10

Bonds and Bond Valuation

Figure 10.1 Bonds are very useful investments to add to a portfolio. (credit: modification of "US Treasury Checks - 3D Illustration" by DonkeyHotey/flickr, CC BY 2.0)

Chapter Outline

Why It Matters

When an investor purchases a bond, that person is, for all intents and purposes, making a loan to the bond issuer. Bonds issues are used to raise funds and can be issued by corporations, governments, or even subagencies of governments (including local municipalities).

As with any type of loan, the borrowing party is expected to offer something to the lender in exchange for their time and trouble. In this case, the bond-issuing entity will agree not only to repay the original face value of the loan on a specific date (the maturity of the bond) but also to pay the lender interest—or, in bond terminology, coupon payments.

Coupon payments are designed to make a bond purchase more acceptable for investors by helping compensate them for the time value of money. Because investors are parting with money that they have right now in order to make the initial bond purchase but will not see repayment of principal until the maturity date of the bond, they will experience the negative impact of time value over the bond term. When a bond issuer offers periodic coupon payments, this helps offset the negative effect of the delayed receipt of the principal amount for the investor. Also, because coupon payments will be coming to the investor throughout the term of the bond, essentially in installment payments (an annuity), the time value of money plays a critical role in bond transactions and in calculating bond valuation.

Bonds, along with stocks and mutual funds, are considered to be one of the most basic financial instruments available to any investor. It is quite common for investors to round out their portfolios by purchasing bonds,

adding a degree of safety and diversity to their investment mix.

10.1 Characteristics of Bonds

Learning Outcomes

By the end of this section, you will be able to:

- List and define the basic characteristics of bonds.
- List and describe the various types of bonds available.
- Explain how a bond price is inversely related to its return (yield).

Bonds as Investments

One way to look at bond investments is to consider the fact that any investor who purchases a bond is essentially buying a future cash flow stream that the bond issuer (or borrower) promises to make as per agreement.

Because bonds provide a set amount of cash inflow to their owners, they are often called fixed-income securities. Thus, future cash flows from the bond are clearly stated per agreement and fixed when the bond sale is completed.

Bonds are a basic form of investment that typically include a straightforward financial agreement between issuer and purchaser. Nevertheless, the terminology surrounding bonds is unique and rather extensive. Much of the specialized vocabulary surrounding bonds is designed to convey the concept that a bond is similar to other financial instruments in that it is an investment that can be bought and sold. Much of this unique terminology will be covered later in this chapter, but we can set out some of the basics here with an example.

Let's say that you buy a $1,000 bond that was issued by Apple Inc. at 5% interest, paid annually, for 20 years. Here, you are the lender, and Apple Inc. is the borrower.

LINK TO LEARNING

Informational Basics on Bonds

This video (https://openstax.org/r/the-basics-of-bonds) from *MoneyWeek* editor Tim Bennett provides information about the basics of bonds—what they are, how they work, why companies and governments issue them, and why investors might buy them.

Basic Terminology

We need to know the following basic bond terms and pricing in order to apply the necessary time value of money equation to value this Apple, Inc. bond issue:

- **Par value**: A bond will always clearly state its par value, also called face amount or face value. This is equal to the principal amount that the issuer will repay at the end of the bond term or maturity date. In our example, the par value of the bond is $1,000.
- **Coupon rate**: This is the interest rate that is used to calculate periodic interest, or coupon payments, on the bond. It is important to note that coupon rates are always expressed in annual terms, even if coupon payments are scheduled for different periods of time. The most common periods for coupon payments other than annual are semiannual and quarterly. Coupon rates will typically remain unchanged for the entire life of the bond. In our example, the coupon rate is the 5% interest rate.
- **Coupon payment**: This refers to the regular interest payment on the bond. The coupon or periodic interest payment is determined by multiplying the par value of the bond by the coupon rate. It is important to note that no adjustment needs to be made to the coupon rate if the bond pays interest

annually. However, if a bond pays interest on a semiannual or quarterly basis, the coupon rate will have to be divided by 2 or 4, respectively, to convert the stated annual rate to the correct periodic rate. In our example, coupons are paid annually, so the periodic or annual interest that is paid is equal to $\$1{,}000 \times 0.05 = \$50$. You may notice that because these payments are the same amount and made at regular intervals, they constitute an annuity stream (refer to Time Value of Money II: Equal Multiple Payments.

- **Maturity date**: The maturity date is the expiration date of the bond, or the point in time when the term of a bond comes to an end. On the maturity date, the issuer will make the final interest or coupon payment on the bond and will also pay off its principal, or face value. In our example, the maturity date is at the end of the 20-year period.
- **Yield to maturity (YTM)**: The YTM is essentially the discount rate used to bring the future cash flows of a bond into present value terms. It also equals the return that the investor will receive if the bond is held to maturity. The YTM helps quantify the overall investment value of a bond. We will explore how to compute this rate later in the chapter.

Table 10.1 displays a selected listing of bonds available for purchase or sale. First, let's review the columns so you can learn how to read this table.

Issuer	Bond Type	Current Price %	Callable?	Coupon Rate %	Maturity Date	Yield%	Rating
3M Co.	Corp	105.120	Yes	2.25	9/19/2026	1.240	A+
Alteryx	Corp	98.818	No	1.00	8/1/2026	1.206	None
Anheuser-Busch Cos. LLC	Corp	125.319	Yes	5.95	1/25/2033	3.340	BBB+
City of Chicago	Muni	103.164	Yes	5.00	1/1/2033	1.030	BBB+
Coca-Cola Co.	Corp	95.206	Yes	1.00	3/15/2028	1.731	A+
DuPont De Nemours Inc.	Corp	100.815	Yes	2.17	5/1/2023	1.775	BBB+
Exxon Mobil Corp.	Corp	107.325	Yes	3.18	3/15/2024	0.483	AA-
Ford Motor Co.	Corp	114.880	No	7.13	11/15/2025	3.623	BB+
Nordstrom Inc.	Corp	112.905	No	6.95	3/15/2028	4.758	BB+
Tennessee Energy Acquisition Corp.	Muni	102.168	No	5.25	9/1/2021	0.451	BBB+

Table 10.1 Bond Information, March 2021 (source: FINRA-Markets.Morningstar.com)

- **Column 1: Issuer.** The first column shows the company, city, or state issuing the bond. This bond listing includes two municipal issuers (City of Chicago and Tennessee Energy) as well as several corporate issuers.
- **Column 2: Bond Type.** This describes the issue of the bond and indicates whether it is a corporation or a municipality.
- **Column 3: Current Price.** The third column shows the price as a percent of par value. It is the price someone is willing to pay for the bond in today's market. We quote the price in relation to $100. For example, the Nordstrom bond is selling for 112.905% of its par value, or $112.905 per $100.00 of par value. If this bond has a $1,000.00 par value, it will sell for $\$1{,}129.05$ ($\$1{,}000 \times 1.12905$). Note: Throughout this chapter, we use $1,000 as the par value of a bond because it is the most common par value for corporate bonds.
- **Column 4: Callable?** This column states whether or not the bond has a call feature (if it can be retired or ended before its normal maturity date).
- **Column 5: Coupon Rate.** The fifth column states the coupon rate, or annual interest rate, of each bond.
- **Column 6: Maturity Date.** This column shows the maturity date of the issue—the date on which the corporation will pay the final interest installment and repay the principal.

- **Column 7: Yield.** The seventh column indicates each bond's yield to maturity—the yield or investment return that you would receive if you purchased the bond today at the price listed in column 3 and held the bond to maturity. We will use the YTM as the discount rate in the bond pricing formula.
- **Column 8: Rating.** The final column gives the bond rating, a grade that indicates credit quality. As we progress through this chapter, we will examine prices, coupon rates, yields, and bond ratings in more detail

Types of Bonds

There are three primary categories of bonds, though the specifics of these different types of bond can vary depending on their issuer, length until maturity, interest rate, and risk.

Government Bonds

The safest category of bonds are short-term **US Treasury bills (T-bills)**. These investments are considered safe because they have the full backing of the US government and the likelihood of **default** (nonpayment) is remote. However, T-bills also pay the least interest due to their safety and the economics of risk and return, which state that investors must be compensated for the assumption of risk. As risk increases, so should return on investment. Treasury notes are a form of government security that have maturities ranging from one to 10 years, while Treasury bonds are long-term investments that have maturities of 10 to 30 years from their date of issue.

Savings bonds are debt securities that investors purchase to pay for certain government programs. Essentially, the purchase of a US savings bond involves the buyer loaning money to the government with a guaranteed promise that they will earn back the face value of the bond plus a certain amount of interest in the future. Savings bonds are backed by the US government, meaning that there is virtually no possibility of the buyer losing their investment. For this reason, the return on savings bonds is relatively low compared to other forms of bonds and investments.

LINK TO LEARNING

Government Bonds

Review this introductory video (https://openstax.org/r/treasury-bonds-prices) about government bonds.

Municipal bonds ("munis") are issued by cities, states, and localities or their agencies. Munis typically will return a little more than Treasury bills while being just a bit riskier.

Corporate Bonds

Corporate bonds are issued by companies. They carry more risk than government bonds because corporations can't raise taxes to pay for their bond issues. The risk and return of a corporate bond will depend on how creditworthy the company is. The highest-paying and highest-risk corporate bonds are often referred to as non-investment grade or, more commonly, **junk bonds**.

Corporate bonds that do not make regular coupon payments to their owners are referred to as **zero-coupon bonds**. These bonds are issued at a deep discount from their par values and will repay the full par value at their maturity date. The difference between what the investor spends on them in original purchase price and the par value paid at maturity will represent the investor's total dollar value return.

Convertible bonds are similar to other types of corporate bonds but have a feature that allows for their conversion into a predetermined number of common stock shares. The conversion from the bond to stock can be done at certain times during the bond's life, usually at the discretion of the bondholder.

The Global Bond Market versus the Global Stock Market

Bonds have long been a trusted investment vehicle for many investors. Though the global fixed-income debt market remains considerably larger than the global stock market, this is not an entirely fair comparison. Bond markets include sovereign bonds, or bonds that are issues by governments, while stock markets do not. Some experts believe that a more relevant comparison is between the value of corporate bond markets only (excluding sovereign bonds) and total stock market value.

The chart in Figure 10.2 provides global market value information by category so that we may make our own conclusions about these markets.

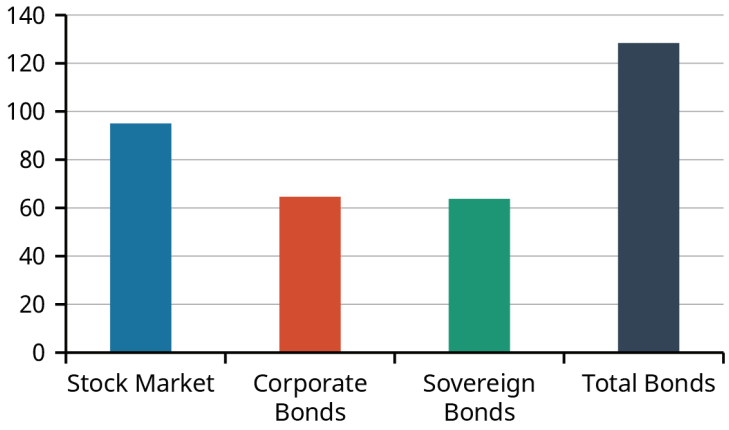

Figure 10.2 Global Bonds versus Stocks: Total Market Values ($Trillions), November 2020 (data source: Nasdaq)

While the total value of bond markets continues to exceed that of stocks, the prevailing trend over the past several years has been that stock markets are gaining in terms of total market size. The primary reason for this is that stocks have traditionally outperformed bonds in terms of return on investment over extended periods of time and are likely to continue to do so. This makes them more attractive to investors, despite the higher risk associated with stock.

The Two Sides of a Bond Investment

There are essentially two sides to a bond investment, meaning the bondholder will receive two types of cash inflow from the bond investment over its term. These are the payment of the par value at maturity (often referred to as payment of the face value of the bond at term end), and the periodic coupon payments (also called **interest income**) from the bond. These coupon payments are contractually determined and clearly indicated in the bond issue documentation received by the bondholder upon purchase.

As a result of these two types of inflow, bond valuation requires two different time value of money techniques—specifically, present value calculations—to be computed separately and then added together.

The Relationship between Bond Prices and Interest Rates

Bond price and interest rate have an inverse relationship. When interest rates fall, bond prices rise, and vice versa (see Figure 10.3). If interest rates increase, the value of bonds sold at lower interest rates will decline. Similarly, if interest rates decline, the value of fixed-rate bonds will increase. An exception to this general rule is **floating-rate bonds** (often referred to as “floaters,” floating-rate notes, or FRNs).

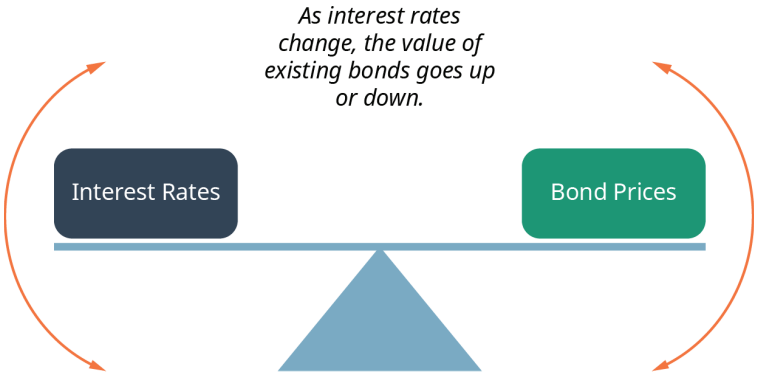

Figure 10.3 The Seesaw Effect of Bond Prices and Interest Rates

A floating-rate note is a form of debt instrument that is similar to a standard fixed-rate bond but has a variable interest rate. Rates for floating-rate bonds are typically tied to a benchmark interest rate that exists in the economy. Common benchmark rates include the **US Treasury note rate**, the **Federal Reserve funds rate (federal funds rate)**, the **London Interbank Offered Rate (LIBOR)**, and the **prime rate**.

So, investors who decide to purchase normal (fixed rate) bonds may not be thrilled to hear that the economy is signaling inflation and that interest rates are forecasted to rise. These bond investors are aware that when interest rates rise, their bond investments will lose value. This is not the case with floating- or variable-rate bonds.

Bonds with very low coupon rates are referred to as **deep discount bonds**. Of course, the bond that has the greatest discount is the zero-coupon bond, with a coupon rate of zero. The smaller the coupon rate, the greater the change in price when interest rates move.

LINK TO LEARNING

Relationship between Bond Prices and Interest Rates

Review this video (https://openstax.org/r/relationship-bond-prices) explaining the relationship between bond prices and interest rates within financial and capital markets.

10.2 Bond Valuation

Learning Outcomes

By the end of this section, you will be able to:

- Determine the value (price) of a bond.
- Understand the characteristics of and differences between discount and premium bonds.
- Draw a timeline indicating bond cash flows.
- Differentiate between fixed-rate and variable-rate bonds.
- Determine bond yields.

Pricing a Bond in Steps

Why do we want to learn how to price a bond? The answer goes to the heart of finance: the valuation of assets. We need to ascertain what a given bond is worth to a willing buyer and a willing seller. What is its value to these interested parties? Remember that a bond is a financial asset that a company sells to raise money from willing investors. Whether you are the company selling the bond or the investor buying the bond, you want to make sure that you are selling or buying at the best available price.

Let's begin our pricing examples with the 3M Company corporate bond listed in Table 10.1 above. The table

information tells us that 3M issued a series of corporate bonds that promise to pay coupons annually on September 19 and to pay back the principal, or face value, on the maturity date of September 19, 2026. While this is not specified in the table, let's say these are 15-year corporate bonds. In that case, we know that they were issued on September 20, 2011.

The 3M bonds have an annual coupon rate of 2.25%, which indicates that the annual interest payment on the bond will be the face value (assumed to be $1,000.00 multiplied by 2.25%), or $22.50. The appropriate discount rate to apply to these future payments is the yield to bond maturity, 1.24%.

Note that the 3M bond is selling at a premium (above par or face value) due to the fact that its coupon rate is greater than the YTM percentage. This means that the bond earns more value in interest than it loses due to discounting its cash flows to allow for the time value of money principle.

Finally, the table tells us some of the bond's features. For example, Standard & Poor's, an international rating agency, rates 3M Co. as A+ (high credit quality). Additionally, the bonds are designated as callable, meaning that 3M has the option of redeeming them before their maturity on September 19, 2026.

We can price a bond using the same methods from earlier chapters: an equation, a calculator, and a spreadsheet. Let's start with the equation method (see Figure 10.4).

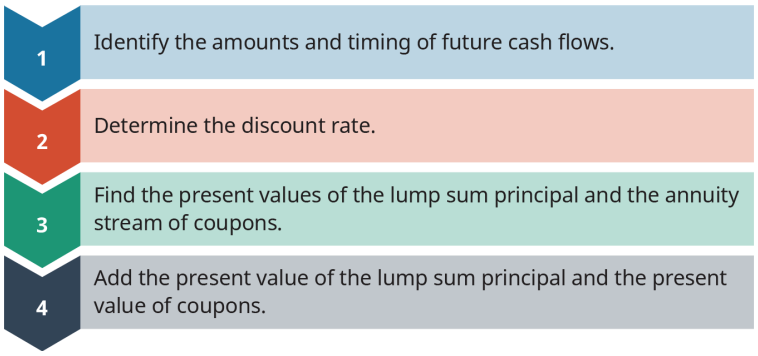

Figure 10.4 Steps in Pricing a Bond

The first step is to identify the amounts and the timing of the two types of future cash flows to be received on the bond. Any bond that pays interest or coupon payments (coupon bonds) will have two sources of future cash flow to its bondholder/investor: the periodic coupon payments, which are a form of annuity, and the final lump sum payment of the face value amount at maturity.

As discussed above, the principal or face value is paid in a one-time lump sum payment at bond maturity. In our example with 3M Co., this is the $1,000 par value of the bond that will be paid on the maturity date of September 19, 2026. Step 1 is to lay out the timing and amount of the future cash flows. The first future cash flow we need to determine is the annual interest payment. Here, it is the coupon rate of 2.25% times the par value of the bond. As mentioned above, we will use $1,000 as the par value of this bond, so the annual coupon or interest payment will equal $22.50:

$$\text{Par Value} \times \text{Annual Coupon Rate} = \text{Annual Coupon Payment} \quad \textbf{10.1}$$

$$\$1{,}000 \times 2.25\% = \$22.50 \quad \textbf{10.2}$$

The next future cash flow that we need to determine is the payment of the par value or principal—in this case, the $1,000 par value of the bond—at the maturity date of September 19, 2026. We can set out the future cash flows for the bond as shown in Table 10.2:

Year (Period)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Coupons	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50
Principal															$1,000

Table 10.2

Note that annual coupon payments are made each year on September 19, and the first annual coupon payment date is September 19, 2012. The annual payments continue for 15 years, with the last payment being made on September 19, 2026. At this point, we can apply previously learned concepts: the coupon payments constitute an annuity stream, or payments of the same amount at regular intervals.

The principal of $1,000 is also paid out at maturity. Here, we recognize another key concept: the final amount is a lump sum payment. So, we now have the promised set of future cash flows for the 3M Co. bond.

In Step 2, we will need to decide on a discount rate to use on these future bond cash payments. For now, we will jump to the answer and simply use the YTM of 1.24% from the bond data in Table 10.1. Later in the chapter, we will develop the concepts behind how an appropriate discount rate is determined.

For Step 3, we now apply two equations to the set of future cash flows from the bond. This will then provide us with the present values of these cash flows, or the expected present-day value of the bond. Because we know that the coupon payments constitute an annuity stream, we can use the equation for the present value of an annuity (discussed in Time Value of Money II: Equal Multiple Payments. To value the one-time par value payment, we use the equation for the present value of a lump sum payment. So, by combining these, we will have the present value of the coupon payment stream, or

$$\text{Coupon Payment Amount} \times \frac{\left[1 - \frac{1}{(1+r)^n}\right]}{r} = \text{PV}_{\text{Coupon}} \tag{10.3}$$

So, for our example above, this becomes

$$\begin{aligned} \$22.50 \times \frac{\left[1 - \frac{1}{(1+0.0124)^{15}}\right]}{0.0124} &= \text{PV}_{\text{Coupon}} \\ \$22.50 \times 13.61099 &\approx \$306.25 \end{aligned} \tag{10.4}$$

Next, we need to determine the present value of the payment of the par or face value of the bond at maturity. This is calculated as follows:

$$\text{Par Value} \times \frac{1}{(1+r)^n} = \text{PV}_{\text{Principal}} \tag{10.5}$$

Inserting our values into this formula gives us

$$\begin{aligned} \$1{,}000 \times \frac{1}{(1+0.0124)^{15}} &= \text{PV}_{\text{Principal}} \\ \$1{,}000 \times 0.831224 &\approx \$831.22 \end{aligned} \tag{10.6}$$

Adding the present values of the two payment streams gives us

$$\$306.25 + \$831.22 = \$1{,}137.47 \tag{10.7}$$

Our bond price is $1,137.47. This bond price represents the value of the financial asset to both a willing buyer and a willing seller.

In this example, the willing seller is 3M Company. The willing buyer is an investor who is demanding a 1.24% yield on the investment. As per Table 10.1 above, the 3M bond sold for $1,051.20 in March 2021. However, we display the price as a percentage of the par value, so we have the displayed price as

$$\frac{\$1{,}051.20}{\$1{,}000} = 1.05120 \text{ or } 105.120\% \quad \textbf{10.8}$$

Because we round the percent of par, we do not see the cents digit in the quoted price.

Pricing a Bond Using a Financial Calculator

A financial calculator can also be used to solve common types of bond valuations. For example, what would be the current price (value) of a 4% coupon bond, paid semiannually, with a face value of $1,000 and a remaining term to maturity of 15 years, assuming a required YTM rate of 5%? The steps to solve this problem are shown in Table 10.3 below.

Step	Description	Enter	Display	
1	Clear calculator register	CE/C		0.0000
2	Enter future or par value as a negative amount	1000 +|− FV	FV =	-1,000.0000
3	Enter interest rate $\left(\frac{5\% \text{ annual rate}}{2} = 2.5\% \text{ semiannual rate}\right)$	2.5 I/Y	I/Y =	2.5000
4	Enter periods Enter periods $(15 \text{ years} \times 2 = 30 \text{ semiannual periods})$	30 N	N =	30.0000
5	Enter coupon payment $\frac{\$1{,}000 \times 4\%}{2} = \$20$ as a negative amount	20 +|− PMT	PMT =	-20.0000
6	Compute present value or price	CPT PV	PV =	895.3485

Table 10.3 Calculator Steps for Bond Valuations[1]

The current price is $895.35.

