accumulated losses of $3.3 billion. That loss caused the company to default on many of its bond obligations. The bonds' rating was eventually downgraded all the way to junk status, Caa2.

The downgrading of Southern California Edison's debt wasn't surprising since there was serious talk about the company going into bankruptcy. The state of California eventually stepped in and agreed to help pay off the debt. The company later recovered its credit rating and resumed paying dividends which had been suspended during the crisis.

Sources: Jacob Fine, "California's Silver Lining," *The Bond Buyer* (January 31, 2001): 1; Christopher O'Leary, "Wall Street Pans for Gold in the Detritus of California's Big Utilities," *The Investment Dealers' Digest* (January 15, 2001): 3–4; Mark Golden, *Dow Jones Newswires* (October 5, 2001); *Dow Jones Newswires* (February 25, 2003).

All bond yields (interest rates) move up and down over time, but there's always a *differential* between the rates required on high- and low-quality issues. The lower curve associated with high-quality bonds means that the issuing companies can borrow at lower rates (more cheaply) than those associated with risky, low-quality bonds. The safest, highest quality bond is a federal treasury bond, which has no default risk (Chapter 5, pages 202–203). Its yield plotted on a graph like Figure 7.7 would be lower than that of any other bond.

A bond's rating affects the size of the differential between the rate it must pay to borrow and the rate demanded of high-quality issues. It does not affect the overall up and down motion of the rate structure. Clearly, the differential reflects the risk of default perceived to exist with lower-quality bonds. This is the default risk premium we discussed in Chapter 5.

The Differential Over Time

The **differential** between the yields on high- and low-quality bonds is an indicator of the health of the economy.

Notice that the quality differential tends to be larger when interest rates are generally high than when they're low. This is an important fact and makes logical sense. High rates tend to be associated with recessions and tough economic times. It's during those periods that marginal companies are prone to fail. In other words, the risk of default associated with weak companies is greater in bad times than in good times. Because it expresses the level of risk, the differential tends to be larger in recessionary periods.

In fact, this phenomenon is strong enough to be considered an *economic indicator*. That means a high differential is taken as a signal that harder times are on the way.

The Significance of the Investment Grade Rating

Most bonds are purchased by institutional investors rather than by individuals. These investors include mutual funds, banks, insurance companies, and pension funds. Many such institutions are required by law to make only relatively safe, conservative investments. Therefore, they can deal only in investment grade bonds. This requirement severely limits the market for the debt of companies whose bonds aren't considered investment grade.

BOND INDENTURES—CONTROLLING DEFAULT RISK

In Chapter 1 we discussed a conflict of interest between creditors and stockholders (page 18). Virtually all business operations involve some risk. However, higher levels of risk are usually associated with higher rewards. The conflict of interest arises because the rewards of successful risk taking accrue largely to stockholders, while the penalties for failure can be shared between stockholders and creditors.

Indeed, bondholders can be hurt even if failure doesn't occur. If a company is perceived to become more risky, the return investors require on its debt increases immediately, which in turn drives down the market price of its bonds. When that happens, bondholders suffer an immediate loss.

Investors contemplating lending to a company by buying its bonds look at the current level of risk associated with the business. If they're comfortable with that level, they purchase bonds, but remain concerned that future operations could become more risky. That might happen if the firm takes on riskier projects, encounters financial problems, or is managed unwisely.

ETHICS

Ethical Debt Management

Suppose a firm borrows through a bond issue with a relatively weak indenture that doesn't say anything about additional future debt. Then suppose it wants to borrow more later on, but the new lender is concerned about safety, and insists that its debt be made *senior* to existing debt. If the firm agrees it will damage the investors who hold the old bonds.

It's fairly obvious that the original bondholders will suffer if the firm fails, because they'll stand behind the new creditors in being paid out of any assets that survive the failure. But they may be hurt even if the firm does well. That's because the old bond's rating is likely to be lowered because of its new subordinate status. That means the market will perceive the issue as having more risk, and is likely to lower its price immediately. Hence, old bondholders will take a loss if they sell.

Is it ethical for a firm to do that without in some way compensating the old bondholders? What if management argues that the firm desperately needs the new money and will be in big trouble without it? What would you do if you were CFO?

Bond indentures attempt to prevent firms from becoming riskier after the bonds are purchased.

To ensure that bond-issuing companies maintain an even level of risk, lenders usually insist that bond agreements contain restrictions on the borrower's activities until the bonds are paid off. The contractual document containing such *restrictive covenants* is called the **bond indenture**.

Typical indenture provisions preclude entering certain high-risk businesses and limit borrowing more money from other sources. Indentures may also require that certain financial ratios be held above minimum levels. For example, an indenture might require that times interest earned (TIE) be maintained above a particular figure, say seven.

Every bond issue has a *trustee* whose job is to administer and enforce the terms of the indenture on behalf of the bondholders. Trustees are usually banks.

Sinking Funds

Sinking funds provide money for the repayment of bond principal.

Recall that bonds are non-amortized debt, meaning that the borrowed principal is not repaid until maturity. This creates a risk for bondholders in that borrowing firms may not have the funds to make large principal repayments.

Considerable safety is provided by a *sinking fund* that spreads the repayment of principal over time. We've already discussed two sinking fund arrangements. The first calls for periodic deposits such that the amount available at maturity is equal to the principal to be repaid. We illustrated that approach as a future value of an amount problem in Example 6.6 on page 235. A second arrangement involves randomly calling in some bonds for retirement prior to maturity. We discussed that approach on page 288 of this chapter.

Still another approach is to issue serial bonds, splitting the total amount borrowed into several separate issues with different maturities, usually about a year apart.

1. What is valuation, and why are we interested in the results?

2. Contrast real assets and financial (paper) assets. What is the basis for the value of each?

3. How can two knowledgeable people come to different conclusions about the value of the same security? Can this happen if they have access to the same information?

4. Describe the nature of a bond. Include at least the following ideas.

term/maturity	face value
debt versus equity	"buying" a bond
non-amortized	one borrower/many lenders
risk	conflict with stockholders

5. What is a call provision? Why do companies put them in bonds? Define call-protected period and call premium/penalty.

6. Two interest rates are associated with pricing a bond. Name and describe each. How are they used? Describe a third rate not used in pricing.

7. If bonds pay fixed interest rates, how can they be sold year after year on the secondary market? Include the idea of how yields adjust to changing market interest rates.

8. Why do bonds have indentures?

9. Describe bond pricing as two time value of money problems.

10. What is the relationship between bond prices and interest rates? Verbally describe how this relationship comes about. How can we use this relationship to estimate the value of a bond?

11. What is interest rate or price risk? Why is it sometimes called maturity risk? Explain fully.

12. What causes maturity risk? In other words, *why* do long-term bonds respond differently to interest rate changes than short-term bonds? (*Hint:* Think about how the present value formulas work.)

13. Using words only, describe the process of finding a bond's yield at a given selling price.

14. Under what conditions is a bond almost certain to be called at a particular date in the future? How does this condition affect its price?

15. How and why do sinking funds enhance the safety of lenders?

BUSINESS ANALYSIS

1. You're an analyst in the finance department of Flyover Corp., a new firm in a profitable but risky high-tech business. Several growth opportunities have come along recently, but the company doesn't have enough capital to undertake them. Stock prices are down, so it doesn't make sense to try to raise new capital through the sale of equity. The company's bank won't lend it any more money than it

already has, and investment bankers have said that debentures are out of the question. The treasurer has asked you to do some research and suggest a few ways in which bonds might be made attractive enough to allow Flyover to borrow. Write a brief memo summarizing your ideas.

2. The Everglo Corp., a manufacturer of cosmetics, is financed with a 50–50 mix of debt and equity. The debt is in the form of debentures that have a relatively weak indenture. Susan Moremoney, the firm's president and principal stockholder, has proposed doubling the firm's debt by issuing new bonds secured by the company's existing assets, and using the money raised to attack the lucrative but very risky European market. You're Everglo's treasurer, and have been directed by Ms. Moremoney to implement the new financing plan. Is there an ethical problem with the president's proposal? Why? Who is likely to gain at whose expense? (*Hint:* How are the ratings of the existing debentures likely to change?) What would you do if you really found yourself in a position like this?

