Interest Rates and Bond Valuation 5

OPENING CASE

2015 and early 2016 proved to be a very unusual period for bonds. For example, in February 2016, Sweden's central bank lowered its interest rate from negative .35 percent to negative .5 percent! Sweden was not alone as the Eurozone, Switzerland, and Japan, among others, all had negative interest rates set by the respective central banks. Why was this happening? Central banks were in a race to the bottom, lowering interest rates in an attempt to improve their domestic economies.

While central bank interest rates are a monetary policy tool, you would expect that the interest rates determined by the market would never be negative. After all, why would you accept less in the future than you would now? However, this proved to be incorrect as the yield on the two-year Swiss government bond was negative 1.12 percent. And, in an event that had never previously occurred, bonds issued by chocolate giant Nestlé and Deutsche Bank AG both traded with negative yields.

This chapter takes what we have learned about the time value of money and shows how it can be used to value one of the most common of all financial assets, a bond. It then discusses bond features, bond types, and the operation of the bond market. What we will see is that bond prices depend critically on interest rates, so we will go on to discuss some very fundamental issues regarding interest rates. Clearly, interest rates are important to everybody because they underlie what businesses of all types—small and large—must pay to borrow money.

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Our goal in this chapter is to introduce you to bonds. We begin by showing how the techniques we developed in Chapter 4 can be applied to bond valuation. From there, we go on to discuss bond features and how bonds are bought and sold. One important thing we learn is that bond values depend, in large part, on interest rates. We therefore close out the chapter with an examination of interest rates and their behavior.

5.1 BONDS AND BOND VALUATION

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When a corporation (or government) wishes to borrow money from the public on a long-term basis, it usually does so by issuing or selling debt securities that are generically called bonds. In this section, we describe the various features of corporate bonds

and some of the terminology associated with bonds. We then discuss the cash flows associated with a bond and how bonds can be valued using our discounted cash flow procedure.

page 131

Bond Features and Prices

A bond is normally an interest-only loan, meaning that the borrower will pay the interest every period, but none of the principal will be repaid until the end of the loan. For example, suppose the Beck Corporation wants to borrow $1,000 for 30 years. The interest rate on similar debt issued by similar corporations is 12 percent. Beck will thus pay .12 × $1,000 = $120 in interest every year for 30 years. At the end of 30 years, Beck will repay the $1,000. As this example suggests, a bond is a fairly simple financing arrangement. There is, however, a rich jargon associated with bonds, so we will use this example to define some of the more important terms.

In our example, the $120 regular interest payments that Beck promises to make are called the bond's **coupons**. Because the coupon is constant and paid every year, the type of bond we are describing is sometimes called a *level coupon bond.* The amount that will be repaid at the end of the loan is called the bond's **face value**, or **par value**. As in our example, this par value is usually $1,000 for corporate bonds, and a bond that sells for its par value is called a *par value bond.* Government bonds frequently have much larger face, or par, values. Finally, the annual coupon divided by the face value is called the **coupon rate** on the bond; in this case, because $120/1,000 = 12 percent, the bond has a 12 percent coupon rate.

The number of years until the face value is paid is called the bond's time to **maturity**. A corporate bond will frequently have a maturity of 30 years when it is originally issued, but this varies. Once the bond has been issued, the number of years to maturity declines as time goes by.

Bond Values and Yields

As time passes, interest rates change in the marketplace. The cash flows from a bond, however, stay the same. As a result, the value of the bond will fluctuate. When interest rates rise, the present value of the bond's remaining cash flows declines, and the bond is worth less. When interest rates fall, the bond is worth more.

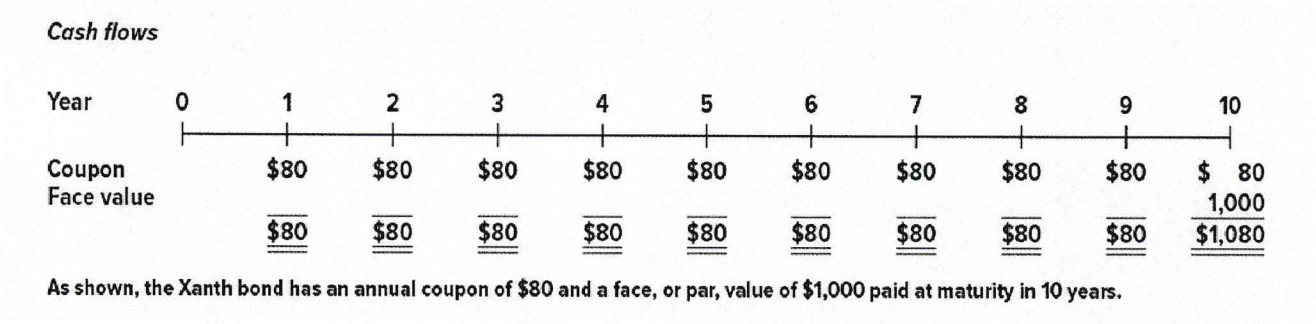
To determine the value of a bond at a particular point in time, we need to know the number of periods remaining until maturity, the face value, the coupon, and the market interest rate for bonds with similar features. This interest rate required in the market on a bond is called the bond's **yield to maturity (YTM)**. This rate is sometimes called the bond's *yield* for short. Given all this information, we can calculate the present value of the cash flows as an estimate of the bond's current market value.

For example, suppose the Xanth (pronounced "zanth") Co. were to issue a bond with 10 years to maturity. The Xanth bond has an annual coupon of $80. (Most, but not all, straight coupon bonds in the U.S. pay interest semiannually. Practice differs around the world.) Similar bonds have a yield to maturity of 8 percent. Based on our preceding discussion, the Xanth bond will pay $80 per year for the next 10 years in coupon interest. In 10 years, Xanth will pay $1,000 to the owner of the bond. The cash flows from the bond are shown in Figure 5.1 What would this bond sell for?

