# Financial Management 5e 

Principles \& Practices

By Timothy Gallagher Colorado State University



3 things about Gallagher 5e

1. Complete coverage of recent financial criseslgreat recession
2. Review of systematic risk and "too big to fail" concepts
3. Best value proposition on the market (see quote on backside)

3 things about Textbook Media Press*


1. Proven content from trusted authors since 2004
2. Unique student options (online; desktop-PDF; paperback; iPhone)
3. Uniquely affordable prices

For Instructors
Instructor's Manual
Solutions Manual
Computerized Test Bank
PowerPoint Lecture Slides
(Distributed on a Compact Disk)

To Review Online Textbook www.textbookmedia.com

To Request Paperback info@textbookmedia.com

Student Textbook Options
Online Book:
\$17.95
Digital Bundle (PDF + Online) $\quad \$ 24.95$
Hybrid Bundle (Paperback +Online) \$39.95

Student Study Tools
Online Study Guide: $\quad \$ 5.95$
Printable Study Guide: $\quad \$ 7.95$
Additional Problems: $\quad \$ 5.95$
Interactive Spreadsheets \$ 0.00
Lecture Guide: $\quad \$ 4.95$
StudyUpGrade*: $\quad \$ 9.95$
iPhone book: $\quad \$ 9.95$
*Layers interactive quizzing into online versions of the textbook.


Endorsement: "I just had to let you know what a big fan I am of Gallagher's Financial Management: Principles and Practices. In the world of finance texts I have found either books that present material an MBA may have trouble digesting, or some that are so watered down they insult the students' intelligence. And believe me I have used all of the biggest selling finance texts over the years.

Gallagher has a knack for presenting difficult concepts in a clear and straightforward manner without compromising the rigorous standards I have for my students. And all this in your low-cost format? Amazing! I just can't say enough. You've got to get the word out about this book!"
-Susan C. Myrick; Professor of Business Community College of Allegheny County

Updates Include:

- Completely updated to include developments/lessons from the recent financial crisis/great recession
- Review of systematic risk and "too big to fail" concepts
- Coverage includes auto industry; AIG; Fannie/Freddie Mac; Merrill Lynch
- New for Spring 2010: online self-scoring quizzes via StudyUpGrades

From the author: "What distinguishes our book is our consistent emphasis on value; what creates it; what destroys it; how value is measured; and how value and risk are related. In doing so we maximize the value of the finance course to the student."

## 3 FAQ's about Textbook Media:

I've never heard of Textbook Media... We formerly published as Freeload Press. To celebrate our 5th year in business, we rebranded in 2009 as Textbook Media to emphasize the increased number of student options that are now available. The publishers who founded the business have been in college publishing since 1980 and have published textbooks for Irwin, McGraw Hill and Houghton Mifflin.
I don't want to have to provide software support... What program is does the online book use ? The online book is served up using Silverlight, a Microsoft product that's commonly-used rich media application used by companies like Netflix. Most of your students may already have it. If not, it's free and fast download from Microsoft. The software behind the book is supported by Microsoft; the online book experience is supported by our customer service staff.
How do I review the book and or request a desk copy? Register at the site to review online immediately. Or we'll register you and then send you a follow up e-mail with your registration information and a online book in your account. If you like what you see with the online review, awe can then send you a paperback desk copy.

## Here's a partial list of colleges/universities who used the 4th edition of Gallagher:

Cal State U - Dominguez Hills
California State University, Sacramento
University of the Pacific
Colorado State University
Fort Lewis College
George Washington University
Brenau University
Georgia Southern University
Piedmont College
Hawaii Pacific University
Illinois State U-Normal Northwestern University

Ball State University
Frostburg State University
Towson University
U Maryland U College MBA
Northern Michigan University
University of Missouri - Columbia

U of North Carolina - Pembroke
City College of New York
SUNY Stonybrook
Notre Dame College (Ohio)
The University of Portland
Carnegie Mellon University
C.C. of Allegheny County

Philadelphia School of the Sciences Saint Scholastica
St. Vincent College
University of the Sciences-Philadelphia University of Houston - Downtown University of Texas - Arlington University of Texas - Dallas
University of Texas - El Paso
George Wash U-- Virginia Campus Northern Virginia Community College Webster University

University of Wyoming

## Table of Contents

1 Finance and the Firm
2 Financial Markets and Interest Rates
3 Financial Institutions
4 Review of Accounting
5 Analysis of Financial Statements
6 Forecasting for Financial Planning
7 Risk and Return
8 The Time Value of Money
9 The Cost of Capital
10 Capital Budgeting Decision Methods
11 Estimating Incremental Cash Flows
12 Business Valuation
13 Capital Structures Basics
14 Corporate Bonds, Preferred Stock and Leasing
15 Common Stock
16 Dividend Policy
17 Working Capital Policy
18 Managing Cash
19 Accounts Receivable and Inventory
20 Short-Term Financing
21 International Finance

## 12 <br> Business Valuation

## "Nowadays we know the price of

everything and the value of nothing."
-Oscar Wilde

## Valuing the M\&M Mushroom Company

Melissa and Mark were young and in love. They also shared a passion for mushrooms. In fact, they were so passionate about mushrooms they liked to grow them in their basement. They were quite good at it, and often had more mushrooms than they knew what to do with. Then they had the idea of selling their mushrooms to friends and neighbors. This endeavor was successful beyond their wildest dreams and soon they had quite a business going. The expanded out of their basement into dedicated production facilities, incorporated under the name "M\&M Mushrooms," and became quite famous in the local area for having the best tasting mushrooms around.

The M\&M Mushroom Company grew steadily for ten years, enlarging its sales territory to five states and employing 150 people in three plants. That's when the trouble began. Melissa wanted to keep expending the business, but Mark missed the small, informal operation they used to have years ago. Also, Mark had recently begun taking flying lessons and had developed a close relationship with his flight instructor. Mark and Melissa began spending more and more time apart, and began having more and more disagreements, until it was apparent that everyone would be better off if they went their separate ways.

The divorce was amicable, as Melissa and Mark had no children and the only major assets they owned were their common stock shares in the M\&M Mushroom Corporation (Melissa and Mark each owned 50\% of the shares outstanding, 500 shares each). Since Melissa wanted to continue managing the business and Mark wanted out, he agreed to sell her his 500 shares. However, they could not agree on a price. Melissa was of the

opinion that the shares were worth in the neighborhood of \$1,000 each, making the total value of Mark's 500 shares $\$ 500,000$. Mark disagreed. Pointing to their steady growth during the past ten years, and current wide area of operations, he maintained the shares were worth at least $\$ 2,000$ each for a total of $\$ 1,000,000$.

Melissa and Mark could not settle their differences on their own and soon found themselves facing each other in court. The primary issue before the court was to establish the "fair market value" of the shares in question. Each side engaged an expert to provide an opinion on the value of the shares.

Now suppose you were approached by Melissa or Mark's attorney and asked if you would write a report containing an estimate of the fair market value per share of M\&M Mushroom company's stock. How would you go about this task? The stock is privately held, and not traded on any stock exchange, so it would appear that you face a formidable task.

The valuation task is formidable, but it is not impossible. Indeed, professional appraisers do it regularly, not only to support opposing sides in court cases, but also to establish a value when the business is to be used for collateral for a loan, an asking price when the sale of the business is contemplated, or a value for tax purposes when the business is a part of an estate settlement.

The techniques appraisers use to estimate market value vary from case to case, but at their heart they generally involve the calculation of the present value of an assumed set of future cash flows. You are already familiar with this technique from your studies of the time value of money in Chapter 8. In this chapter we show you how to adapt those techniques specifically to the task of valuing stocks, bonds, and complete businesses.