3. You're the CFO of Nildorf Inc., a maker of luxury consumer goods that, because of its product, is especially sensitive to economic ups and downs (people cut back drastically on luxury items during recessionary times). In an executive staff meeting this morning, Charlie Suave, the president, proposed a major expansion. You felt the expansion would be feasible if the immediate future looked good, but were concerned that spreading resources too thin in a recessionary period could wreck the company. When you expressed your concern, Charlie said he wasn't worried about the economy because the spread between AAA and B bonds is relatively small, and that's a good sign. You observed, however, that rates seem to have bottomed out recently and are rising along with the differential between strong and weak companies. After some general discussion, the proposal was tabled pending further research. Later in the day, Ed Sliderule, the chief engineer, came into your office and asked, "What in the world were you guys talking about this morning?" Prepare a brief written explanation for Ed.

4. Paliflex Corp. needs new capital, but is having difficulty raising it. The firm's stock price is at a 10-year low, so selling new equity means giving up an interest in the company for a very low price. The debt market is tight and interest rates are unusually high, making borrowing difficult and expensive. In fact, Paliflex isn't certain that anyone will lend to it because it's a fairly risky company.

On the other hand, the firm's long-term prospects are good, and management feels the stock price will recover within a year or two. Ideally, management would like to expand the company's equity base, so it can borrow more later on, but at the moment the stock price is just too low.

Suggest a capital strategy that addresses both the short and long run, explaining why it is likely to work.

PROBLEMS

Assume all bonds pay interest semiannually.

1. The Altoona Company issued a 25-year bond 5 years ago with a face value of $1,000. The bond pays interest semiannually at a 10% annual rate.

   a. What is the bond's price today if the interest rate on comparable new issues is 12%?

   b. What is the price today if the interest rate is 8%?

   c. Explain the results of parts (a) and (b) in terms of opportunities available to investors.

   d. What is the price today if the interest rate is 10%?

   e. Comment on the answer to part (d).

2. Calculate the market price of a $1,000 face value bond under the following conditions.

	Coupon Rate	Time Until Maturity	Current Market Rate
a.	12%	15 years	10%
b.	7	5	12
c.	9	25	6
d.	14	30	9
e.	5	6	8

3. What is the current yield on each of the bonds in the previous problem?

4. The Sampson Company issued a $1,000 bond 5 years ago with an initial term of 25 years and a coupon rate of 6%. Today's interest rate is 10%.

   a. What is the bond's current price if interest is paid semiannually as it is on most bonds?

   b. What is the price if the bond's interest is paid annually? Comment on the difference between (a) and (b).

   c. What would the price be if interest was paid semiannually and the bond was issued at a face value of $1,500?

5. Fix-It Inc. recently issued 10-year, $1,000 par value bonds at an 8% coupon rate.

   a. Two years later, similar bonds are yielding investors 6%. At what price are Fix-It's bonds selling?

   b. What would the bonds be selling for if yields had risen to 12%?

   c. Assume the conditions in part a. Further assume interest rates remain at 6% for the next 8 years. What would happen to the price of the Fix-It bonds over that time?

6. The Mariposa Co. has two bonds outstanding. One was issued 25 years ago at a coupon rate of 9%. The other was issued 5 years ago at a coupon rate of 9%. Both bonds were originally issued with terms of 30 years and face values of $1,000. The going interest rate is 14% today.

   a. What are the prices of the two bonds at this time?

   b. Discuss the result of part (a) in terms of risk in investing in bonds.

7. Longly Trucking is issuing a 20-year bond with a $2,000 face value tomorrow. The issue is to pay an 8% coupon rate, because that was the interest rate while it was being planned. However, rates increased suddenly and are expected to be 9% when the bond is marketed. What will Longly receive for each bond tomorrow?

8. Daubert, Inc., planned to issue and sell at par 10-year, $1,000 face value bonds totaling $400 million next month. The bonds have been printed with a 6% coupon rate. Since that printing, however, Moody's downgraded Daubert's bond rating from Aaa to Aa. This means the bonds will have to be offered to yield buyers 7%. How much less than it expected will Daubert collect when the bonds are issued? Ignore administrative costs and commissions.

9. Tutak Industries issued a $1,000 face value bond a number of years ago that will mature in eight years. Similar bonds are yielding 8%, and the Tutak bond is currently selling for $1,291.31. Compute the coupon rate on this bond. (In practice we generally aren't asked to find coupon rates.)

10. John Wilson is a conservative investor who has asked your advice about two bonds he is considering. One is a seasoned issue of the Capri Fashion Company that was first sold 22 years ago at a face value of $1,000, with a 25-year term, paying 6%. The other is a new 30-year issue of the Gantry Elevator Company that is coming out now at a face value of $1,000. Interest rates are now 6%, so both bonds will pay the same coupon rate.

    a. What is each bond worth today? (No calculations should be necessary.)
    b. If interest rates were to rise to 12% today, estimate without making any calculations what each bond would be worth. Review page 279 on estimating if necessary.
    c. Calculate the prices in part (b) to check your estimating ability. If interest rates are expected to rise, which bond is the better investment?
    d. If interest rates are expected to fall, which bond is better? Are long-term rates likely to fall much lower than 6%? Why or why not? (*Hint:* Think about the interest rate model of Chapter 5 and its components.)

11. Smithson Co.'s Class A bonds have 10 years to go until maturity. They have a $1,000 face value and carry coupon rates of 8%. Approximately what do the bonds yield at the following prices?

    a. $770
    b. $1,150
    c. $1,000

12. Pam Smith just inherited a $1,000 face value K-S Inc. bond from her grandmother. The bond clearly indicates a 12% coupon rate, but the maturity date has been smudged and can't be read. Pam called a broker and determined that similar bonds are currently returning about 8% and that her bond is selling for $1,326.58. How many more interest payments can Pam expect to receive on her inherited bond?

13. Hoste Corp. issued a $1,000 face value 20-year bond 7 years ago with a 12% coupon rate. The bond is currently selling for $1,143.75. What is its yield to maturity (YTM)?

14. Ernie Griffin just purchased a five-year zero coupon corporate bond for $680.60 and plans to hold it until maturity. Assume Ernie has a marginal tax rate of 25%.

    a. Calculate Ernie's after-tax cash flows from the bond for the first two years. Assume annual compounding.
    b. Describe in words the difference in cash flows between owning Ernie's bond and a five-year U.S. savings bond for the same amount.
       (*Hint:* See the Insights box on page 284 for this problem.)

    Problems 15 through 17 refer to the bonds of The Apollo Corporation, all of which have a call feature. The call feature allows Apollo to pay off bonds anytime after the first 15 years, but requires that bondholders be compensated with an extra year's interest at the coupon rate if such a payoff is exercised.

15. Apollo's Alpha bond was issued 10 years ago for 30 years with a face value of $1,000. Interest rates were very high at the time, and the bond's coupon rate is 20%. The interest rate is now 10%.

    a. At what price should an Alpha bond sell?

    b. At what price would it sell without the call feature?

16. Apollo's Alpha-1 bond was issued at a time when interest rates were even higher. It has a coupon rate of 22%, a $1,000 face value, an initial term of 30 years, and is now 13 years old. Calculate its price if interest rates are now 12%, compare it with the price that would exist if there were no call feature, and comment on the difference.

17. Apollo's Beta bond has just reached the end of its period of call protection, has 10 years to go until maturity, and has a face value of $1,000. Its coupon rate is 16% and the interest rate is currently 10%. Should Apollo refund this issue if refunding costs a total of 8% of the value of the debt refunded plus the call penalty?

18. Snyder Mfg. issued a $1,000 face value 30-year bond 5 years ago with an 8% coupon. The bond is subject to call after 10 years, and the current interest rate is 7%. What call premium will make a bondholder indifferent to the call? (*Hint:* Equate the formulas for the bond's price with and without the call.)