Time Value Connection

As we have briefly discussed, bond valuation is determined by time value of money techniques, most notably present value calculations. This makes logical sense when one considers that an investment in a bond involves a series of future cash inflows, or payments from the bond issuer to the bondholder over the term of the bond's maturity.

To determine the value of a bond today, the two-step time value of money calculation we discussed earlier must be used, and the present value of a series of coupon payments (or an annuity) must be determined. This present value amount will then be added to the present value of a single lump sum payment (the principal or face value) that will come to the bondholder at the end of the bond's term (maturity).

Fixed Income

Because standard fixed-rate bonds have their coupon payments and maturity amounts locked in, they are often referred to as fixed-income investments. This is because their values are relatively straightforward to calculate. Bonds are generally viewed as stable investments that offer income and a lower amount of volatility compared to stocks.

1 The specific financial calculator in these examples is the Texas Instruments BA II Plus™ Professional model, but you can use other financial calculators for these types of calculations.

While yields provided by corporate and government bonds such as US T-bills and municipal bonds are currently low because the **Federal Reserve System (the Fed)** has kept interest rates low for several years, investors may still consider adding bonds to their portfolios.[2] This is especially true as investors enter their retirement years and seek to generate income while avoiding the volatility of the stock market. Such investors can add a mix of individual bonds, mutual funds, or exchange-traded funds to their portfolios, thus generating potential return while keeping risks at a minimum. Fixed-income investments such as intermediate- or longer-term bond funds are still providing good yields despite the low-interest-rate state of the economy.

It is important to note, however, that even though bonds are generally thought of as safer investments, they still are subject to a number of risks. Because income from most bonds is fixed, such instruments can have their values eroded by external factors such as interest rates and inflation. We will discuss some of these risks after the next section.

Period	1	2	3	4	5	6	7	8	9	10
End Date	6/30/20	12/31/20	6/30/21	12/31/21	6/30/22	12/31/22	6/30/23	12/31/23	6/30/24	12/31/24
Coupon	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500
Principal										$100,000

Table 10.4

Table 10.4 shows the cash inflow of a five-year, 9%, $100,000 corporate bond dated January 1, 2020. The bond will have coupon (interest) payment dates of June 30 and December 31 for each of the following five years. Because the bond was issued on January 1, 2020, the year 2020 is the first full year of the bond, followed by the years 2021, 2022, 2023, and 2024, with the bond maturing in December of the latter year.

Cash inflows will be (1) the coupon or interest payments of $\frac{9\% \times \$100{,}000}{2} = \$4{,}500$, paid to the bondholder every six months, and (2) the one-time principal or face-value payment of $100,000 upon maturity on December 31, 2024.

Yields and Coupon Rates

The two interest rates that we associate with a bond are often confusing to students when they first begin to work with bonds. The coupon rate is the interest rate printed on the bond; this is only used to determine the interest or coupon payments. The yield to maturity (YTM) is an interest rate that is used to discount the bond's future cash flow. The YTM is derived from the marketplace and is based on the riskiness of future cash flows.

As we have seen when pricing bonds, a bond's YTM is the rate of return that the bondholder will receive at the current price if the investor holds the bond to maturity.

Yield to Maturity

As noted above, the market sets this discount rate, or the yield to maturity. The YTM reflects the going rate in the bond market for this type of bond and the bond issuer's perceived ability to make the future payments. Hence, we base the yield on a mutually agreeable price between seller and buyer. The bond market determines the YTM and the available supply of competing financial assets. By competing against other available financial assets, the YTM reflects the risk-free rate and inflation, plus such premiums as maturity and default specific to the issued bond.

The YTM is the expected return rate on the bond held to maturity. How do we determine the bond's YTM? We can use our same three trusty methods: equations, a financial calculator, and Microsoft Excel (as shown at the end of the chapter).

2 Adam Hayes. "What Do Constantly Low Bond Yields Mean for the Stock Market?" *Investopedia*. June 15, 2021. https://www.investopedia.com/ask/answers/061715/how-can-bond-yield-influence-stock-market.asp

Determining Bond Yield Using an Equation

The solution, when solving for discount rates, requires us to revisit the bond pricing formula, which is

$$\text{Bond Price} = \text{Par Value} \times \frac{1}{(1+r)^n} + \text{Coupon Payment Amount} \times \frac{\left[1 - \frac{1}{(1+r)^n}\right]}{r} \quad \textbf{10.9}$$

Of course, with one equation, we can solve for only one unknown, and here the variable of concern is *r*, which is the YTM. Unfortunately, it is difficult to isolate *r* on the left-hand side of the equation. Therefore, we need to use a calculator or spreadsheet to solve for the bond's YTM.

Let's take another bond, the Coca-Cola bond, from Table 10.1 above and again back up our time to March 2021. If the Coca-Cola bond has just been issued in March 2021, then it would be a seven-year, semiannual bond with a coupon rate of 1.0% and an original price of $952.06 at the time of issue (Table 10.5).

Bond Characteristic	Details
Price (% of par)	95.20
Coupon rate	1%
Maturity date	March 15, 2028
Standard & Poor's Rating	A+
Coupon payment frequency	Semiannual
First coupon date	September 1, 2021
Type	Corporate
Callable?	Yes

Table 10.5 Overview of Coca-Cola Bond (as of March 2021) (credit: FINRA-Markets.Morningstar)

Determining Bond Yield Using a Calculator

For the Coca-Cola bond above, what was the bond's YTM at its issue date? This is not an easy problem to solve with a mathematical formula. It is far more practical, not to mention easier, to use a financial calculator or an Excel spreadsheet to solve for bond prices, yields, and maturity periods.

We will cover Excel applications later, but we can jump into some calculator examples right now. So, to calculate the yield on the Coca-Cola bond, we'll start by entering the values we have for this bond into a calculator. The values we know are as follows:

$$\$1{,}000 \text{ par value} \quad \textbf{10.10}$$

$$14 \text{ payments } (n = 7 \text{ years} \times 2 \text{ payments per year}) \quad \textbf{10.11}$$

$$\$5.00 \text{ coupon per period} \left(\frac{\$1{,}000 \times 1\%}{2} = \$5.00\right) \quad \textbf{10.12}$$

If the bond's selling price was $952.06 at issue, we have all the information we need to determine the bond's YTM at issue. Table 10.6 shows the steps for using a calculator to come to an answer.

Step	Description	Enter	Display	
1	Clear calculator register	CE/C		0.0000
2	Enter present value or price as a negative amount	952.06 +|− PV	PV =	-952.0600
3	Enter future or par value	1000 FV	FV =	1,000.0000

Table 10.6 Calculator Steps for Bond's Yield to Maturity at Issue

Step	Description	Enter	Display	
4	Enter periods $7 \text{ years} \times 2 = 14 \text{ semiannual periods}$	14 **N**	N =	14.0000
5	Enter coupon payment $\left(\frac{\$1{,}000 \times 1\%}{2} = \$5.00\right)$	5 **PMT**	PMT =	5.0000
6	Compute interest rate	**CPT I/Y**	I/Y =	0.8651

Table 10.6 Calculator Steps for Bond's Yield to Maturity at Issue

The calculated I/Y (interest rate or YTM) of 0.8651 is a semiannual figure because the periods and coupon payments we entered for the calculation are semiannual values. To covert the semiannual value into an annual rate, we will need multiply the calculated I/Y by 2. This gives us an amount of 1.73%.

So, the YTM of the Coca-Cola bond at issue date was 1.73%. It is important to know that unless otherwise indicated, bond yields are expressed in annual percentage terms.

We have just demonstrated how a calculator can be used to determine the YTM or interest rate of a bond. Let's look at a few more examples that cover the most common types of bond problems. These are determining a YTM, calculating a bond's current price (or value), and determining a bond's maturity period.

First, let's work through another example of calculating a YTM, but this time with a bond that has annual interest payments instead of semiannual coupons.

Let's say you are considering buying a bond, but you want to calculate the YTM to determine if it will meet your overall return requirements. Some facts you have on the bond are that it has a $1,000 face value and that it matures in 12 years. Assume that the current price of the bond is $675 and it pays coupons annually at 3.5%. See Table 10.7 for the steps to calculate the YTM.

Step	Description	Enter	Display	
1	Clear calculator register	**CE/C**		0.0000
2	Enter present value or price as a negative amount	675 **+|−** **PV**	PV =	-675.0000
3	Enter future or par value	1000 **FV**	FV =	1,000.0000
4	Enter periods (12 years)	12 **N**	N =	12.0000
5	Enter coupon payment $(\$1{,}000 \times 3.5\% = \$35.00)$	35 **PMT**	PMT =	35.0000
6	Compute interest rate	CPT **I/Y**	I/Y =	7.7589

Table 10.7 Calculator Steps for Computing Yield to Maturity

By following the steps in the table above, you will arrive at a YTM of 7.76%.

Using a calculator is fast and accurate for finding bond yields. Thus, if you know the bond's current price and all of the future cash flows, you can find the YTM, or the return rate that the bond buyer is receiving on the funds loaned to the bond issuer. As mentioned, Excel spreadsheets are as easy and accurate as a financial calculator for determining bond rates, and we will cover these later in the chapter.

Determining Bond Price or Value Using a Calculator

Let's say a friend recommends a 20-year bond that has a face value of $1,000 and a 6% annual coupon rate. If similar bonds are yielding 4% annually, what would be a fair price for this bond today? Table 10.8 shows the steps to make this determination.

Step	Description	Enter	Display	
1	Clear calculator register	CE/C		0.0000
2	Enter future or par value as a negative amount	1000 +|− FV	FV =	-1,000.0000
3	Enter interest rate (4% annual rate)	4 I/Y	I/Y =	4.0000
4	Enter periods (20 years)	20 N	N =	20.0000
5	Enter coupon payment ($\$1{,}000 \times 6\% = \$60$) as a negative amount	60 +|− PMT	PMT =	-60.0000
6	Compute present value or price	CPT PV	PV =	1,271.8065

Table 10.8 Calculator Steps for Computing Present Value

So, the bond should be priced today at $1,271.81.

Determining Bond Maturity Using a Calculator

Imagine you are considering investing in a bond that is selling for $820, has a face value of $1,000, and has an annual coupon rate of 3%. If the YTM is 10%, how long would it take for the bond to mature? See Table 10.9 for the steps to calculate the time to maturity.

Step	Description	Enter	Display	
1	Clear calculator register	CE/C		0.0000
2	Enter present value or price as a negative amount	820 +|− PV	PV =	-820.0000
3	Enter interest rate (10% annual rate)	10 I/Y	I/Y =	10.0000
4	Enter future or par value	1000 FV	FV =	1,000.0000
5	Enter coupon payment ($\$1{,}000 \times 3\% = \$30.00$)	30 PMT	PMT =	30.0000
6	Compute periods until maturity	CPT N	N =	3.1188

Table 10.9 Calculator Steps for Computing Time to Maturity

So, the bond's time to maturity would be 3.12 years.

THINK IT THROUGH

Using a Calculator

If a $1,000 face value bond is selling for $595, has 20 years until it matures, and has a YTM of 6.5%, what are the coupon rate and the periodic coupon payment of the bond? Follow the steps in Table 10.10.

Step	Description	Enter	Display	
1	Clear calculator register	CE/C		0.0000
2	Enter present value or price as a negative amount	595 +|− PV	PV =	-595.0000
3	Enter periods	20 N	N =	20.0000
4	Enter future or par value	1000 FV	FV =	1,000.0000

Table 10.10 Calculator Steps for Computing Coupon Payment

Step	Description	Enter	Display	
5	Enter interest rate or YTM	6.5 I/Y	I/Y =	6.5000
6	Compute coupon payment	CPT PMT	PMT =	28.2437

Table 10.10 Calculator Steps for Computing Coupon Payment

Solution:

The annual coupon payment amount is \$28.24. This means the coupon rate on the bond is $\frac{28.24}{1{,}000} = 2.824\%$.

The Coupon Rate

The coupon rate is the rate that we use to determine the amount of a bond's coupon payments. The issuer states the rate as an annual rate, even though payments may be made more frequently. Thus, for semiannual bonds, the most common type of corporate and government bond, the coupon payment is the par value of the bond multiplied by the annual coupon rate and then divided by the number of payments per year, 2.

We have already seen the coupon rate. The first bond we reviewed, the 3M Co. bond, was an annual coupon bond with a coupon rate of 2.25%. Using a par value of \$1,000, we determined that the annual coupon payments would be $\$1{,}000 \times 0.0225 = \$22.50$.

For the Coca-Cola bond, we note from Table 10.5 that it has a coupon rate of 1% and is paid semiannually. Using a par value of \$1,000, we can determine that the coupon payments would be $\frac{\$1{,}000 \times 1\%}{2} = \$5.00$.

The Relationship of Yield to Maturity and Coupon Rate to Bond Prices

The value or price of any bond has a direct relationship with the YTM and the coupon rate.

- When the coupon rate of a bond exceeds the YTM, the bond sells at a premium compared to its par value. That is, market demand will push the price of the bond to an amount greater that than its face or par value. We call this kind of bond a **premium bond**.
- When the coupon rate is less than the YTM, the bond sells at a discounted amount, or less than its par value. We refer to such a bond as a **discount bond**.
- When the coupon rate and YTM are identical, a bond will sell at its par value. Bonds that experience this scenario in the market are referred to as par value bonds.

The interest or coupon payments of a bond are determined by its coupon rate and are calculated by multiplying the face value of the bond by this coupon rate.

The inverse relationship of interest rates and bond prices is an important concept for investors to know. Because interest rates fluctuate and can change significantly over time, it is important to understand how these changes will impact bond values.

10.3 Using the Yield Curve

Learning Outcomes

By the end of this section, you will be able to:

- Use the yield curve to show the term structure of interest rates.
- Describe and define changes in the yield curve shape.
- Explain the importance of the yield curve shape.

Term Structure of Interest Rates

The expected yields of various bonds across different maturity periods are referred to as the *term structure of interest rates*. This is because they represent interest rates for different periods of time, maturities, or terms.

When interest rate yields are plotted against their respective maturity periods and these plotted points are connected, the resulting line is called a **yield curve**. Essentially, the yield curve is a result of this plotting process and becomes a graphical representation of the term structure of interest rates. A yield curve will always be constructed by showing the value of yields (rates) on the *y*-axis and maturities or time periods on the *x*-axis (see Figure 10.5).

To create a useful graph of the yield curve, interest rate yields should be computed for all government bonds at all remaining times to maturity. For example, the yields on all government bonds with a single year remaining until maturity should be calculated. This value is then plotted on the *y*-axis against the one-year term on the *x*-axis. Similarly, yields on government bonds with two years remaining until maturity are calculated and plotted on the *y*-axis against two years on the *x*-axis, and so on, until a point of critical mass of information is reached and the resulting graph displays useful information.

The yield curve for government bonds is also known as the *risk-free yield curve* because these securities are thought of as safe investments that are not expected to fail or default and will in all likelihood repay or otherwise meet all financial obligations made through the bond issuance.

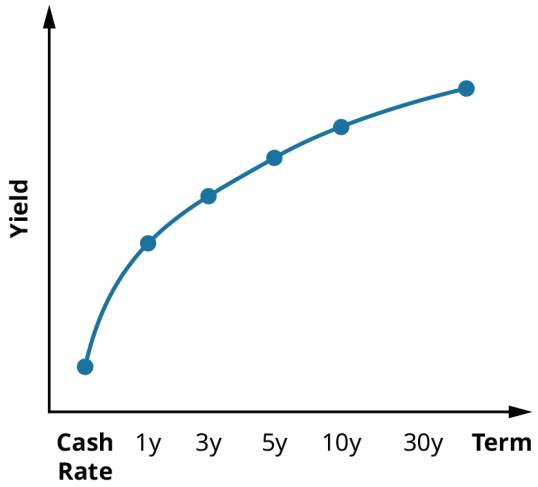

Figure 10.5 A Normal Yield Curve: Long-Term Rates Are Higher Than Short-Term Rates

A normal yield curve slopes upward, with yield increasing as the term increases. This is because yields on fixed-income investments such as bonds will rise as maturity periods increase and produce greater levels of risk.

Corporate issuers of bonds will usually offer bond issues at higher yields that the government, which is understandable because they are potentially riskier for investors. Government securities are guaranteed by governments and have little to no chance of default or nonpayment. This is not the case for corporate bonds, where there is always a chance of default, though the likelihood of this occurring will vary by individual company or issuer as well as by bond type and term. We will discuss bond default and default risk next.

LINK TO LEARNING

The Yield Curve

Review this video (https://openstax.org/r/introduction-to-the-yield-curve) that introduces the concept of the yield curve.

Different Shapes of the Yield Curve

There are two important elements to any yield curve that will define its shape: its level and its slope. The level of a yield curve directly relates to the yield rates depicted on the *y*-axis of the graph (see Figure 10.6). The slope of the yield curve indicates the difference between yields on short-term and longer-term investments. The difference in yields is primarily due to investors' expectations of the direction of interest rates in the economy and how the federal funds rate (referred to as **cash rate** in many countries) is uncertain and may differ significantly over time. As an example, yields on three-year bonds incorporate the expectations of investors on how bank rates might move over the next three years, combined with the uncertainty of those rates over the three-year period.

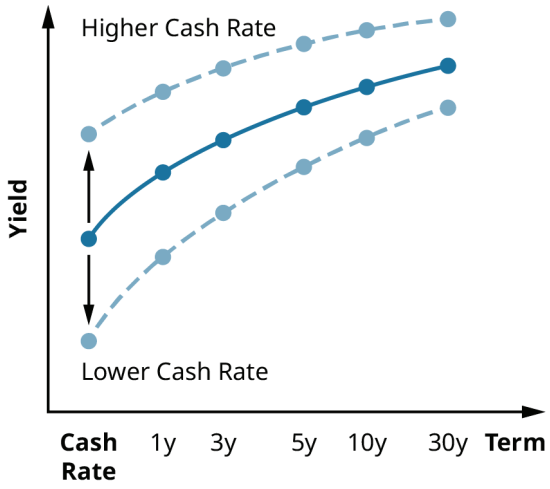

Figure 10.6 Changes in Yield Curve Depending on Cash Rate

As we briefly discussed above, a positive or normal yield curve is indicative of the investment community's requirements for higher rates of return as financial consideration for assuming the risk of entering into fixed-income investments, such as the purchase of bond issues. Typically, as a bond term increases, so will the potential interest rate risk to the bondholder. Therefore, bonds with longer terms will usually carry higher coupon rates to make returns greater for investors. Additionally, economists have come to believe that a steep positive yield curve is a sign that investors anticipate relatively high inflation in the future and thus higher interest rates accompanied by higher investment yields over shorter (inflationary) periods of time.

Normal yield curves are generally observed during periods of economic expansion, when growth and inflation are increasing. In any expansionary economy, there is a greater likelihood that future interest rates will be higher than current rates. This tends to occur because investors will anticipate the Fed or the central bank raising its short-term rates in response to higher inflation rates within the economy.

CONCEPTS IN PRACTICE

How COVID-19 Impacted the Yield Curve

Figure 10.7 shows the relatively normal-shaped yield curve effective in February 2021.

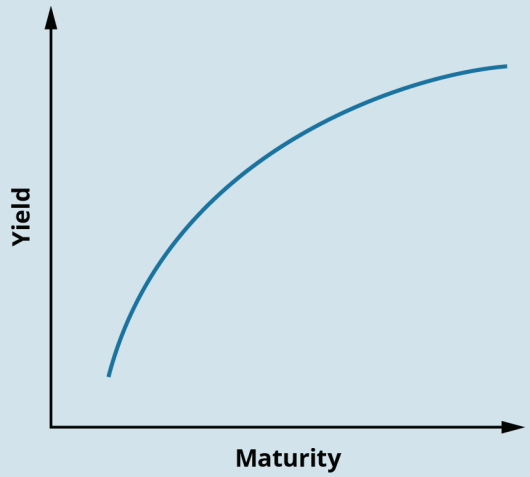

Figure 10.7 Yield Curve in February 2021

A yield curve with an inverted (downward-sloping) shape is considered unusual and will occur when long-term rates are lower than short-term rates. This causes the yield curve to assume an inverted shape with a negative slope. An inverted yield curve has historically been observed as a prelude to a general decline in economic activity and interest rate levels. In some countries, such as the United States, an inverted yield curve has been associated with upcoming recession and economic contraction.

This may occur because central banks, such as the Federal Reserve in the United States, will often attempt to stimulate a stagnant economy by reducing interest rates. Essentially, the potential actions of the central bank to improve the economy have the effect of lowering overall money rates with the economy, which is exactly what investors anticipated would happen and why the yield curve was inverted to begin with.

The yield curve was considered normal with an upward slope in August 2018, as shown in Figure 10.8, but the curve inverted in March 2019 as yields on short-term bonds exceeded those of longer-term bonds, resulting in concerns surrounding impending recession and other economic problems. This inverted shape to the yield curve continued into 2020, as evidenced in Figure 10.9.

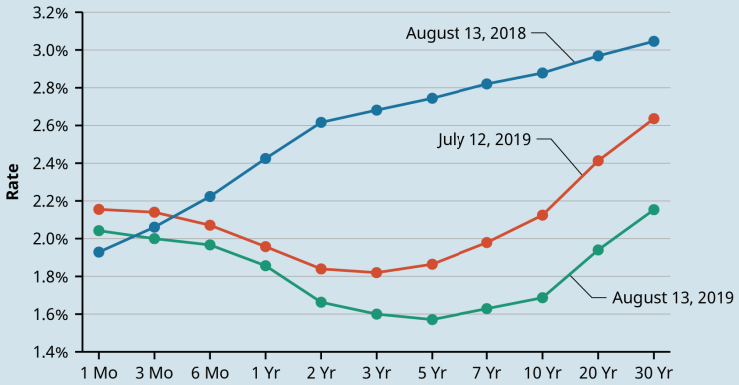

Figure 10.8 The Economy Shifts to an Inverted Yield Curve (data source: US Department of the Treasury, Resource Center, Daily Treasury Yield Curve Rates)

Yield curves constructed on different days in early 2020 appeared similar to the examples below. Again, these are obviously not normal yield structures. As a specific example, note on the February 21, 2020, curve that rates on five-year securities are lower than those of one-year and even three-month securities.

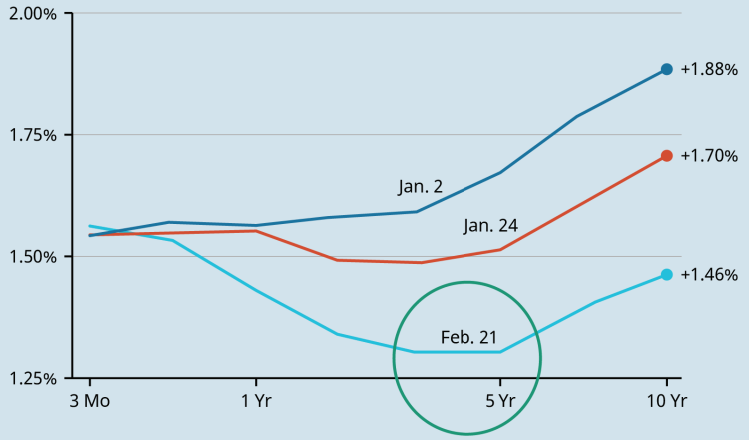

Figure 10.9 Elements of Inversion in Recent Yield Curves (data source: US Department of the Treasury, Resource Center, Daily Treasury Yield Curve Rates)

This inverted yield curve signaled the beginning of a recessionary period in the United States, which was compounded by the COVID-19 pandemic and the closing of many restaurants and businesses.