## Learning Objectives

After reading this chapter, you should be able to:

1. Explain the importance of business valuation.
2. Discuss the concept of business valuation.
3. Compute the market value and the yield to maturity of a bond.
4. Calculate the market value and expected yield of preferred stock.
5. Compute the market value per share of common stock.
6. Compute the market value of total common equity.
7. Compute the yield on common stock.
8. Compute the value of a complete business.

## Chapter Overview

In this chapter we will discuss how to value businesses in a dynamic marketplace. First, we will investigate the importance of business valuation and introduce a general model that analysts and investors use to value assets. Then we will show how to adapt the model to bonds, preferred stock, and common stock. For common stock, we'll explore additional valuation techniques.

## The Importance of Business Valuation

As Chapter 1 explained, the primary financial goal of financial managers is to maximize the market value of their firm. It follows, then, that financial managers need to assess the market value of their firms to gauge progress.

Accurate business valuation is also a concern when a corporation contemplates selling securities to raise long-term funds. Issuers want to raise the most money possible from selling securities. Issuers lose money if they undervalue their businesses. Likewise, would-be purchasers are concerned about businesses' value because they don't want to pay more than what the businesses are worth.

## A General Valuation Model

The value of a business depends on its future earning power. To value a business then, we consider three factors that affect future earnings:

- Size of cash flows
- Timing of cash flows
- Risk

These three factors also determine the value of individual assets belonging to a business, or interests in a business, such as those possessed by bondholders and stockholders.

In Chapter 7 we examined how risk factors affect an investor's required rate of return. In Chapter 8 we learned that time value of money calculations can determine an investment's value, given the size and timing of the cash flows. In Chapters 9, 10, and 11 we learned how to evaluate future cash flows.

Financial managers determine the value of a business, a business asset, or an interest in a business by finding the present value of the future cash flows that the owner of the business, asset, or interest could expect to receive. For example, we can calculate a bond's value by taking the sum of the present values of each of the future cash flows from the bond's interest and principal payments. We can calculate a stock's value by taking the sum of the present values of future dividend cash flow payments.

Analysts and investors use a general valuation model to calculate the present value of future cash flows of a business, business asset, or business interest. This model, the discounted cash flow model (DCF), is a basic valuation model for an asset that is expected to generate cash payments in the form of cash earnings, interest and principal payments, or dividends. The DCF equation is shown in Equation 12-1:

The Discounted Cash Flow Valuation Model

$$
\begin{equation*}
\mathrm{V}_{0}=\frac{\mathrm{CF}_{1}}{(1+\mathrm{k})^{1}}+\frac{\mathrm{CF}_{2}}{(1+\mathrm{k})^{2}}+\frac{\mathrm{CF}_{3}}{(1+\mathrm{k})^{3}}+\ldots+\frac{\mathrm{CF}_{\mathrm{n}}}{(1+\mathrm{k})^{\mathrm{n}}} \tag{12-1}
\end{equation*}
$$

where: $\quad V_{0}=$ Present value of the anticipated cash flows from the asset, its current value
$\mathrm{CF}_{1,2,3, \text { and } \mathrm{n}}=$ Cash flows expected to be received one, two, three, and so on up to n periods in the future
$k=$ Discount rate, the required rate of return per period
The DCF model values an asset by calculating the sum of the present values of all expected future cash flows.

The discount rate in Equation 12-1 is the investor's required rate of return per time period, which is a function of the risk of the investment. Recall from Chapter 7 that the riskier the security, the higher the required rate of return.

The discounted cash flow model is easy to use if we know the cash flows and discount rate. For example, suppose you were considering purchasing a security that entitled you to receive payments of $\$ 100$ in one year, another $\$ 100$ in two years, and $\$ 1,000$ in three years. If your required rate of return for securities of this type were 20 percent, then we would calculate the value of the security as follows:

$$
\begin{aligned}
\mathrm{V}_{0} & =\frac{\$ 100}{(1+.20)^{1}}+\frac{\$ 100}{(1+.20)^{2}}+\frac{\$ 1,000}{(1+.20)^{3}} \\
& =\$ 83.3333+\$ 69.4444+\$ 578.7037 \\
& =\$ 731.48
\end{aligned}
$$

The total of the security's three future cash flows at a 20 percent required rate of return yields a present value of $\$ 731.48$.

In the sections that follow, we'll adapt the discounted cash flow valuation model to apply to businesses and business components.

## Applying the General Valuation Model to Businesses

According to the general valuation model, Equation 12-1, the value of a business asset is the present value of the anticipated cash flows from the asset. The value of a complete business, therefore, is the present value of the cash flows expected to be generated by the business. In order to use the general valuation model to estimate the value of a complete business, we must forecast the cash flows expected to be generated by the business and discount them to the present using the required rate of return appropriate for the business. This sounds relatively simple, but in fact it is an extremely complex task requiring the cash flow estimation techniques that you learned in Chapter 11 and the cost of capital estimation techniques that you learned in Chapter 9.

Instead of tackling the value of a complete business all at once, we will begin with the present values of the components of the business, as illustrated in Figure 12-1.

Figure 12-1
Total Market Value
of a Business
This figure illustrates how the total market value of a business is the sum of the present values of the components of the business.

Total Market Value of a Business

|  | Value of Current Liabilities |
| :---: | :---: |
| Total Value <br> of <br> Business Assets | Value of Long-Term Debt |
|  | Value of Preferred Stock |
|  | Value of Common Stockholders' Equity |

As Figure 12-1 shows, the value of all of a businesses assets (that is, the complete business) equals the sum of the present values of its current liabilities, long-term debt, preferred stock, and common stock. In the remainder of this chapter, we will apply this approach, first examining the valuation of current liabilities and long-term debt (corporate bonds), then preferred stock, and finally common stock. Following those individual discussions, we will show how the same techniques can be used to estimate the total value of a business.

## Valuing Current Liabilities and Long-Term Debt

Current liabilities are short-term obligations of a company that are fixed by agreement. Accounts payable, for example, represents amounts that the company has purchased from its suppliers and has agreed to pay for in a specified amount of time. Because the time to maturity of these obligations is not lengthy, the market value of current liabilities is most often taken to be equal to their book value. Therefore, when analysts value the current-liability component of a complete business, they normally just read the value of the current liabilities from the firm's balance sheet.

Long-Term Debt A company's long-term obligations may be long-term loans from a commercial bank or a private investor, corporate bonds, or notes issued to the public. In each case the value of the debt is the present value of the future cash flows that would accrue to the owner of the debt, as we have explained previously. In this chapter we will discuss the valuation of long-term debt when it is in the form of bonds.

## Bond Valuation

Remember from Chapter 2 that a bond's cash flows are determined by the bond's coupon interest payments, face value, and maturity.