As illustrated in Figure 5.1, the Xanth bond's cash flows have an annuity component (the coupons) and a lump sum (the face value paid at maturity). We thus estimate the market value of the bond by calculating the present value of these two components separately and adding the results together. First, at the going rate of 8 percent, the present value of the $1,000 paid in 10 years is:

Present value = $1,000/1.08^{10} = $1,000/2.1589 = $463.19

FIGURE 5.1
Cash Flows for Xanth Co. Bond



Second, the bond offers $80 per year for 10 years; the present value of this annuity stream is:

$$\begin{aligned}\text{Annuity present value} &= \$80 \times (1 - 1/1.08^{10})/.08 \\ &= \$80 \times (1 - 1/2.1589)/.08 \\ &= \$80 \times 6.7101 \\ &= \$536.81\end{aligned}$$

We can now add the values for the two parts together to get the bond's value:

$$\text{Total bond value} = \$424.10 + 460.72 = \$884.82$$

This bond sells for exactly its face value. This is not a coincidence. The going interest rate in the market is 8 percent. Considered as an interest-only loan, what interest rate does this bond have? With an $80 coupon, this bond pays exactly 8 percent interest only when it sells for $1,000.

To illustrate what happens as interest rates change, suppose that a year has gone by. The Xanth bond now has nine years to maturity. If the interest rate in the market has risen to 10 percent, what will the bond be worth? To find out, we repeat the present value calculations with 9 years instead of 10, and a 10 percent yield instead of an 8 percent yield. First, the present value of the $1,000 paid in nine years at 10 percent is:

$$\text{Present value} = \$1{,}000/1.10^{9} = \$1{,}000/2.3579 = \$424.10$$

Second, the bond now offers $80 per year for nine years; the present value of this annuity stream at 10 percent is:

$$\begin{aligned}\text{Annuity present value} &= \$80 \times (1 - 1/1.10^{9})/.10 \\ &= \$80 \times (1 - 1/2.3579)/.10 \\ &= \$80 \times 5.7590 \\ &= \$460.72\end{aligned}$$

We can now add the values for the two parts together to get the bond's value:

$$\text{Total bond value} = \$424.10 + 460.72 = \$884.82$$

Therefore, the bond should sell for about $885. In the vernacular, we say that this bond, with its 8 percent coupon, is priced to yield 10 percent at $885.

The Xanth Co. bond now sells for less than its $1,000 face value. Why? The market interest rate is 10 percent. Considered as an interest-only loan of $1,000, this bond only pays 8 percent, its coupon rate. Because this bond pays less than the going rate, investors

are willing to lend only something less than the $1,000 promised repayment. Because the bond sells for less than face value, it is said to be a *discount bond.* page 133

A good bond site to visit is finance.yahoo.com/bonds, which has loads of useful information.

The only way to get the interest rate up to 10 percent is to lower the price to less than $1,000 so that the purchaser, in effect, has a built-in gain. For the Xanth bond, the price of $885 is $115 less than the face value, so an investor who purchased and kept the bond would get $80 per year and would have a $115 gain at maturity as well. This gain compensates the lender for the below-market coupon rate.

Another way to see why the bond is discounted by $115 is to note that the $80 coupon is $20 below the coupon on a newly issued par value bond, based on current market conditions. The bond would be worth $1,000 only if it had a coupon of $100 per year. In a sense, an investor who buys and keeps the bond gives up $20 per year for nine years. At 10 percent, this annuity stream is worth:

$$\begin{aligned}\text{Annuity present value} &= \$20 \times (1 - 1/1.10^{9})/.10 \\ &= \$20 \times 5.7590 \\ &= \$115.18\end{aligned}$$

This is the amount of the discount.

What would the Xanth bond sell for if interest rates had dropped by 2 percent instead of rising by 2 percent? As you might guess, the bond would sell for more than $1,000. Such a bond is said to sell at a *premium* and is called a *premium bond.*

Online bond calculators are available at personal.fidelity.com; interest rate information is available at money.cnn.com/data/bonds and www.bankrate.com.

This case is just the opposite of that of a discount bond. The Xanth bond now has a coupon rate of 8 percent when the market rate is only 6 percent. Investors are willing to pay a premium to get this extra coupon amount. In this case, the relevant discount rate is 6 percent, and there are nine years remaining. The present value of the $1,000 face amount is:

$$\text{Present value of face amount} = \$1{,}000/1.06^{9} = \$1{,}000/1.6895 = \$591.89$$

The present value of the coupon stream is:

$$\begin{aligned}\text{Annuity present value} &= \$80 \times (1 - 1/1.06^{9})/.06 \\ &= \$80 \times (1 - 1/1.6895)/.06 \\ &= \$80 \times 6.8017 \\ &= \$544.14\end{aligned}$$

We can now add the values for the two parts together to get the bond's value:

$$\text{Total bond value} = \$591.89 + 544.14 = \$1,136.03$$

Total bond value is therefore about $136 in excess of par value. Once again, we can verify this amount by noting that the coupon is now $20 too high, based on current market conditions. The present value of $20 per year for nine years at 6 percent is:

$$\begin{aligned}\text{Annuity present value} &= \$20 \times (1 - 1/1.6^9)/.06 \\ &= \$20 \times 6.8017 \\ &= \$136.03\end{aligned}$$

This is just as we calculated.

Based on our examples, we can now write the general expression for the value of a bond. If a bond has (1) a face value of F paid at maturity, (2) a coupon of C paid per period, (3) T periods to maturity, and (4) a yield of r per period, its value is:

$$\text{Bond value} = C \times [1 - 1/(1 + r)^T]/r + F/(1 + r)^T \qquad [5.1]$$

being equal, its value will fluctuate more as interest rates change. Put another way, the bond with the higher coupon has a larger cash flow early in its life, so its value is less sensitive to changes in the discount rate. page 136

Bonds are rarely issued with maturities longer than 30 years. However, low interest rates in recent years have led to the issuance of bonds with much longer terms. In the 1990s, Walt Disney issued "Sleeping Beauty" bonds with a 100-year maturity. Similarly, BellSouth, Coca-Cola, and Dutch banking giant ABN AMRO all issued bonds with 100-year maturities. These companies evidently wanted to lock in the historical low interest rates for a *long* time. Before these fairly recent issues, it appears the last time 100-year bonds were issued was in May 1954, by the Chicago and Eastern Railroad. And low interest rates in recent years have led to more 100-year bonds. For example, in July 2015, Brazilian oil company Petrobras issued 100-year bonds, and those weren't the longest maturity bonds issued in 2015 as issuance of perpetual bonds hit a record. For example, French energy company Total issued $5.7 billion in perpetual bonds and Volkswagen issued $2.6 billion in perpetual debt.

We can illustrate the effect of interest rate risk using the 100-year BellSouth issue. The following table provides some basic information on this issue, along with its prices on December 31, 1995, July 31, 1996, and December 9, 2014.