In March and April 2020, the US economy experienced a significant decline. Most economic indicators dropped so badly that the National Bureau of Economic Research's **Business Cycle Dating Committee**, the US agency that officially declares recessions, was required to intervene.[3]

The recession declaration process by the committee is completed over the course of four months, but in this instance, it only took a total of 15 weeks for the committee to make its declaration. This remains the fastest declaration by the committee on record since the founding of the National Bureau of Economic Research (NBER) in 1978.[4]

In July 2021, the committee declared that the economy had reached a trough in April 2020, marking the end of the recession of the early 2020s and making it the shortest US recession on record as well as the most quickly identified one.[5]

(sources: www.nytimes.com/2019/11/08/business/yield-curve-recession-indicator.html; www.nber.org/news/business-cycle-dating-committee-announcement-june-8-2020; fredblog.stlouisfed.org/2020/11/are-we-still-in-a-recession/)

A flat shape for the yield curve occurs when there is not a great deal of difference between short-term and long-term yields (see Figure 10.10). A flat curve is usually not long lasting and is often observed when the curve is transitioning between a normal and an inverted shape, or vice versa.

A flat yield curve has also been observed as a result of low interest rate levels or some types of unconventional monetary policy.

3 National Bureau of Economic Research. "Business Cycle Dating Committee Announcement June 8, 2020." *NBER News.*
4 Jeffrey Frankel. "The US Is Officially in Recession Thanks to the Corona Virus Crisis." *The Belfer Center for Science and International Affairs.* Harvard Kennedy School, June 16, 2020. https://www.belfercenter.org/publication/us-officially-recession-thanks-corona-virus-crisis
5 National Bureau of Economic Research. "Business Cycle Dating Committee Announcement July 19, 2021." *NBER News.* July 19, 2021. https://www.nber.org/news/business-cycle-dating-committee-announcement-july-19-2021

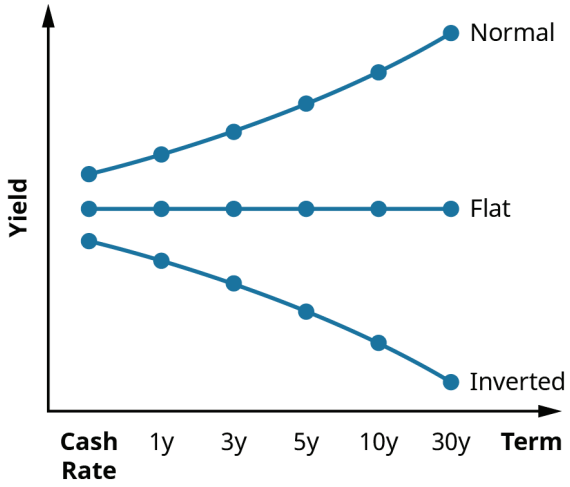

Figure 10.10 Graph Depicting Normal, Flat, and Inverted Yield Curves

Why Is the Yield Curve Important?

Market technicians, brokers, and investment analysts will study the yield curve in great detail by keeping track of its many changes and movements. This is because of the overall importance of the yield curve as an economic indicator and how it can be representative of the ideas, attitudes, and bond market expectations of individuals as well as large institutional investors that exert significant influence on investment markets and the economy as a whole.

10.4 Risks of Interest Rates and Default

Learning Outcomes

By the end of this section, you will be able to:

- Define interest rate, default, and other common forms of bond risk.
- Calculate the primary indicator of interest rate risk.
- Determine factors impacting default risk.
- Understand bond laddering as an investment strategy.
- List major rating agencies and their indications of default.
- Define and calculate the yield to maturity (YTM) on a bond.

Bond Risks

As we touched on earlier, bonds are fixed-income investments, and because of this, they are subject to a number of risks that could have negative effects on their market value. The most common and best-known risks are **interest rate risk** and **default risk**, but other risks exist that should be understood. Among these risks are the following:

- **Credit risk**. If investors believe that a bond issuer is unlikely to meet its payment commitments, they may demand a higher yield to purchase the bond issue in the first place. Due to the relative stability of governments compared to corporations, government bonds are considered to have low credit risk.
- **Liquidity risk**. If investors believe that a bond may be difficult to sell, it will likely have a higher yield. This has the effect of compensating the bondholder for the lack of liquidity (the ability to cash out of the bond). Government bonds usually have the lowest yields of all investments available and are typically among the most liquid in any country where they are traded. Government securities will only face significant liquidity risk in times of great economic distress.
- **Duration risk**. Duration risk is the risk associated with the sensitivity of a bond's price to a single 1% change in interest rates. A bond's **duration** is expressed in numerical measurements. The higher the duration number, the more sensitive a bond investment will be to changes in interest rates.

- **Call risk and reinvestment risk. Call risk** is the risk of bonds being redeemed or called by the issuing firm before their maturity dates. Corporations may elect to call a bond issue (provided the bond issue has a call feature) when interest rates drop and companies are in a position to save a great deal of money by issuing new bonds with lower coupon rates. To investors, this is a risk in and of itself, but call risk also has the effect of potentially causing reinvestment risk. **Reinvestment risk** is defined as the risk to investors when they find themselves facing unfavorable alternatives for investing the proceeds from their called bonds in new, lower-paying investments. This can potentially lead to substantial financial loss for the original bond investors.
- **Term risk**. Investors will generally demand higher returns for lending funds at fixed interest rates. This is because doing so exposes them to the risks presented by rising interest rates and the negative impact of these higher rates on their bond holdings. In a scenario of rising interest rates, investors will find that their return from lending money through a bond purchase just once, at a fixed interest rate, will be lower than the return they might have realized from making several different investments for much shorter periods of time. Term risk is usually measured by a special indicator referred to as the *term premium*.

As mentioned above, however, the most common forms of bond risk are interest rate risk and default risk.

Interest Rate Risk

As we have discussed, when interest rates rise, bond values will fall. This is the general concept behind interest rate risk. Any investor in **fixed-income securities** (such as bonds) will have to contend with interest rate risk at one time or another. Interest rate risk is also referred to as *market risk* and usually increases the longer an investor maintains a bond investment.

Default Risk

Any time a bond is purchased, the investor is taking a risk that the bond issuer may be late in making scheduled payments on a bond issue—or, in the worst case, may not be able to make payments at all. This is the underlying idea behind the concept of default risk.

Because US Treasury securities have the full backing of the government, they are generally considered free of default risk. However, most corporate bonds will face some possibility of default. Obviously, some bonds and their issuing companies are riskier in this respect than others.

To assist potential bond investors in understanding some of these risks, **bond ratings** are regularly published by a number of organizations to express their assessment of the risk quality of various bond issues. We will discuss these bond ratings and the companies that issue them next.

Bond Ratings and Rating Providers

It is important for investors to know the risks they are assuming when investing in bonds. Many investors will take advantage of information provided by bond rating services to assess the likelihood of borrowers (bond issuers) defaulting on the financial obligations of their bond issues.

To help investors evaluate the default risks of bonds, **rating agencies (bond rating services)** were established to evaluate bonds and other fixed-income investments, taking into consideration and then analyzing any information that has been published or otherwise made available to the investing public. These services then apply a rating system that has been developed for measuring the quality of bonds and assign individual grades to each bond and its issuing company.

The three largest and best-known bond rating providers are Fitch Ratings, Moody's Investors Service, and Standard & Poor's (S&P) Global Ratings. The rating system used by these services identifies the very highest-quality bonds (the least likely to default) as triple-A (AAA or Aaa), followed next in quality level by double-A bonds (AA or Aa), and so on. Any bond that is rated BBB (S&P, Fitch) / Baa (Moody's) or higher is referred to as **investment grade** and is considered strong and stable by the investment community (see Table 10.11).

It is important to note that investment-grade bonds are among the most popular due to the fact that many commercial banks, as well as several pension funds, are only allowed to trade bonds that are investment grade.

Any bond that is below investment grade, or rated lower than BBB (S&P, Fitch) or Baa (Moody's), is referred to as a high-yield bond or a junk bond. Junk bonds have had mixed levels of success for companies wishing to issue them to raise capital. In the early 1990s, the market for junk bonds collapsed, due in part to a political movement involving influential people who had been dominating corporate debt markets. This movement, combined with illegal insider trading activities conducted by investments banks, ultimately resulted in the bankruptcy of former financial giant Drexel Burnham Lambert.[6]

S&P / Fitch	Moody's	Grade	Meaning
AAA	Aaa	Investment	Risk almost zero
AA	Aa	Investment	Low risk
A	A	Investment	Risky if economy declines
BBB	Baa	Investment	Some risk; more if economy declines
BB	Ba	Speculative	Risky
B	B	Speculative	Risky; expected to get worse
CCC	Caa	Speculative	Probably bankruptcy
CC	Ca	Speculative	Probably bankruptcy
C	C	Speculative	In bankruptcy or default
D		Speculative	In bankruptcy or default

Table 10.11 Bond Ratings (sources: S&P Global Ratings; Moody's)

The market for junk bonds enjoyed a brief resurgence in popularity when the economy improved later in the 1990s. However, in 2001, the junk bond market shrank once again, resulting in 11% of US junk bond issues defaulting.

In general, it is important to understand that bond ratings are only judgments on corporations' future ability to repay debt obligation and their growth prospects. There is no fixed methodology or basis for calculating a bond rating. However, some financial analysts can get a strong indication of how a bond will be rated by examining certain financial ratios of the issuing firm, such as company debt ratio, earnings-to-interest ratio, and their return on assets.

CONCEPTS IN PRACTICE

The Collapse of Enron: Bond and Credit Ratings and How They Change

The bond rating system is not infallible. A perfect example of this is when energy giant Enron failed in 2001. After the collapse, investors correctly pointed out that a mere two months before this occurred, the company's bonds were rated as investment grade and considered relatively safe, having little risk for investors.

Background on Enron

From its formation in 1985 through the late 1990s, Enron grew to become an energy mega-conglomerate, expanding into areas such as trading of futures contracts, paper products, electricity, water, pipelines, and

6 Lawrence Delevingne. "The Drexel Collapse, 25 Years Later." *CNBC*. February 13, 2015. https://www.cnbc.com/2015/02/13/the-drexel-collpase-25-years-later.html

broadband services. Reported revenues grew at an exceptional pace, Enron's stock price continued to rise, and business was proceeding exceptionally well.

However, things were not as they appeared on the surface. Enron's financial statements were often very confusing to shareholders and analysts. Additionally, Enron's unscrupulous business practices included revenue misstatements and other questionable accounting practices to indicate favorable financial performance. On top of this, some of Enron's speculative business ventures proved to be disastrous, resulting in substantial financial losses.

Initial allegations against Enron also focused on the role of their public accountants, Arthur Andersen. Andersen was one of the Big Five accounting firms in the United States at that time and had served as Enron's auditing firm for over 16 years. According to court documents, Enron and Arthur Andersen had improperly categorized hundreds of millions of dollars of transactions as increases to the company's shareholder equity. It was also later discovered that Andersen failed to follow generally accepted accounting principles (GAAP) when considering Enron's dealings with related partnerships. As a result, Enron was able to conceal some of its losses from the investing public. After investigation by the United States Justice Department, the firm was indicted on obstruction of justice charges in March 2002. The combination of all of these irregularities and issues resulted in the December 2, 2001, bankruptcy of the corporation.[7] It was later determined that the majority of these unethical issues had been perpetuated with the indirect knowledge or even, in some cases, by the direct actions of the board of directors or senior operational management of the company.

Specifics and Enron's Bond Ratings

On October 27, 2001, the company began buying back all its commercial paper, valued at around $3.3 billion, in an effort to calm investor fears about Enron's supply of cash. On November 8, Enron announced that restatements to its financial statements for the years 1997–2000 were necessary to correct several accounting violations. However, by November 28, 2001, credit rating agencies had reduced Enron's bond rating to junk status.[8]

Other Examples of Significant Bond Ratings Downgrades

Some companies that have recently experienced downgrades (or potential downgrades) to their credit and bond ratings include Delta Airlines, Ford, Occidental Petroleum, Carnival Cruises, and T-Mobil. Some of these businesses, such as Delta and Carnival, are suffering the effects of the COVID-19 pandemic, but the hope is that they don't experience the same disastrous fate as Enron.

(sources: www.britannica.com/event/Enron-scandal; www.journalofaccountancy.com/issues/2002/apr/theriseandfallofenron.html; corporatefinanceinstitute.com/resources/knowledge/other/enron-scandal/; www.wsj.com/articles/corporate-bond-downgrades-grow-as-coronavirus-spreads-11585849497)

Concepts of Bond Returns

Bond investors earn profits through two different means: collecting interest income and generating **capital gains**. These are important concepts for any investor who considers putting their money in fixed-income securities such as bonds.

Collecting Interest Income

As we have covered, when investors buy bonds, they are lending money to bond issuers. The coupon rate of a

7 Douglas O. Linder. "Enron (Lay & Skilling) Trial (2006)." *Famous Trials*. Accessed November 24, 2021. https://famous-trials.com/enron

8 Paul M. Healy and Krishna G. Palepu. "The Fall of Enron." *Journal of Economic Perspectives* 17, no. 2 (Spring 2003): 3–26. https://doi.org/10.1257/089533003765888403

bond is determined by the issuer and is generally tied to the overall level of interest rates in the economy at the time of issue as well as the maturity period of the bond and the credit rating of the issuer. The established coupon rate then governs how much periodic interest is paid to bondholders. For example, if an investor purchases a 5%, $1,000 bond with a 20-year maturity and annual coupon payments, that investor will receive 20 coupon payments equal to $\$1{,}000 \times 5\%$ or $20 \times \$50$ for a total of $1,000.

Depending on interest and inflation rates over the 20-year period, this could be a very favorable situation resulting in significant **realized return** for the investor. However, if interest rates and inflation over the investment period are at high levels, the investment is not nearly as attractive.

Generating Capital Gains

Many bonds are not held until their maturity dates. Should an investor require funds before maturity, they have the option to sell them through a broker in the secondary market. When this situation occurs, the investor may earn a capital gain or experience a capital loss, depending on whether the bond ends up being sold at a premium (above face value) or at a discount (below face value).

For example, if an investor bought a corporate bond yielding 7% and then the economy changed so that comparable bonds yielded 10%, the investor would have to lower their price on the original 7% bond until it also yielded the 10% market rate. Potential investors would not be very likely to buy the bond if they could simply buy a newly issued bond from an alternate issuer and receive a higher coupon rate.

It is equally possible that prevailing bond rates could fall and an investor could end up selling their bond at a higher price, thus earning a capital gain.

Bond Laddering as an Investment Strategy

There are several successful strategies for successful bond investments, but perhaps one of the most common yet ingenious of these strategies is called *bond laddering*. Bond ladders help investors achieve diversity in their portfolios and reduce risk while helping maintain regular cash inflows in the form of coupon payments or interest. In a bond ladder, an investor will divide their total investment dollars among various bonds that mature at regular intervals, thereby balancing risk and return. An example of a bond ladder would be to purchase 10 different bonds that have maturities of one year, two years, three years, and so on, all the way through to 10 years.

When the first bond matures, the investor will purchase a new bond that matures in 10 years to take its place in the ladder and continue the overall laddering strategy.

This strategy has several benefits. First, the shorter-term bonds in the ladder provide stability because they are less sensitive to risk than longer-term bonds. The longer-term bonds within the ladder will generally provide higher returns but with higher risk due to such factors as rising interest rates. So, by investing in bonds with different maturities and creating a bond ladder, investors can realize superior financial returns to what they would earn by only investing in short-term bonds. Also, the general level of risk from a bond ladder is reduced by the shorter-term component of the investment mix, making the bond ladder less risky than an investment that only included long-term bonds.

It is easy to see why bond laddering has become such a highly adopted bond investment strategy with investors ranging from novice to the most well-seasoned and experienced.

Interest Rate Movements and Bond Prices

We now know that when investors buy bonds, either directly or through mutual funds, they are lending money to bond-issuing firms or governments. In turn, issuers promise to pay back the principal (par or face value) when the loan is due at the bond's maturity date.

Issuers also promise to pay bondholders periodic interest or coupon payments to compensate them for the use of their money over the term of the bond. The rate at which issuers pay investors, or the bond's stated

coupon rate, is typically fixed at the time of issuance.

We have also covered the concept that bond values have an inverse relationship with interest rates. As interest rates rise, bond prices fall, and when interest rates fall, bond values increase. Movement of interest rates can have a dramatic effect on a bond's value and presents the typical bondholder with a number of different financial risks that we have described in detail.

Also in this chapter, we have discussed how bond values can be estimated through the use of several different factors. Prevailing interest rates are among the most critical of these, but also important are factors such as maturity periods, the taxability of bond interest, the credit standing of bond issuers, and the likelihood of **bond call**, or issuers paying off their debt early.

When considering purchasing bonds or any such fixed-income investment, investors should remain aware that interest rates are always in a state of flux and can change at any time. The movements of bond values and bond yields will be significantly affected by these changes and can be favorable or unfavorable for any investor.

10.5 Using Spreadsheets to Solve Bond Problems

Learning Outcomes

By the end of this section, you will be able to:

- Demonstrate bond valuations using Excel.
- Demonstrate bond yield calculations using Excel.

Calculating the Price (Present Value) of a Bond

The following examples illustrate how Microsoft Excel can be used to calculate common bond problems. Please be sure to refer to the chapters on the time value of money for examples of using spreadsheets to solve present value problems, as these same concepts are also used in solving bond problems.

You can use the following steps in Excel to determine the price or present value of a coupon bond. Suppose that a bond has a par or face value of $1,000, pays coupons semiannually at a 4% annual rate, and matures in 15 years. We can assume a YTM rate of 5%.

1. First, select Formulas from the Excel upper menu bar, and from the dialog box, select PV (see Figure 10.11).

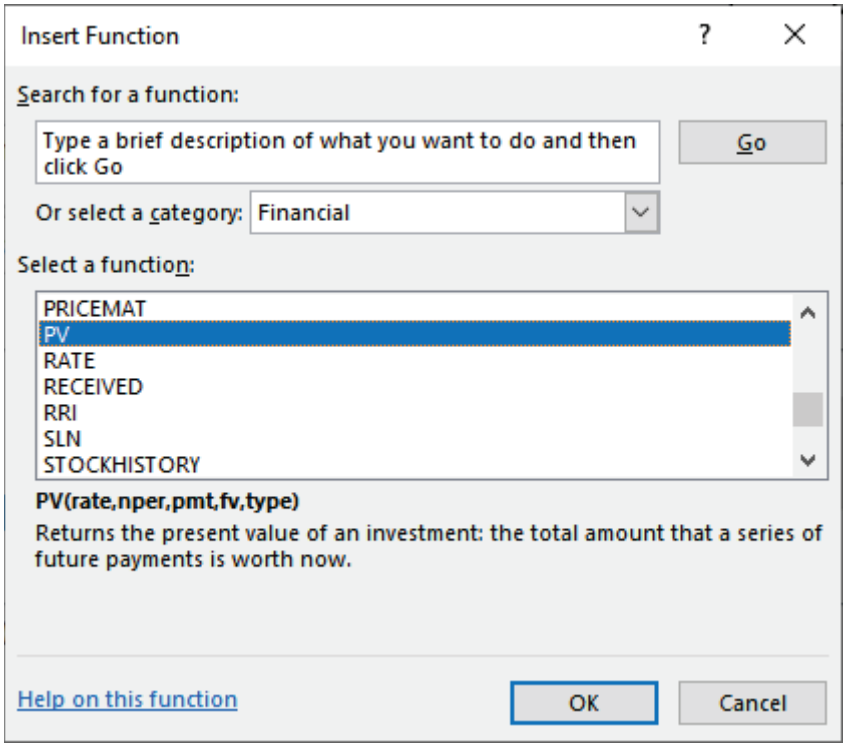

Figure 10.11 Using Excel to Enter a PV (Present Value) Function

2. When the PV function is selected, another dialog box will appear (see Figure 10.12). It is here that the function variables, or arguments, will be entered. It is preferable to use cell addresses to refer to these arguments so that the spreadsheet can be easily used again if inputs/arguments change.

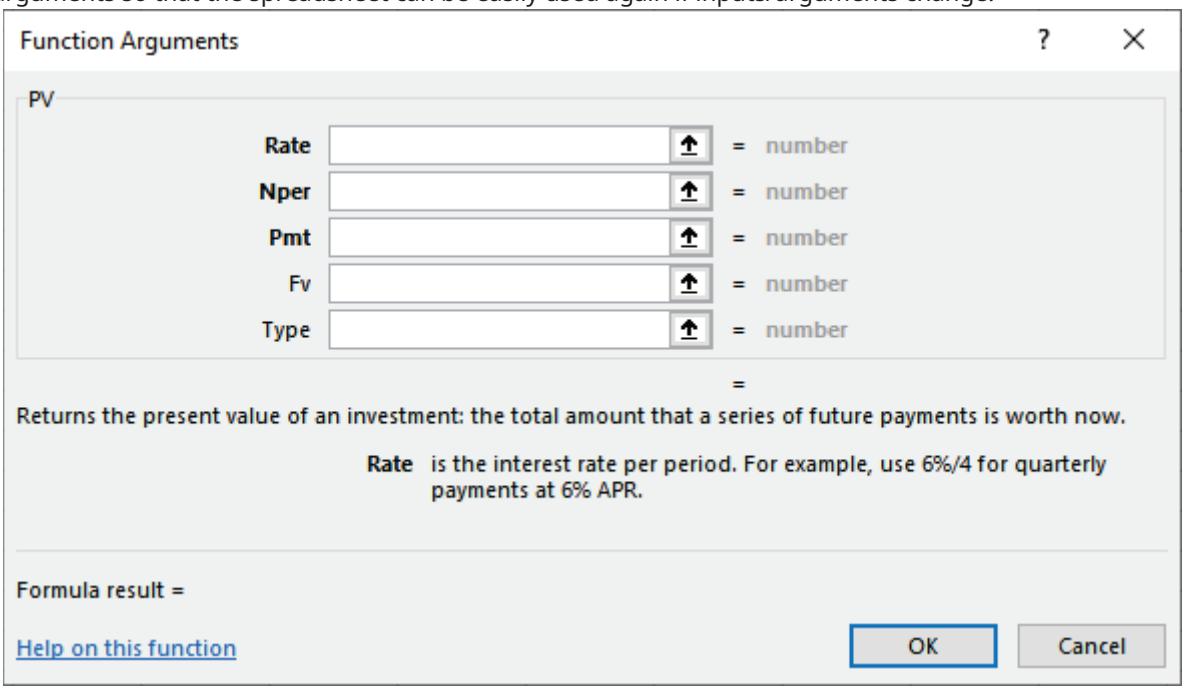

Figure 10.12 Function Arguments Dialog Box

3. Enter the function inputs or arguments (see Figure 10.13). We refer to the cell addresses as per our example spreadsheet.