Because coupon interest payments occur at regular intervals throughout the life of the bond, those payments are an annuity. Instead of using several terms representing the individual cash flows from the future coupon interest payments $\left(\mathrm{CF}_{1}, \mathrm{CF}_{2}\right.$, and so
on), we adapt Equation $12-1$ by using one term to show the annuity. The remaining term represents the future cash flow of the bond's face value, or principal, that is paid at maturity. Equation 12-2 shows the adapted valuation model:

The Bond Valuation Formula (Algebraic Method)

$$
\begin{equation*}
V_{B}=I N T \times\left[\frac{1-\frac{1}{\left(1+k_{d}\right)^{n}}}{\mathrm{k}_{\mathrm{d}}}\right]+\frac{\mathrm{M}}{\left(1+\mathrm{k}_{\mathrm{d}}\right)^{\mathrm{n}}} \tag{12-2}
\end{equation*}
$$

where: $\quad \mathrm{V}_{\mathrm{B}}=$ Current market value of the bond
INT $=$ Dollar amount of each periodic interest payment
$\mathrm{n}=$ Number of times the interest payment is received (which is also the number of periods until maturity)
$\mathrm{M}=$ Principal payment received at maturity
$\mathrm{k}_{\mathrm{d}}=$ Required rate of return per period on the bond debt instrument

The table version of the bond valuation model is shown in Equation 12-3, as follows:

$$
\begin{equation*}
\mathrm{V}_{\mathrm{B}}=\left(\mathrm{INT} \times \mathrm{PVIFA}_{\mathrm{k}, \mathrm{n}}\right)+\left(\mathrm{M} \times \mathrm{PVIF}_{\mathrm{k}, \mathrm{n}}\right) \tag{12-3}
\end{equation*}
$$

where: PVIFA $_{k, n}=$ Present Value Interest Factor for an Annuity from Table IV
$\mathrm{PVIF}_{\mathrm{k}, \mathrm{n}}=$ Present Value Interest Factor for a single amount from Table II
To use a calculator to solve for the value of a bond, enter the dollar value of the interest payment as [PMT], the face value payment at maturity as [FV], the number of payments as n , and the required rate of return, $\mathrm{k}_{\mathrm{d}}$ depicted as [I/Y] on the TI BAII Plus calculator. Then compute the present value of the bond's cash flows.

Now let's apply the bond valuation model. Suppose Microsoft Corporation issues a 7 percent coupon interest rate bond with a maturity of 20 years. The face value of the bond, payable at maturity, is $\$ 1,000$.

First, we calculate the dollar amount of the coupon interest payments. At a 7 percent coupon interest rate, each payment is $.07 \times \$ 1,000=\$ 70$.

Next, we need to choose a required rate of return, $\mathrm{k}_{\mathrm{d}}$. Remember that $\mathrm{k}_{\mathrm{d}}$ is the required rate of return that is appropriate for the bond based on its risk, maturity, marketability, and tax treatment. Let's assume that 8 percent is the rate of return the market determines to be appropriate.

Now we have all the factors we need to solve for the value of Microsoft Corporation's bond. We know that $\mathrm{k}_{\mathrm{d}}$ is 8 percent, n is 20 , the coupon interest payment is $\$ 70$ per year, and the face value payment at maturity is $\$ 1,000$. Using Equation 12-2, we calculate the bond's value as follows:

## Take Note

The determinants of nominal interest rates, or required rates of return, include the real rate of interest, the inflation premium, the default risk premium, the illiquidity premium, and the maturity premium. Each person evaluating a bond will select an appropriate required rate of return, $k_{d^{\prime}}$ for the bond based on these determinants.

$$
\begin{aligned}
V_{\text {B }} & =\$ 70 \times\left[\frac{1-\frac{1}{(1+.08)^{20}}}{.08}\right]+\frac{\$ 1,000}{(1+.08)^{20}} \\
& =(\$ 70 \times 9.8181474)+\left(\frac{\$ 1,000}{4.660957}\right) \\
& =\$ 687.270318+\$ 214.548214 \\
& =\$ 901.82
\end{aligned}
$$

Notice that the value of Microsoft Corporation's bond is the sum of the present values of the 20 annual $\$ 70$ coupon interest payments plus the present value of the one time $\$ 1,000$ face value to be paid 20 years from now, given a required rate of return of 8 percent.

To find the Microsoft bond's value using present value tables, recall that the bond has a face value of $\$ 1,000$, a coupon interest payment of $\$ 70$, a required rate of return of 8 percent, and an $n$ value of 20 . We apply Equation $12-3$ as shown:

$$
\begin{aligned}
\mathrm{V}_{\mathrm{B}} & =\left(\$ 70 \times \mathrm{PVIFA}_{8 \%, 20 \text { yrs }}\right)+\left(\$ 1,000 \times \mathrm{PVIF}_{8 \%, 20 \text { yrs }}\right) \\
& =(\$ 70 \times 9.8181)+(\$ 1,000 \times .2145) \\
& =\$ 687.267+\$ 214.500 \\
& =\$ 901.77
\end{aligned}
$$

We see that the sum of the present value of the coupon interest annuity, \$687.267, plus the present value of the principal, $\$ 214.500$, results in a bond value of $\$ 901.77$. There is a five-cent rounding error in this example when the tables are used.

Here's how to find the bond's value using the TI BAII PLUS financial calculator. Enter the $\$ 70$ coupon interest payment as PMT, the one-time principal payment of $\$ 1,000$ as FV , the 20 years until maturity as n ( N on the TI BAII PLUS), and the 8 percent required rate of return-depicted as I/Y on the TI BAII Plus. As demonstrated in Chapter 8 calculator solutions, clear the time value of money TVM registers before entering the new data. Skip steps 2 and 3 if you know your calculator is set to one payment per year and is also set for end-of-period payment mode.

## TI BAII PLUS Financial Calculator Solution

Step 1: Press 2nd CLR TVM to clear previous values.
Step 2: Press 2nd PY 1 ENTER, 2nd BGN 2nd SET 2nd SET repeat 2nd SET until END shows in the display 2nd QUIT to set the annual interest rate mode and to set the annuity payment to end of period mode.

Step 3: Input the values and compute.


The $\$ 901.82$ is negative because it is a cash outflow-the amount an investor would pay to buy the bond today.

We have shown how to value bonds with annual coupon interest payments in this section. Next, we show how to value bonds with semiannual coupon interest payments.

## Semiannual Coupon Interest Payments

In the hypothetical bond valuation examples for Microsoft Corporation, we assumed the coupon interest was paid annually. However, most bonds issued in the United States pay interest semiannually (twice per year). With semiannual interest payments, we must adjust the bond valuation model accordingly. If the Microsoft bond paid interest twice per year, the adjustments would look like this:

|  | Annual <br> Basis | Semiannual <br> Basis |
| :--- | :---: | :---: |
| Coupon Interest Payments | $\$ 70$ | $\div 2=\$ 35$ per six-month period |
| Maturity | 20 yrs | $\times 2=40$ six-month periods |
| Required Rate of Return | $8 \%$ | $\div 2=4 \%$ semiannual rate |

These values can now be used in Equation 12-2, Equation 12-3, or a financial calculator, in the normal manner. For example, if Microsoft's 7 percent coupon, 20-year bond paid interest semiannually, its present value per Equation 12-2 would be

$$
\begin{aligned}
V_{\text {B }} & =\$ 35 \times\left[\frac{1-\frac{1}{(1+.04)^{40}}}{.04}\right]+\frac{\$ 1,000}{(1+.04)^{40}} \\
& =(\$ 35 \times 19.792774)+\left(\frac{\$ 1,000}{4.801021}\right) \\
& =\$ 692.74709+\$ 208.2890 \\
& =\$ 901.04
\end{aligned}
$$

The value of our Microsoft bond with semiannual interest and a 4 percent per semiannual period discount rate is $\$ 901.04$. This compares to a value of $\$ 901.82$ for the same bond if it pays annual interest and has an 8 percent annual discount rate. Note that a required rate of return of 4 percent per semiannual period is not the same as 8 percent per year. The difference in the frequency of discounting gives a slightly different answer.

## The Yield to Maturity of a Bond

Most investors want to know how much return they will earn on a bond to gauge whether the bond meets their expectations. That way, investors can tell whether they should add the bond to their investment portfolio. As a result, investors often calculate a bond's yield to maturity before they buy a bond. Yield to maturity (YTM) represents the average rate of return on a bond if all promised interest and principal payments are made on time and if the interest payments are reinvested at the YTM rate given the price paid for the bond.

Calculating a Bond's Yield to Maturity To calculate a bond's YTM, we apply the bond valuation model. However, we apply it differently than we did when solving for a bond's present value (price) because we solve for $\mathrm{k}_{\mathrm{d}}$, the equivalent of YTM.