MATURITY	COUPON RATE	PRICE ON 12/31/95	PRICE ON 7/31/96	PERCENTAGE CHANGE IN PRICE 1995–96	PRICE ON 12/9/14	PERCENTAGE CHANGE IN PRICE 1996–2014
2095	7.00%	$1,000.00	$800.00	−20.0%	$1,235.59	+54.4%

Several things emerge from this table. First, interest rates apparently rose between December 31, 1995, and July 31, 1996 (why?). After that, however, they fell (why?). The bond's price first lost 20 percent and then gained 54.4 percent. These swings illustrate that longer-term bonds have significant interest rate risk.

Finding the Yield to Maturity: More Trial and Error

Frequently, we will know a bond's price, coupon rate, and maturity date, but not its yield to maturity. For example, suppose we are interested in a six-year, 8 percent coupon bond with annual coupons. A broker quotes a price of $955.14. What is the yield on this bond?

We've seen that the price of a bond can be written as the sum of its annuity and lump-sum components. Knowing that there is an $80 coupon for six years and a $1,000 face value, we can say that the price is:

$$\$955.14 = \$80 \times [1 - 1/(1 + r)^6]/r + 1{,}000/(1 + r)^6$$

where r is the unknown discount rate, or yield to maturity. We have one equation here and one unknown, but we cannot solve for r explicitly. The only way to find the answer is to use trial and error.

This problem is essentially identical to the one we examined in the last chapter when we tried to find the unknown interest rate on an annuity. However, finding the rate (or yield) on a bond is even more complicated because of the $1,000 face amount.

We can speed up the trial-and-error process by using what we know about bond prices and yields. In this case, the bond has an $80 coupon and is selling at a discount. We thus know that the yield is greater than 8 percent. If we compute the price at 10 percent:

$$\begin{aligned}\text{Bond value} &= \$80 \times \left(1 - 1/1.10^{6}\right)/.10 + 1{,}000/1.10^{6} \\ &= \$80 \times 4.3553 + 1{,}000/1.7716 \\ &= \$912.89\end{aligned}$$

At 10 percent, the value we calculate is lower than the actual price, so 10 percent is too high. The true yield must be somewhere between 8 and 10 percent. At this point, it's "plug and chug" to find the answer. You would probably want to try 9 percent next. If you did, you would see that this is in fact the bond's yield to maturity.

Current market rates are available at www.bankrate.com.

A bond's yield to maturity should not be confused with its **current yield**, which is a bond's annual coupon divided by its price. In the example we just worked, the bond's annual coupon was $80, and its price was $955.14. Given these numbers, we see that the current yield is $80/955.14 = 8.38 percent, which is less than the yield to maturity of 9 percent. The reason the current yield is too low is that it only considers the coupon portion of your return; it doesn't consider the built-in gain from the price discount. For a premium bond, the reverse is true, meaning that current yield would be higher because it ignores the built-in loss.

Our discussion of bond valuation is summarized in Table 5.1. A nearby *Spreadsheet Techniques* box shows how to find prices and yields the easy way.

TABLE 5.1 Summary of Bond Valuation

I. Finding the Value of a Bond

Bond value = $C \times [1 - 1/(1 + r)^T]/r + F/(1 + r)^T$

where

C = Coupon paid each period

r = Discount rate per period

T = Number of periods

F = Bond's face value

II. Finding the Yield on a Bond

Given a bond value, coupon, time to maturity, and face value, it is possible to find the implicit discount rate, or yield to maturity, by trial and error only. To do this, try different discount rates until the calculated bond value equals the given value (or let a spreadsheet or a financial calculator do it for you). Remember that increasing the rate decreases the bond value.

EXAMPLE 5.2

Current Events

A bond has a quoted price of $1,080.42. It has a face value of $1,000, a semiannual coupon of $30, and a maturity of five years. What is its current yield? What is its yield to maturity? Which is bigger? Why?

Notice that this bond makes semiannual payments of $30, so the annual payment is $60. The current yield is thus $60/1,080.42 = 5.55 percent. To calculate the yield to maturity, refer back to

Example 5.1. Now, in this case, the bond pays $30 every six months and it has 10 six-month periods until maturity. So, we need to find *r* as follows:

$$\$1{,}080.42 = \$30 \times \left[1 - 1/(1+r)^{10}\right]/r + 1{,}000/(1+r)^{10}$$

After some trial and error, we find that *r* is equal to 2.1 percent. But, the tricky part is that this 2.1 percent is the yield *per six months.* We have to double it to get the yield to maturity, so the yield to maturity is 4.2 percent, which is less than the current yield. The reason is that the current yield ignores the built-in loss of the premium between now and maturity.

5.2 MORE ON BOND FEATURES

In this section, we continue our discussion of corporate debt by describing in some detail the basic terms and features that make up a typical long-term corporate bond. We discuss additional issues associated with long-term debt in subsequent sections.

How to Calculate Bond Prices and Yields Using a Spreadsheet

Most spreadsheets have fairly elaborate routines available for calculating bond values and yields; many of these routines involve details that we have not discussed. However, setting up a simple spreadsheet to calculate prices or yields is straightforward, as our next two spreadsheets show:

	A	B	C	D	E	F	G	H
1								
2	**Using a spreadsheet to calculate bond values**							
3								
4	Suppose we have a bond with 22 years to maturity, a coupon rate of 8 percent, and a yield to							
5	maturity of 9 percent. If the bond makes semiannual payments, what is its price today?							
6								
7	Settlement date:	1/1/00						
8	Maturity date:	1/1/22						
9	Annual coupon rate:	.08						
10	Yield to maturity:	.09						
11	Face value (% of par):	100						
12	Coupons per year:	2						
13	Bond price (% of par):	**90.49**						
14								
15	The formula entered in cell B13 is =PRICE(B7,B8,B9,B10,B11,B12); notice that face value and bond							
16	price are given as a percentage of face value.							