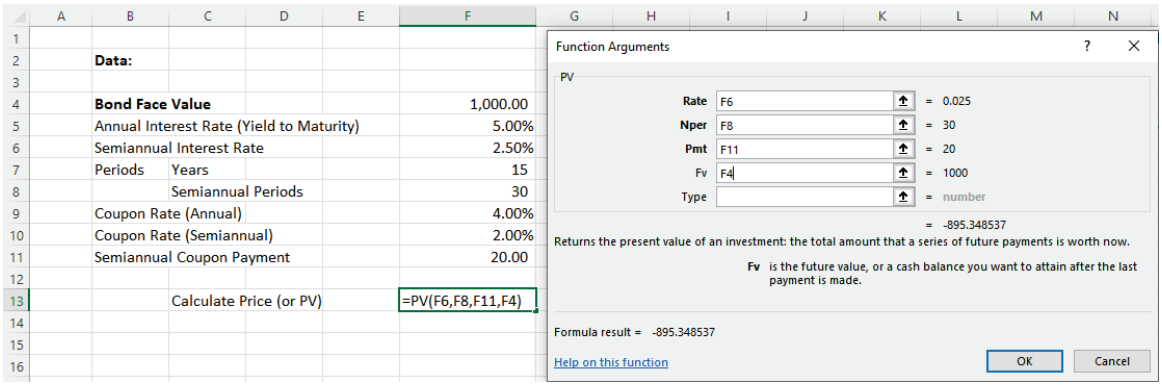

Figure 10.13 Completed Data Entry Menu

Note that the result, the price or present value, will appear in the bottom left section of the Function Arguments box once the arguments are entered. It will appear as a negative value because of the sign convention and because the bond face value in cell F4 was entered as a positive value.

Calculating the Yield to Maturity (Interest Rate) of a Bond

Use the following steps in Excel to determine the YTM (interest rate) of a bond. Assume that you want to find the YTM of a $1,000, 3.5% bond with annual coupon payments that is selling for $675.00 and will mature in 12 years.

1. First, select Formulas from the Excel upper menu bar, and from the dialog box, select Rate (see Figure 10.14).

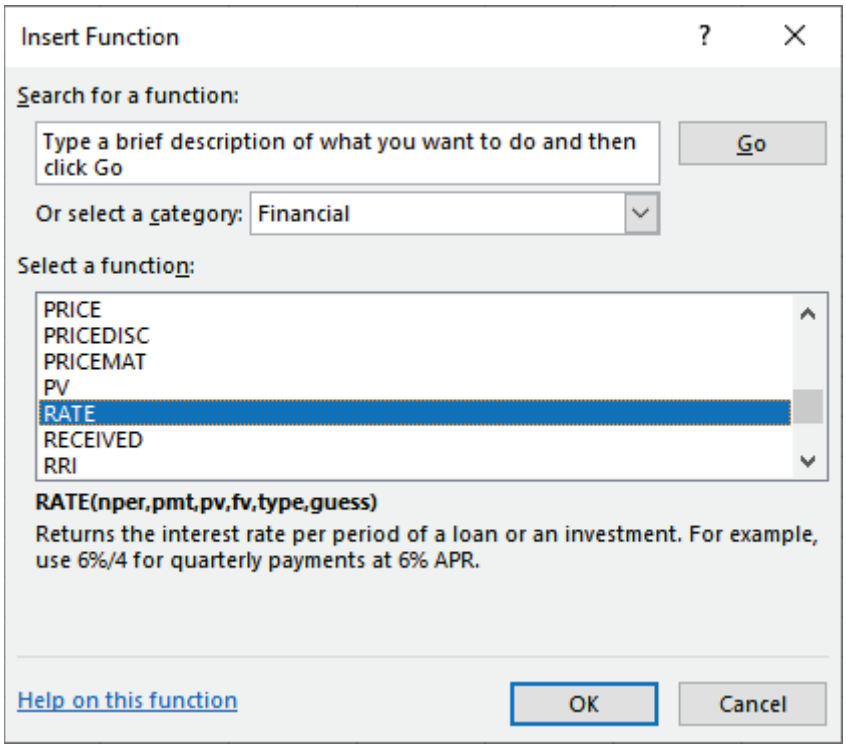

Figure 10.14 Using Excel to Enter a Rate Function

2. After the dialog box appears, enter the variables or arguments. As with our earlier example, we will use the preferred method of identifying the arguments with cell addresses (see Figure 10.15).

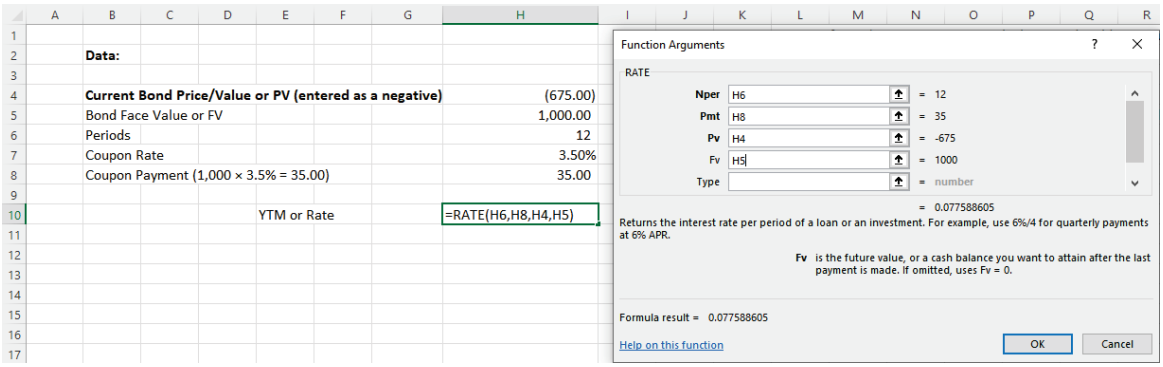

Figure 10.15 Completed Data Entry Menu

3. Again, after all arguments are entered through their correct cell references, the answer will appear in the lower left corner of the box. Once satisfied with the result, you can hit Enter to insert this final calculated value in your spreadsheet. This has been set up in this sheet in cell H10.

THINK IT THROUGH

Calculating a Coca-Cola Bond to Maturity

Earlier, we covered how a financial calculator could be used to determine the YTM of our Coca-Cola bond example. If we wanted to use an Excel spreadsheet to perform this calculation instead of a calculator, we would set up our spreadsheet as shown in the steps below. The current bond price, entered as a negative, is ($952.06). The bond face value of FV is $1,000; the time period is $7 \text{ years} \times 2$, or 14 semiannual periods; the coupon rate is $\frac{1\%}{2}$, or 0.05%; and the coupon payment is $5.00.

1. First, select Formulas from the Excel upper menu bar, and from the dialog box, select Rate (see Figure 10.16).

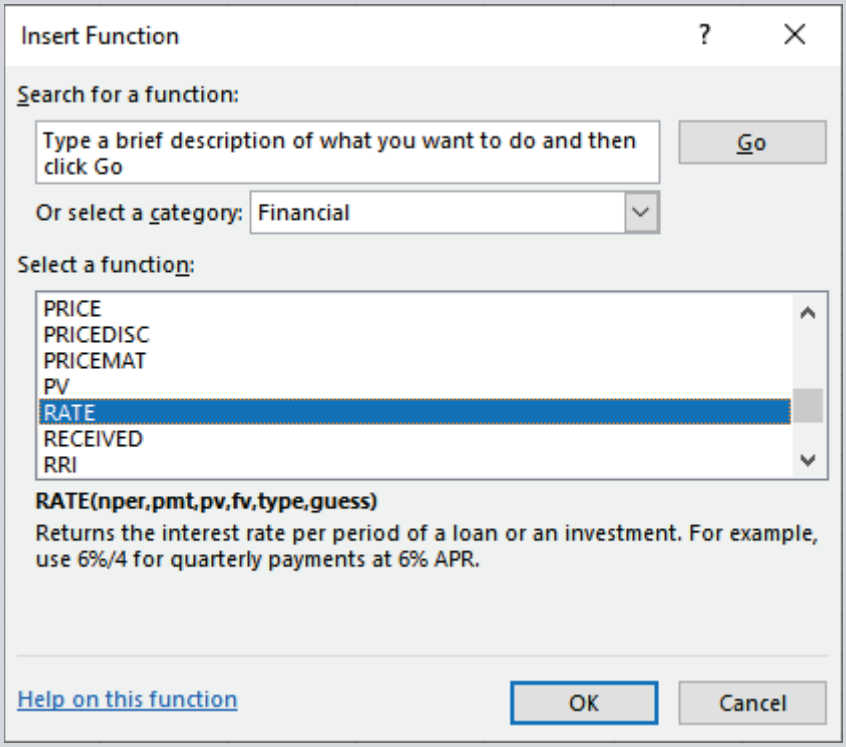

Figure 10.16 Using Excel to Enter a Rate Function

2. After the dialog box appears, enter the variables or arguments. As with our earlier examples, we will use the preferred method of identifying arguments with cell addresses (see Figure 10.17).

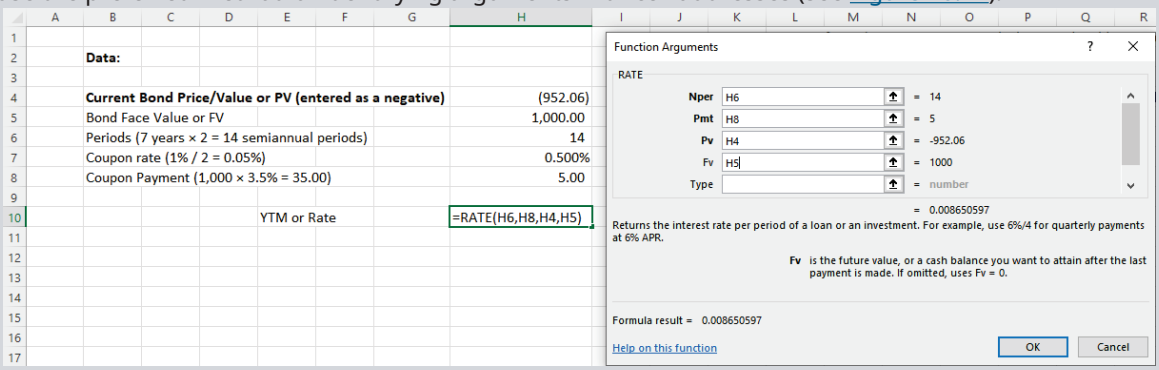

Figure 10.17 Completed Data Entry Menu

3. Again, after all arguments are entered through their correct cell references, the answer will appear in the lower left corner of the box. Once satisfied with the result, you can hit Enter to insert this final calculated value into your spreadsheet. This has been set up in this sheet in cell H10.

As noted above, remember that this is a semiannual rate because it was calculated using semiannual coupon payments and periods. To express it as an annual YTM rate, you must multiply it by 2.

Calculating the Maturity Period (Term) of a Bond

You can use the following steps in Excel to determine the maturity period or term of a bond. Assume that you are considering investing in a bond that is selling for $820.00, has a face value of $1,000, and has an annual coupon rate of 3%. If the YTM is 10%, how long will it be until the bond matures?

1. First, select Formulas from the Excel upper menu bar, and from the dialog box, select Nper (see Figure 10.18).

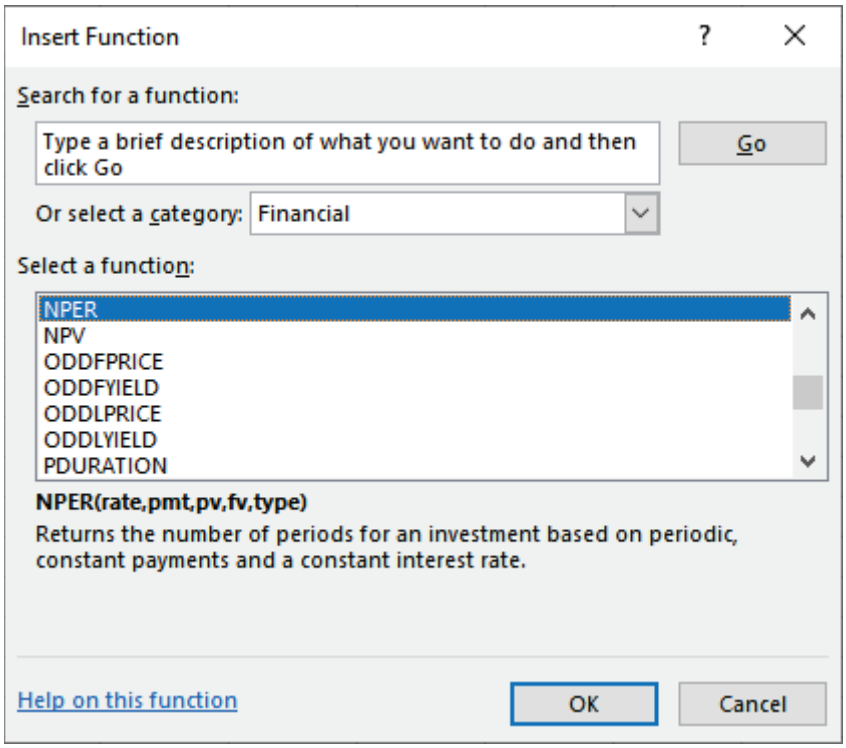

Figure 10.18 Using Excel to Calculate Bond Time to Maturity

2. When the dialog box appears, enter function arguments (see Figure 10.19). Once again, we will use the preferred method of using cell addresses as reference points.

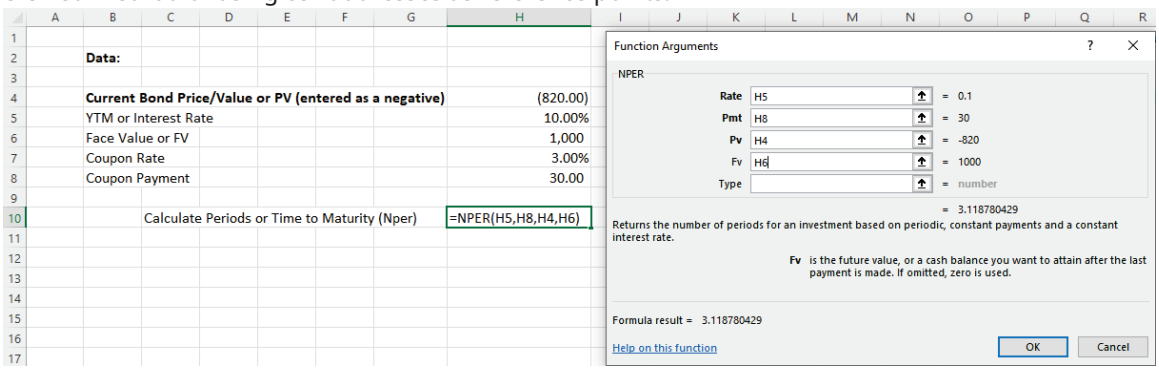

Figure 10.19 Completed Data Entry Menu

3. When arguments have all been entered, the answer will appear in the lower left of the Function Arguments box, as per the above. We arrive at a final answer of 3.12 years until this bond matures.

Calculating Coupon Rate and Interest (Coupon) Payments

Here is how you would determine the coupon or interest rate and coupon payment using Excel. Assume a $1,000 face value bond is selling for $595, has 20 years until it matures, and has a YTM of 6.5%. What are the coupon rate and the periodic coupon payment amount of the bond?

1. First, select Formulas from the Excel upper menu bar, and from the dialog box, select PMT (see Figure 10.20).

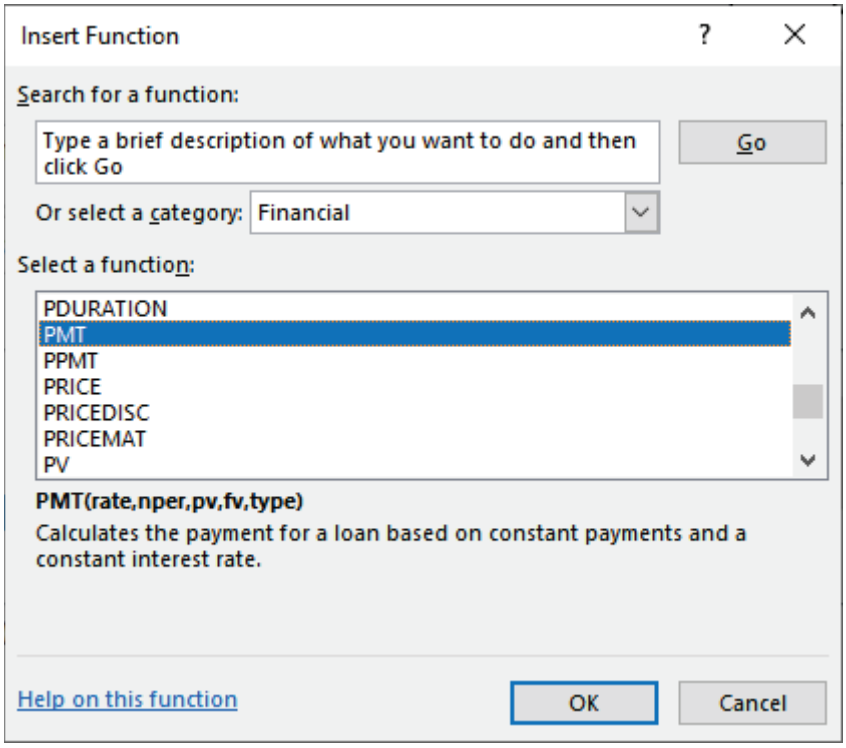

Figure 10.20 Using Excel to Enter a PMT or Payment Function

2. When the dialog box appears, enter function arguments. Once again, we will use the preferred method of using cell addresses as reference points (see Figure 10.21).

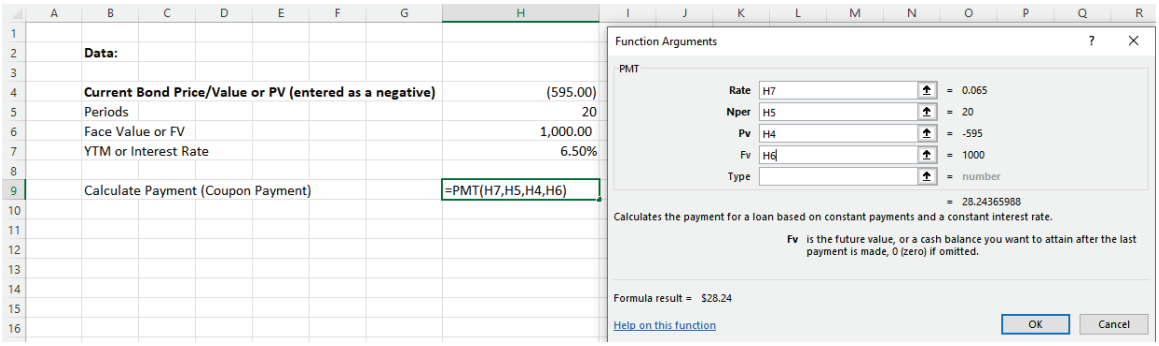

Figure 10.21 Completed Data Entry Menu

3. When arguments have all been entered, the answer will appear in the lower left of the Function Arguments box, as per the above. We arrive at a final answer of $28.24 as the coupon payment.

The coupon rate can be calculated by taking this coupon payment amount and dividing it by the face value:

$$\frac{\$28.24}{\$1{,}000} = 2.824\% \quad \textbf{10.13}$$

So, the coupon rate is 2.824%.

Summary

10.1 Characteristics of Bonds

Bonds are typically a basic form of investment that entails a straightforward financial agreement between issuer and purchaser. There are three primary categories of bonds: government bonds, corporate bonds, and convertible bonds. These different types of bond vary depending on their issuer, length until maturity, interest rate, and risk.

10.2 Bond Valuation

It is important to ascertain what a given bond is worth to a willing buyer and a willing seller. We can price a bond using an equation, a calculator, or a spreadsheet. The essential steps are (1) identify the amount and timing of the future cash flow; (2) determine the discount rate; (3) find the present values of the lump sum principal and the annuity stream of coupons; and (4) add the present value of the lump sum principal and the present value of the coupons.

10.3 Using the Yield Curve

When interest rate yields are plotted against their respective maturity periods and these plotted points are connected, the resulting line is called the yield curve. The yield curve is a graphical representation of the term structure of interest rates. A yield curve always shows the value of yields (rates) on the *y*-axis and maturities or time periods on the *x*-axis.

10.4 Risks of Interest Rates and Default

Because bonds are fixed-income investments, they are subject to a number of risks that could have negative effects on their market value. The most common and best-known risks are interest rate risk and default risk, but there are some others risks that should be understood, such as credit risk, liquidity risk, duration risk, call risk, investment risk, and term risk. To assist potential bond investors in understanding some of these risks, bond ratings have been developed and are regularly published by a number of organizations to express their assessment of the risk quality of various bond issues.

10.5 Using Spreadsheets to Solve Bond Problems

Microsoft Excel can be used to solve common bond problems. It can be used to calculate the value of a coupon bond, the yield to maturity (interest rate) of a bond, the maturity period of a bond, and the coupon rate and interest (coupon) payments of a bond.