To compute a bond's YTM, we must know the values of all variables except $\mathrm{k}_{\mathrm{d}}$. We take the market price of the bond, $\mathrm{P}_{\mathrm{B}}$, as the value of a bond, $\mathrm{V}_{\mathrm{B}}$, examining financial sources such as The Wall Street Journal for current bond prices.

Once you have all variables except $\mathrm{k}_{\mathrm{d}}$, solving for $\mathrm{k}_{\mathrm{d}}$ algebraically is exceedingly difficult because that term appears three times in the valuation equation. Instead, we use the trial-and-error method. In other words, we guess a value for $k_{d}$ and solve for $V_{B}$ using that value. When we find a $\mathrm{k}_{\mathrm{d}}$ value that results in a bond value that matches the published bond price, $P_{B}$, we know that the $k_{d}$ value is the correct YTM. The YTM is the return that bond investors require to purchase the bond. ${ }^{1}$

Here's an illustration of the trial-and-error method for finding YTM. Suppose that The Wall Street Journal reported that the Microsoft bond in our earlier example is currently selling for $\$ 1,114.70$. What is the bond's YTM if purchased at this price?

Recall the annual coupon interest payments for the Microsoft bond were $\$ 70$ each, and the bond had a 20 -year maturity and a face value of $\$ 1,000$. Applying the bond valuation model, we solve for the $\mathrm{k}_{\mathrm{d}}$ that produces a bond value of $\$ 1,114.70$.

$$
\$ 1,114.70=\$ 70 \times\left[\frac{1-\frac{1}{\left(1+\mathrm{k}_{\mathrm{d}}\right)^{20}}}{\mathrm{k}_{\mathrm{d}}}\right]+\frac{\$ 1,000}{\left(1+\mathrm{k}_{\mathrm{d}}\right)^{20}}
$$

Although we can try any $\mathrm{k}_{\mathrm{d}}$ value, remember that when k was 8 percent, the bond's calculated value, $\mathrm{V}_{\mathrm{B}}$, was $\$ 901.82$. Bond prices and yields vary inversely-the higher the YTM, the lower the bond price; and the lower the YTM, the higher the bond price. The bond's current market price of $\$ 1,114.70$ is higher than $\$ 901.82$, so we know the YTM must be less than 8 percent. If you pay more than $\$ 901.82$ to buy the bond, your return will be less than 8 percent.

Because we know that YTM and bond prices are inversely related, let's try 7 percent in our bond valuation model, Equation 12-2. We find that a $\mathrm{k}_{\mathrm{d}}$ value of 7 percent results in the following bond value:

$$
\begin{aligned}
\mathrm{V}_{\text {B }} & =\$ 70 \times\left[\frac{1-\frac{1}{(1+.07)^{20}}}{.07}\right]+\frac{\$ 1,000}{(1+.07)^{20}} \\
& =(\$ 70 \times 10.59401425)+\left(\frac{\$ 1,000}{3.86968446}\right) \\
& =\$ 741.5809975+\$ 258.4190028 \\
& =\$ 1,000.00
\end{aligned}
$$

${ }^{1}$ In Chapter 9 this required rate of return was called the firm's cost of debt capital, which we adjust for taxes. In this chapter, however, our main focus is finding the value of different types of securities, so $\mathrm{k}_{\mathrm{d}}$ is referred to as the investor's required rate of return.

At a $\mathrm{k}_{\mathrm{d}}$ of 7 percent, the bond's value is $\$ 1,000$ instead of $\$ 1,114.70$. We'll need to try again. Our second guess should be lower than 7 percent because at $\mathrm{k}_{\mathrm{d}}=7 \%$ the bond's calculated value is lower than the market price. Let's try 6 percent. At a $k_{d}$ of 6 percent, the bond's value is as follows:

$$
\begin{aligned}
V_{\text {B }} & =\$ 70 \times\left[\frac{1-\frac{1}{(1+.06)^{20}}}{.06}\right]+\frac{\$ 1,000}{(1+.06)^{20}} \\
& =(\$ 70 \times 11.46992122)+\left(\frac{\$ 1,000}{3.20713547}\right) \\
& =\$ 802.8944853+\$ 311.8047269 \\
& =\$ 1,114.70
\end{aligned}
$$

With a $\mathrm{k}_{\mathrm{d}}$ of 6 percent, the bond's value equals the current market price of $\$ 1,114.70$. We conclude that the bond's YTM is 6 percent. ${ }^{2}$

To use the table method to find the YTM of Microsoft's 7 percent coupon rate, 20 -year bond at a price of $\$ 1,114.70$, use Equation $12-3$ as follows:

First guess: $\mathrm{k}_{\mathrm{d}}=7 \%$ :

$$
\begin{aligned}
\mathrm{V}_{\mathrm{B}} & =\left(\$ 70 \times \mathrm{PVIFA}_{7 \%, 20 \text { periods }}\right)+\left(\$ 1,000 \times \mathrm{PVIF}_{7 \%, 20 \text { periods }}\right) \\
& =(\$ 70 \times 10.5940)+(\$ 1,000 \times .2584) \\
& =\$ 741.58+\$ 258.40 \\
& =\$ 999.98
\end{aligned}
$$

\$999.98 is too low. We must guess again. Let's try $\mathrm{k}_{\mathrm{d}}=6 \%$, as follows:

$$
\begin{aligned}
\mathrm{V}_{\mathrm{B}} & =\left(\$ 70 \times \mathrm{PVIFA}_{6 \%, 20 \text { periods }}\right)+\left(\$ 1,000 \times \mathrm{PVIF}_{6 \%, 20 \text { periods }}\right) \\
& =(\$ 70 \times 11.4699)+(\$ 1,000 \times .3118) \\
& =\$ 802.893+\$ 311.80 \\
& =\$ 1,114.69
\end{aligned}
$$

Close enough (to $\$ 1,114.70$ ). The bond's YTM is about 6 percent.
Finding a bond's YTM with a financial calculator avoids the trial-and-error method. Simply plug in the values on the calculator and solve for $\mathrm{k}_{\mathrm{d}}$, as shown:

[^0]
## TI BAII PLUS Financial Calculator Solution

Step 1: Press 2nd CLR TVM to clear previous values.
Step 2: Press 2nd PM 1 ENTER, 2nd BGN 2nd SET 2nd SET repeat 2nd SET until END shows in the display 2nd QuIT to set the annual interest rate mode and to set the annuity payment to end of period mode.

Step 3: Input the values and compute.


Answer: 6.00

Using the financial calculator, we find that the YTM of the Microsoft $\$ 1,000$ face value 20 -year bond with a coupon rate of 7 percent and a market price of $\$ 1,114.70$ is 6 percent.

## The Relationship between Bond YTM and Price

A bond's market price depends on its yield to maturity. When a bond has a YTM greater than its coupon rate, it sells at a discount from its face value. When the YTM is equal to the coupon rate, the market price equals the face value. When the YTM is less than the coupon rate, the bond sells at a premium over face value.

For instance, in our initial calculations of the Microsoft bond, we found that the present value of its future cash flows was $\$ 901.82$. That price was lower than the bond's $\$ 1,000$ face value. Because its market price was lower than its face value, the bond sold at a discount (from its face value). A bond will sell at a discount because buyers and sellers have agreed that the appropriate rate of return for the bond should be higher than the bond's coupon interest rate. With the Microsoft bond, investors required an 8 percent rate of return, but the fixed coupon interest rate was only 7 percent. To compensate for a coupon interest rate that is lower than the required rate, investors would be unwilling to pay the $\$ 1,000$ face value. Instead, they would only be willing to pay $\$ 901.82$ to buy the bond.