19. Pacheco Inc. issued convertible bonds 10 years ago. Each bond had an initial term of 30 years, had a face value of $1,000, paid a coupon rate of 11%, and was convertible into 20 shares of Pacheco stock, which was selling for $30 per share at the time. Since then the price of Pacheco shares has risen to $65, and the interest rate has dropped to 8%. What are the bonds worth today? Comment on the function of the bond valuation procedure for convertibles.

20. The Maritime Engineering Corp. sold 1,500 convertible bonds two years ago at their $1,000 par value. The 20-year bonds carried a coupon rate of 8% and were convertible into stock at $20 per share. At the time, the firm's stock was selling for $15, and similar bonds without a conversion feature were yielding 10%. Maritime's stock is now selling for $25. The firm does not pay dividends.

    a. Calculate the return on investment from buying the bond when it was issued, exercising the conversion today, and immediately selling the stock received.

    b. What would the return on an investment in Maritime's stock have been?

    c. What was the conversion premium of the bond at the time it was issued?

    d. Last year Maritime had net income (EAT) of $4.5 million and 3 million shares outstanding. The company's marginal tax rate was 34%. Compute Maritime's basic and diluted EPS.

21. Lindstrom Corp. reported earnings after tax (EAT) of $2,160,000 last year along with basic EPS of $3. All of Lindstrom's bonds are convertible and, if converted, would increase the number of shares of the firm's stock outstanding by 15%. Lindstrom is subject to a total effective tax rate of 40% and has a TIE of 10. Compute Lindstrom's diluted earnings per share.

22. Your friend Marvin is excited because he believes he's found an investment bargain. A broker at QuickCash Investments has offered him an opportunity to buy a bond issued by Galveston Galleries Inc. at a very attractive price. The 30-year bond was issued ten years ago at a face value of $1,000, paying a coupon rate of 8%. Interest rates have risen recently driving bond prices down, but most economists think they'll fall again soon driving prices back up. That makes Marvin and his broker think this bond may be a real money maker if he buys now, holds for a year or two, and then sells. The bonds of companies that were similar to Galveston at the time its bond was issued are now yielding 12%. Galveston's bond

is selling at $300 which the broker claims is a fantastic bargain. Marvin knows you're a finance major and has asked your opinion of the opportunity. How would you advise him?

INTERNET PROBLEM

23. A broad range of bond information is available at http://www.Bondsonline.com. Visit the site, scroll down to "site search" at the left margin, and type in "downgrades" to view companies that have had their bond ratings lowered recently. Choose two firms and write a short report explaining why the ratings changed. Use the same procedure to report on two firms that have been upgraded recently.

COMPUTER PROBLEMS

24. You are a securities salesperson. Many of your clients are elderly people who want very secure investments. They remember the days when interest rates were very stable (before the 1970s) and bond prices hardly fluctuated at all regardless of their terms. You've had a hard time convincing some of them that bonds, especially those with longer terms, can be risky during times when interest rates move rapidly.

    Use the BONDVAL program to make up a chart using the format shown to help illustrate your point during discussions with your clients.

The Value of a $1,000 Par, 12% Coupon Bond as a Function of Term as Interest Rates Change

		Bond Term in Years			
		1	*5*	*10*	*25*
Market	6%				
	8%				
Rates	10%				
	12%				

Write a brief paragraph outlining your warning about bond price volatility to an elderly customer. Refer to your chart.

25. Use BONDVAL to find the YTM of the following $1,000 par value bonds.

	1	**2**	**3**
Market price	$752.57	$1,067.92	$915.05
Coupon rate	6.5%	7.24%	12.5%
Term	15.5 yrs	8.5 yrs	2.5 yrs

A P P E N D I X   7 A

Lease Financing

A "lease" is a contract that gives one party the right to use an asset owned by the other in return for a periodic payment. The owner of the property is called the lessor and the user is the lessee. Leasing is a method of financing assets that is actually similar to debt.

Most of us are familiar with leases in the context of houses and apartments where the lessor is the landlord and the lessee is the tenant.[6] In recent years, leasing automobiles has also become common practice. In business, companies lease equipment of all kinds as well as real estate.

THE DEVELOPMENT OF LEASING IN BUSINESS

Prior to the 1950s leasing was almost entirely limited to real estate (i.e., leasing office or factory space). Since then the technique has spread to equipment to the extent that today approximately 30% of all equipment acquired by businesses is leased.

LEASING AND FINANCIAL STATEMENTS

The best way to understand the early development of leasing is through an example. Imagine that Textronix Inc. has the following simplified balance sheet.

Textronix Inc.
Balance Sheet
($ooo)

Current assets	$ 10	Current liabilities	$ 5
Fixed assets	90	Long-term debt	45
Total assets	$100	Equity	50
		Total debt & equity	$100

We're interested in the firm's debt management ratios (review pages 87–89 if necessary), recalling that excessive debt is perceived as risky and is generally a negative to investors.[7] For simplicity we'll focus on the debt ratio which is defined as total debt divided by total assets, where total debt is current liabilities plus long-term debt. Notice that Textronix's debt ratio is a fairly high 50%, calculated as follows.

$$\text{debt ratio} = (\text{current liabilities} + \text{long-term debt})/\text{total assets}$$

$$= (\$5 + \$45)/\$100$$

$$= \$50/\$100$$

$$= 50\%$$

---

6. It's important to distinguish between a lease and a rental. Renting implies paying for the temporary use of an asset, but without a longer-term commitment. However, the term "rent" is often used loosely to refer to lease payments as well as rental payments.

7. When debt is high, adding more causes investors to bid the firm's stock price down. It also worries lenders who charge higher interest on new borrowing, and may refuse to extend more credit.

Now suppose management wants to acquire a $50,000 asset, but doesn't want to use equity[8] funds to buy it. One approach is to purchase the equipment with borrowed money using the asset itself as collateral.[9] Doing that would put an additional $50,000 asset on the balance sheet along with another $50,000 in long-term debt. The new balance sheet would appear as follows.

Textronix Inc.
Balance Sheet
($ooo)

Current assets	$ 10	Current liabilities	$ 5
Fixed assets	140	Long-term debt	95
Total assets	$150	Equity	50
		Total debt & equity	$150

Notice that the loan makes the debt ratio considerably worse (higher).

$$\text{debt ratio} = (\$5 + \$95)/\$150$$

$$= \$100/\$150$$

$$= 66.7\%$$

Seen in this light, borrowing to buy is a real problem for Textronix. Deterioration in the debt ratio would probably mean paying a premium interest rate for the funds and might even make borrowing impossible. It's also likely to have a negative impact on the price of Textronix's stock. Notice that the problem is ownership. Since Textronix owns the asset, it and the associated debt have to go on the balance sheet.

But suppose the asset could be used without ownership. Then Textronix's balance sheet would be unaffected and its financial ratios would not deteriorate. Originally, leasing allowed a firm to do just that, use something without owning it. Lease payments were recognized as expenses on the income statement, but had no impact on the balance sheet. Hence, in the beginning, leasing avoided the ratio problems that come with borrowing to buy. Recognition of this result in the 1950s and 1960s led to a rapid increase in the amount of *lease financed* equipment in the United States. Leasing became the leading form of **off balance sheet financing**—using an asset without reflecting it or its financing on the balance sheet.

Misleading Results

It's important to notice that the result we've described made financial statements misleading. The risk in debt comes from the fact that payments are obligatory charges that if missed can cause the firm to fail. Essentially the same is true of lease payments when leases are noncancelable. Noncancelability means that if the lessee returns the equipment during the lease term, the remaining payments are still a legal obligation much the same as an unpaid loan. Since long-term leases on major equipment are virtually always noncancelable, they are effectively debt with all of its problems and risks. But in the early days, they didn't show up on balance sheets. In other words, an investor reading the financial statements of a company that used lease financing could have been misled into thinking the firm was stronger than it was.

---

8. Retained earnings or money raised by selling new stock.
9. If a borrower defaults on a loan, the lender can sell collateral to satisfy the loan obligation.