	A	B	C	D	E	F	G	H
1								
2	**Using a spreadsheet to calculate bond yields**							
3								
4	Suppose we have a bond with 22 years to maturity, a coupon rate of 8 percent, and a price of							
5	$960.17. If the bond makes semiannual payments, what is its yield to maturity?							
6								
7	Settlement date:	1/1/00						
8	Maturity date:	1/1/22						
9	Annual coupon rate:	.08						
10	Bond price (% of par):	96.017						
11	Face value (% of par):	100						
12	Coupons per year:	2						
13	Yield to maturity:	**.084**						
14								
15	The formula entered in cell B13 is =YIELD(B7,B8,B9,B10,B11,B12); notice that face value and bond							
16	price are entered as a percentage of face value.							
17								

In our spreadsheets, notice that we had to enter two dates, a settlement date and a maturity date. The settlement date is just the date you actually pay for the bond, and the maturity date is the day the bond actually matures. In most of our problems, we don't explicitly have these dates, so we have to make them up. For example, since our bond has 22 years to maturity, we just picked 1/1/2000 (January 1, 2000) as the settlement date and 1/1/2022 (January 1, 2022) as the maturity date. Any two dates would do as long as they are exactly 22 years apart, but these are particularly easy to work with. Finally, notice that we had to enter the coupon rate and yield to maturity in annual terms and then explicitly provide the number of coupon payments per year.

page 139

Securities issued by corporations may be classified roughly as *equity securities* and *debt securities.* At the crudest level, a debt represents something that must be repaid; it is the result of borrowing money. When corporations borrow, they generally promise to make regularly scheduled interest payments and to repay the original amount borrowed (that is, the principal). The person or firm making the loan is called the *creditor,* or *lender.* The corporation borrowing the money is called the *debtor,* or *borrower.*

From a financial point of view, the main differences between debt and equity are the following:

1. Debt is not an ownership interest in the firm. Creditors generally do not have voting power.
2. The corporation's payment of interest on debt is considered a cost of doing business and is fully tax deductible. Dividends paid to stockholders are *not* tax deductible.
3. Unpaid debt is a liability of the firm. If it is not paid, the creditors can legally claim the assets of the firm. This action can result in liquidation or reorganization, two of the possible consequences of bankruptcy. Thus, one of the costs of issuing debt is the possibility of financial failure. This possibility does not arise when equity is issued.

Information for bond investors can be found at www.investinginbonds.com.

Long-Term Debt: The Basics

Ultimately, all long-term debt securities are promises made by the issuing firm to pay principal when due and to make timely interest payments on the unpaid balance. Beyond this, there are a number of features that distinguish these securities from one another. We discuss some of these features next.

The maturity of a long-term debt instrument is the length of time the debt remains outstanding with some unpaid balance. Debt securities can be short term (with maturities of one year or less) or long term (with maturities of more than one year).[1] Short-term debt is sometimes referred to as *unfunded debt.*[2]

Debt securities are typically called *notes, debentures,* or *bonds.* Strictly speaking, a bond is a secured debt. However, in common usage, the word *bond* refers to all kinds of secured and unsecured debt. We will therefore continue to use the term generically to refer to long-term debt. Also, usually, the only difference between a note and a bond is the original maturity. Issues with an original maturity of 10 years or less are often called notes. Longer-term issues are called bonds.

The two major forms of long-term debt are public issue and privately placed. We concentrate on public-issue bonds. Most of what we say about them holds true for private-issue, long-term debt as well. The main difference between public-issue and privately placed debt is that the latter is directly placed with a lender and not offered to the public. Because this is a private transaction, the specific terms are up to the parties involved.

There are many other dimensions to long-term debt, including such things as security, call features, sinking funds, ratings, and protective covenants. The following table illustrates these features for a bond issued by the Walt Disney Company. If some of these terms are unfamiliar, have no fear. We will discuss them all presently.

Information on individual bonds can be found at finra-markets.morning-star.com/MarketData/Default.jsp.

FEATURES OF A WALT DISNEY COMPANY BOND

TERM		EXPLANATION
Amount of issue	$1 billion	The company issued $1 billion worth of bonds.
Date of issue	01/08/2016	The bonds were sold on 01/08/2016.
Maturity	02/13/2026	The bonds mature on 02/13/2026.
Face value	$2,000	The denomination of the bonds is $2,000.
Annual coupon	3.00%	Each bondholder will receive $60 per bond per year (3.00% of face value).
Offer price	99.600	The offer price will be 99.600% of the $2,000 face value, or $1,992, per bond.
Coupon payment dates	2/13, 8/13	Coupons of $60/2 = $30 will be paid on these dates.
Security	None	The bonds are not secured by specific assets.
Sinking fund	None	The bonds have no sinking fund.
Call provision	At any time	The bonds do not have a deferred call.
Call price	Treasury rate plus .15%	The bonds have a "make whole" call price.
Rating	Moody's A2, Fitch A	The bonds have a medium-quality credit rating.

Many of these features will be detailed in the bond indenture, so we discuss this first.

The Indenture

The **indenture** is the written agreement between the corporation (the borrower) and its creditors. It is sometimes referred to as the *deed of trust.*[3] Usually, a trustee (a bank perhaps) is appointed by the corporation to represent the bondholders. The trust company must (1) make sure the terms of the indenture are obeyed, (2) manage the sinking fund (described in the following pages), and (3) represent the bondholders in default, that is, if the company defaults on its payments to them.

The bond indenture is a legal document. It can run several hundred pages and generally makes for very tedious reading. It is an important document, however, because it generally includes the following provisions:

1. The basic terms of the bonds.
2. The total amount of bonds issued.
3. A description of property used as security.
4. The repayment arrangements.
5. The call provisions.
6. Details of the protective covenants.

We discuss these features next.

TERMS OF A BOND Corporate bonds usually have a face value (that is, a denomination) of $1,000. This is called the *principal value* and it is stated on the bond certificate. So, if a corporation wanted to borrow $1 million, 1,000 bonds would have to be sold. The par value (that is, initial accounting value) of a bond is almost

always the same as the face value, and the terms are used interchangeably in practice. Although a par value of $1,000 is most common, essentially any par value is possible. For example, looking at our Walt Disney bond, the par value is $2,000.

Corporate bonds are usually in **registered form**. For example, the indenture might read as follows:

Interest is payable semiannually on July 1 and January 1 of each year to the person in whose name the bond is registered at the close of business on June 15 or December 15, respectively.

This means that the company has a registrar who will record the ownership of each bond and record any changes in ownership. The company will pay the interest and principal by check mailed directly to the address of the owner of record. A corporate bond may be registered and have attached "coupons." To obtain an interest payment, the owner must separate a coupon from the bond certificate and send it to the company registrar (the paying agent).