Now recall the trial-and-error calculations for the YTM of the Microsoft 7 percent coupon rate bond in the previous section. We found that when the YTM was 7 percent, the bond's price was $\$ 1,000$. This was no coincidence. When the YTM is equal to the coupon interest rate-that is, when the bond is selling at par-the bond's price is equal to its face value. We saw that when would-be buyers and sellers of Microsoft Corporation's bond agree that the appropriate yield to maturity for the bond is 6 percent instead of 7 percent, the price is above $\$ 1,000$.

The change from a 7 percent to a 6 percent YTM results in a market value of $\$ 1,114.70$. That market value for the bond is higher than the $\$ 1,000$ face value. Because the market price is higher than the bond's face value in our case, the bond sells at a premium. Why? Investors pay more to receive "extra" interest because the coupon rate paid is higher than the YTM demanded.

In our example, the calculations show that investors were willing to pay $\$ 1,114.70$ for a bond with a face value of $\$ 1,000$ because the coupon interest was one percentage point higher than the required rate of return.

Figure 12-2 shows the relationship between YTM and the price of a bond.


The inverse relationship between bond price and YTM is important to bond traders. Why? Because if market YTM interest rates rise, bond prices fall. Conversely, if market YTM interest rates fall, bond prices rise. The suggestion that the Fed might raise interest rates is enough to send the bond market reeling as bond traders unload their holdings.

In this section we examined bond valuation for bonds that pay annual and semiannual interest. We also investigated how to find a bond's yield to maturity and the relationship between a bond's YTM and its price. We turn next to preferred stock valuation.

## Preferred Stock Valuation

To value preferred stock, we adapt the discounted cash flow valuation formula, Equation 12-1, to reflect the characteristics of preferred stock. First, recall that the value of any security is the present value of its future cash payments. Second, review the characteristics of preferred stock. Preferred stock has no maturity date, so it has no maturity value. Its future cash payments are dividend payments that are paid to preferred stockholders at regular time intervals for as long as they (or their heirs) own the stock. Cash payments from preferred stock dividends are scheduled to continue forever. To value preferred stock, then, we must adapt the discounted cash flow model to reflect that preferred stock dividends are a perpetuity.

## Finding the Present Value of Preferred Stock Dividends

To calculate the value of preferred stock, we need to find the present value of its future cash flows-which are a perpetuity. In Chapter 8 we learned how to find the present

Figure 12-2 Bond YTM versus Bond Price

Figure 12-2 shows the inverse relationship between the price and the YTM for a \$1,000 face value, 20 -year, $7 \%$ coupon interest rate bond that pays annual interest.
value of a perpetuity. We use the formula for the present value of a perpetuity, Equation $8-5$, but adapt the terms to reflect the nature of preferred stock. ${ }^{3}$

The preferred stock valuation calculations require that we find the present value $\left(\mathrm{V}_{\mathrm{p}}\right)$ of preferred stock dividends $\left(\mathrm{D}_{\mathrm{p}}\right)$, discounted at required rate of return, $\mathrm{k}_{\mathrm{p}}$. The formula for preferred stock valuation follows:

The Formula for the Present Value of Preferred Stock

$$
\begin{equation*}
\mathrm{V}_{\mathrm{P}}=\frac{\mathrm{D}_{\mathrm{p}}}{\mathrm{k}_{\mathrm{p}}} \tag{12-4}
\end{equation*}
$$

where: $\mathrm{V}_{\mathrm{P}}=$ Current market value of the preferred stock
$D_{p}=$ Amount of the preferred stock dividend per period
$\mathrm{k}_{\mathrm{p}}=$ Required rate of return per period for this issue of preferred stock
Let's apply Equation 12-4 to an example. Suppose investors expect an issue of preferred stock to pay an annual dividend of $\$ 2$ per share. Investors in the market have evaluated the issuing company and market conditions and have concluded that 10 percent is a fair rate of return on this investment. The present value for one share of this preferred stock, assuming a 10 percent required rate of return follows:

$$
\begin{aligned}
\mathrm{V}_{\mathrm{P}} & =\left(\frac{\$ 2}{.10}\right) \\
& =\$ 20
\end{aligned}
$$

We find that for investors whose required rate of return $\left(k_{p}\right)$ is 10 percent, the value of each share of this issue of preferred stock is $\$ 20$.

## The Yield on Preferred Stock

The yield on preferred stock represents the annual rate of return that investors would realize if they bought the preferred stock for the current market price and then received the promised preferred dividend payments.

Like bond investors, preferred stock investors want to know the percentage yield they can expect if they buy shares of preferred stock at the current market price. That way, investors can compare the yield with the minimum they require to decide whether to invest in the preferred stock.

Fortunately, calculating the yield on preferred stock is considerably easier than calculating the YTM for a bond. To calculate the yield, we rearrange Equation 12-4 so that we solve for $k_{p}$. We are not solving for the value of the preferred stock, $V_{p}$, but rather are taking the market value as a given and solving for $\mathrm{k}_{\mathrm{p}}$ as follows:

Formula for the Yield on Preferred Stock

$$
\begin{equation*}
\mathrm{k}_{\mathrm{P}}=\frac{\mathrm{D}_{\mathrm{P}}}{\mathrm{~V}_{\mathrm{P}}} \tag{12-5}
\end{equation*}
$$

$\overline{{ }^{3} \text { Equation 8-5 is } P V}=\frac{P M T}{k}$. In Equation $12-4, \mathrm{~V}_{\mathrm{P}}$ substitutes for $\mathrm{PV}, \mathrm{D}_{\mathrm{p}}$ replaces PMT , and $\mathrm{k}_{\mathrm{p}}$ replaces k .
where: $\mathrm{k}_{\mathrm{p}}=$ Yield per period on investment that an investor can expect if the shares are purchased at the current market price, $\mathrm{P}_{\mathrm{p}}$, and if the preferred dividend, $D_{p}$, is paid forever
$D_{p}=$ Amount of the preferred stock dividend per period
$\mathrm{V}_{\mathrm{P}}=$ Current market value of the preferred stock
To illustrate how to find the yield using Equation 12-5, suppose Sure-Thing Corporation's preferred stock is selling for $\$ 25$ per share today and the dividend is $\$ 3$ a share. Now assume you are a potential buyer of Sure-Thing's preferred stock, so you want to find the expected annual percent yield on your investment. You know that the current market value of the stock, $\mathrm{V}_{\mathrm{p}}$, is $\$ 25$, and the stock dividend, $\mathrm{D}_{\mathrm{p}}$, is $\$ 3$. Applying Equation 12-5, you calculate the yield as follows:

$$
\begin{aligned}
\mathrm{k}_{\mathrm{P}} & =\frac{\$ 3}{\$ 25} \\
& =.12, \text { or } 12 \%
\end{aligned}
$$

You find that the yield for Sure-Thing's preferred stock is 12 percent. If your minimum required rate of return is less than or equal to 12 percent, you would invest in the Sure-Thing preferred stock. If your required rate of return is greater than 12 percent, you would look for another preferred stock that had a yield of more than 12 percent.

## Common Stock Valuation

The valuation of common stock is somewhat different from the valuation of bonds and preferred stock. Common stock valuation is complicated by the fact that common stock dividends are difficult to predict compared with the interest and principal payments on a bond or dividends on preferred stock. Indeed, corporations may pay common stock dividends irregularly or not pay dividends at all. Moreover, because owners of more than 50 percent of a corporation's stock have control over the affairs of the business and can force their will, the value of a controlling interest of common stock is relatively more valuable than the value of one share. This means that different procedures must be used to value controlling interests (or total common stockholders' equity) than are used to value one share. Often, ownership of less than 50 percent of a corporation's common stock can result in control if the percentage owned is significant and if the remaining shares are widely disbursed among investors not working in concert with each other.