By the early 1970s there was substantial concern within the accounting profession over distortions in reported financial results due to leasing. Along with that concern, pressure built to provide accounting rules that would require disclosing long-term leases as the equivalent of debt.

Accounting rules at the time did state that all leases had to be disclosed in notes to the financial statements. Those opposed to change argued that this footnote disclosure was enough. They insisted that sophisticated users of financial statements read the notes and understand exactly what companies are doing in spite of off balance sheet financing. The counterargument, which prevailed, is that not all investors are sophisticated or attentive enough to fully appreciate financial statement notes, and that more explicit disclosure is required to prevent financial statements from being misleading.

THE FINANCIAL ACCOUNTING STANDARDS BOARD AND FASB 13

The task of curing the distortion in financial results caused by leasing fell to the Financial Accounting Standards Board (FASB), a professional accounting organization that promulgates rules governing how financial statements are put together. The board issued *Statement of Financial Accounting Standards No. 13* (FASB 13 for short, referred to verbally as "fazbee thirteen") on the subject in November 1976. This standard dictates rules for the financial reporting of leases that are based on economic effects rather than legal technicalities.

The distorting effects of lease financing arose from the fact that asset ownership is crucial to financial reporting, and leasing allows use without ownership. The FASB attacked the problem by redefining ownership.

FASB 13 redefines ownership in an **economic** sense.

Prior to FASB 13 ownership for financial-reporting purposes was defined legally. An asset was owned by whoever held its title (usually a bill of sale). It didn't matter that someone else (a lessee) was using the asset. FASB 13 said that concept of ownership didn't reflect economic reality. It maintained that the real owner of an asset is whoever enjoys its benefits and is burdened with its risks and responsibilities.

Specifically, the standard says that if a lease transfers those benefits and burdens to a lessee for most of an asset's life, then that lessee is the owner for financial-reporting purposes, and must account for the asset on its balance sheet.[10]

The FASB also addressed leases that include provisions that pass legal ownership to lessees at the lease ends or provide that lessees can purchase the assets at prices below *fair market value* (called *bargain purchase options*). According to the Board, those leases are just disguised installment sales contracts and must be accounted for as sales. That is, the lessor is really just lending the purchase price to the lessee, and subsequent lease payments are actually loan payments.

OPERATING AND CAPITAL (FINANCING) LEASES

The FASB said that there are essentially two kinds of leases which it called operating and capital. Capital leases are often called financing leases, because they're a method of financing the permanent acquisition of equipment. They effectively transfer economic ownership while operating leases do not.

---

10. The benefit of ownership is the productive use of the equipment. The burdens include providing for maintenance, insurance, and property taxes.

Under FASB 13, lessees must *capitalize* financing leases. That means they must make accounting entries that put the value of leased assets and the associated liabilities on their balance sheets. The value of a leased asset is usually its fair market value and the associated liability reflects the obligation to make lease payments in the future. The resulting balance sheet accounts are similar to those that would appear if the lessee purchased the asset with borrowed money.

In other words, after FASB 13 operating leases can still be used to provide off balance sheet financing, but financing leases cannot. Naturally lessees strive to interpret leases as operating whenever they can. The Board made it easy to determine the nature of the lease by promulgating four rules, all of which must be met for a lease to qualify as operating.

1. The lease must not transfer legal ownership to the lessee at its end.
2. There must not be a bargain purchase option at the end of the lease.
3. The lease term must be less than 75% of the asset's estimated economic life.[11]
4. The present value of the lease payments must be less than 90% of the asset's fair market value at the beginning of the lease.[12]

The first two rules exclude disguised installment sales contracts from treatment as operating leases. The third says that if the attributes of ownership are transferred for most of the asset's life, it no longer truly belongs to the lessor and the lease must be treated as a financing lease. The fourth addresses whether the lessor is really selling the equipment through the lease. If the present value of the committed lease payments is close to the asset's value, then the transaction is probably a sale, and ownership should effectively pass to the lessee.

As a practical matter it's fairly easy to identify operating leases. They're usually relatively short, say one to three years. The lease payments usually include a charge for equipment maintenance, and lessors generally pay for insurance and property taxes. Because these things are included, operating leases are sometimes called *service leases*.

Operating leases are also generally cancelable on short notice (usually 30 days), although a cancellation penalty may be required. Financing leases, on the other hand, are *noncancelable*.

FINANCIAL STATEMENT PRESENTATION OF LEASES BY LESSEES

The financial statement presentation and accounting for operating and financing leases are very different. Operating leases are simple, while financing leases are complex. We'll discuss both, presenting only the highlights of the financing lease treatment.

Operating Leases

The financial statement treatment of operating leases is straightforward. There are no balance sheet entries, and lease payments are simply treated as an expense on the income statement. There is, however, a requirement that the details of all leases be disclosed in footnotes to the financial statements.

---

11. An asset's economic life is the period over which it will be used. That is generally longer than the period over which it is depreciated.
12. The interest rate used to take this present value is the rate the lessee would pay if it borrowed new money at the time the lease is signed.

Financing (Capital) Leases

Financing leases are usually capitalized at the **present value** of committed **lease payments**.

At the beginning of a financing lease, the lessee must record an asset on its balance sheet reflecting the leased equipment's value. It must also record an offsetting liability related to its obligation to make lease payments. Both of these amounts are usually taken to be equal to the present value of the stream of committed lease payments, a sum that is usually about equal to the fair market value of the equipment. The liability appears in the debt section of the balance sheet and is normally called Lease Obligation. The interest rate for the present value calculation is generally the rate the lessee would have to pay if it was borrowing new money at the time the lease begins.

Leased **assets** are **depreciated**. Lease **obligations** are amortized as **loans**.

Once these accounts are set up, they are amortized[13] independently. The asset is simply depreciated. The Lease Obligation liability is treated like a loan. An effective interest rate is assumed,[14] and lease payments are divided between interest and principal reduction as if they were loan payments. The technique is identical to the one we studied in Chapter 6 under Loan Amortization Schedules (see page 248).

| **Example 7A.1** | Emeral Inc. is a moderately sized construction company that operates in upstate New York. Last year it leased a crane from GD Credit Corp. for a term of 15 years at an annual rental of $20,000 payable at the end of each year. The crane is expected to be completely worn out and valueless at the end of the lease. Before the lease agreement was made, other financing sources were willing to lend to Emeral at 5%. Emeral will depreciate the crane using the straight line method over the 15-year life of the lease. |

Just before the lease was signed, Emeral's balance sheet was as follows:

Emeral Inc.
Balance Sheet
($000)

Current assets	$ 20	Current liabilities	$ 10
Fixed assets	180	Long-term debt	90
Total assets	$200	Equity	100
		Total liabilities & equity	$200

The lease is treated as a financing lease.

a. Construct Emeral's balance sheet after the lease is signed showing the leased asset and lease obligation separately. (We'll work in whole dollars but present balance sheet accounts rounded to the nearest $1,000.)

b. Calculate the firm's debt ratio before and after the lease takes effect, and comment on the difference.

c. (Optional) Reconstruct the balance sheet after the first annual lease payment is made assuming all other accounts are unchanged.

---

13. Amortizing balance sheet accounts means writing them down to zero over time. Assets are amortized through depreciation, while liabilities (think in terms of a loan) are amortized as they are paid off.

14. Usually the same rate used to take the present value of the lease payments.

SOLUTION:

a. Emeral will capitalize the lease at an amount equal to the present value of the annuity formed by the contracted lease payments. That amount is calculated using the present value of an annuity formula, equation 6.19 (see page 243).

$$PVA = PMT[PVFA_{k,n}]$$
$$= \$20,000[PVFA_{5,15}]$$
$$= \$20,000(10.3797)$$
$$= \$207,594$$

Hence, the balance sheet immediately after the lease is signed is as follows.