Alternatively, the bond could be in **bearer form**. This means that the certificate is the basic evidence of ownership, and the corporation will "pay the bearer." Ownership is not otherwise recorded, and, as with a registered bond with attached coupons, the holder of the bond certificate detaches the coupons and sends them to the company to receive payment.

There are two drawbacks to bearer bonds. First, they are difficult to recover if they are lost or stolen. Second, because the company does not know who owns its bonds, it cannot notify bondholders of important events. Bearer bonds were once the dominant type, but they are now much less common (in the United States) than registered bonds.

SECURITY Debt securities are classified according to the collateral and mortgages used to protect the bondholder.

Collateral is a general term that frequently means securities (for example, bonds and stocks) that are pledged as security for payment of debt. For example, collateral trust bonds often involve a pledge of common stock held by the corporation. However, the term *collateral* is commonly used to refer to any asset pledged on a debt.

Mortgage securities are secured by a mortgage on the real property of the borrower. The property involved is usually real estate, for example, land or buildings. The legal document that describes the mortgage is called a *mortgage trust indenture* or *trust deed.*

Sometimes mortgages are on specific property, for example, a railroad car. More often, blanket mortgages are used. A blanket mortgage pledges all the real property owned by the company.[4]

Bonds frequently represent unsecured obligations of the company. A **debenture** is an unsecured bond, for which no specific pledge of property is made. The term **note** is generally used for such instruments if the maturity of the unsecured bond is less than 10 or so years when the bond is originally issued. Debenture holders have a claim only on property not otherwise pledged, in other words, the property that remains after mortgages and collateral trusts are taken into account.

The terminology that we use here and elsewhere in this chapter is standard in the United States. Outside the United States, these same terms can have different meanings. For example, bonds issued by the British government ("gilts") are called treasury "stock." Also, in the United Kingdom, a debenture is a *secured* obligation.

At the current time, public bonds issued in the United States by industrial and financial companies are typically debentures. However, most utility and railroad bonds are secured by a pledge of assets.

SENIORITY In general terms, *seniority* indicates preference in position over other lenders, and debts are sometimes labeled as *senior* or *junior* to indicate seniority. Some debt is *subordinated,* as in, for example, a subordinated debenture.

The Securities Industry and Financial Markets Association (SIFMA) site is www.sifma.org.

In the event of default, holders of subordinated debt must give preference to other specified creditors. Usually, this means that the subordinated lenders will be paid off only after the specified creditors have been compensated. However, debt cannot be subordinated to equity.

REPAYMENT Bonds can be repaid at maturity, at which time the bondholder will receive the stated, or face, value of the bond, or they may be repaid in part or in entirety before maturity. Early repayment in some form is

more typical and is often handled through a sinking fund.

A **sinking fund** is an account managed by the bond trustee for the purpose of repaying the bonds. The company makes annual payments to the trustee, who then uses the funds to retire a portion of the debt. The trustee does this by either buying up some of the bonds in the market or calling in a fraction of the outstanding bonds. This second option is discussed in the next section. page 142

There are many different kinds of sinking fund arrangements, and the details would be spelled out in the indenture. For example:

1. Some sinking funds start about 10 years after the initial issuance.
2. Some sinking funds establish equal payments over the life of the bond.
3. Some high-quality bond issues establish payments to the sinking fund that are not sufficient to redeem the entire issue. As a consequence, there is the possibility of a large "balloon payment" at maturity.

THE CALL PROVISION A **call provision** allows the company to repurchase, or "call," part or all of the bond issue at stated prices over a specific period. Corporate bonds are usually callable.

Generally, the call price is above the bond's stated value (that is, the par value). The difference between the call price and the stated value is the **call premium**. The amount of the call premium may become smaller over time. One arrangement is to initially set the call premium equal to the annual coupon payment and then make it decline to zero as the call date moves closer to the time of maturity.

Call provisions are often not operative during the first part of a bond's life. This makes the call provision less of a worry for bondholders in the bond's early years. For example, a company might be prohibited from calling its bonds for the first 10 years. This is a **deferred call provision**. During this period of prohibition, the bond is said to be **call protected**.

In recent years, a new type of call provision, a "make-whole" call, has become very widespread in the corporate bond market. With such a feature, bondholders receive approximately what the bonds are worth if they are called. Because bondholders don't suffer a loss in the event of a call, they are "made whole."

To determine the make-whole call price, we calculate the present value of the remaining interest and principal payments at a rate specified in the indenture. For example, looking at our Walt Disney issue, we see that the discount rate is "Treasury rate plus .15%." What this means is that we determine the discount rate by first finding a U.S. Treasury issue with the same maturity. We calculate the yield to maturity on the Treasury issue and then add on an additional .15 percent to get the discount rate we use.

Notice that, with a make-whole call provision, the call price is higher when interest rates are lower and vice versa (why?). Also notice that, as is common with a make-whole call, the Walt Disney issue does not have a deferred call feature. Why might investors not be too concerned about the absence of this feature?

PROTECTIVE COVENANTS A **protective covenant** is that part of the indenture or loan agreement that limits certain actions a company might otherwise wish to take during the term of the loan. Protective covenants can be classified into two types: negative covenants and positive (or affirmative) covenants.

A *negative covenant* is a "thou shalt not" type of covenant. It limits or prohibits actions that the company might take. Here are some typical examples:

1. The firm must limit the amount of dividends it pays according to some formula.
2. The firm cannot pledge any assets to other lenders.
3. The firm cannot merge with another firm.
4. The firm cannot sell or lease any major assets without approval by the lender.
5. The firm cannot issue additional long-term debt.

A *positive covenant* is a "thou shalt" type of covenant. It specifies an action that the company agrees to take or a condition the company must abide by. Here are some examples:

Want detailed information on the amount and terms of the debt issued by a particular firm? Check out its latest financial statements by searching SEC filings at www.sec.gov.

1. The company must maintain its working capital at or above some specified minimum level.
2. The company must periodically furnish audited financial statements to the lender.
3. The firm must maintain any collateral or security in good condition.

This is only a partial list of covenants; a particular indenture may feature many different ones.

5.3 BOND RATINGS

Firms frequently pay to have their debt rated. The two leading bond-rating firms are Moody's and Standard & Poor's (S&P). The debt ratings are an assessment of the creditworthiness of the corporate issuer. The definitions of creditworthiness used by Moody's and S&P are based on how likely the firm is to default and the protection creditors have in the event of a default.