In the sections that follow, we examine the most popular methods of valuing individual shares of common stock. We will then illustrate how these methods are applied to the valuation of total common stockholders' equity.

## Valuing Individual Shares of Common Stock

As with bonds and preferred stock, we value individual shares of common stock by estimating the present value of the expected future cash flows from the common stock. Those future cash flows are the expected future dividends and the expected price of the stock when the stock is sold. The discounted cash flow valuation model, Equation 12-1, adapted for common stock is shown in Equation 12-6:

Interactive Module
Go to www.textbookmedia. com and find the free companion material for this book. Follow the instructions there. See how the various input variables affect the estimated value.

The DCF Valuation Model Applied to Common Stock

$$
\begin{equation*}
P_{0}=\frac{D_{1}}{\left(1+k_{s}\right)^{1}}+\frac{D_{2}}{\left(1+k_{s}\right)^{2}}+\frac{D_{3}}{\left(1+k_{s}\right)^{3}}+\ldots+\frac{P_{n}}{\left(1+k_{s}\right)^{n}} \tag{12-6}
\end{equation*}
$$

where: $\quad P_{0}=$ Present value of the expected dividends, the current price of the common stock
$D_{1}, D_{2}, D_{3}$, etc. $=$ Common stock dividends expected to be received at the end of periods $1,2,3$, and so on until the stock is sold
$\mathrm{P}_{\mathrm{n}}=$ Anticipated selling price of the stock in n periods
$\mathrm{k}_{\mathrm{s}}=$ Required rate of return per period on this common stock investment

In practice, however, using Equation 12-6 to value shares of common stock is problematic because an estimate of the future selling price of a share of stock is often speculative. This severely limits the usefulness of the model.

Instead, some analysts use models that are a variation of Equation 12-6 that do not rely on an estimate of a stock's future selling price. We turn to those models next.

The Constant Growth Dividend Model Common stock dividends can grow at different rates. The two growth patterns we examine here are constant growth and nonconstant, or supernormal, growth.

The constant growth dividend model assumes common stock dividends will be paid regularly and grow at a constant rate. The constant growth dividend model (also known as the Gordon growth model because financial economist Myron Gordon helped develop and popularize it) is shown in Equation 12-7:

The Constant Growth Version of the Dividend Valuation Model

$$
\begin{equation*}
P_{0}=\frac{D_{1}}{k_{s}-g} \tag{12-7}
\end{equation*}
$$

where: $\quad P_{0}=$ Current price of the common stock
$D_{1}=$ Dollar amount of the common stock dividend expected one period from now
$\mathrm{k}_{\mathrm{s}}=$ Required rate of return per period on this common stock investment
$\mathrm{g}=$ Expected constant growth rate per period of the company's common stock dividends

Equation 12-7 is easy to use if the stock dividends grow at a constant rate. For example, assume your required rate of return ( $\mathrm{k}_{\mathrm{s}}$ ) for Wendy's common stock is 10 percent. Suppose your research leads you to believe that Wendy's Corporation will pay a $\$ 0.25$ dividend in one year $\left(\mathrm{D}_{1}\right)$, and for every year after the dividend will grow at a constant rate (g) of 8 percent a year. Using Equation 12-7, we calculate the present value of Wendy's common stock dividends as follows:

$$
\begin{aligned}
P_{0} & =\frac{\$ 0.25}{.10-.08} \\
& =\frac{\$ 0.25}{.02} \\
& =\$ 12.50
\end{aligned}
$$

We find that with a common stock dividend in one year of $\$ 0.25$, a constant growth rate of 8 percent, and a required rate of return of 10 percent, the value of the common stock is $\$ 12.50$.

In a no-growth situation, g , in the denominator of Equation 12-7 becomes zero. To value stocks that have no growth is particularly easy because the value is simply the expected dividend $\left(D_{1}\right)$ divided by $k_{s}$.

The Nonconstant, or Supernormal, Growth Model In addition to the constant growth dividend cash flow pattern that we discussed in the previous section, some companies have very high growth rates, known as supernormal growth of the cash flows. Valuing the common stock of such companies presents a special problem because high growth rates cannot be sustained indefinitely. A young high-technology firm may be able to grow at a 40 percent rate per year for a few years, but that growth must slow down because it is not sustainable given the population and productivity growth rates. In fact, if the firm's growth rate did not slow down, its sales would surpass the gross domestic product of the entire nation over time. Why? The company has a 40 percent growth rate that will compound annually, whereas the gross domestic product may grow at a 4 percent compounded average annual growth rate.

The constant growth dividend model for common stock, Equation 12-7, then, must be adjusted for those cases in which a company's dividend grows at a supernormal rate that will not be sustained over time. We do this by dividing the projected dividend cash flow stream of the common stock into two parts: the initial supernormal growth period and the next period, in which normal and sustainable growth is expected. We then calculate the present value of the dividends during the fast-growth time period first. Then we solve for the present value of the dividends during the constant growth period that are a perpetuity. The sum of these two present values determines the current value of the stock.

To illustrate, suppose Supergrowth Corporation is expected to pay an annual dividend of $\$ 2$ per share one year from now and that this dividend will grow at a 30 percent annual rate during each of the following four years (taking us to the end of year 5). After this supernormal growth period, the dividend will grow at a sustainable 5 percent rate each year beyond year 5. The cash flows are shown in Figure 12-3.

Figure 12-3 Timeline of Supergrowth Common Stock Dividend with Initial Supernormal Growth


The valuation of a share of Supergrowth Corporation's common stock is described in the following three steps.

Step 1: Add the present values of the dividends during the supernormal growth period. Assume that the required rate of return, $\mathrm{k}_{\mathrm{s}}$, is 14 percent.

$$
\begin{array}{r}
\$ 2.00 \times 1 / 1.14^{1}=\$ 1.75 \\
\$ 2.60 \times 1 / 1.14^{2}=\$ 2.00 \\
\$ 3.38 \times 1 / 1.14^{3}=\$ 2.28 \\
\$ 4.39 \times 1 / 1.14^{4}=\$ 2.60 \\
\$ 5.71 \times 1 / 1.14^{5}=\$ 2.97 \\
\sum=\$ 11.60
\end{array}
$$

Step 2: Calculate the sum of the present values of the dividends during the normal growth period, from $\mathrm{t}_{6}$ through infinity in this case. To do this, pretend for a moment that $\mathrm{t}_{6}$ is $\mathrm{t}_{1}$. The present value of the dividend growing at the constant rate of 5 percent to perpetuity could be computed using Equation 12-7.

$$
P_{0}=\frac{D_{1}}{k_{s}-g}
$$

Substituting our values we would have:

$$
\begin{aligned}
P_{0} & =\frac{\$ 6.00}{.14-.05} \\
& =\$ 66.67
\end{aligned}
$$

Because the $\$ 6.00$ dividend actually occurs at $\mathrm{t}_{6}$ instead of $\mathrm{t}_{1}$, the $\$ 66.67$ figure is not a $\mathrm{t}_{0}$ value, but rather $a \mathrm{t}_{5}$ value. Therefore, it needs to be discounted back five years at our required rate of return of 14 percent. This gives us $\$ 66.67 \times\left(1 / 1.14^{5}\right)=\$ 34.63$. The result of $\$ 34.63$ is the present value of the dividends from the end of year 6 through infinity.

Step 3: Finally we add the present values of the dividends from the supernormal growth period and the normal growth period. In our example we add $\$ 11.60$ $+\$ 34.63=\$ 46.23$. The sum of $\$ 46.23$ is the appropriate market price of Supergrowth Corporation's common stock, given the projected dividends and the 14 percent required rate of return on those dividends.