Emeral Inc.
Balance Sheet
($000)

Current assets	$ 20	Current liabilities	$ 10
Leased crane	208	Lease obligation	208
Fixed assets	180	Long-term debt	90
Total assets	$408	Equity	100
		Total liabilities & equity	$408

b. Emeral's debt ratio before the lease is ($000)

$$\text{debt ratio} = \frac{\text{current liabilities} + \text{long-term debt}}{\text{total assets}}$$
$$= (\$10 + \$90)/\$200$$
$$= 50\%$$

After the lease is signed, the lease obligation is included as debt in calculating the debt ratio, which increases substantially.

$$\text{debt ratio} = \frac{\text{current liabilities} + \text{lease obligation} + \text{long-term debt}}{\text{total assets}}$$
$$= (\$10 + \$208 + \$90)/\$408$$
$$= \$308/\$408$$
$$= 75\%$$

Comment: The lease creates a major deterioration in Emeral's debt ratio that could jeopardize its viability. It would certainly lessen the firm's ability to borrow from other sources.

c. (Optional) To construct the new balance sheet, we must calculate the first year's amortization of the leased crane and lease obligation accounts. Each of those is then subtracted from the respective beginning account balances. The asset is simply depreciated, while the liability is amortized as if it was a loan at 5%.

First consider the leased crane account. After the first year, it is reduced by one year's depreciation.

$$\text{depreciation} = \frac{\$207{,}594}{15} = \$13{,}840$$

Leased crane:

$$\text{ending balance} = \text{beginning balance} - \text{depreciation}$$

$$= \$207{,}594 - \$13{,}840$$

$$= \$193{,}754$$

Next consider the lease obligation account. It's treated as a loan bearing 5% interest. We'll calculate the first year's ending balance just as we would if we were constructing a loan amortization schedule (see page 248).

Interest in the first year is 5% of the beginning obligation (loan).

$$\text{interest} = \$207{,}594 \times .05 = \$10{,}380$$

Subtract this from the lease payment to calculate the portion of the payment that reduces the lease obligation (loan principal).

$$\text{obligation reduction} = \text{lease payment} - \text{interest}$$

$$= \$20{,}000 - \$10{,}380$$

$$= \$9{,}620$$

Subtract the reduction from the beginning obligation (loan) balance to get the first year's ending balance.

$$\text{new lease obligation} = \text{beginning balance} - \text{obligation reduction}$$

$$= \$207{,}594 - \$9{,}620$$

$$= \$197{,}974$$

Finally put the new asset and obligation balances into the balance sheet rounded to the nearest $1,000.

Emeral Inc.
Balance Sheet
($000)

Current assets	$ 20	Current liabilities	$ 10
Leased crane	194	Lease obligation	198
Fixed assets	180	Long-term debt	90
Total assets	$394	Lease balancing account	(4)
		Equity	100
		Total liabilities & equity	$394

Leased assets and obligations are **amortized independently** and usually have unequal balances.

Notice that because the leased crane and the lease obligation accounts are amortized using different methods, there's no reason that their balances should be equal until the end of the lease when both will be amortized to zero. For illustrative purposes, we've shown the difference in a small balancing account which would disappear at the end of the lease. In practice what we're showing in the balancing account would just fall into equity.

LEASING FROM THE PERSPECTIVE OF THE LESSOR

Being a lessor is an investment alternative to lending. It's usually done by financial institutions like banks, finance companies, and insurance companies, rather than individuals. Instead of lending money to a customer company to buy equipment, the finance company buys the equipment and leases it to the customer firm.

Recall from our work on the time value of money in Chapter 6 that the mathematics of lending are governed by the formula for the present value of an annuity, which we presented as equation 6.19 (see page 243 for the equation and page 247 for its application to lending). We'll renumber that expression and repeat it here for convenience.

$$(7A.1) \qquad PVA = PMT[PVFA_{k,n}]$$

When this expression is applied to loans, PVA is the amount borrowed, PMT is the loan payment (including interest and a return of principal), k is the loan's interest rate, and n is its term. $PVFA_{k,n}$, of course, is a table factor. Keep in mind that the interest rate is the lender's return on its investment in the loan.

If any three of these variables are known, equation 7A.1 can be solved for the fourth. Specifically, if a lender wants to earn a particular return on an invested amount over some period, the formula lets us calculate the payment it must ask of the borrower.

The **mathematics** of basic **leases and loans** are **identical**.

Basic financing leases work the same way. Instead of giving a company money to buy equipment, a lessor buys the equipment and delivers it along with a lease contract. Then it collects lease payments instead of loan payments. The lease payments required to provide the lessor with a given return are calculated in exactly the same way as the payments would be on a loan of equal term and amount. In the leasing arrangement, the interest rate is referred to either as the lessor's return or the *rate implicit in the lease*.

The **lessor's return** is the rate **implicit in the lease**.

Leasing can be a safe way to invest if the leased assets have a continuing market value. The lessor holds legal title, so if the lessee defaults, it's relatively easy to repossess the assets and recover the lessor's investment by selling or leasing those assets again. Lessors also get better treatment than lenders if the lessee/borrower enters bankruptcy. (We'll discuss bankruptcy in Chapter 17.)

Example 7A.2 Suppose the Prudential Insurance Co. is looking for a safe, long-term investment that will earn 6%. Further assume that Ford Motor Company wants to acquire a number of special purpose railroad cars to transport new automobiles to distribution hubs around the country. Ford wants to buy railroad cars valued at a total of $50 million and expects them to last 20 years after which they will be essentially worthless. Prudential considers the investment relatively safe because there's an active market for used railroad cars. It is therefore willing to buy the cars and lease them to Ford.

a. What annual lease payment should Prudential ask of Ford to achieve its targeted 6% return on a 20-year lease? Assume lease payments will be made at the end of each year.

b. Suppose Ford wants to take the lease but is unwilling to pay more than $4 million per year. What will be Prudential's return if it agrees to Ford's terms?

SOLUTION:

a. The required lease payment is calculated using equation 7A.1, the present value of an annuity formula.

$$PVA = PMT[PVFA_{k,n}]$$

$$\$50{,}000{,}000 = PMT[PVFA_{6,20}]$$

$$\$50{,}000{,}000 = PMT(11.4699)$$

$$PMT = \$4{,}359{,}236$$

Calculator Solution

Key	Input
n	20
I/Y	6
PV	50,000,000
FV	0
Answer	
PMT	4,359,228

b. Here we're simply asked to solve an annuity problem for the interest rate rather than for the payment. The technique should be familiar from our work in Chapter 6. (See Example 6.3 on page 229.)

$$PVA = PMT[PVFA_{k,n}]$$

$$\$50{,}000{,}000 = \$4{,}000{,}000[PVFA_{k,20}]$$

$$PVFA_{k,20} = \frac{\$50{,}000{,}000}{\$4{,}000{,}000}$$

$$= 12.5000$$

Calculator Solution

Key	Input
n	20
PMT	4,000,000
PV	50,000,000
FV	0
Answer	
I/Y	4.96

Examination of Table A-4 shows the return at this payment level to be just under 5%. A financial calculator gives an exact answer of k = 4.96%.

RESIDUAL VALUES

*The leased asset's estimated **value** at the **end** of the lease is the **residual**.*

In the examples we've considered so far, the equipment was assumed to have no value at the end of the lease. That essentially means the assets' economic lives were estimated to be equal to the lease terms. In many cases, equipment is expected to have a positive **residual value** at the end of the lease. This makes pricing and return calculations slightly more complex.

A residual value means the lessor can expect an additional cash flow at the end of the lease. The cash can come from one of three sources. The lessee may buy the equipment, the lessor may sell it to someone else, or it may be re-leased to the original or another lessee.

The last alternative is usually associated with operating leases that have relatively short terms. In such cases, lessors may need to lease equipment several times to recover their investments and earn a reasonable return. We'll concentrate on situations in which a relatively small residual is expected at the end of a long-term lease.

Example 7A.3

*The **present value** of the **residual** is **subtracted** from the lessor's **investment** in payment and return calculations.*

Reconsider Example 7A.2 part (a) assuming Prudential estimates that the railroad cars will be worth $3 million at the end of the 20-year lease. Calculate the lease payment that will bring Prudential a 6% return on its investment.