Key Terms

bond call a feature of certain bonds or other fixed-income instruments that allows the issuer to repurchase and retire these instruments before maturity

bond price the present, discounted value of the future cash stream generated by a bond; the sum of the present values of all likely coupon payments and the present value of the par value at maturity

bond ratings grades assigned to bonds by rating services that indicate their overall credit quality

Business Cycle Dating Committee a subdivision of the National Bureau of Economic Research (NBER), the US government agency that maintains a chronology of US business cycles

call risk the risk that a bond issuer will redeem a callable bond prior to maturity

capital gains the increase in a capital asset's value that is realized when the asset is sold

cash rate the interest rate that a central bank, such as the Reserve Bank of Australia or the US Federal Reserve System, will charge commercial banks for loans; also known as the bank rate or the base interest rate

convertible bonds fixed-income corporate debt securities that yield interest payments but can be converted into a predetermined number of common stock or equity shares

coupon payment the periodic dollar value of interest that is paid to a bondholder by the bond issuer
coupon rate the amount of annual interest paid by the bond issuer; is multiplied by the face value of a bond to determine annual interest or coupon payment amounts
credit risk the risk taken by a bond investor that the bond issuer will default by failing to pay interest and repay the principal on schedule
deep discount bonds bonds that sell at significantly lower values than their par values
default when an issuer fails to make scheduled interest or principal payments on its bonds
default risk the risk taken by investors that payments will be delayed or will not occur
discount bond a bond currently trading for less than its par value in the secondary market; offers a coupon rate that is lower than prevailing interest rates
duration a measure of how much bond prices are likely to change if and when interest rates move
duration risk the risk associated with the sensitivity of a bond's price to a 1% change in interest rates
Federal Reserve funds rate (federal funds rate) the target interest rate, set by the Federal Reserve, at which commercial banks borrow and lend their excess reserves to each other
Federal Reserve System (the Fed) the central banking system of the United States, responsible for administering fiscal policy for the country
fixed-income securities investments that provide a return in the form of fixed, periodic interest payments and the eventual return of principal at maturity; the most common forms are bonds
floating-rate bonds bonds with variable interest rates that allow investors to benefit from rising interest rates
interest income annual interest amounts paid, or coupon payments made, on a bond between its issue date and the date of maturity
interest rate risk the risk of investment losses that result from changes in interest rates
investment grade describes a municipal or corporate bond with a rating that indicates it presents a low risk of default
junk bonds bonds that have been given a low credit rating, below investment grade; riskier than other bonds due to a greater chance that the issuer will default or experience a credit event
liquidity risk risk that stems from the lack of marketability of an investment, meaning that it cannot be bought or sold quickly enough to prevent or minimize a loss
London Interbank Offered Rate (LIBOR) a benchmark interest rate at which major global banks lend to one another in the international interbank market for short-term loans
maturity date the date on which a bondholder ceases to receive interest payments on a bond investment and instead is repaid its par, or face, value
municipal bonds ("munis") debt securities issued by state and local governments; can be thought of as loans that investors make to local governments to fund infrastructure
par value also called the face amount or face value; the value written on the front of the bond, which is the amount of money that bond issuers promise to be paid at maturity
premium bond a bond that is trading above its par value in the secondary market; offers a coupon rate that is higher than the current prevailing interest rates being offered
prime rate the interest rate that banks charge creditworthy corporate customers; among the most widely used benchmarks for setting home equity lines of credit and credit card rates, based on the federal funds rate set by the Federal Reserve
rating agencies (bond rating services) independent service agencies, such as Fitch, Moody's, or Standard & Poor's, that perform the isolated function of credit risk evaluation
realized return the actual return that an investor earns over a given time period through the buying and selling of a security
reinvestment risk the risk that an investor will be unable to reinvest cash flows received from an investment (e.g., coupon payments or interest) at a rate comparable to their current rate of return
savings bonds debt securities purchased by investors, as a personal investments or as gifts, that the US government issues to pay for certain public or government programs

term risk the risk of potentially earning lower returns on longer-term bond holdings compared to those potentially available when making several shorter-term investments over the same period of time

US Treasury bills (T-bills) short-term US government debt obligations backed by the Treasury Department with a maturity of one year or less

US Treasury note rate the interest rate that the US government pays to borrow money for different lengths of time; notes are issued in terms of two, three, five, seven, and 10 years

yield curve a line that plots yields (interest rates) of bonds having equal credit quality but differing maturity dates; gives an idea of future interest rate changes and economic activity

yield to maturity (YTM) the total return anticipated on a bond if the investment is held until maturity

zero-coupon bonds bonds that are issued at a deep discount from face value and offer no interest or coupon payments

CFA Institute

This chapter supports some of the Learning Outcome Statements (LOS) in this CFA® Level I Study Session (https://openstax.org/r/study-session-14). Reference with permission of CFA Institute.

Multiple Choice

1. When solving bond problems relating to a bond that pays interest on a quarterly basis, the _____ before being applied.
   a. quoted annual yield to maturity should be multiplied by 4
   b. quoted number of years until maturity should be divided by 4
   c. quoted annual coupon payments should be divided by 4
   d. stated face value should be divided by 4

2. Which of the following is NOT an adjustment that must be made when interest is paid semiannually instead of annually?
   a. Dividing the annual coupon payment by 2
   b. Dividing the annual interest rate by 2
   c. Dividing the total number of years by 2
   d. Dividing the annual yield to maturity by 2

3. Which of the following is NOT considered a factor that influences a bondholder's required rate of return?
   a. Financial risk
   b. Other investments by the bondholder
   c. Risk premium
   d. Business risk

4. How might an investment in a bond fund be affected by a decline in interest rates?
   a. The fund investment would not be affected.
   b. The fund investment would likely decrease in value.
   c. The fund investment would likely increase in value.
   d. Coupon payments from bonds in the fund would decline.

5. Interest rates and bond prices _____.
   a. are unrelated
   b. have an inverse relationship
   c. have a direct relationship
   d. are both economic factors set by central banks

6. The coupon rate of a bond is typically _____.
   a. fixed at the time of bond issuance
   b. subject to change based on the federal funds rate

c. zero in the case of zero-coupon bonds
d. Both A and C

7. A zero-coupon bond is a bond that _____.
a. has no value
b. has no periodic coupon payments
c. has been rated below investment grade
d. Both A and C

8. A bond that has a coupon rate less than prevailing interest rates will _____.
a. sell at par value
b. sell at a discount
c. sell at a premium
d. be overpriced

9. Determining bond prices often involves using which two TVM (time value of money) equations?
a. The future value of a lump sum and the present value of a lump sum
b. The present value of an annuity and the future value of a lump sum
c. The future value of an annuity and the present value of a lump sum
d. None of the above

10. A normal yield curve will _____.
a. slope downward as it moves along its *x*-axis (term).
b. slope upward as it moves along its *x*-axis (yield).
c. fluctuate depending on the federal funds rate
d. slope upward as it moves along its *x*-axis (term).

11. An inverted yield curve is an indication that _____.
a. long-term yields and interest rates are higher than short-term rates
b. the economy is in the process of a significant recovery
c. short-term yields and interest rates are higher than long-term rates
d. the yields to maturity on all bonds are less than market interest rates

12. Bond laddering is _____.
a. a risky bond investment strategy that may yield tremendous returns
b. a strategy in which bonds with several different maturity periods are added to a portfolio
c. a strategy that involves replacing equity investments with bonds in a portfolio
d. a bond strategy that sacrifices diversity for potential capital gains

13. A call feature _____.
a. is desirable to an investor
b. may cause additional risk for the bond issuer
c. may cause additional risk for an investor
d. Both A and B

14. The duration of a bond is _____.
a. a measurement of the bond's overall risk
b. synonymous with the bond's term
c. a measurement of how long an investor holds the bond
d. a measurement of the bond's sensitivity to interest rate changes

Review Questions

1. What is a junk bond?

2. Briefly describe interest income within the context of bond investments.
3. Briefly describe the two types of cash flow that a bondholder will receive from the issuer.
4. What is an inverted yield curve, and what is its significance?
5. Describe reinvestment risk for a bondholder.

Problems

1. A $1,000 Expo Corp. bond has a coupon rate of 5%, pays interest semiannually, and matures in six years. If the yield to maturity is 7%, what is the bond's value today?
2. A $1,000 Omega Corp. bond has an 8% coupon rate that is paid semiannually. The bond matures in three years. If the current price of the bond is $1,125, what is the yield to maturity?
3. You are considering buying a bond that is currently priced at $830, has a face value of $1,000, and matures in seven years. If interest is paid semiannually and the bond has a yield to maturity of 6%, what is the bond's annual coupon rate?
4. A $1,000 Noah Corp. bond has a coupon rate of 5% with semiannual payments, matures in 10 years, and has a yield to maturity of 6.5%. What is the bond's current price?
5. Chronowerx Inc. has issued a bond that has a face value of $1,000, a 3% coupon rate (with semiannual interest), and a maturity date four years from now. If the bond's current price is $895, what is its yield to maturity?
6. You are considering adding a $1,000, 25-year bond to your portfolio. It has a coupon rate of 8%, which is paid annually, and your required return is 10%. What is the current price of the investment?
7. A Cameron Corp. bond has a $1,000 par value, a 5 percent coupon rate paid semiannually, and nine years until maturity. If similar investments yield 6%, what is the current value of Cameron Corp. bonds?
8. McLaren Motors just issued a series of $1,000.00 bonds with a 10-year maturity and an 8% coupon rate, paid quarterly. If you purchase a McLaren bond at a price of $920.00, what is your required rate of return?
9. Three years ago, Petty Partners Inc. issued 15-year, $1,000 bonds that are currently priced at $911.37. If the prevailing rate of return on similar investments is 5%, what is the coupon rate on Petty Partners bonds, and what is the annual interest payment?
10. A $1,000 Riker Corp. bond has a 20-year maturity and a 6% coupon rate, with interest paid annually. If similar bonds from Riker Corp. are yielding 4%, what is the current market value of the Riker issue?
11. A $1,000 bond that matures in eight years, has quarterly coupon payments of $25, and is currently priced at $962.00 will have a yield to maturity of _____.

Video Activity

Using TI BA II+ to Price a Bond

Access multimedia content (http://openstax.org/books/principles-finance/pages/10-video-activity)

1. If you are provided with annual information in a bond problem, which bond variables must be adjusted to accommodate semiannual compounding periods, and how must they be adjusted? Review the video to follow along as this information is provided.
2. Following the instructions laid out in the video, practice using a calculator to find the price of a bond under two scenarios. The first scenario should be when compounding periods are annual, or once a year, and the second scenario should be when compounding periods are semiannual, or once every six months.

Start out this exercise with the bond factor input variables that are used in the video: par value of $1,000, annual coupon rate of 4%, time to maturity of 10 years, and yield to maturity of 8%. Calculate the current value or price of the bond under both of the different compounding period scenarios.

Once you have arrived at the same results demonstrated in the video, practice calculating prices using different bond factor variables for inputs, changing time or years to maturity, coupon rate (and coupon payments), and yield to maturity until you are completely confident using a financial calculator to find the price or value of any bond.

Bond Pricing, Valuation, Formulas, and Functions in Excel

Access multimedia content (http://openstax.org/books/principles-finance/pages/10-video-activity)
Review the examples included in this video, and practice setting up spreadsheets that solve for each of the five primary bond variables using the values in the videos (maturity 10 years, coupon rate 10%, coupon payment $100, yield to maturity 8%, and par value $1,000). Parallel the spreadsheets that are set up in the video, ensuring that you arrive at the same results for each bond variable amount.

3. Name and describe the five primary bond variables that can be solved using Excel spreadsheets.
4. What are the Excel functions that allow you to perform these calculations, and where in the standard Excel spreadsheet are they located?

11

Stocks and Stock Valuation

Figure 11.1 In addition to bonds, corporations will often issue common stock as a means of raising necessary capital to finance future operations. (credit: modification of "New York Stock Exchange Huge US Flag Photo i018" by Grant Wickes/flickr, CC BY 2.0)

Chapter Outline

Why It Matters

Similar to bonds, shares of **common stock** entitle investor owners to a portion of a company's future earnings and cash flows. However, stocks differ significantly from bonds in how they are issued and managed by companies, the methodology used to calculate their values in public markets, and how they can generate income and eventual value for individual investors.

With common stock, there is no specific promise of how much cash investors will receive or when they will receive it. This differs from bond investments, which are valued entirely on the basis of their guaranteed timing of future cash flows to bondholders.

This means that with stocks, there are no maturity dates, face values, or coupon payment guarantees. It also means that stocks do not promise any specified cash flows in the form of coupons or a face value payment at some point in the future. Instead, stocks (only some, not all) may pay dividends. These dividends are declared after shares of stock have been issued by a company and then purchased by the investing public. Following a dividend declaration, the designated per-share amounts are paid to shareholders of record on a specified date, also determined by a company's board.

Because stock investments carry no guarantee of payments to investors, they are far riskier than bonds and other forms of fixed-income investments.

While there are many reasons for an investor to choose to purchase common stock, three of the most common reasons are

- to use stocks as instruments or repositories for maintaining value;
- to accumulate wealth over the term of the stock investment; and
- to earn income through capital gains and dividend payments.

As with any financial instrument, common stock purchases offer advantages and disadvantages to investors. Important advantages include the following:

- Returns through dividends and price appreciation of shares can be substantial.
- Stocks are a liquid form of investment and can be bought or sold within **secondary markets** relatively easily.
- Information about companies, markets, and important trends are widely published and readily available to the investing public.

These advantages are significant and lead many individuals to move into stock investments. Yet it is important to realize that stock has some significant disadvantages, which can include the following:

- General risk levels are greater than with bonds or other fixed-income investments.
- Timing the buy-and-sell transactions of stock can be tricky and may lead to losses or not taking full advantage of share price opportunities.
- Dividends (provided that the stock does indeed pay them, as not all do) are uncertain and subject to change based on decisions of company management.

We will discuss these topics in this chapter and cover many of the details regarding why corporations issue common stock and why investors purchase that stock.

11.1 Multiple Approaches to Stock Valuation

Learning Outcomes

By the end of this section, you will be able to:

- Define and calculate a P/E (price-to-earnings) ratio given company data.
- Determine relative under- or overvaluation indicated by a P/E (price-to-earnings) ratio.
- Define and calculate a P/B (price-to-book) ratio given company data.
- Determine relative under- or overvaluation indicated by a P/B (price-to-book) ratio.
- Define and detail alternative valuation multipliers, including P/S (price-to-sales) ratio, P/CF (price-to-cash-flow) ratio, and dividend yield.

The Price-to Earnings (P/E) Ratio

Experienced investors use a number of different methods to evaluate information on companies and their common stock before deciding on any potential purchase. One of the most popular techniques used by investors and analysts is to study a company's financial statements in order to uncover basic fundamental information on the company. This involves calculating a number of financial ratios that help identify trends, bringing elements of operational performance to light and allowing for clearer analysis and evaluation.

A well-proven analytical approach for investors to use in evaluating common stock is to review the overall market value of the company that issues a stock. One of the most consistently used calculations in this analysis, which has important applications in company and common stock evaluation, is the **price-to-earnings (P/E) ratio**.

The P/E ratio is computed using the following formula:

$$\text{P/E Ratio} = \frac{\text{Price per Share}}{\text{Earnings per Share}} \tag{11.1}$$

The P/E ratio is extremely useful to analysts in that it shows the expectations of the market. Essentially, the P/E ratio is representative of the price an investor must pay for every unit of current (or future) corporate earnings.

Bottom-line earnings are a critical factor in valuing common stock. Investors will always want to know how profitable a company is now as well as how profitable it will be in the future. When a company's bottom line remains relatively flat over a period of time, leaving **earnings per share (EPS)** relatively unchanged, the P/E ratio can be interpreted as the payback period for the original amount paid for each share of common stock.

For example, the common stock price of Cameo Corp. is currently at $24.00 a share, and its EPS for the year is $4.00. Cameo's P/E ratio is calculated as

$$\text{P/E}_{\text{Cameo}} = \frac{\$24.00}{\$4.00} = 6 \qquad \textbf{11.2}$$

This ratio would typically be expressed in the form $6\times$. Essentially, this means that investors are willing to pay up to six dollars for every one dollar of earnings. It can also be stated that Cameo stock is currently trading at a multiple of six.

The P/E ratio is typically expressed in two primary ways. The first is as a metric listed by most finance websites and often carries the notation *P/E (ttm)*. This refers to the Wall Street acronym for "trailing 12 months" and signals the company's operating performance over the past 12 months.

Another form of the P/E ratio is known as the forward (or leading) P/E. This uses future earnings projections rather than actual trailing amounts. The leading P/E, sometimes called the *estimated price to earnings*, is useful for comparing current earnings to future earnings and helps provide a clearer picture of what earnings may look like, assuming there are no major changes in the company's operations or accounting treatments.

Referring back to our calculation for Cameo Corp. above, because the current EPS was used in the calculation, this ratio would be classified as a trailing P/E ratio. If we had used an estimated or projected EPS as the denominator in the calculation, it would then be considered a leading P/E ratio.

Analyzing a company's P/E ratio alone or within a vacuum will actually tell an analyst very little. It is only when a company's P/E is compared to historical P/E ratios or the P/E ratios of other companies in the same industry that it becomes a useful tool for analysis. One of the most important benefits of using comparative P/E ratios is that they can standardize stocks with different prices and various earnings levels.

Generally speaking, it is very difficult to make any conclusions about a stand-alone **stock value**, such as whether a stock that has a ratio of $8\times$ is a good buy at its current price or if a stock with a P/E ratio of $35\times$ is too expensive, without performing any relevant comparisons or further analysis.

Analysts have many different ways to interpret P/E ratio data. One of the most common interpretations is that firms with high P/E ratios should be growth companies. Also, a high P/E ratio could mean that a stock's price is high relative to earnings and possibly overvalued. This could signal a possible undesired downward adjustment in market price in the future.

We can extrapolate from the argument above to put forward the idea that stocks with low P/E ratios should be stabler, more mature organizations. A low P/E might indicate that the current stock price is low relative to earnings and that there may be an opportunity to take advantage of upward price movements and potential investment gains through stock price appreciation.

While this information is often very useful for evaluating stocks and making investment decisions, caution must always be used, as a current stock price may simply be out of line with the company's earning potential, which would mean that price adjustments are likely to occur in the short term. This is why experienced analysts and investors will use multiple evaluation techniques when conducting stock analysis and evaluation and not rely solely on insights provided by a single set of facts or one form of statistical measurement.

The Price-to-Book (P/B) Ratio

Another financial ratio commonly used by investors and analysts is the **price-to-book (P/B) ratio**, also called the market-to-book (M/B) ratio. This is a financial metric used to evaluate a company's current market value

relative to its book value.

The market value, or **market capitalization**, of a company is defined as the current price of all its outstanding shares of common stock. This is essentially equal to the total value of the company as perceived by the market. For all intents and purposes, the book value is representative of the residual of a company after it has liquidated all assets and paid off all of its liabilities.

Book value can be determined by performing some financial analysis on a company's balance sheet. Essentially, analysts will use the P/B ratio to compare a business's available net assets relative to the current sales price of its stock. The price-to-book-value ratio formula is

$$\text{P/B Ratio} = \frac{\text{Market Price per Share}}{\text{Book Value per Share}} \tag{11.3}$$

One of the primary uses of the P/B ratio is to understand market perceptions of a particular stock's value. It is often the metric of choice for evaluating financial services firms such as real estate firms, insurance companies, and investment trusts. The P/B ratio has a notable shortcoming, however, in that it does not evaluate companies that have a high level of **intangible assets** such as patents, trademarks, and copyrights.

Ultimately, this ratio will tell an analyst exactly how much potential investors are willing to pay for each dollar of asset value. The PB(M/B) ratio is computed by dividing the current closing price of the stock by the company's current book value per share, which is calculated by either of the following two equations:

$$\text{P/B Ratio} = \frac{\text{Market Capitalization}}{\text{Net Book Value}}$$
$$\text{P/B Ratio} = \frac{\text{Price per Share}}{\text{Net Book Value per Share}} \tag{11.4}$$

Net book value is equal to net assets, or the total assets minus the total liabilities of the company.

Analysts often consider a low P/B ratio (less than 1) to indicate that a stock is undervalued and a higher ratio (greater than 1) to mean that a stock is overvalued. A low ratio may be an indication that something is wrong with the company or that an investor may be paying too much for any residual value should the company be liquidated.

However, many market experts will argue the exact opposite of the above interpretations. Because of these discrepancies in interpretation and overall variance of opinion, the use of alternate stock valuation metrics, either in addition to or in place of the P/B ratio, is always worth exploring.

In conclusion, the P/B ratio can help a company understand if its net assets are comparable to the market price of its stock. However, as with the P/E ratio, it is always a good idea to compare P/B ratios of companies within the same industry and use them in conjunction with other metrics and analytical methodologies.

LINK TO LEARNING

Price-to-Earnings Ratio and Price-to-Book Ratio

Two videos cover the price-to-earnings (P/E) ratio (https://openstax.org/r/price-to-earnings) and the price-to-book (P/B) ratio (https://openstax.org/r/price-to-book_ratio). These are excellent introductory videos that will provide you with helpful information on what these ratios represent and how they can be used in stock valuation.

Alternative Multipliers

There are two main types of valuation metrics multiples used to value common stock. These are **equity multiples** and **enterprise value (EV) multiples**. Additionally, there are two primary methods by which to perform analysis using these multiples. These methods are **comparable company analysis (comps)** and

precedent transaction analysis (precedents).

Experienced financial analysts advocate the use of multiples in valuation analysis for a number of reasons, the most important being that they help generate realistic and sound judgments of enterprise values (total company values), they are relatively easy to use and interpret, and they can provide helpful information on a company's overall financial condition when used appropriately.

However, it should be noted that simplicity may have some important disadvantages. When such complex information is reduced to a single equation or final value, it can easily be misunderstood, and the influence of important factors may be masked or lost in the evaluation process.

What's more, the calculation of multiples represents a snapshot in time for a firm and cannot easily show how a company grows or progresses. Thus, these calculations are only applicable to short-term analysis, not to long-term scenarios.

Equity Multiples

Equity multiples are especially useful for investment decisions when an investor aspires to minority positions in companies. Below are some common equity multiples used in valuation analyses.

The price-to-earnings (P/E) ratio, which we discussed earlier, is probably the most common equity multiple used in stock valuation because it is relatively simple to calculate and all necessary data are easily accessible by analysts and investors. The market-to-book (M/B), or price-to-book (P/B), ratio is also useful if assets primarily drive a company's earnings. Again, it is computed as the proportion of share price to book value per share.

Dividend yield is another form of equity multiple and is primarily used when conducting comparisons between cash returns and investment types. Dividend yield is computed as the proportion of **dividend** per share to share price. The **price-to-sales (P/S) ratio** is an additional metric used for firms that are experiencing financial losses. The P/S ratio is often used for quick estimates and is computed as the proportion of share price to sales (or revenue) per share.

Another useful metric is the **price-to-cash-flow (P/CF) ratio**. The P/CF ratio is used to compare a company's market value to its operating cash flow (or the company's stock price per share to its operating cash flow per share). This measurement is suitable only in certain cases, such as when a company has substantial noncash expenses (e.g., **depreciation** or **amortization**). In some situations, companies may have positive cash flows but still show a bottom-line loss due to large noncash expenses. The P/CF ratio is helpful for arriving at a less distorted view of such a company's value.

While these various metrics are important, a financial analyst must always consider that companies often operate under their own unique sets of circumstances that ultimately will influence many of these equity multiples.

Enterprise Value (EV) Multiples

The following are some common EV multiples used in valuation analyses:

Gordon growth model is as follows

$$\frac{\text{Enterprise Value}}{\text{Revenue}} \tag{11.5}$$

$$\frac{\text{Enterprise Value}}{\text{EBIT}} \tag{11.6}$$

$$\frac{\text{Enterprise Value}}{\text{EBITDA}} \tag{11.7}$$

$$\frac{\text{Enterprise Value}}{\text{EBITDAR}} \tag{11.8}$$

EV multiples take an increasingly important role when value decisions surround recent mergers and acquisitions. **Enterprise value (EV)** is a measurement of the total value of a company. Companies often believe that EV offers a more accurate representation of a firm's total value than a basic market capitalization method. Generally, EV is perceived to offer an aggregate value of the firm as an enterprise, which is a more comprehensive measurement (see Figure 11.2).