It is important to recognize that bond ratings are concerned *only* with the possibility of default. Earlier, we discussed interest rate risk, which we defined as the risk of a change in the value of a bond resulting from a change in interest rates. Bond ratings do not address this issue. As a result, the price of a highly rated bond can still be quite volatile.

Want to know what criteria are commonly used to rate corporate and municipal bonds? Go to www.standardandpoors.com, www.moodys.com, and www.fitchratings.com.

Bond ratings are constructed from information supplied by the corporation and other sources. The rating classes and some information concerning them are shown in the following table.

MOODY'S	S&P	
Aaa	AAA	Debt rated Aaa and AAA has the highest rating. Capacity to pay interest and principal is extremely strong.
Aa	AA	Debt rated Aa and AA has a very strong capacity to pay interest and repay principal. Together with the highest rating, this group comprises the high-grade bond class.
A	A	Debt rated A has a strong capacity to pay interest and repay principal, although it is somewhat more susceptible to the adverse effects of changes in circumstances and economic conditions than debt in higher-rated categories.
Baa	BBB	Debt rated Baa and BBB is regarded as having an adequate capacity to pay interest and repay principal. Whereas it normally exhibits adequate protection parameters, adverse economic conditions or changing circumstances are more likely to lead to a weakened capacity to pay interest and repay principal for debt in this category than in higher-rated categories. These bonds are medium-grade obligations.
Ba;B Caa Ca C	BB;B CCC CC C	Debt rated in these categories is regarded, on balance, as predominantly speculative with respect to capacity to pay interest and repay principal in accordance with the terms of the obligation. BB and Ba indicate the lowest degree of speculation, and Ca, CC, and C the highest degree of speculation. Although such debt is likely to have some quality and protective characteristics, these are outweighed by large uncertainties or major risk exposures to adverse conditions. Issues rated C by Moody's are typically in default.
	D	Debt rated D is in default, and payment of interest and/or repayment of principal is in arrears.

Note: At times, both Moody's and S&P use adjustments (called notches) to these ratings. S&P uses plus and minus signs: A1 is the strongest A rating and A− the weakest. Moody's uses a 1, 2, or 3 designation, with 1 being the highest. Moody's has no D rating.

The highest rating a firm's debt can have is AAA or Aaa, and such debt is judged to be the best quality and to have the lowest degree of risk. For example, as of April 2016,

Microsoft and Johnson & Johnson were the only U.S.-based nonfinancial companies with a AAA credit rating. AA or Aa ratings indicate very good quality debt and are much more common. page 144

Another good bond market site is money.cnn.com.

A large part of corporate borrowing takes the form of low-grade, or "junk," bonds. If these low-grade corporate bonds are rated at all, they are rated below investment grade by the major rating agencies. Investment-grade bonds are bonds rated at least BBB by S&P or Baa by Moody's.

Rating agencies don't always agree. For example, some bonds are known as "crossover" or "5B" bonds. The reason is that they are rated triple-B (or Baa) by one rating agency and double-B (or Ba) by another, a "split rating." For example, in July 2015, Spanish cell tower company Cellnex issued €600 million worth of seven-year notes that were rated BBB− by Fitch and BB+ by S&P.

A bond's credit rating can change as the issuer's financial strength improves or deteriorates. For example, in February 2016, S&P cut the bond rating on British mining company Anglo American from BBB- to BB, lowering the company's bond rating from investment-grade to junk bond status. S&P's ratings cut followed a similar ratings cut by both Moody's and Fitch earlier that same week. Bonds that drop into junk territory like this are called *fallen angels.* Anglo American was downgraded because metal prices had fallen to a six-year low.

Credit ratings are important because defaults really do occur, and when they do, investors can lose heavily. For example, in 2000, AmeriServe Food Distribution, Inc., which supplied restaurants such as Burger King with everything from burgers to giveaway toys, defaulted on $200 million in junk bonds. After the default, the bonds traded at just 18 cents on the dollar, leaving investors with a loss of more than $160 million.

Even worse in AmeriServe's case, the bonds had been issued only four months earlier, thereby making AmeriServe an NCAA champion. While that might be a good thing for a college basketball team such as the University of Kentucky Wildcats, in the bond market NCAA means "No Coupon At All," and it's not a good thing for investors.

5.4 SOME DIFFERENT TYPES OF BONDS

Thus far, we have considered only "plain vanilla" corporate bonds. In this section, we briefly look at bonds issued by governments and also at bonds with unusual features.

If you're nervous about the level of debt piled up by the U.S. government, *don't* go to www.treasury.gov/resource-center or to www.brillig.com/debt_clock! Learn all about government bonds at www.newyorkfed.org.

Government Bonds

The biggest borrower in the world—by a wide margin—is everybody's favorite family member, Uncle Sam. In early 2016, the total debt of the U.S. government was about $19 *trillion,* or approximately $59,000 per citizen (and growing!). When the government wishes to borrow money for more than one year, it sells what are known as Treasury notes and bonds to the public (in fact, it does so every month). Currently, outstanding Treasury notes and bonds have original maturities ranging from 2 to 30 years.

Most U.S. Treasury issues are just ordinary coupon bonds. There are two important things to keep in mind, however. First, U.S. Treasury issues, unlike essentially all other bonds, have no default risk because (we hope) the Treasury can always come up with the money to make the payments. Second, Treasury issues are exempt from state income taxes (though not federal income taxes). In other words, the coupons you receive on a Treasury note or bond are only taxed at the federal level.

State and local governments also borrow money by selling notes and bonds. Such issues are called *municipal* notes and bonds, or just "munis." Unlike Treasury issues, munis have varying degrees of default risk, and, in

fact, they are rated much like corporate issues. Also, they are almost always callable. The most intriguing thing about munis is that their coupons are exempt from federal income taxes (though not necessarily state income taxes), which makes them very attractive to high-income, high-tax bracket investors.

Because of the enormous tax break they receive, the yields on municipal bonds are much lower than the yields on taxable bonds. For example, in February 2016, long-term AAA-rated corporate bonds were yielding about 3.65 percent. At the same time, long-term AAA munis were yielding about 3.21 percent. Suppose an investor was in a 30 percent tax bracket. All else being the same, would this investor prefer a AAA corporate bond or a AAA municipal bond?