The P/E Model Many investment analysts use the price to earnings, or P/E, ratio to value shares of common stock. As we discussed in Chapter 6, the P/E ratio is the price per share of a common stock divided by the company's earnings per share:

$$
\mathrm{P} / \mathrm{E} \text { ratio }=\frac{\text { Price per Share }}{\text { Earnings per Share }}
$$

The P/E ratio indicates how much investors are willing to pay for each dollar of a stock's current earnings. So, a P/E ratio of 20 means that investors are willing to pay $\$ 20$ for $\$ 1$ of a stock's earnings. A high P/E ratio indicates that investors believe the stock's earnings will increase, or that the risk of the stock is low, or both.

Financial analysts often use a P/E model to estimate common stock value for businesses that are not public. First, analysts compare the P/E ratios of similar companies within an industry to determine an appropriate $\mathrm{P} / \mathrm{E}$ ratio for companies in that industry. Second, analysts calculate an appropriate stock price for firms in the industry by multiplying each firm's earnings per share (EPS) by the industry average P/E ratio. The P/E model formula, Equation 12-8, follows:

The P/E Model

$$
\begin{equation*}
\text { Appropriate Stock Price }=\text { Industry P/E Ratio } \times \text { EPS } \tag{12-8}
\end{equation*}
$$

To illustrate how to apply the P/E model, let's value the common stock of the Zumwalt Corporation. Suppose that Zumwalt Corporation has current earnings per share of $\$ 2$ and, given the risk and growth prospects of the firm, the analyst has determined that the company's common stock should sell for 15 times current earnings. Applying the P/E model, we calculate the following price for Zumwalt Corporation's common stock:

$$
\begin{aligned}
\text { Appropriate Stock Price } & =\text { Industry P/E Ratio } \times \text { EPS } \\
& =15 \times \$ 2 \\
& =\$ 30
\end{aligned}
$$

Our P/E model calculations show that $\$ 30$ per share is the appropriate price for common stock that has a $\$ 2$ earnings per share and an industry P/E ratio of 15 . The industry $\mathrm{P} / \mathrm{E}$ ratio would be adjusted up or down according to the individual firm's growth prospects and risk relative to the industry norm.

## Valuing Total Common Stockholders' Equity

As we said earlier, different procedures must be used to value total common stockholders' equity than are used to value one share of common stock. The primary reason for this is that owners of some large percentage of a corporation's stock have control over the affairs of the business and can force their will on the remaining shareholders. This makes the value of a controlling interest of common stock relatively more valuable than a noncontrolling interest. Therefore, to value controlling interests of common stock, or total stockholders' equity, we must use models that account for this "control premium." In the sections that follow, we examine the most popular methods of valuing total stockholders' equity.

Book Value One of the simplest ways to value total common stockholders' equity is to subtract the value of the firm's liabilities and preferred stock, if any, as recorded on the balance sheet from the value of its assets. The result is the book value, or net worth.

> Book Value of Common Equity

The book value approach has severe limitations. The asset values recorded on a firm's balance sheet usually reflect what the current owners originally paid for the assets, not the current market value of the assets. Due to these and other limitations, the book value is rarely used to estimate the market value of common equity.

Liquidation Value The liquidation value and book value valuation methods are similar, except that the liquidation method uses the market values of the assets and liabilities, not book values, as in Equation 12-9. The market values of the assets are the amounts the assets would earn on the open market if they were sold (or liquidated). The market values of the liabilities are the amounts of money it would take to pay off the liabilities.

The liquidation value is the amount each common stockholder would receive if the firm closed, sold all assets and paid off all liabilities and preferred stock, and distributed the net proceeds to the common stockholders.

Although more reliable than book value, liquidation value is a worst-case valuation assessment. A company's common stock should be worth at least the amount generated at liquidation. Because liquidation value does not consider the earnings and cash flows the firm will generate in the future, it may provide misleading results for companies that have significant future earning potential.

## The Free Cash Flow DCF Model

The Free Cash Flow DCF Model is very similar to the nonconstant, or supernormal, dividend growth model discussed earlier, but instead of discounting dividend cash flows, the free cash flow model discounts the total cash flows that would flow to the suppliers of the firm's capital. Once the present value of those cash flows is determined, liabilities and preferred stock (if any) are subtracted to arrive at the present value of common stockholders' equity.

Free Cash Flows Free cash flows represent the total cash flows from business operations that flow to the suppliers of a firm's capital each year. In forecasts, free cash flows are calculated as follows:

Cash Revenues

- Cash Expenses
= Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA)
- Depreciation and Amortization
= Earnings Before Interest and Taxes (EBIT)
- Federal and State Income Taxes
$=$ Net Operating Profit After-Tax (NOPAT)
+ Add Back Depreciation and Amortization
- Capital Expenditures
- New Net Working Capital
= Free Cash Flow
Free cash flow represents those amounts in each operating period that are "free" to be distributed to the suppliers of the firm's capital-that is, the debt holders, the preferred stockholders, and the common stockholders. In the previous calculation, you can see that free cash flow is that amount remaining after cash expenses, income taxes, capital expenditures, and new net working capital are subtracted from cash revenues.

A Real World Example In July 2001, the Abiomed Corporation of Danvers, Massachusetts, received a lot of publicity when the company's AbioCor self-contained artificial heart was implanted in a terminally ill patient, marking the first time that such a device was used on a human being. Let us put ourselves in the shoes of someone valuing this company on April 1, 2006, and that you work for a firm that is interested in acquiring Abiomed. In support of the acquisition analysis, you have been asked to prepare an estimate of the market value of the firm's common equity. The methodology you have chosen is the discounted free cash flow model.

Following a lengthy analysis of the artificial heart market, the medical equipment industry, and Abiomed's financial statements, you produce the discounted free cash flow forecast and valuation shown in Figure 12-4. In the following paragraphs we explain the procedure. The forecasting variables that form the basis for the valuation are listed at the top of Figure 12-4 (these are the product of your lengthy analysis). For convenience, we have numbered each line in the figure at the left-hand side.

The "Actual 2006" column in Figure 12-4 contains Abiomed's operating results for the fiscal year ended March 31, 2006, as recorded on the firm's SEC Form 10-K. ${ }^{4}$ The remaining columns contain the forecast for the next 10 years.

Product revenues (line 12) are expected to accelerate from 20 to 50 percent annual growth over four years, with the growth rate decreasing 10 percentage points a year after that until the ninth year of the forecast, when revenue growth settles out at an expected long-term growth rate of 5 percent a year (the growth factor is on line 1). Funded research and development revenue (line 13), on the other hand, is expected to decrease 50 percent a year until it is almost negligible after 10 years (the growth factor is on line 2). These factors produce total revenues (line 14) exceeding $\$ 52$ million in 2007 and $\$ 376$ million in 2016.

Direct costs of revenues on line 15 are a function of the expected gross profit margin on line 3. In Abiomed's forecast, 2006's gross margin of 77 percent is extended for each year through 2016. This produces gross profits (see line 16) ranging from just over $\$ 40$ million in 2007 to over $\$ 289$ million in 2016. Given the forecasted gross profit figures, direct costs on line 15 are "plugged" by subtracting gross profit from total revenues.

Research and development expenses (line 17) are expected to grow by 10 percent in 2007 and then to decrease by 10 percent a year through 2016. Selling, general, and administrative expenses (line 18) are forecast as a percentage of revenue, starting at 70 percent of revenue in 2007 (the same percentage as in 2006) and declining to 54 percent in 2016. Subtracting these operating expenses from gross profit leaves earnings before interest, taxes, depreciation, and amortization (EBITDA on line 19) of negative $\$ 15.176$ million in 2007, positive $\$ 2.067$ million in 2010, and positive $\$ 78.966$ million in 2016.