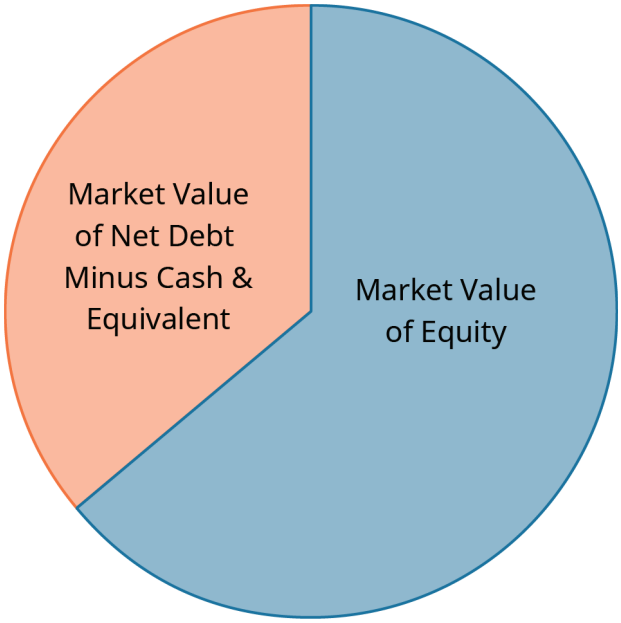

Figure 11.2 Enterprise Value: The Complete Picture

Following are two of the most common enterprise values metrics used in valuing companies and their common stock:

EV/Revenue (EV/R). Also called EV/Sales, EV/R is a valuation metric used to understand a company's total valuation compared to its annual sales levels. EV/R can help provide an analyst with an idea of exactly how much investors pay for every dollar of a company's sales revenue.

EV/R is considered a relatively crude metric but can be useful when analyzing companies that have different methods of revenue recognition. P/E ratios, for example, can be significantly affected by changes in the accounting policies of companies being evaluated. This is another reason why multiple metrics should be used in valuations.

Additionally, EV/R is a useful measure for companies that are consuming cash or experiencing financial losses. Such companies may be start-ups or emerging technology firms that have not fully matured and are still in a growth stage of development.

EV/EBIT. A firm's earnings before interest and taxes (**EBIT**) is an indicator of its profitability before the effects of interest or taxes. EBIT is also referred to as operating earnings, operating profit, and profit before interest and tax.

- **EV/EBITDA.** EV/EBITDA is a ratio that compares a company's enterprise value (EV) to its earnings before interest, taxes, depreciation, and amortization (EBITDA). EBITDA is often used by analysts as a substitute for cash flow and can be applied to capital analysis using tools such as net present value and internal rate of return. It is relatively easy to calculate, as all information required to compete the calculation is available from any publicly traded company's financial statements. Because of this, the EV/EBITDA ratio is a commonly used metric to compare the relative values of different businesses.
- **EV/EBITDAR.** Another form of valuation based on enterprise value is EV/EBITDAR. This metric divides enterprise value by earnings before interest, tax, depreciation, amortization, and rental costs (EBITDAR).

This multiple is used in businesses that have substantial rental and lease expenses, such as hotel chains and airlines. Capital investment can differ significantly for these firms, and when assets are leased, these companies tend to have artificially lower debt and operating income compared to firms that actually own their assets.

EV/Capital Employed. The EV-to-**capital employed** ratio is a measure of enterprise value compared to the level of capital used by a business. For example, a business with a large capital basis is bound to carry a large enterprise value simply due to its large capital holdings.

Final Thoughts on Valuation Ratios and Multiples

There are many equity and enterprise value multiples used in company valuation, but the discussions above cover those that are most commonly used. In any case, gaining a thorough understanding of each multiple and its related concepts can help analysts make better use of these metrics in their stock analysis and valuation efforts. Also, as discussed, it is important that analysts and technicians use multiple ratios and alternate measures for any evaluation of a company and its common stock. Not doing so will limit the ultimate interpretation of the results, can lead to incorrect conclusions, and may cause fundamental mistakes in overall investment strategy.

LINK TO LEARNING

Graph of Historical P/E for S&P 500

Look at the 90-year historical average P/E ratio of the S&P 500 (https://openstax.org/r/90-year_historical_average_P/E). When viewing this information on historical P/E ratios, think about the following:

- Note that the general trend for historical P/E ratios has been one of growth.
- Note that in May 2009, the P/E ratio reached a staggering $123.73\times$, the highest ratio in US history. This was primarily due to depressed earnings during the Great Recession.

11.2 Dividend Discount Models (DDMs)

Learning Outcomes

By the end of this section, you will be able to:

- Identify and use DDMs (dividend discount models).
- Define the constant growth DDM.
- List the assumptions and limitations of the Gordon growth model.
- Understand and be able to use the various forms of DDM.
- Explain the advantages and limitations of DDMs.

The **dividend discount model (DDM)** is a method used to value a stock based on the concept that its worth is the present value of all of its future dividends. Using the stock's price, a required rate of return, and the value of the next year's dividend, investors can determine a stock's value based on the total present value of future dividends.

This means that if an investor is buying a stock primarily based on its dividend, the DDM can be a useful tool to determine exactly how much of the stock's price is supported by future dividends. However, it is important to understand that the DDM is not without flaws and that using it requires assumptions to be made that, in the end, may not prove to be true.

The Gordon Growth Model

The most common DDM is the **Gordon growth model**, which uses the dividend for the next year (D_1), the **required return** (r), and the estimated future dividend **growth rate** (g) to arrive at a final price or value of the stock. The formula for the Gordon growth model is as follows:

$$\text{Stock Value} = \frac{D_1}{r - g} \tag{11.9}$$

This calculation values the stock entirely on expected future dividends. You can then compare the calculated price to the actual market price in order to determine whether purchasing the stock at market will meet your requirements.

LINK TO LEARNING

Dividend Discount Model

Watch this short video on the dividend discount model (https://openstax.org/r/short_video_on_the_dividend) and how it is used it in stock valuation and analysis.

The Gordon growth model equation is presented and then applied to a sample problem to demonstrate how the DDM yields an estimated share price for the stock of any company.

Now that we have been introduced to the basic idea behind the dividend discount model, we can move on to cover other forms of DDM.

Zero Growth Dividend Discount Model

The zero growth DDM assumes that all future dividends of a stock will be fixed at essentially the same dollar value forever, or at least for as long as an individual investor holds the shares of stock. In such a case, the stock's **intrinsic value** is determined by dividing the annual dividend amount by the required rate of return:

$$\text{Stock Value} = \frac{\text{Annual Dividends}}{\text{Required Rate of Return}} \tag{11.10}$$

When examined closely, it can be seen that this is the exact same formula that is used to calculate the present value of a perpetuity, which is

$$\text{Present Value} = \frac{\text{Dividend}}{\text{Discount Rate}} \tag{11.11}$$

For the purpose of using this formula in stock valuation, we can express this as

$$\text{PV} = \frac{D}{r} \tag{11.12}$$

where PV is equal to the price or value of the stock, D represents the dividend payment, and r represents the required rate of return.

This makes perfect sense because a stock that pays the exact same dividend amount forever is no different from a **perpetuity**—a continuous, never-ending annuity—and for this reason, the same formula can be used to price preferred stock. The only factor that might alter the value of a stock based on the zero-growth model would be a change in the required rate of return due to fluctuations in perceived risk levels.

Example:

What is the intrinsic value of a stock that pays $2.00 in dividends every year if the required rate of return on

similar investments in the market is 6%?

Solution:

We can apply the zero growth DDM formula to get

$$\text{Stock Value} = \frac{\$2.00}{0.6} = \$33.33 \tag{11.13}$$

While this model is relatively easy to understand and to calculate, it has one significant flaw: it is highly unlikely that a firm's stock would pay the exact same dollar amount in dividends forever, or even for an extended period of time. As companies change and grow, dividend policies will change, and it naturally follows that the payout of dividends will also change. This is why it is important to become familiar with other DDMs that may be more practical in their use.

Constant Growth Dividend Discount Model

As indicated by its name, the constant growth DDM assumes that a stock's dividend payments will grow at a fixed annual percentage that will remain the same throughout the period of time they are held by an investor. While the constant growth DDM may be more realistic than the zero growth DDM in allowing for dividend growth, it assumes that dividends grow by the same specific percentage each year. This is also an unrealistic assumption that can present problems when attempting to evaluate companies such as Amazon, Facebook, Google, or other organizations that do not pay dividends. Constant growth models are most often used to value mature companies whose dividend payments have steadily increased over a significant period of time. When applied, the constant growth DDM will generate the present value of an infinite stream of dividends that are growing at a constant rate.

The constant growth DDM formula is

$$\text{Stock Value} = \frac{D_0(1 + g)}{r - g} = \frac{D_1}{r - g} \tag{11.14}$$

where D_0 is the value of the dividend received this year, D_1 is the value of the dividend to be received next year, g is the growth rate of the dividend, and r is the required rate of return.

As can be seen above, after simplification, the constant growth DDM formula becomes the Gordon growth model formula and works in the same way. Let's look at some examples.

THINK IT THROUGH

Constant Growth DDM: Example 1

If a stock is paying a dividend of $5.00 this year and the dividend has been steadily growing at 4% annually, what is the intrinsic value of the stock, assuming an investor's required rate of return of 8%?

Solution:

Apply the constant growth DDM formula:

$$\text{Stock Value} = \frac{D_0\ (1+g)}{r-g} = \frac{\$5.00(1+0.04)}{0.08-0.04} \tag{11.15}$$

Simplify to the Gordon growth model:

$$D_1 = D_0(1 + g) = \$5.00 \times 1.04 = \$5.20 \tag{11.16}$$

$$\text{Stock Value} = \frac{D_1}{r-g} = \frac{\$5.20}{0.08-0.04} = \$130.00 \tag{11.17}$$

THINK IT THROUGH

Constant Growth DDM: Example 2

If a stock is selling at $250 with a current dividend of $10, what would be the dividend growth rate of this stock, assuming a required rate of return of 12%?

Solution:

Apply the constant growth DDM formula:

$$\$250 = \frac{\$10 \times (1 + g)}{0.12 - g} \tag{11.18}$$

Simplify and continue the calculation:

$$\begin{aligned} 30 - 250g &= 10 + 10g \\ 0 &= 10 + 260g \\ 20 &= 260g \\ 7.69\% &= g \end{aligned} \tag{11.19}$$

So, the growth rate is 7.69%.

LINK TO LEARNING

Dividend Discount Model: A Complete Animated Guide

In this video for the Investing for Beginners course and podcast, Andrew Sather introduces the DDM, (https://openstax.org/r/Andrew_Sather_introduces_the_DDM) demonstrating both the constant growth DDM (Gordon growth model) and the two-stage DDM.

Variable or Nonconstant Growth Dividend Discount Model

Many experienced analysts prefer to use the variable (nonconstant) growth DDM because it is a much closer approximation of businesses' actual dividend payment policies, making it much closer to reality than other forms of DDM. The variable growth model is based on the real-life assumption that a company and its stock value will progress through different stages of growth.

The variable growth model is estimated by extending the constant growth model to include a separate calculation for each growth period. Determine present values for each of these periods, and then add them all together to arrive at the intrinsic value of the stock. The variable growth model is more involved than other DDM methods, but it is not overly complex and will often provide a more realistic and accurate picture of a stock's true value.

As an example of the variable growth model, let's say that Maddox Inc. paid $2.00 per share in common stock dividends last year. The company's policy is to increase its dividends at a rate of 5% for four years, and then the growth rate will change to 3% per year from the fifth year forward. What is the present value of the stock if the required rate of return is 8%? The calculation is shown in Table 11.1.

Year	Growth %	Dividend ($)	Value after Year 4 ($)	PV Discount Factor at 8%	Present Value of Dividend ($)
0	5%	2.00			
1	5%	2.10		1.0800	1.9444
2	5%	2.21		1.1664	1.8904
3	5%	2.32		1.2597	1.8379
4	5%	2.43		1.3605	1.7869
5	3%	2.50	50.07886	1.4693	35.7870
					Total: $43.2466

Table 11.1 Value of Stock with 8% Required Rate of Return

Note:

$$\text{Value after Year 4} = \frac{2.4310125 \times 1.03}{0.08 - 0.03} = 50.078858 \quad \textbf{11.20}$$

The value of Maddox stock in this example would be $43.25 per share.

Two-Stage Dividend Discount Model

The two-stage DDM is a methodology used to value a dividend-paying stock and is based on the assumption of two primary stages of dividend growth: an initial period of higher growth and a subsequent period of lower, more stable growth.

The two-stage DDM is often used with mature companies that have an established track record of making residual cash dividend payments while experiencing moderate rates of growth. Many analysts like to use the two-stage model because it is reasonably grounded in reality. For example, it is probably a more reasonable assumption that a firm that had an initial growth rate of 10% might see its growth drop to a more modest level of, say, 5% as the company becomes more established and mature, rather than assuming that the firm will maintain the initial growth rate of 10%. Experts tend to agree that firms that have higher payout ratios of dividends may be well suited to the two-stage DDM.

As we have seen, the assumptions of the two-stage model are as follows:

- The first period analyzed will be one of high initial growth.
- This stage of higher growth will eventually transition into a period of more mature, stable, and sustainable growth at a lower rate than the initial high-growth period.
- The dividend payout ratio will be based on company performance and the expected growth rate of its operations.

Let's use an example. Lore Ltd. estimates that its dividend growth will be 13% per year for the next five years. It will then settle to a sustainable, constant, and continuing rate of 5%. Let's say that the current year's dividend is $14 and the required rate of return (or discount rate) is 12%. What is the current value of Lore Ltd. stock?

Step 1:

First, we will need to calculate the dividends for each year until the second, stable growth rate phase is reached. Based on the current dividend value of $14 and the anticipated growth rate of 13%, the values of dividends (D_1, D_2, D_3, D_4, D_5) can be determined for each year of the first phase. Because the stable growth rate is achieved in the second phase, after five years have passed, if we assume that the current year is 2021, we can lay out the profile for this stock's dividends through the year 2026, as per Figure 11.3.

	A	B	C	D	E	F	G
1	Step 1						
2		Current					
3		2021	2022	2023	2024	2025	2026
4							
5	Dividend at 13% Growth	14.00	15.82	17.88	20.20	22.83	25.79
6							
7	Growth Rate of Dividends	N/A	13%	13%	13%	13%	13%

Figure 11.3 Profile of Stock Dividend through 2026

Step 2:

Next, we apply the DDM to determine the terminal value, or the value of the stock at the end of the five-year high-growth phase and the beginning of the second, lower growth-phase.

We can apply the DDM formula at any point in time, but in this example, we are working with a stock that has constant growth in dividends for five years and then decreases to a lower growth rate in its secondary phase. Because of this timing and dividend structure, we calculate the value of the stock five years from now, or the terminal value. Again, this is calculated at the end of the high-growth phase, in 2026. By applying the constant growth DDM formula, we arrive at the following:

$$\text{Stock Value}_N = \frac{D_N(1+g)}{r-g} = \frac{D_{N+1}}{r-g} \tag{11.21}$$

The terminal value can be calculated by applying the DDM formula in Excel, as seen in Figure 11.4 and Figure 11.5. The terminal value, or the value at the end of 2026, is $386.91.

	A	B	C	D	E	F	G	H
9	Step 2A							
10		Current						
11		2021	2022	2023	2024	2025	2026	2027
12								
13	Dividend at 13% Growth	14.00	15.82	17.88	20.20	22.83	25.79	**27.08**
14								
15	Growth Rate of Dividends	N/A	13%	13%	13%	13%	13%	5%
16	Terminal Value						**=H13/(B17-H15)**	
17	Required Rate of Return	**0.12**						

Figure 11.4 Terminal Value at the End of 2026 (Showing Formula)

	A	B	C	D	E	F	G	H
19	Step 2B							
20		Current						
21		2021	2022	2023	2024	2025	2026	2027
22								
23	Dividend at 13% Growth	14.00	15.82	17.88	20.20	22.83	25.79	27.08
24								
25	Growth Rate of Dividends	N/A	13%	13%	13%	13%	13%	5%
26	**Terminal Value**						**386.91**	
27	**Required Rate of Return**	**0.12**						

Figure 11.5 Terminal Value at the End of 2026

Step 3:

Next, we find the PV of all paid dividends that occur during the high-growth period of 2022–2026. This is shown in Figure 11.6. Our required rate of return (discount rate) is 12%.

	A	B	C	D	E	F	G	H
29	Step 3							
30		Current						
31		2021	2022	2023	2024	2025	2026	2027
32								
33	Dividend at 13% Growth	14.00	15.82	17.88	20.20	22.83	25.79	27.08
34								
35	Growth Rate of Dividends	N/A	13%	13%	13%	13%	13%	5%
36	Terminal Value						386.91	
37	Required Rate of Return	0.12						
38								
39	**Present Value of Dividends**	**N/A**	**14.13**	**14.25**	**14.38**	**14.51**	**14.64**	

Figure 11.6 Present Value of All Paid Dividends, 2022–2026

Step 4:

Next, we calculate the PV of the single lump-sum terminal value:

$$\begin{aligned} &\text{Future Value (FV)} = 386.91 \\ &\text{Interest Rate (I/Y)} = 12 \\ &\text{Number of Periods (N)} = 5 \\ &\text{Payment (PMT)} = 0 \\ &\text{Compute Present Value (CPTPV)} = 219.54 \end{aligned} \quad \textbf{11.22}$$

Remember that due to the sign convention, either the FV must be entered as a negative value or, if entered as a positive value, the resulting PV will be negative. This example shows the former.

Step 5:

Our next step is to find the current fair (intrinsic) value of the stock, which comprises the PV of all future dividends plus the PV of the terminal value. This is represented in the following formula, with all factors shown in Figure 11.7:

$$\text{Fair Value} = \text{PV}_{\text{Projected Dividends}} + \text{PV}_{\text{Terminal Value}} \quad \textbf{11.23}$$

	A	B	C	D	E	F	G	H	I
42	Step 5								
43		Current							
44		2021	2022	2023	2024	2025	2026	2027	
45									
46	Dividend at 13% Growth	14.00	15.82	17.88	20.20	22.83	25.79	27.08	
47									
48	Growth Rate of Dividends	N/A	13%	13%	13%	13%	13%	5%	
49	Terminal Value						386.91		
50	Required Rate of Return	0.12							
51									
52	**Present Value of Dividends**	**N/A**	**14.13**	**14.25**	**14.38**	**14.51**	**14.64**		**71.90**
53									
54	**Present Value of Terminal Value**						**219.54**		**219.54**
55									
56						**Fair Value**			**291.44**

Figure 11.7 Fair Value of the Stock

So, we end up with a total current fair value of Lore Ltd. stock of $291.44 (due to Excel's rounding), although the sum can also be calculated as shown below:

$$\text{Fair Value} = 14.13 + 14.25 + 14.38 + 14.51 + 14.64 + 219.54 = 291.45 \quad \textbf{11.24}$$

LINK TO LEARNING

Determining Stock Value

Take a few minutes to review this video, which covers methods used to determine stock value (https://openstax.org/r/covers_methods_used_to_determine_stock_value) when dividend growth is nonconstant.

Advantages and Limitations of DDMs

Some of the primary advantages of DDMs are their basis in the sound logic of present value concepts, their consistency, and the implication that companies that pay dividends tend to be mature and stable entities. Also, because the model is essentially a mathematical formula, there is little room for misinterpretation or subjectivity. As a result of these advantages, DDMs are a very popular form of stock evaluation that most analysts show faith in.

Because dividends are paid in cash, companies may keep making their dividend payments even when doing so is not in their best long-term interests. They may not want to manipulate dividend payments, as this can directly lead to stock price volatility. Rather, they may manipulate dividend payments in the interest of buoying up their stock price.

To further illustrate limitations of DDMs, let's examine the Concepts in Practice case.

CONCEPTS IN PRACTICE

Limitations of DDMs

A major limitation of the dividend discount model is that it cannot be used to value companies that do not pay dividends. This is becoming a growing trend, particularly for young high-tech companies. Warren Buffett, CEO of Berkshire Hathaway, has stated that companies are usually better off if they take their excess funds and reinvest them into infrastructure, evolving technologies, and other profitable ventures. The payment of dividends to shareholders is "almost a last resort for corporate management,"[1] says Buffett, and cash balances should be invested in "projects to become more efficient, expand territorially, extend and improve product lines or . . . otherwise widen the economic moat separating the company from its competitors."[2] Berkshire follows this practice of reinvesting cash rather than paying dividends, as do tech companies such as Amazon, Google, and Biogen.[3] So, rather than receiving cash dividends, stockholders of these companies are rewarded by seeing stock price appreciation in their investments and ultimately large capital gains when they finally decide to sell their shares.

The sensitivity of assumptions is also a drawback of using DDMs. The fair price of a stock can be highly sensitive to growth rates and the required rates of return demanded by investors. A single percentage point change in either of these two factors can have a dramatic impact on a company's stock, potentially changing it by as much as 10 to 20%.

1 Dan Caplinger. "Why Don't These Winning Stocks Pay Dividends?" The Motley Fool. Updated October 3, 2018. https://www.fool.com/investing/general/2015/03/01/why-dont-these-winning-stocks-pay-dividends.aspx
2 The Motley Fool. "Why Warren Buffet's Berkshire Hathaway Won't Pay a Dividend in 2015." Nasdaq. November 16, 2014. https://www.nasdaq.com/articles/why-warren-buffetts-berkshire-hathaway-wont-pay-dividend-2015-2014-11-16.
3 Caplinger, "Why Don't These Winning Stocks Pay Dividends?" The Motley Fool.

Finally, the results obtained using DDMs may not be related to the results of a company's operations or its profitability. Dividend payments should theoretically be tied to a company's profitability, but in some instances, companies will make misguided efforts to maintain a stable dividend payout even through the use of increased borrowing and debt, which is not beneficial to an organization's long-term financial health.

(sources: www.wallstreetmojo.com/dividend-discount-model/; pages.stern.nyu.edu/~adamodar/pdfiles/valn2ed/ch13d.pdf; www.managementstudyguide.com/disadvantages-of-dividend-discount-model.htm)

Stock Valuation with Changing Growth Rates and Time Horizons

Before we move on from our discussion of dividend discount models, let's work through some more examples of how the DDM can be used with a number of different scenarios, changing growth rates, and time horizons.

As we have seen, the value or price of a financial asset is equal to the present value of the expected future cash flows received while maintaining ownership of the asset. In the case of stock, investors receive cash flows in the form of dividends from the company, plus a final payout when they decide to relinquish their ownership rights or sell the stock.