SOLUTION: Even though Prudential will have to spend $50 million to acquire the railroad cars, it doesn't have to recover quite that much from the lease payments. In a present value sense, Prudential's investment is $50 million reduced by the present value of the expected residual.

Calculator Solution

Key	Input
n	20
I/Y	6
FV	3,000,000
PMT	0
	Answer
PV	935,414

First calculate the present value of the $3 million residual over 20 years at 6% using equation 6.7 for the present value of an amount. (See page 228.)

$$PVA = FV_n[PVF_{k,n}]$$
$$= \$3,000,000[PVF_{6,20}]$$
$$= \$3,000,000(.3118)$$
$$= \$935,400$$

Now subtract that amount from the $50 million purchase price of the railroad cars.

$$\$50,000,000 - \$935,400 = \$49,064,600$$

Calculator Solution

Key	Input
n	20
I/Y	6
PV	49,064,600
FV	0
	Answer
PMT	4,277,675

Finally calculate the required lease payment based on this smaller investment and notice that it is slightly reduced.

$$PVA = PMT[PVFA_{k,n}]$$
$$\$49,064,600 = PMT[PVFA_{6,20}]$$
$$\$49,064,600 = PMT(11.4699)$$
$$PMT = \$4,277,683$$

Residuals are **soft numbers**.

It's important to understand that the residual is a very *soft* number. That means it's an inaccurate estimate, largely because it's so far in the future. The actual value of the equipment at the end of 20 years will depend on its condition *and* the market for used railroad cars at that time, both of which are difficult to predict. The residual could turn out to be anything from zero to two or three times the amount estimated.

Residuals in General

Residual values are included in most leases and are often important in negotiations between lessors and lessees. A higher residual means lower payments, so lessees argue that the equipment will hold its value over a long time. Lessors want higher payments so their investments will be returned quickly and argue the opposite.

A **higher residual** means a **lower payment** so residuals are important in **negotiations**.

Since the actual residual value of equipment at the end of a lease depends in large part on its condition, lessors often insist on a penalty if residual values turn out to be lower than planned. In theory, such a clause simply asks the lessee to pay for abusing the equipment during the lease. But it can be a trap for lessees, because a weak market for used equipment can depress the value of items coming off lease regardless of condition.

Automobile leases are notorious for manipulating payments and residuals. Lower lease payments can often be negotiated if the lessee accepts a higher residual. That sounds good when the lease is signed. However, the residual is usually the price the customer will pay if he wants to keep the car when the lease is over. If he doesn't, there can be a penalty if the residual in the contract exceeds the used car value of the vehicle at the end of the lease. So what may seem like a good deal in terms of car payments can lead to a big charge in the longer run.

LEASE VERSUS BUY—THE LESSEE'S PERSPECTIVE

Companies rarely have enough cash on hand to purchase major pieces of equipment or real estate. That means the decision to acquire an asset is usually accompanied by a decision about financing. There are three broad financing possibilities,

equity,[15] debt, and leasing. For purposes of this discussion, we'll assume the company doesn't want to use equity, so the choice is between debt (borrowing to buy) and leasing.

Both lenders and lessors are easy to find if the company needing equipment is a reasonably good credit risk. Firms can borrow through bonds or directly from banks, while lease financing is available from *leasing companies* (lessors) which may be banks or finance companies (General Electric Capital is the nation's largest leasing company). Lessors often work through brokers who match them with equipment users, handle negotiations, and take care of contractual paperwork.

It's always appropriate to conduct a *lease-buy analysis* to compare the cost of the two approaches when new assets are being acquired. The analysis involves laying out the cash flows associated with the two financing methods and calculating the present value of each series. The approach with the lowest cost in a present value sense is the best choice.

The interest rate used in taking both present values is the rate the firm is currently paying on new debt adjusted for taxes. The debt rate is used because leasing and borrowing have similar risks, and it is easily ascertained.

The tax adjustment states the debt rate after taxes. The idea is that interest is a tax deductible expense so every dollar spent on it saves taxes of ($1 × T), where T is the tax rate. In general, an after-tax rate is just the pretax rate times $(1 - T)$. For example, if the interest rate is 10% and the tax rate is 40%, the after-tax debt rate is

$$10\%(1 - T) = 10\%(1 - .4) = 10\%(.6) = 6\%$$

We'll discuss after-tax rates at length in a later chapter.

Lease-buy analysis is straightforward, but care must be exercised so that depreciation, taxes, and residual values are treated properly. The best way to understand the technique is through an example.

> A **lease-buy** analysis demonstrates whether it's **cheaper** to **lease** or to **borrow** to buy equipment.

Example 7A.4

Halidane Transfer Inc. is an armored car service that operates in the Chicago area transferring cash between customer locations and various banks. The firm has 22 armored vehicles which are fully utilized serving existing customers. Management recently accepted a new business opportunity that requires two additional vehicles, each of which costs $150,000. Halidane expects to use the new cars for 10 years, but will depreciate them over 5 years for tax purposes. Assume that tax law dictates the allowable depreciation in each year of the vehicles' lives as follows.[16]

Year	Percent of Original Cost
1	35%
2	25
3	20
4	10
5	10

---

15. Money from retained earnings or the sale of new stock.
16. We're using a simplified tax depreciation schedule to keep the example straightforward. We'll use the actual tax system called MACRS in a problem at the end of this appendix and discuss it in Chapter 11.

Halidane can acquire the cars with $300,000 borrowed from its bank at 10% repayable over five years.

Alternately, it can lease both cars for five years from BNI Leasing Inc. for an annual payment of $70,000 with an option to purchase at fair market value at the end of the lease. BNI and Halidane agree that the cars will probably be worth about $30,000 each at that time.

The terms of the lease specify that Halidane will bear the cost of maintenance, property taxes, and insurance on the vehicles. The firm's marginal tax rate is 40%. Should Halidane lease or buy the new armored cars?

SOLUTION: To answer this question, we'll lay out the five-year cash flows implied by the alternatives and calculate the present value of net outflows associated with each. The alternative with the lower present value of net outflows is then preferred.

Since all of the cash flows we'll calculate are after tax, it's appropriate to take present values with an after-tax interest rate. We're using Halidane's 10% cost of debt, so our discount rate for present value calculations is

$$10\%(1 - T) = 10\%(1 - .4) = 6\%$$

Notice that Halidane pays for maintenance, taxes, and insurance in both options, so they need not be considered in the analysis. Also recall that parentheses mean negative cash flows (i.e., outflows).

We'll start with borrowing to purchase the assets. The following worksheet develops the appropriate cash flows which are discussed in the subsequent paragraph.

A **lease-buy** analysis compares the **present values** of **cash outflows** for **leasing** versus **buying** equipment.

			Year			
Purchase ($000)	**0**	**1**	**2**	**3**	**4**	**5**
(1) Purchase cars	$(300)					
(2) Allowable depreciation %		35%	25%	20%	10%	10%
(3) Tax depreciation [(2) × $300]		$105	$75	$60	$30	$30
(4) Tax savings [(3) × 40%]		$ 42	$30	$24	$12	$12
(5) Net cash flow [(1) + (4)]	$(300)	$ 42	$30	$24	$12	$12

Line (1) reflects the present (time 0) purchase of the cars with borrowed money.[17] The next three lines calculate the cash flow associated with depreciation. Notice that depreciation is not itself a cash expense, but has a cash impact because it is deductible and reduces taxes as shown in line (4). Line (5) reflects net cash flow, the sum of the purchase price and tax savings from depreciation.

The present value of the purchase approach is just the present value of line (5), which is an uneven stream of cash flows. The present value of an uneven stream is taken by treating the flows individually. (See Chapter 6, page 259.)

$$PV = -\$300,000 + FV_1[PVF_{6,1}] + FV_2[PVF_{6,2}] + FV_3[PVF_{6,3}]$$
$$+ FV_4[PVF_{6,4}] + FV_5[PVF_{6,5}]$$

$$= -\$300,000 + \$42,000(.9434) + \$30,000(.8900) + \$24,000(.8396)$$
$$+ \$12,000(.7921) + \$12,000(.7473)$$

$$= -\$300,000 + \$104,946 = -\$195,054$$

---

17. There's no reason to show the loan as an inflow and the payments as outflows because their present values will just cancel one another. This is true because we're discounting using an after-tax interest rate.