To answer, we need to compare the *aftertax* yields on the two bonds. Ignoring state and local taxes, the muni pays 3.21 percent on both a pretax and an aftertax basis. The corporate issue pays 3.65 percent before taxes, but it pays .0365 × (1 − .30) = .0256, or 2.56 percent, once we account for the 30 percent tax bite. Given this, the muni bond has a better yield.

For information on municipal bonds, including prices, checkout emma.msrb.org.

EXAMPLE 5.3

Taxable versus Municipal Bonds

Suppose taxable bonds are currently yielding 8 percent, while at the same time, munis of comparable risk and maturity are yielding 6 percent. Which is more attractive to an investor in a 40 percent tax bracket? What is the break-even tax rate? How do you interpret this rate?

For an investor in a 40 percent tax bracket, a taxable bond yields 8 × (1 − .40) = 4.8 percent after taxes, so the muni is much more attractive. The break-even tax rate is the tax rate at which an investor would be indifferent between a taxable and a nontaxable issue. If we let t^* stand for the break-even tax rate, then we can solve for it as follows:

$$\begin{aligned} .08 \times (1 - t^*) &= .06 \\ 1 - t^* &= .06/.08 = .75 \\ t^* &= .25 \end{aligned}$$

Thus, an investor in a 25 percent tax bracket would make 6 percent after taxes from either bond.

Zero Coupon Bonds

A bond that pays no coupons at all must be offered at a price that is much lower than its stated value. Such bonds are called **zero coupon bonds**, or just *zeroes*.[5]

Suppose the Eight-Inch Nails (EIN) Company issues a $1,000 face value, five-year zero coupon bond. The initial price is set at $508.35. Even though no interest payments are made on the bond, zero coupon bond calculations use semiannual periods to be consistent with coupon bond calculations. Using semiannual periods, it is straightforward to verify that, at this price, the bond yields 14 percent to maturity. The total interest paid over the life of the bond is $1,000 − 508.35 = $491.65.

For tax purposes, the issuer of a zero coupon bond deducts interest every year even though no interest is actually paid. Similarly, the owner must pay taxes on interest accrued every year, even though no interest is actually received.

The way in which the yearly interest on a zero coupon bond is calculated is governed by tax law. Before 1982, corporations could calculate the interest deduction on a straight-line basis, For EIN, the annual interest deduction would have been $491.65/5 = $98.33 per year.

Under current tax law, the implicit interest is determined by amortizing the loan. We do this by first calculating the bond's value at the beginning of each year. For example, after one year, the bond will have four

years until maturity, so it will be worth $\$1{,}000/1.07^8 = \$582.01$; the value in two years will be $\$1{,}000/1.07^6 = \$666.34$; and so on. The implicit interest each year is the change in the bond's value for the year.

Notice that under the old rules, zero coupon bonds were more attractive for corporations because the deductions for interest expense were larger in the early years (compare the implicit interest expense with the straight-line expense).

Under current tax law, EIN could deduct $73.66 (= $582.01 − 508.35) in interest paid the first year, and the owner of the bond would pay taxes on $73.66 of taxable income (even though no interest was actually received). This second tax feature makes taxable zero coupon bonds less attractive to individuals. However, they are still a very attractive investment for tax-exempt investors with long-term dollar-denominated liabilities, such as pension funds, because the future dollar value is known with relative certainty. page 146

Some bonds are zero coupon bonds for only part of their lives. For example, at one time, General Motors had a debenture outstanding that for the first 20 years of its life, no coupon payments would be made, but after 20 years, it would begin paying coupons at a rate of 7.75 percent per year, payable semiannually.

Floating-Rate Bonds

The conventional bonds we have talked about in this chapter have fixed-dollar obligations because the coupon rate is set as a fixed percentage of the par value. Similarly, the principal is set equal to the par value. Under these circumstances, the coupon payment and principal are completely fixed.

With *floating-rate bonds (floaters),* the coupon payments are adjustable. The adjustments are tied to an interest rate index such as the Treasury bill interest rate or the 30-year Treasury bond rate.

The value of a floating-rate bond depends on exactly how the coupon payment adjustments are defined. In most cases, the coupon adjusts with a lag to some base rate. For example, suppose a coupon rate adjustment is made on June 1. The adjustment might be based on the simple average of Treasury bond yields during the previous three months. In addition, the majority of floaters have the following features:

1. The holder has the right to redeem his/her note at par on the coupon payment date after some specified amount of time. This is called a *put* provision, and it is discussed in the following section.
2. The coupon rate has a floor and a ceiling, meaning that the coupon is subject to a minimum and a maximum. In this case, the coupon rate is said to be "capped," and the upper and lower rates are sometimes called the *collar.*

Official information on U.S. inflation-indexed bonds is at www.treasurydirect.gov.

A particularly interesting type of floating-rate bond is an *inflation-linked* bond. Such bonds have coupons that are adjusted according to the rate of inflation (the principal amount may be adjusted as well). The U.S. Treasury began issuing such bonds in January of 1997. The issues are sometimes called "TIPS," or Treasury Inflation-Protected Securities. Other countries, including Canada, Israel, and Britain, have issued similar securities.

Other Types of Bonds

Many bonds have unusual or exotic features. For example, at one time, Berkshire Hathaway, the company run by the legendary Warren Buffett, issued bonds with a negative coupon. The buyers of these bonds also received the right to purchase shares of stock in Berkshire at a fixed price per share over the subsequent five years. Such a right, which is called a warrant, would be very valuable if the stock price climbed substantially (a later chapter discusses this subject in greater depth).

Bond features are really only limited by the imaginations of the parties involved. Unfortunately, there are far too many variations for us to cover in detail here. We therefore close out this section by mentioning only a few of the more common types. A nearby *Finance Matters* box has some additional discussion on more exotic bonds.

Income bonds are similar to conventional bonds, except that coupon payments are dependent on company income. Specifically, coupons are paid to bondholders only if the firm's income is sufficient. This would appear to be an attractive feature, but income bonds are not very common.