Let's look at a simple illustration of the price of a single share of common stock when we know the future dividends and final selling price.

Problem:

Steve wants to purchase shares of Old Peak Construction Company and hold these common shares for five years. The company will pay $5.00 annual cash dividends per share for the next five years.

At the end of the five years, Steve will sell the stock. He believes that he will be able to sell the stock for $25.00 per share. If Steve wants to earn 10% on this investment, what price should he pay today for this stock?

Solution:

The current price of the stock is the discounted cash flow that Steve will receive over the next five years while holding the stock. If we let the final price represent a lump-sum future value and treat the dividend payments as an annuity stream over the next five years, we can apply the time value of money concepts we covered in earlier chapters.

Method 1: Using an Equation

$$\begin{aligned} \text{Price} &= \text{Future Price} \times \frac{1}{(1+r)^n} + \text{Dividend Stream} \times \frac{\left[1 - \frac{1}{(1+r)^n}\right]}{r} \\ &= \$25.00 \times \frac{1}{(1+0.10)^5} + \$5.00 \times \frac{\left[1 - \frac{1}{(1+0.10)^5}\right]}{0.10} \\ &= \$25.00 \times 0.6209 + \$5.00 \times 3.7908 \\ &= \$15.52 + \$18.95 = \$34.47 \end{aligned} \qquad \textbf{11.25}$$

Method 2: Using a Financial Calculator

We can also use a calculator or spreadsheet to find the price of the stock (see Table 11.2).

Step	Description	Enter	Display	
1	Clear calculator register	CE/C		0.00
2	Enter number of periods (5)	5 N	N =	5.00
3	Enter rate of return or interest rate (10%)	10 I/Y	I/Y =	10.00
4	Enter eventual sales price ($25)	25 FV	FV =	25.00
5	Enter dividend amount ($5)	5 PMT	PMT =	5.00
6	Compute present value	CPT PV	PV =	– 34.47

Table 11.2 Calculator Steps for Finding the Price of the Stock[4]

The stock price is calculated as $34.47.

Note that the value given is expressed as a negative value due to the sign convention used by financial calculators. We know the actual stock value is not negative, so we can just ignore the minus sign.

In cases such as the above, we find the present value of a dividend stream and the present value of the lump-sum future price. So, if we know the dividend stream, the future price of the stock, the future selling date of the stock, and the required return, it is possible to price stocks in the same manner that we price bonds.

Method 3: Using Excel

Figure 11.8 shows a spreadsheet setup in Excel to reach a solution to this problem.

	A	B	C	D	E	F
1						
2	Nper (N) or Number of Periods					5
3	Rate of Return or Interest Rate					10%
4	Future Value or Stock Sale Price					$ 25.00
5	Payment (Dividend Amount)					$ 5.00
6						$ (34.48)

Figure 11.8 Excel Solution for Finding the Price of the Stock

Due to the sign convention in Excel, we can ignore the parentheses around the solution, which indicate a negative value. Therefore, the price is $34.48. The Excel command used in cell F6 to calculate present value is as follows:

```
=PV(rate,nper,pmt,[fv],[type])
```

Finding Stock Price with Constant Dividends

Example 1:

Four Seasons Resorts pays a $0.25 dividend every quarter and will maintain this policy forever. What price should you pay for one share of common stock if you want an annual return of 10% on your investment?

Solution:

You can restate your annual required rate of 10% as a quarterly rate of 2.5% $\left(\frac{10\%}{4}\right)$. Apply the quarterly dividend amount and the quarterly rate of return to determine the price:

4 The specific financial calculator in these examples is the Texas Instruments BA II Plus™ Professional model, but you can use other financial calculators for these types of calculations.

$$\text{Price} = \frac{\text{Dividend}}{r} \qquad \text{Price} = \frac{\$0.25}{0.025} = \$10.00 \tag{11.26}$$

Even though we anticipate that companies will be in business "forever," we are not going to own a company's stock forever. Therefore, the dividend stream to which we would have legal claim is only for that period of the company's life during which we own the stock. We need to modify the dividend model to account for a finite period when we will sell the stock at some future time. This modification brings us from an infinite to a finite dividend pricing model, which we will use to price a finite amount of dividends and the future selling price of the stock. We will maintain a constant dividend assumption. Let's assume we will hold a share in a company that pays a $1 dividend for 20 years and then sell the stock.

Method 1: Using an Equation

The dividend pricing model under a finite horizon is a concept we have seen earlier. It is a simple present value annuity stream application:

$$\text{Value of Future Dividends for Specific Periods} = \text{Dividend} \times \text{PVIFA (Present Value Interest Factor of an Annuity)} \tag{11.27}$$

$$\text{Dividend Stream} \times \frac{\left[1 - \frac{1}{(1+r)^n}\right]}{r} = \$1.00 \times \frac{\left[1 - \frac{1}{(1+0.10)^{20}}\right]}{0.10} \tag{11.28}$$

$$= \$1.00 \times 8.5136 = \$8.51$$

We now need to determine the selling price that we would get in 20 years if we were to sell the stock to someone else at that time. What would a willing buyer give us for the stock 20 years from now? This price is difficult to estimate, so for the sake of this exercise, we will assume that the price in 20 years will be $30. So, what is the present value of the price in 20 years with a 10% discount rate? Again, this is just a simple application of the PV formula we covered earlier in the text:

$$\text{PV} = \frac{\text{Price}_{20}}{(1+r)^{20}} = \frac{\$30}{(1.10)^{20}} = \$4.46 \tag{11.29}$$

We can now price the stock as if it were a bond with a dividend stream of 20 years, a sales price in 20 years, and a required return of 10%:

- The dividend stream is analogous to the coupon payments.
- The sales price is analogous to the bond's principal.
- The 20-year investment horizon is analogous to the bond's maturity date.
- The required return is analogous to the bond's yield.

Carrying on with the PV calculations, we have

$$\text{Price} = \$30 \times \frac{1}{(1+0.10)^{20}} + \frac{\left[\$1.00 \times 1 - \frac{1}{(1+0.10)^{20}}\right]}{0.10} \tag{11.30}$$

$$= \$4.46 + \$8.51 = \$12.97$$

Method 2: Using a Financial Calculator

We can also use a calculator or spreadsheet to find the price of the stock using constant dividends (see Table 11.3).

Step	Description	Enter	Display	
1	Clear calculator register	CE/C		0.00
2	Enter number of periods (20)	20 N	N =	20.00
3	Enter rate of return or interest rate (10%)	10 I/Y	I/Y =	10.00
4	Enter eventual sales price (30)	30 FV	FV =	30.00
5	Enter dividend amount ($1)	1 PMT	PMT =	1.00
6	Compute present value	CPT PV	PV =	−12.97

Table 11.3 Calculator Steps for Finding the Price of Stock Using Constant Dividends

The stock price resulting from the calculation is $12.97.

Method 3: Using Excel

This same problem can be solved using Excel with a setup similar to that shown in Figure 11.9.

	A	B	C	D	E	F
8						
9	Nper (N) or Number of Periods					20
10	Rate of Return or Interest Rate					10%
11	Payment (Dividend Amount)					$ 1.00
12	Future Value or Stock Sale Price					$ 30.00
13						$ (12.97)

Figure 11.9 Excel Solution for Finding the Price of Stock Using Constant Dividends

Once again, we can ignore the negative indicator that is generated by the Excel sign convention because we know that the stock will not have a negative value 20 years from now. Therefore, the price is $12.97. The Excel command used in cell F13 to calculate present value is as follows:

```
=PV(rate,nper,pmt,[fv],[type])
```

Example 2:

Let's look at an example and estimate current stock price given a 10.44% constant growth rate of dividends forever and a desired return on the stock of 13.5%. We will assume that the current stock owner has just received the most recent dividend, D_0, and the new buyer will receive all future cash dividends, beginning with D_1. This part of the setup of the model is important because the price reflects all future dividends, starting with D_1, discounted back to today. (Price_0 refers to the price at time zero, or today.) The first dividend the buyer would receive is one full period away. Using the discounted cash flow approach, we have

$$\text{Price}_0 = \frac{D_0 \times (1+g)^1}{(1+r)^1} + \frac{D_0 \times (1+g)^2}{(1+r)^2} + \frac{D_0 \times (1+g)^3}{(1+r)^3} + \frac{D_0 \times (1+g)^4}{(1+r)^4} \ldots \quad \textbf{11.31}$$

where g is the annual growth rate of the dividends and r is the required rate of return on the stock. We can simplify the equation above into the following:

$$\begin{aligned} \text{Price}_0 &= \frac{D_0 \times (1+g)}{r-g} \\ D_1 &= D_0 \times (1+g) \\ \text{Price}_0 &= \frac{D_1}{r-g} \end{aligned} \quad \textbf{11.32}$$

As we discussed above, this classic model of constant dividend growth, known as the Gordon growth model, is a fundamental method of stock pricing. The Gordon growth model determines a stock's value based on a future stream of dividends that grows at a constant rate. Again, we assume that this constantly growing dividend stream will pay forever. To see how the constant growth model works, let's use our example from above once again as a test case. The most recent dividend (D_0) is \$1.76, the growth rate (g) is 10.44%, and the required rate of return (r) is 13.5%, so applying our PV equation, we have

$$\text{Price}_0 = \frac{\$1.76 \times (1 + 0.1044)}{0.135 - 0.1044} = \frac{\$1.943774}{0.0306} = \$63.52 \quad \textbf{11.33}$$

Our estimated price for this example is \$63.52. Notice that the formula requires the return rate r to be greater than the growth rate g of the dividend stream. If g were greater than r, we would be dividing by a negative number and producing a negative price, which would be meaningless.

Let's pick another company and see if we can apply the dividend growth model and price the company's stock with a different dividend history. In addition, our earlier example will provide a shortcut method to estimate g, although you could still calculate each year's percentage change and then average the changes over the 10 years.

Estimating a Stock Price from a Past Dividend Pattern

Problem:

Phased Solutions Inc. has paid the following dividends per share from 2011 to 2020:

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
\$0.700	\$0.800	\$0.925	\$1.095	\$1.275	\$1.455	\$1.590	\$1.795	\$1.930	\$2.110

Table 11.4

If you plan to hold this stock for 10 years, believe Phased Solutions will continue this dividend pattern forever, and you want to earn 17% on your investment, what would you be willing to pay per share of Phased Solutions stock as of January 1, 2021?

Solution:

First, we need to estimate the annual growth rate of this dividend stream. We can use a shortcut to determine the average growth rate by using the first and last dividends in the stream and the time value of money equation. We want to find the average growth rate given an initial dividend (present value) of \$0.70, the most recent dividend (future value) of \$2.11, and the number of years (n) between the two dividends, or the number of dividend changes, which is 9. So, we calculate the average growth rate as follows:

$$\begin{aligned} g &= \left(\frac{\text{FV}}{\text{PV}}\right)^{\frac{1}{n}} - 1 \\ &= \left(\frac{\$2.11}{\$0.70}\right)^{\frac{1}{9}} - 1 = 3.0142857^{\frac{1}{9}} - 1 \\ &= 0.1304, \text{ or } 13.04\% \end{aligned} \quad \textbf{11.34}$$

Table 11.5 shows the step-by-step process of using a financial calculator to solve for the growth rate.

Step	Description	Enter	Display	
1	Clear calculator register	CE/C		0.0000
2	Enter number of periods (9)	9 N	N =	9.0000

Table 11.5 Calculator Steps for Solving the Growth Rate

Step	Description	Enter	Display	
3	Enter present value or initial dividend ($0.70) as a negative value	0.7 +|− PV	PV =	-0.7000
4	Enter future value or the most recent dividend ($2.11)	2.11 FV	FV =	2.1100
5	Enter a zero value for payment as a placeholder, as this factor is not used here	0 PMT	PMT	0.0000
6	Compute annual growth rate	CPT I/Y	I/Y =	13.0427

Table 11.5 Calculator Steps for Solving the Growth Rate

The calculated growth rate is 13.04%.

We can also use Excel to set up a spreadsheet similar to the one in Figure 11.10 that will calculate this growth rate.

	A	B	C	D	E	F	G
15							
16							
17	Present Value or Current Dividend Amount (enter as a negative value)						$ (0.70)
18	Nper (N) or Number of Periods						9
19	Payment or PMT (unused here, so enter zero as a placeholder)						-
20	Future Value (dividend amount in nine years)					13.04%	$ 2.11
21							
22	Growth Rate						13.0427%

Figure 11.10 Excel Solution for Growth Rate

The Excel command used in cell G22 to calculate the growth rate is as follows:

```
=RATE(nper,pmt,pv,[fv],[type],[guess])
```

We now have two methods to estimate *g*, the growth rate of the dividends. The first method, calculating the change in dividend each year and then averaging these changes, is the arithmetic approach. The second method, using the first and last dividends only, is the geometric approach. The arithmetic approach is equivalent to a simple interest approach, and the geometric approach is equivalent to a compound interest approach.

To apply our PV formula above, we had to assume that the company would pay dividends forever and that we would hold on to our stock forever. If we assume that we will sell the stock at some point in the future, however, can we use this formula to estimate the value of a stock held for a finite period of time? The answer is a qualified yes. We can adjust this model for a finite horizon to estimate the present value of the dividend stream that we will receive while holding the stock. We will still have a problem estimating the stock's selling price at the end of this finite dividend stream, and we will address this issue shortly. For the finite growing dividend stream, we adjust the infinite stream in our earlier equation to the following:

$$\text{Price}_0 = D_0 \times \frac{1+g}{r-g} \times \left[1 - \left(\frac{1+g}{1+r}\right)^n\right] \quad \textbf{11.35}$$

where *n* is the number of future dividends.

This equation may look very complicated, but just focus on the far right part of the model. This part calculates the percentage of the finite dividend stream that you will receive if you sell the stock at the end of the *n*th year. Say you will sell Johnson & Johnson after 10 years. What percentage of the $60.23 (the finite dividend stream) will you get? Begin with the following:

$$10 \text{ Years: Percent} = 1 - \left(\frac{1 + 0.1304}{1 + 0.170}\right)^{10} \quad \textbf{11.36}$$
$$= 1 - 0.966154^{10} = 1 - 0.7087 = 0.2913$$

Now, multiply the result by the price for your portion of the infinite stream:

$$\text{Price} = \$60.23 \times 0.2913 = \$17.55 \quad \textbf{11.37}$$

The next step is to discount the selling price of Johnson & Johnson in 10 years at 17% and then add the two values to get the stock's price. So, how do we estimate the stock's price at the end of 10 years? If we elect to sell the stock after 10 years and the company will continue to pay dividends at the same growth rate, what would a buyer be willing to pay? How could we estimate the selling price (value) of the stock at that time?

We need to estimate the dividend in 10 years and assume a growth rate and the required return of the new owner at that point in time. Let's assume that the new owner also wants a 17% return and that the dividend growth rate will remain at 13.04%. We calculate the dividend in 10 years by taking the current growth rate plus one raised to the tenth power times the current dividend:

$$D_{10} = \$2.11 \times (1.1304)^{10} = \$2.11 \times 3.4066 = \$7.1879 \quad \textbf{11.38}$$

We then use the dividend growth model with infinite horizon to determine the price in 10 years as follows:

Your price for the stock today—given that you will receive the growing dividend stream for 10 years and sell for $258.10 in 10 years, and also given that you want a 17% return over the 10 years—is as shown below:

$$\text{Price} = \frac{\$205.18}{(1.1700)^{10}} + \frac{\$2.11 \times (1 + 0.1304)}{(0.1700 - 0.1304)} \times \left[1 - \left(\frac{1 + 0.1304}{1 + 0.1700}\right)^{10}\right] \quad \textbf{11.39}$$
$$= \$42.68 + \$17.55 = \$60.23$$

Why did you get the same price of $60.23 for your stock with both the infinite growth model and the finite model? The reason is that the required rate of return of the stock remained at 17% (your rate) and the growth rate of the dividends remained at 13.04%. The infinite growth model gives the same price as the finite model with a future selling price as long as the required return and the growth rate are the same for all future sales of the stock.

Although this point may be subtle, what we have just shown is that a stock's price is the present value of its future dividend stream. When you sell the stock, the buyer purchases the remaining dividend stream. If that individual should sell the stock in the future, the new owner would buy the remaining dividends. That will always be the case; a stock's buyer is always buying the future dividend stream.

LINK TO LEARNING

Determining Stock Value Using Different Scenarios

This video explains methods for determining stock value (https://openstax.org/r/explains_methods_for_determining_stock_value) using scenarios of constant dividends and scenarios of constant dividend growth.

THINK IT THROUGH

Nonconstant Growth Dividends

One final issue to address in this section is how we price a stock when dividends are neither constant nor growing at a constant rate. This can make things a bit more complicated. When a future pattern is not an annuity or the modified annuity stream of constant growth, there is no shortcut. You have to estimate every

future dividend and then discount each individual dividend back to the present. All is not lost, however. Sometimes you can see patterns in the dividends. For example, a firm might shift into a dividend stream pattern that will allow you to use one of the dividend models to take a shortcut for pricing the stock. Let's look at an example.

JM and Company is a small start-up firm that will institute a dividend payment—a $0.25 dividend—for the first time at the end of this year. The company expects rapid growth over the next four years and will increase its dividend to $0.50 at the end of the second year, then to $1.50 at the end of the third year, and then to $3.00 thereafter, settling into a constant growth dividend pattern with dividends growing at 5% every year (see Table 11.6). If you believe that JM and Company will deliver this dividend pattern and you desire a 13% return on your investment, what price should you pay for this stock?

T1	T2	T3	T4
$0.25	$0.50	$1.50	$3.00 × 1.05

Table 11.6

Solution: To price this stock, we will need to discount the first three dividends at 13% and then discount the constant growth portion of the dividends, the first payment of which will be received at the end of the 6th year. Let's calculate the first three dividends:

$$\begin{aligned} PV &= \frac{\$0.25}{1.13} + \frac{\$0.50}{1.13} + \frac{\$1.50}{1.13} \\ &= \$0.22 + \$0.39 + \$1.04 = \$1.65 \end{aligned} \quad \textbf{11.40}$$

We now turn to the constant growth dividend pattern, where we can use our infinite horizon constant growth model as follows:

$$\text{Price}_6 = \frac{\$3.00 \times (1 + 0.05)}{0.13 - 0.05} = \frac{\$3.15}{0.08} = \$39.375 \quad \textbf{11.41}$$

This figure is the price of the constant growth portion at the end of the fourth period, so we still need to discount it back to the present at the 13% required rate of return:

$$\text{Price} = \frac{\$39.375}{(1.13)^4} = \$24.15 \quad \textbf{11.42}$$

So, the price of this stock with a nonconstant dividend pattern is

$$\text{Price} = \$1.65 + \$24.15 = \$25.80 \quad \textbf{11.43}$$

Some Final Thoughts on Dividend Discount Models

The dividend used to calculate a price is the expected future payout and expected future dividend growth. This means the DDM is most useful when valuing companies that have long, consistent dividend records.

If the DDM formula is applied to a company with a limited dividend history, or in an industry exposed to significant risks that could affect a company's ability to maintain its payout, the resulting derived value may not be entirely accurate.

In most cases, dividend models, whether constant growth or constant dividend, appeal to a fundamental concept of asset pricing: the future cash flow to which the owner is entitled while holding the asset and the required rate of return for that cash flow determine the value of a financial asset. However, problems can arise when using these models because the timing and amounts of future cash flows may be difficult to predict.

11.3 Discounted Cash Flow (DCF) Model

Learning Outcomes

By the end of this section, you will be able to:

- Explain how the DCF model differs from DDMs.
- Apply the DCF model.
- Explain the advantages and disadvantages of the DCF model.

When investors buy stock, they do so in order to receive cash inflows at different points in time in the future. These inflows come in the form of cash dividends (provided the stock does indeed pay dividends, because not all do) and also in the form of the final cash inflow that will occur when the investor decides to sell the stock.

The investor hopes that the final sale price of the stock will be higher than the purchase price, resulting in a capital gain. The hope for capital gains is even stronger in the case of stocks that do not pay dividends. When securities have been held for at least one year, the seller is eligible for long-term capital gains tax rates, which are lower than short-term rates for most investors. This makes non-dividend-paying stocks even more attractive, provided that they do indeed appreciate in value over the investor's holding period. Meanwhile, short-term gains, or gains made on securities held for less than one year, are taxed at ordinary income tax rates, which are usually higher and offer no particular advantage to an investor in terms of reducing their taxes.

Understanding How the DCF Model Differs from DDMs

The valuation of an asset is typically based on the present value of future cash flows that are generated by the asset. It is no different with common stock, which brings us to another form of stock valuation: the **discounted cash flow (DCF)** model. The DCF model is usually used to evaluate firms that are relatively young and do not pay dividends to their shareholders. Examples of such companies include Facebook, Amazon, Google, Biogen, and Monster Beverage. The DCF model differs from the dividend discount models we covered earlier, as DDM methodologies are almost entirely based on a stock's periodic dividends.

The DCF model is an absolute valuation model, meaning that it does not involve comparisons with other firms within any specific industry but instead uses objective data to evaluate a company on a stand-alone basis. The DCF model focuses on a company's cash flows, determining the present value of the entire organization and then working this down to the share-value level based on total shares outstanding of the subject organization. This highly regarded methodology is the evaluation tool of choice for experienced financial analysts when evaluating companies and their common stock. Many analysts prefer DCF methods of valuation because these are based on a company's cash flows, which are far less easily manipulated through accounting treatments than revenues or bottom-line earnings.

The DCF model formula in its mathematical form is presented below:

$$\text{Stock Value} = \frac{\text{CF}_1}{(1+r)^1} + \frac{\text{CF}_2}{(1+r)^2} + \ldots + \frac{\left(\frac{\text{TCF}}{r-g}\right)}{(1+r)^{n-1}} \qquad \textbf{11.44}$$

where CF_1 is the estimated cash flow in year 1, CF_2 is the estimated cash flow in year 2, and so on; TCF is the terminal cash flow, or expected cash flow from the ending asset sale; r is the discount rate or required rate of return; g is the anticipated growth rate of the cash flow; and n is the number of years covered in the model.

Applying the DCF Model

We can apply the DCF model to an example to demonstrate this methodology and how the formula works. Calculate the value of Mayweather Inc. and its common stock based on the next six years of cash flow results. Assume that the discount rate (required rate of return) is 8%, Mayweather's growth rate is 3%, and the terminal value (TCF) will be two and one-half times the discounted value of the cash flow in year 6.

Mayweather has a cash flow of $2.0 million in year 1, so its discounted cash flow after one year (CF_1) is $1,851,851.85. We arrive at this amount by applying the discount rate of 8% for a one-year period to determine the present value.