The lease alternative involves tax deductible lease payments that result in a constant after-tax cash outflow which can be treated as an annuity. However, at the end of the lease Halidane won't own the vehicles. Since the plan is to use them for 10 years, it will have to exercise the purchase option at the end of year 5 for an estimated $60,000.

		Year				
Lease ($000)	**0**	**1**	**2**	**3**	**4**	**5**
(1) Lease payments		$(70)	$(70)	$(70)	$(70)	$ (70)
(2) Tax savings [(1) × 40%]		28	28	28	28	28
(3) After-tax lease payment [(1) − (2)]		$(42)	$(42)	$(42)	$(42)	$ (42)
(4) Purchase option						(60)
(5) Net cash flow [(3) + (4)]		$(42)	$(42)	$(42)	$(42)	$(102)

The easiest way to calculate the present value of the leasing alternative is to treat the annuity and the fifth year purchase separately. The present value of the after-tax annuity is

$$\text{PVA} = \text{PMT}[\text{PVFA}_{6,5}] = -\$42,000(4.2124) = -\$176,921$$

And the present value of the ending purchase is

$$\text{PV} = \text{FV}_5[\text{PVF}_{6,5}] = -\$60,000(.7473) = -\$44,838$$

Hence, the present value of cash outflows associated with leasing is

$$\text{PV} = -\$176,921 - \$44,838 = -\$221,759$$

Comparing the two alternatives, we see that the leasing plan is about 13% more costly. Further, the lease has a small element of risk in that purchasing the cars at its end may turn out to cost more than $60,000.

(Notice that lease-buy calculations have nothing to do with the financial statement presentation of capital leases illustrated in Example 7A.1. Those issues involve the firm's financial books. Lease-buy analysis deals strictly with cash flows.)

Leasing is usually **more expensive** than borrowing to buy, because lessors demand higher returns than borrowers.

The result shown in the preceding example, that lease financing is more expensive than borrowing, is the usual situation. It exists because lessors generally demand higher returns than lenders. Given that, and the fact that FASB 13 takes away much of the benefit of off balance sheet financing, it's fair to ask why leasing is as popular as it is. We'll look into that in the next two sections.

THE ADVANTAGES OF LEASING

Leasing often offers several advantages that can make it worth its extra cost. We'll discuss a few issues in this section and a major tax advantage in the next.

NO MONEY DOWN

Leasing offers several **advantages** other than off balance sheet financing that may **justify its cost**.

Lenders typically won't finance the entire cost of an asset. They require that borrowers put some of their own money into the deal. We're all familiar with this idea in the context of buying cars and houses, where we call the purchaser's contribution a *down payment*. Lessors don't usually require a down payment, essentially offering 100% financing. This can be very attractive to firms that have good prospects, but are cash poor. A great many small businesses are in that position.

RESTRICTIONS

Lenders usually put restrictions on the activities of borrowers to ensure they will be able to pay off their debt. These restrictive rules are called indentures when the lending is through bonds and covenants with loans. Typical restrictions limit the amount of dividends the borrower can pay, restrict the types of business it can pursue, and require that it maintain certain financial ratios at acceptable levels. Lessors' restrictions are usually much less stringent or nonexistent.

EASIER CREDIT WITH MANUFACTURER/LESSORS

Equipment manufacturers sometimes lease their own products. In an effort to place their equipment, they will often lease to marginally creditworthy customers. This may be the only way some financially weak companies can acquire equipment.

AVOIDING THE RISK OF OBSOLESCENCE

Certain equipment tends to become obsolete very rapidly. In this context, obsolescence means newer equipment does a job so much better or cheaper that a company using older equipment is at a competitive disadvantage. In certain high-tech businesses, that can happen in a year or two.

Short leases have the effect of transferring that risk to lessors, because lessees can walk away from the obsolete equipment when leases are over. This can be attractive to lessees even though they're paying for the privilege through a higher cost of financing.

TAX DEDUCTING THE COST OF LAND

Land is not depreciable for either tax or financial-reporting purposes. Hence, if a company owns real estate, the portion of the cost representing land can never be recognized as an expense which when subtracted from income reduces taxes.

However, if real estate is leased, the entire lease payment can be deducted by a lessee regardless of the fact that some of it represents a recovery of the cost of land purchased by the lessor. Hence, leasing effectively allows lessees to depreciate land for tax purposes.

INCREASING LIQUIDITY—THE SALE AND LEASEBACK

Firms sometimes find themselves short of cash while owning substantial assets that are not encumbered by debt.[18] In that situation, it isn't unusual to sell the asset to a financial institution to generate liquid cash and then lease the asset back from the same institution over a long period of time. The technique is called a *sale and leaseback* and is usually used to free up cash invested in real estate.

TAX ADVANTAGES FOR MARGINALLY PROFITABLE COMPANIES

Under certain conditions, for tax reasons, it doesn't make financial sense to own assets when leasing is available. This usually occurs when companies expect to lose money or be marginally profitable for several years. The technique is called leveraged leasing and is described in the next section.

---

18. The asset is not serving as collateral for a loan.

LEVERAGED LEASES

A benefit of owning assets is the ability to deduct depreciation from income in the calculation of taxes. This effectively reduces the cost of those assets in the long run. For example, suppose a piece of equipment costs $100 million and the owner's marginal tax rate is 40%. Then for each dollar of cost that flows into depreciation, the firm saves $.40 in taxes, and over the asset's life the owner pays $40 million less tax. In essence, the government splits the cost of ownership with taxpayers. If assets are acquired with borrowed money, interest provides a similar benefit because it is also tax deductible.

But if a company isn't making a profit, it doesn't pay any tax, and depreciation and interest deductions don't save any money. Situations like that are fairly common; the airline industry provides a good example. The combination of a unionized workforce, federal regulation, and price competition has kept many airlines at or below breakeven profitability for years.

But unprofitable companies still need to acquire new assets. Airlines, for example, must continually acquire new planes to replace old equipment that becomes obsolete. If they don't, they lose the ability to compete.

Leveraged leases (also called *tax leases*) can provide a solution to this problem. In a leveraged lease, a profitable lessor purchases equipment with a combination of its own and borrowed money and enters into a financing lease with a lessee. The lessor generally contributes 20% to 40% of the asset's cost and borrows the rest. The term *leveraged* refers to the use of debt in a transaction. The higher the proportion of debt, the higher is the degree of leverage. A leveraged lease is illustrated in Figure 7A.1.

The lessee treats the transaction as it would any financing lease, but there's a difference in the lessor's treatment on its own books and for tax purposes. Ordinarily, lessors account for financing leases as if they were loans. That means they're not allowed to depreciate the assets and don't get the tax benefits of ownership. But the rules change when assets are purchased with a substantial proportion of borrowed money. Then lessors are permitted to depreciate leased assets and gain the associated tax benefits. They can also tax deduct interest on the borrowed money.

> The **government splits** the **cost** of **ownership** through **lower taxes** from **depreciation deductions**.

> In a **leveraged lease**, the **lessor acquires** the equipment with a combination of its own and **borrowed** money.