FINANCE MATTERS

BEAUTY IS IN THE EYE OF THE BONDHOLDER

Many bonds have unusual or exotic features. One of the most common types is an asset-backed, or securitized, bond. Mortgage-backed securities were big news in 2007. For several years, there had been rapid growth in so-called subprime mortgage loans, which are mortgages made to individuals with less than top-quality credit. However, a combination of cooling (and in some places dropping) housing prices and rising interest rates caused mortgage delinquencies and foreclosures to rise. This increase in problem mortgages caused a significant number of mortgage-backed securities to drop sharply in value and created huge losses for investors. Bondholders of a securitized bond receive interest and principal payments from a specific asset (or pool of assets) rather than a specific company. For example, at one point rock legend David Bowie sold $55 million in bonds backed by future royalties from his albums and songs (that's some serious ch-ch-ch-change!). Owners of these "Bowie" bonds received the royalty payments, so if Bowie's record sales fell, there was a possibility the bonds could have defaulted. Other artists have sold bonds backed by future royalties, including James Brown, Iron Maiden, and the estate of the legendary Marvin Gaye.

Mortgage-backs are the best known type of asset-backed security. With a mortgage-backed bond, a trustee purchases mortgages from banks and merges them into a pool. Bonds are then issued, and the bondholders receive payments derived from payments on the underlying mortgages. One unusual twist with mortgage bonds is that if interest rates decline, the bonds can actually decrease in value. This can occur because homeowners are likely to refinance at the lower rates, paying off their mortgages in the process. Securitized bonds are usually backed by assets with long-term payments, such as mortgages. However, there are bonds securitized by car loans and credit card payments, among other assets, and a growing market exists for bonds backed by automobile leases.

The reverse convertible is a relatively new type of structured note. This type generally offers a high coupon rate, but the redemption at maturity can be paid in cash at par value or paid in shares of stock. For example, one recent General Motors (GM) reverse convertible had a coupon rate of 16 percent, which is a very high coupon rate in today's interest rate environment. However, at maturity, if GM's stock declined sufficiently, bondholders would receive a fixed number of GM shares that were worth less than par value. So, while the income portion of the bond return would be high, the potential loss in par value could easily erode the extra return.

CAT bonds are issued to cover insurance companies against natural catastrophes. The type of natural catastrophe is outlined in the bond's indenture. For example, about 30 percent of all CAT bonds protect against a North Atlantic hurricane. The way these issues are structured is that the borrowers can suspend payment temporarily (or even permanently) if they have significant hurricane-related losses. These CAT bonds may seem like pretty risky investments, but to date, only three such bonds have not made their scheduled payments, courtesy of the massive destruction caused by Hurricane Katrina, the 2011 Japanese tsunami, and an unusually active 2011 tornado season.

Perhaps the most unusual bond (and certainly the most ghoulish) is the "death bond." Companies such as Stone Street Financial purchase life insurance policies from individuals who are expected to die within the next 10 years. They then sell bonds that are paid off from the life insurance proceeds received when the policyholders pass away. The return on the bonds to investors depends on how long the policyholders live. A major risk is that if medical treatment advances quickly, it will raise the life expectancy of the policyholders, thereby decreasing the return to the bondholder.

A *convertible bond* can be swapped for a fixed number of shares of stock anytime before maturity at the holder's option. Convertibles are relatively common, but the number has been decreasing in recent years.

A *put bond* allows the *holder* to force the issuer to buy the bond back at a stated price. For example, International Paper Co. has bonds outstanding that allow the holder to force International Paper to buy the bonds back at 100 percent of the face value given that certain "risk" events happen. One such event is a change in

credit rating from investment grade to lower than investment grade by Moody's or S&P. The put feature is therefore just the reverse of the call provision.

Structured notes are bonds that are based on stocks, bonds, commodities, or currencies. One particular type of structured note has a return based on a stock market index. At expiration, if the stock index has declined, the bond returns the principal. However, if the stock index has increased, the bond will return a portion of the stock index return, say 80 percent. Another type of structured note will return twice the stock index return, but with the potential for loss of principal. page 148

A given bond may have many unusual features. Two of the most recent exotic bonds are CoCo bonds, which have a coupon payment, and NoNo bonds, which are zero coupon bonds. CoCo and NoNo bonds are contingent convertible, putable, callable, subordinated bonds. The contingent convertible clause is similar to the normal conversion feature, except the contingent feature must be met. For example, a contingent feature may require that the company stock trade at 110 percent of the conversion price for 20 out of the most recent 30 days. Valuing a bond of this sort can be quite complex, and the yield to maturity calculation is often meaningless.

5.5 BOND MARKETS

ExcelMaster coverage online

www.mhhe.com/RossCore5e

Bonds are bought and sold in enormous quantities every day. You may be surprised to learn that the trading volume in bonds on a typical day is many, many times larger than the trading volume in stocks (by trading volume, we mean the amount of money that changes hands). Here is a finance trivia question: What is the largest securities market in the world? Most people would guess the New York Stock Exchange. In fact, the largest securities market in the world in terms of trading volume is the U.S. Treasury market, with an average daily volume over $500 billion.

How Bonds Are Bought and Sold

Most trading in bonds takes place over the counter, or OTC. Recall that this means that there is no particular place where buying and selling occur. Instead, dealers around the country (and around the world) stand ready to buy and sell. The various dealers are connected electronically.

One reason the bond markets are so big is that the number of bond issues far exceeds the number of stock issues. There are two reasons for this. First, a corporation would typically have only one common stock issue outstanding (there are exceptions to this that we discuss in our next chapter). However, a single large corporation could easily have a dozen or more note and bond issues outstanding. Beyond this, federal, state, and local borrowing is enormous. For example, even a small city would usually have a wide variety of notes and bonds outstanding, representing money borrowed to pay for things like roads, sewers, and schools. When you think about how many small cities there are in the United States, you begin to get the picture!

Because the bond market is almost entirely OTC, it has historically had little or no *transparency.* A financial market is transparent if it is possible to easily observe its prices and trading volume. On the New York Stock Exchange, for example, it is possible to see the price and quantity for every single transaction. In contrast, in the bond market, it is often not possible to observe either. Transactions are privately negotiated between parties, and there is little or no centralized reporting of transactions.

Although the total volume of trading in bonds far exceeds that in stocks, only a very small fraction of the total bond issues that exist actually trade on a given day. This fact, combined with the lack of transparency in the bond market, means that getting up-to-date prices on individual bonds can be difficult or impossible, particularly for smaller corporate or municipal issues. Instead, a variety of sources of estimated prices exist and are very commonly used.

Bond Price Reporting

In 2002, transparency in the corporate bond market began to improve dramatically. Under new regulations, corporate bond dealers are now required to report trade information

Source: FINRA reported TRACE prices.

As we mentioned before, the U.S. Treasury market is the largest securities market in the world. As with bond markets in general, it is an OTC market, so there is limited