In subsequent years, Mayweather's cash flow will be increasing by 3%. These future cash flows also must be discounted back to present values at an 8% rate, so the discounted cash flow amounts over the next six years will be as follows:

$$\text{Year 1: \$1,851,852} \tag{11.45}$$

$$\text{Year 2: \$1,766,118} \tag{11.46}$$

$$\text{Year 3: \$1,684,353} \tag{11.47}$$

$$\text{Year 4: \$1,606,374} \tag{11.48}$$

$$\text{Year 5: \$1,532,005} \tag{11.49}$$

$$\text{Year 6: \$1,461,079} \tag{11.50}$$

Our earlier assumption that the terminal value will be 2.5 times the value in the sixth year gives us a total terminal cash flow (TCF) of $\$1{,}461{,}079 \times 2.5$, or $3,652,697. Now, if we take all these future discounted cash flows and add them together, we arrive at a grand total of $13,554,477. So, based on our DCF model analysis, the total value of Mayweather Inc. is just over $13.5 million.

At this point, we have the estimated value of the entire company, but we need to work this down to the level of per-share value of common stock.

Let's say that Mayweather is currently trading at $12 per share, and it has 1,000,000 common shares outstanding. This tells us that the market capitalization of the company is $\$12 \times 1{,}000{,}000$, or $12 million, and that a $12 share price may be considered relatively low. The reason for this is that based on our DCF model analysis, investors would theoretically be willing to pay $13,554,477 divided by 1,000,000 shares, or $13.55 per share, for Mayweather. The overall conclusion would be that at $12.00 per share, Mayweather common stock would be a good buy at the present time. Figure 11.11 shows the Excel spreadsheet approach for arriving at the total value of Mayweather.

	A	B	C	D	E
1					
2	Discount Rate =		8.00%		
3					
4		Year	Cash Flow	Present Value	
5					
6	CF	1	2,000,000	**1,851,852**	**=-PV(C2,B6,0,C6)**
7	CF	2	2,060,000	1,766,118	
8	CF	3	2,121,800	1,684,353	
9	CF	4	2,185,454	1,606,374	
10	CF	5	2,251,018	1,532,005	
11	CF	6	2,318,548	1,461,079	
12					
13	Totals		$ 12,936,820	9,901,780	
14	TCF			3,652,697	
15	Grand Total			**$13,554,477**	

Figure 11.11 Excel Solution for Total Value

Cell E6 displays the present value formula that is active in cell D6.

Advantages and Limitations of the DCF Model

Due to several corporate accounting scandals in recent years, many analysts have given increasing credence to the use of cash flow as a metric for determining accurate corporate valuations. However, it should be noted that cash flow is not always the best means of measuring financial health. A company can always sell a large portion of its assets to generate a positive cash flow, even if it is operating at a loss or experiencing other financial difficulties. Additionally, investors prefer to see companies reinvesting their cash back into their businesses rather than sitting on excessive balances of idle cash.

Similar to other models, the discounted cash flow model is only as good as the information entered. As the common expression goes, "garbage in, garbage out." This can often be the case if reasonably accurate cash flow estimates are not available or if an unrealistic discount rate or required rate of return is used in the calculations. It is always best to use several different methods when valuing companies and their common stock.

LINK TO LEARNING

Discounted Cash Flow

Please view this short video on discounted cash flow (https://openstax.org/r/short_video_on_discounted) and how this method can be applied in stock valuation.

11.4 Preferred Stock

Learning Outcomes

By the end of this section, you will be able to:

- Define preferred stock.
- Calculate the intrinsic value of preferred stock.
- Understand the difference between common stock and preferred stock.

Features of Preferred Stock

Preferred stock is a unique form of equity sold by some firms that offers preferential claims in ownership. Preferred stock will often feature a dividend that a company is obligated to pay out before it makes any dividend payments to common stockholders. In cases of bankruptcy and liquidation of the issuing company, preferred stockholders have priority claim to assets before common stockholders. Additionally, preferred stockholders are usually entitled to a set (or constant) dividend every period.

Preferred stock carries a stated par value, but unlike bonds, they have no maturity date, and consequently, there is no final payment of the par value. The only time a company would pay this par value to the shareholder would be if the company ceased operations or retired the preferred stock. Many preferred stock issues are cumulative in nature, meaning that if a company skips or is otherwise unable to pay a cash dividend, it becomes a liability to the company and must eventually be paid out to preferred shareholders at some point in the future. Other preferred stocks may be noncumulative, in which case if the company skips dividends, they are forever lost to the shareholder.

The term *preferred* comes from preferred shareholders receiving all past (if cumulative) and present dividends before common shareholders receive any cash dividends. In other words, preferred shareholders' dividend claims are given preferential treatment over those of common shareholders. Preferred stock is usually a form of permanent funding, but there are circumstances or covenants that could alter the payoff stream.

For example, a company may convert preferred stock into common stock at a preset point in the future. It is not uncommon for companies to issue preferred stock that has a conversion feature. Such conversion features give preferred shareholders the right to convert to common shares after a predetermined period.

A review of the characteristics of preferred stock will lead to the conclusion that the constant growth dividend model is an excellent approach for valuing such stock. Because shares of preferred stock provide a constant cash dividend based on original par value and the stated dividend rate, these may be considered a form of perpetuity.

It is this constant, preferred dividend stream that makes preferred stock seem more like bonds or another form of debt than like stock. In addition, the constant dividend stream leads nicely to the pricing of preferred stock with the four dividend models we presented earlier in this chapter.

Determining the Intrinsic Value of Preferred Stock

We can apply a version of the present value of a perpetuity formula to value preferred stock, as in the following example. Oh-Well Heath Services Inc. has issued preferred stock that has a par value of $1,000 and pays an annual dividend rate of 5%. If the market considers the risk of Oh-Well to warrant a 10% discount rate, what would be a fair market price for Oh-Well preferred stock?

First, we find the dividend value of Oh-Well:

$$\begin{aligned}\text{Dividend Dollar Value} &= \text{Par Value} \times \text{Annual Dividend Rate} \\ &= \$1{,}000 \times 0.05 \\ &= \$50\end{aligned} \quad \textbf{11.51}$$

We then use the constant dividend model with infinite horizon because we have g equal to zero and n equal to infinity:

$$\begin{aligned}\text{Stock Value} &= \frac{\text{Dividend}}{\text{Discount Rate}} \\ &= \frac{\$50}{.10} \\ &= \$500\end{aligned} \quad \textbf{11.52}$$

We can also rearrange the formula to determine the required return on this stock, given its annual dividend and current price.

THINK IT THROUGH

Calculating the Return on Preferred Stock

Data Forge Inc. has just issued preferred stock (cumulative) with a par value of $100.00 and an annual dividend rate of 7%. The preferred stock is currently selling for $35.00 per share. What is the yield or return on this preferred stock?

Solution:

The first step is to determine the annual dividend by multiplying the dividend rate by the par value:

$$\$100 \times 0.07 = \$7.00 \quad \textbf{11.53}$$

Now, using this $7.00 annual dividend, the $35.00 current price, and the equation above, we calculate the rate of return as follows:

$$r = \frac{\$7.00}{\$35.00} = 0.20 \text{ or } 20\% \quad \textbf{11.54}$$

We have introduced the concept of return here, which should be thought of as both the anticipated return for the preferred stockholder and the company's cost of borrowing money for this particular type of capital.

Differences between Preferred and Common Stock

As we have discussed, preferred stock has important differences from common stock that apply to issuing firms and to investors. Some of the most important of these differences are listed in Table 11.7.

Feature	Common Stock	Preferred Stock
Dividends	Paid only after preferred stockholders are paid	Highest priority, paid first
Dividends	Variable and may increase or decrease	Predetermined rates, so constant dividend amounts
Growth	High potential but tied to company performance	
Liquidation	Paid out last, after all creditors and preferred stockholders are paid	Given preference in terms of payments, similar to bonds
Voting Rights	Yes	No
Arrears	No accrual of missed dividends	If cumulative, unpaid dividends become liability that must be paid out eventually
Certainty	Dividends potentially not paid if company earns no profits	Dividends paid even when company experiences financial losses

Table 11.7 Differences between Common Stock and Preferred Stock

11.5 Efficient Markets

Learning Outcomes

By the end of this section, you will be able to:

- Understand what is meant by the term *efficient markets*.
- Understand the term *operational efficiency* when referring to markets.
- Understand the term *informational efficiency* when referring to markets.
- Distinguish between strong, semi-strong, and weak levels of efficiency in markets.

Efficient Markets

For the public, the real concern when buying and selling of stock through the stock market is the question, "How do I know if I'm getting the best available price for my transaction?" We might ask an even broader question: Do these markets provide the best prices and the quickest possible execution of a trade? In other words, we want to know whether markets are efficient. By **efficient markets**, we mean markets in which costs are minimal and prices are current and fair to all traders. To answer our questions, we will look at two forms of efficiency: operational efficiency and informational efficiency.

Operational Efficiency

Operational efficiency concerns the speed and accuracy of processing a buy or sell order at the best available price. Through the years, the competitive nature of the market has promoted operational efficiency.

In the past, the **NYSE (New York Stock Exchange)** used a designated-order turnaround computer system known as SuperDOT to manage orders. SuperDOT was designed to match buyers and sellers and execute trades with confirmation to both parties in a matter of seconds, giving both buyers and sellers the best available prices. SuperDOT was replaced by a system known as the Super Display Book (SDBK) in 2009 and

subsequently replaced by the Universal Trading Platform in 2012.

NASDAQ used a process referred to as the small-order execution system (SOES) to process orders. The practice for registered dealers had been for SOES to publicly display all limit orders (orders awaiting execution at specified price), the best dealer quotes, and the best customer limit order sizes. The SOES system has now been largely phased out with the emergence of all-electronic trading that increased transaction speed at ever higher trading volumes.

Public access to the best available prices promotes operational efficiency. This speed in matching buyers and sellers at the best available price is strong evidence that the stock markets are operationally efficient.

Informational Efficiency

A second measure of efficiency is informational efficiency, or how quickly a source reflects comprehensive information in the available trading prices. A price is efficient if the market has used all available information to set it, which implies that stocks always trade at their fair value (see Figure 11.12). If an investor does not receive the most current information, the prices are "stale"; therefore, they are at a trading disadvantage.

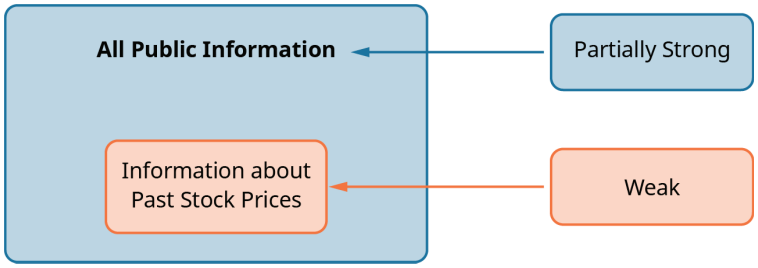

Figure 11.12 Forms of Market Efficiency A market is efficient if it provides all information that is available.

Forms of Market Efficiency

Financial economists have devised three forms of market efficiency from an information perspective: weak form, semi-strong form, and strong form. These three forms constitute the efficient market hypothesis. Believers in these three forms of efficient markets maintain, in varying degrees, that it is pointless to search for undervalued stocks, sell stocks at inflated prices, or predict market trends.

In weak form efficient markets, current prices reflect the stock's price history and trading volume. It is useless to chart historical stock prices to predict future stock prices such that you can identify mispriced stocks and routinely outperform the market. In other words, technical analysis cannot beat the market. The market itself is the best technical analyst out there.

Summary

11.1 Multiple Approaches to Stock Valuation

This section introduced common stock and some of the models and calculation methods used by investors and financial analysts to determine the prices or values of common shares. The most evaluative ratios that can be computed from a company's financial statements include the price-to-earnings (P/E), price-to book (P/B), price-to-sales (P/S), and price-to cash-flow (P/CF) ratios.

11.2 Dividend Discount Models (DDMs)

The dividend discount model, or DDM, is a method used to value a stock based on the concept that its worth is the present value of all of its future dividends. The most common DDM is the Gordon growth model, which values stock entirely on expected future dividends. Other techniques include the zero growth DDM, which depends on fixed dividends; the constant growth DDM, which assumes that dividends will grow at a constant rate; and the variable growth or nonconstant growth DDM, which is based on the assumption that stock value will progress through different stages of growth. There is also the two-stage DDM, which is based on the assumption of two stages of dividend growth: an initial period of higher growth and a subsequent period of lower, more stable growth.

11.3 Discounted Cash Flow (DCF) Model

Investors buy stock to receive cash inflows at different points in the future. These inflows may come in the form of dividends or a final cash inflow. If the investor chooses to wait for a final cash flow, the hope is that capital gains will be even stronger. The DCF model is usually used to evaluate firms that are relatively young and do not pay dividends to their shareholders. The DCF model focuses on a company's cash flows, determining the present value of an entire organization using objective data and then working this down to the share-value level based on total shares outstanding of the subject organization.

11.4 Preferred Stock

Preferred stock is a unique form of equity sold by some firms that offers preferential claims in ownership. Preferred stock carries a stated par value, but unlike bonds, there is no maturity date, and consequently, there is no final payment of the par value. The term *preferred* comes from preferred shareholders receiving all past (if cumulative) and present dividends before common shareholders receive any cash dividends.

11.5 Efficient Markets

Efficient markets are markets in which costs are minimal and prices are current and fair to all traders. There are two forms of efficiency: operational efficiency and informational efficiency. Operational efficiency concerns the speed and accuracy of processing a buy or sell order at the best available price. Informational efficiency concerns how quickly a source reflects comprehensive information in the available trading prices. Financial economists have devised three forms of efficient markets from an information perspective: weak form, semi-strong form, and strong form.

Key Terms

amortization the process of spreading business costs in accounting; similar to depreciation, but differs in that it generally refers to intangible assets such as patents or copyrights

capital employed also known as funds employed; the total amount of capital used for the acquisition of profits by a firm or on a project

common stock a security that represents partial ownership of a corporation

comparable company analysis (comps) a method for valuating a company using the metrics of other businesses of similar size in the same industry

depreciation the process of spreading business costs in accounting; similar to amortization, but differs in

that it generally refers to fixed, tangible assets such as buildings, machinery, furniture, fixtures, and equipment

discounted cash flow (DCF) a method for estimating the value of an investment based on the present value of its expected future cash flows

dividend a sum of money paid regularly (typically quarterly) by a company to its shareholders out of its profits or reserves

dividend discount model (DDM) a quantitative method for predicting the price of a company's stock based on the theory that its present-day price is worth the sum of all of its future dividend payments when discounted back to their present value

dividend yield a financial ratio (dividend/price) that shows how much a company pays out in dividends each year relative to its stock price, expressed as a percentage

earnings per share (EPS) the ratio of a company's profits to the outstanding shares of its common stock; serves as an indicator of a company's profitability

EBIT short for earnings before interest and taxes; an indicator of a firm's profitability before the effects of interest or taxes; also referred to as operating earnings, operating profit, and profit before interest and tax

efficient markets markets in which costs are minimal and prices are current, fair, and reflective of all available relevant information

enterprise value (EV) a company's total value; often used as a more comprehensive alternative to equity market capitalization

enterprise value (EV) multiples also known as company value multiples; ratios used to determine the overall value of a company and, by extension, the value of its common stock

equity multiples metrics that calculate the expected or achieved total return on an initial investment

Gordon growth model a methodology used to determine the intrinsic value of a stock based on a future series of dividends that grow at a constant rate

growth rate the rate at which the dollar amount of dividends paid on a specific stock holding increases

intangible assets assets that are not physical in nature, such as goodwill, brand recognition, and intellectual property (i.e., patents, trademarks, and copyrights)

intrinsic value the value of a firm's stock based entirely on internal factors, such as products, management, and the strength of company brands in the marketplace

market capitalization the value of a company traded on the stock market, calculated by multiplying the total number of shares by the current share price

NASDAQ (National Association of Securities Dealers Automated Quotations) short for National Association of Securities Dealers Automated Quotations; an American stock exchange based in New York City, ranked second behind the New York Stock Exchange in terms of total market capitalization of shares traded

net book value also called net asset value (NAV); the total assets of a company minus its total liabilities

NYSE (New York Stock Exchange) the world's largest stock exchange by market capitalization of its listed companies, based in New York City; often referred to as the "Big Board"

perpetuity in terms of investments, an annuity with no end date

precedent transaction analysis (precedents) a method for valuating a company in which the price paid for similar companies in the past is considered an indicator of the company's current value

preferred stock stock that entitles the holder to a fixed dividend, the payment of which takes priority over payment of common stock dividends

price-to-book (P/B) ratio also called the market-to-book (M/B) ratio; a metric used to compare a company's market capitalization, or market value, to its book value

price-to-cash-flow (P/CF) ratio a stock valuation indicator or multiple that measures the value of a stock's price relative to its operating cash flow per share

price-to-earnings (P/E) ratio a ratio that indicates the dollar amount an investor can expect to invest in a company in order to receive one dollar of that company's earnings

price-to-sales (P/S) ratio a ratio that indicates how much investors are willing to pay for a company's stock

per dollar of that company's sales

required return the minimum return an investor expects to achieve by investing in a project

secondary markets markets where investors buy and sell securities they already own

stock value also called intrinsic value; the fundamental, objective value of a share of stock

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Multiple Choice

1. The price-to-earnings (P/E) ratio is _____.
   - **a.** used to calculate a company's book value
   - **b.** a multiplier used in enterprise valuation
   - **c.** only applied when valuing preferred stock
   - **d.** a metric for showing the expectations of the market

2. The price-to-book (P/B) ratio is also called the _____ ratio.
   - **a.** market-to-book
   - **b.** enterprise-to-book
   - **c.** asset-to-price
   - **d.** liability-to-book

3. The two primary types of stock valuation multiples are _____.
   - **a.** enterprise value multiples and comparable company value multiples
   - **b.** equity multiples and enterprise value multiples
   - **c.** asset value multiples and liability value multiples
   - **d.** None of the above

4. Dividend yield is a form of equity multiple that is primarily used when _____.
   - **a.** the subject company is operating at a loss
   - **b.** conducting comparisons between companies in different industries
   - **c.** conducting comparisons between cash returns and investment types
   - **d.** analyzing mature companies that have been paying dividends for several years

5. Dividend yield is computed as the proportion of dividend per share to _____.
   - **a.** share price
   - **b.** earnings per share
   - **c.** market value per share
   - **d.** book value per share

6. Which of the following statements about enterprise value metrics is NOT true?
   - **a.** EV to revenue can be used to assess companies with negative cash flows or firms that are currently experiencing financial losses.
   - **b.** ROCE is a profitability ratio that measures the return on the equity in a company in comparison to its financing over a short period of time.
   - **c.** EBIT allows investors to assess the core operations of the business without worrying about the costs of the capital structure.
   - **d.** EBITDAR is a metric that is used in businesses that have substantial rental and least expenses.

7. If an investor's required rate of return increases and all other characteristics of a stock remain the same, the value of the stock will _____.
   - **a.** remain the same

b. increase
c. decrease
d. None of the above

8. A major limitation of the dividend discount model (DDM) is that _____.
a. it is extremely complicated to use
b. it cannot be used with companies that do not pay dividends
c. it must always be used in conjunction with another metric
d. None of the above

9. In which of the following ways does preferred stock differ from common stock?
a. Preferred stock carries voting rights for its ownership.
b. Preferred stock must be purchased through a broker dealer.
c. Preferred stock may have a cumulative dividend feature.
d. In the event of corporate liquidation, preferred stockholders are paid last.

10. The term efficient markets refers to the idea that _____.
a. publicly traded companies always file their financial reports on time
b. investors are able to identify underpriced stocks for purchase
c. stocks trade with minimal costs and prices are current and fair to all traders
d. financial information on companies and their stock is only available to efficient traders

Review Questions

1. Briefly discuss one of the primary benefits of using comparative P/E ratios.
2. Name an important characteristic of companies for which the price-to-book (P/B) ratio does not work well.
3. Briefly describe the main type of scenario in which the two-stage DDM approach might be used to value a firm and its stock.
4. Briefly describe a major shortcoming of the zero growth DDM model.
5. Briefly describe the required inputs for the discounted cash flow (DCF) model.
6. Briefly describe preferred stock and some of its ownership advantages compared to common stock.
7. Briefly explain what is meant by the terms *cumulative* and *noncumulative* as they relate to preferred stocks.
8. What were SuperDOT and SOES, and what were they designed to do?
9. What are operational efficiency and informational efficiency, and how do they differ in terms of trading markets?
10. What is meant by informational efficiency, and how does it affect the price of a stock?

Problems

1. Today, Sysco Enterprises paid dividends on its common stock of $1.25 per share. If dividends per share are expected to increase to $3.50 per share six years from now, what is the percentage dividend growth rate?
2. Let's say you want to purchase shares of Fontaine Ltd. and then hold this stock for six years. The company has a stated dividend policy of $2.00 annually per share for the next six years, at the end of which time you will sell the stock. You expect to be able to sell the stock for $35.00 at that time. If you want to earn an 8% return on this investment, what price should you pay today for this stock?
3. Damian Painting Systems has established a dividend policy of $3.00 per share per year. If the company

plans to be in business forever, what is the value of this stock if an investor wants a 10% return?

4. Wilk Productions wants its shareholders to earn a 12% return on their investment in the company. At what value would Wilk stock be priced if the company paid $2.75 per share in constant annual dividends forever?
5. Dax Industrial Systems has stock currently priced at $50.00 per share. If investors are earning a 7% return on Dax Industrial, what is the company's annual dividend payment per share?
6. If a stock is selling at $400 with a dividend in the next period of $40 and a potential investor's required rate of return is 15%, what would be the anticipated dividend growth rate?
7. Mind Max Inc. has a dividend policy that increases annual dividends by 3% each year. If last year's dividend was $2.00, the company intends to stay in business for 50 years, and an investor wants a 9% return, what would be the price of Mind Max stock?
8. Odon Corp. paid dividends today in the amount of $1.50 per share. If Odon will pay dividends of $5.00 10 years from today, what is the annual dividend growth rate over this 10-year period?
9. The Kirkson Distributors common stock is currently selling at $52.00 per share, pays dividends annually at $2.50 per share, and has an annual dividend growth rate of 2%. What is the required return?
10. If a preferred share of stock pays dividends of $2.50 per year and the required rate of return for the stock is 6%, what is its intrinsic value?

Video Activity

Efficient Markets

Access multimedia content (http://openstax.org/books/principles-finance/pages/11-video-activity)

1. In the efficient market hypothesis (EMH), describe what is meant by the terms *weak form efficiency, semi-strong form efficiency*, and *strong form efficiency*. How do these forms of market efficiency differ from each other, and what are their characteristics?
2. What is meant by the term *random walk*, and how does this concept relate to the EMH?

What Is Preferred Stock?

Access multimedia content (http://openstax.org/books/principles-finance/pages/11-video-activity)

3. Discuss the relative risks of the following financial instruments and how they compare to each other: bonds, common stocks, and preferred stocks. How and why will these three investment types typically carry different levels of risk to an investor?
4. Discuss some of the important differences between preferred stocks and common stocks.