Figure 7A.1

Leveraged Lease
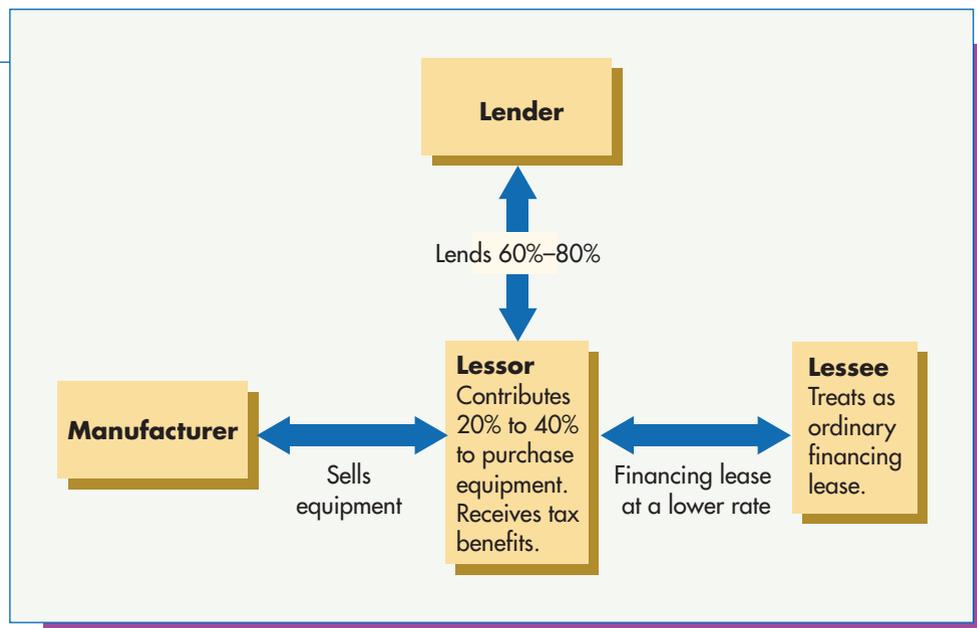
Internalizing the tax benefits of ownership makes the overall transaction more profitable to the lessor *who shares that extra profit with the lessee through reduced lease payments.* Thus, an unprofitable lessee indirectly gains some of the benefits of owner-ship through the lower lease payments offered in a leveraged lease.

QUESTIONS

1. What, in general, is meant by off balance sheet financing?
2. Describe the feature of financial reporting that made leasing popular before FASB 13.
3. What argument was made against adopting FASB 13? (One-line answer.)
4. There's a fundamental difference between rules one, two, and four for qualifying as an operating lease and rule three. What is it?
5. Just what is placed on the balance sheet in a financing lease?
6. In leases with no residuals, lessors calculate the lease payments they must charge as if the lease was a loan. How does the presence of a residual change the calculation?
7. Why are residuals important in negotiations between lessees and lessors?
8. Depreciation is a noncash charge. Why then is it important in lease-buy analysis? (Very short answer.)
9. Leasing is generally more expensive than borrowing to buy, and FASB 13 has reduced the availability of off balance sheet financing. Why then is leasing popular?
10. Leveraged leases offer tax advantages to unprofitable companies.
    a. Why are they called leveraged?
    b. Briefly, how do they work?

BUSINESS ANALYSIS

1. You've just joined SeaCraft Inc., a manufacturer of fiberglass boats, as its CFO. When you took the job, you knew that the company was not in the best financial condition. Profits are adequate, but the firm is carrying substantial debt. To make matters worse, the company's largest fiberglass molding machine is almost com-pletely worn out and needs to be replaced. SeaCraft can't pay for a new machine out of operating profit, and the owner, Sam Alston, doesn't want to sell any new stock which would dilute his interest.

    You've looked into borrowing money to acquire the machine and can get a deal with practically no down payment and a favorable interest rate through some banking contacts. But Sam is concerned about taking on more debt. He would like to sell the company and retire, but he's afraid that a heavier debt load will depress the price he might get. You agree that his concern is well founded.

    Sam rushed into your office this morning with what he described as a great idea. He'd read an article that said just about anything could be leased and also knew that SeaCraft already leased a number of copying machines. On his way to see you, he stopped into the accounting department and found that neither the copying equipment nor any associated liability was on SeaCraft's balance sheet.

    Storming into your office, he declared, "Leasing the molding machine is going to solve my debt problems! You're supposed to be the financial expert, why didn't you think of it? Why do I have to think of everything? Get on this quick! I want

to see a lease deal on my desk by the end of the week." Before you could answer, he rushed out for a meeting with the marketing department.

Prepare a tactful memo to Sam explaining a little more about leasing and why it may not be as wonderful for SeaCraft as he thinks. Write the memo for a reader who is not a financial person (i.e., avoid using technical jargon like FASB, capitalize, equity, annuity, and present value). Talking about financing, balance sheets, assets, and debt is OK.

<div align="center">

PROBLEMS

</div>

1. Caruthers Inc. is a small manufacturing firm and has the following summarized balance sheet.

<div align="center">

Caruthers Inc.
Balance Sheet
($ooo)

</div>

Current assets	$ 20	Current liabilities	$ 15
Fixed assets	130	Long-term debt	65
Total assets	$150	Equity	70
		Total liabilities & equity	$150

The firm is interested in acquiring a fleet of 10 company cars for its sales staff. The cars have an economic life of seven years, but Caruthers plans to keep them for only three because it doesn't want its salespeople driving around in old vehicles. The cars cost $20,000 each, and Caruthers is considering borrowing to purchase them.

a. Restate Caruthers's balance sheet after the loan is made.
b. Calculate the firm's debt ratio now and immediately after the loan is made.
c. Comment on the change in part (b). (Words only.)
d. Suggest a solution and explain why it will qualify for accounting treatment that will avoid the problem highlighted in part (b). (Words only.)

2. Henderson Engineering Ltd. just leased a computer-aided design system for five years with annual payments of $12,000 payable at the end of each year. The lease contains a provision that allows Henderson to purchase the machine at its fair market value as used equipment when the lease expires. Industry data indicate that systems like these normally last for about eight years. Henderson could have purchased the machine for $50,000 with money borrowed at 9%.

Does Henderson have to capitalize the lease on its balance sheet? Why?

3. Taunton Manufacturing Inc. is a machine shop in Taunton, Massachusetts. The firm recently leased a drill press for a 20-year term at payments of $9,000 per year payable at year end. No residual value was assumed in the lease which is clearly a financing lease. Taunton can borrow at 8% and will depreciate the press straight line over 20 years.

Shortly before the lease became effective, Taunton's balance sheet was as follows:

Taunton Manufacturing Inc.
Balance Sheet
($ooo)

Current assets	$ 35	Current liabilities	$ 25
Fixed assets	315	Long-term debt	95
Total assets	$350	Equity	230
		Total liabilities & equity	$350

Answer the following questions working in whole dollars but present balance sheet accounts rounded to the nearest $1,000.

a. Construct Taunton's balance sheet showing the capitalized lease and the related lease obligation.

b. Calculate the firm's debt ratio before and after the lease, and comment on the difference.

c. (Optional) Reconstruct the balance sheet at the end of the first year assuming the other accounts remain the same.

4. Wings Inc. is a commuter airline that serves the Boston area. Wings plans to lease a new plane through Nantucket Capital Inc. The lease term is 15 years, and no residual value is expected at its end.

a. What *monthly* lease payment must Nantucket charge to earn a 12% return on its investment if the plane Wings wants costs $1.5 million?

b. What would Nantucket's return be if it agreed to accept *annual* payments of $200,000?

5. Suppose Wings and Nantucket of the previous problem agreed to assume a $300,000 residual value for the plane at the end of the lease. How much will Wings have to pay monthly to give Nantucket its 12% return?

6. Paxton Sheet Metal Works Inc. is about to acquire a new stamping press that costs $400,000. It is considering purchasing the asset with money it can borrow at 10% repayable in annual, year-end installments over six years. It has also been offered an opportunity to lease the machine for payments of $86,500 per year, payable at year end, also over six years. The machine is depreciable for tax purposes over six years according to the following schedule. (This is the actual tax schedule for five-year life assets; a "half-year convention" takes a half year's depreciation in the first and last years; see page 469.)

Year	Percent of Original Cost
1	20.0%
2	32.0
3	19.2
4	11.5
5	11.5
6	5.8

The lease contains a purchase option at its end at fair market value which is estimated to be $100,000. It also stipulates that Paxton will be responsible for paying for maintenance, taxes, and insurance. Paxton's marginal tax rate is 30%. Conduct a lease-buy analysis to determine which option is preferable from a purely financial point of view.