Although they are noncash expenses, depreciation and amortization are included in discounted free cash flow forecasts in order to calculate income tax expense. In the case of Abiomed, depreciation and amortization expense (line 20) is forecast to be 6 percent of revenue each year. Subtracting depreciation and amortization expense from EBITDA produces earnings before interest and taxes (EBIT), also known as operating income (see line 21).

As shown in Figure 12-4, line 22, Abiomed has $\$ 94.159$ million in tax-loss carryforwards at the beginning of FY 2006. Operating income was a negative $\$ 16.985$ million in 2006, so $\$ 94.159$ million $+\$ 16.985$ million $=\$ 111.144$ million in tax-loss

[^1]Figure 12-4 Discounted Free Cash Flow Forecast and Valuation for Abiomed (in \$ thousands)


| Years Ending March 31 |  |  |  |  |  |  |
| ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Forecast |  |  |  |  |  |  |

## Years Ending March 31

 Forecast| $\mathbf{2 0 0 9}$ | $\mathbf{2 0 1 0}$ | $\mathbf{2 0 1 1}$ | $\mathbf{2 0 1 2}$ | $\mathbf{2 0 1 3}$ | $\mathbf{2 0 1 4}$ | $\mathbf{2 0 1 5}$ | $\mathbf{2 0 1 6}$ |
| ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| $\$ 94,615$ | $\$ 141,923$ | $\$ 198,692$ | $\$ 258,300$ | $\$ 309,960$ | $\$ 340,956$ | $\$ 358,004$ | $\$ 375,904$ |
| 254 | 229 | 206 | 185 | 167 | 150 | 135 | 122 |
| $\mathbf{9 4 , 8 6 9}$ | $\mathbf{1 4 2 , 1 5 2}$ | $\mathbf{1 9 8 , 8 9 8}$ | $\mathbf{2 5 8 , 4 8 5}$ | $\mathbf{3 1 0 , 1 2 7}$ | $\mathbf{3 4 1 , 1 0 6}$ | $\mathbf{3 5 8 , 1 3 9}$ | $\mathbf{3 7 6 , 0 2 6}$ |


| 21,820 | 32,695 | 45,747 | 59,452 | 71,329 | 78,454 | 82,372 | 86,486 |
| ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| $\mathbf{7 3 , 0 4 9}$ | $\mathbf{1 0 9 , 4 5 7}$ | $\mathbf{1 5 3 , 1 5 1}$ | $\mathbf{1 9 9 , 0 3 3}$ | $\mathbf{2 3 8 , 7 9 8}$ | $\mathbf{2 6 2 , 6 5 2}$ | $\mathbf{2 7 5 , 7 6 7}$ | $\mathbf{2 8 9 , 5 4 0}$ |
| $\mathbf{1 4 , 9 1 5}$ | 13,424 | 12,082 | 10,874 | 9,787 | 8,808 | 7,927 | 7,134 |


| 64,608 | 93,966 | 127,499 | 160,526 | 186,394 | 198,191 | 200,925 | 203,440 |
| ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| $(\mathbf{6 , 4 7 4 )}$ | $\mathbf{2 , 0 6 7}$ | $\mathbf{1 3 , 5 7 0}$ | $\mathbf{2 7 , 6 3 3}$ | $\mathbf{4 2 , 6 1 7}$ | $\mathbf{5 5 , 6 5 3}$ | $\mathbf{6 6 , 9 1 5}$ | $\mathbf{7 8 , 9 6 6}$ |
| 5,692 | 8,529 | 11,934 | 15,509 | 18,608 | 20,466 | 21,488 | 22,562 |
| $(\mathbf{1 2 , 1 6 6})$ | $\mathbf{( 6 , 4 6 2 )}$ | $\mathbf{1 , 6 3 6}$ | $\mathbf{1 2 , 1 2 4}$ | $\mathbf{2 4 , 0 0 9}$ | $\mathbf{3 5 , 1 8 7}$ | $\mathbf{4 5 , 4 2 7}$ | $\mathbf{5 6 , 4 0 4}$ |
| $(45,421)$ | $(157,587)$ | $(164,049)$ | $(162,413)$ | $(150,289)$ | $(126,280)$ | $(91,093)$ | $(45,666)$ |
| $(12,166)$ | $(6,462)$ | 0 | 0 | 0 | 0 | 0 | 10,738 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,295 |


| $\mathbf{( 1 2 , 1 6 6 )}$ | $\mathbf{( 6 , 4 6 2 )}$ | $\mathbf{1 , 6 3 6}$ | $\mathbf{1 2 , 1 2 4}$ | $\mathbf{2 4 , 0 0 9}$ | $\mathbf{3 5 , 1 8 7}$ | $\mathbf{4 5 , 4 2 7}$ | $\mathbf{5 2 , 1 0 9}$ |
| ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| 5,692 | 8,529 | 11,934 | 15,509 | 18,608 | 20,466 | 21,488 | 22,562 |
| $(2,365)$ | $(2,129)$ | $(1,916)$ | $(1,724)$ | $(1,552)$ | $(1,397)$ | $(1,257)$ | $(1,131)$ |
| $(2,703)$ | $(4,731)$ | $(5,677)$ | $(5,961)$ | $(5,166)$ | $(3,100)$ | $(1,705)$ | $(1,790)$ |
| $\mathbf{( \$ \mathbf { 1 1 , 5 4 2 } )}$ | $\mathbf{( \$ 4 , 7 9 3 )}$ | $\mathbf{\$} \mathbf{5 , 9 7 7}$ | $\mathbf{\$} \mathbf{1 9 , 9 4 8}$ | $\mathbf{\$} \mathbf{3 5 , 8 9 9}$ | $\mathbf{\$} \mathbf{5 1 , 1 5 6}$ | $\mathbf{\$}$ | $\mathbf{6 3 , 9 5 3}$ |
|  |  | $\mathbf{\$ 7 1 , 7 5 0}$ |  |  |  |  |  |
| $(6,679)$ | $(2,311)$ | 2,402 | 6,681 | 10,019 | 11,897 | 12,395 | 92,704 |

carryforwards are available at the beginning of 2007. This situation continues until 2016, when the carryforwards are finally used up, and Abiomed reports $\$ 10.738$ million in net taxable earnings. After 2016, operating income is fully taxable.

The forecast assumes a combined federal and state income tax rate of 40 percent (see line 9). Applying this rate to Abiomed's net taxable earnings (line 23) in 2016, and $\$ 0$ to the earlier years, produces the income tax expenses shown on line 24. Subtracting taxes from EBIT produces the company's net operating profit after tax (NOPAT on line 25), which is negative $\$ 18.314$ million in 2007 rising to positive $\$ 52.109$ million in 2016.

Once NOPAT has been determined, three further adjustments are necessary to calculate free cash flow. First, on line 26, depreciation and amortization are added back to NOPAT, because these noncash items were subtracted earlier only for the purpose of calculating income tax expense. Next, on line 27, expected capital expenditures are subtracted. Capital expenditures are amounts expected to be spent to procure new plant and equipment. For this forecast, we assume that your research indicates that Abiomed will need to spend about the same amount on plant and equipment in 2007 than it did in 2006 (see line 7), and that this spending may be decreased 10 percent a year in each year after 2007. The resulting capital expenditure budget, shown in Figure 12-4, line 27, gradually decreases from $\$ 2.92$ million in 2007 to just over \$1.13 million in 2016.

Finally, on line 28, new net working capital investment is subtracted. Net working capital is the difference between current assets and current liabilities that must be financed from long-term capital sources (debt and equity). When businesses grow, they typically need more working capital in the form of cash, inventory, and receivables, and not all of it can be financed spontaneously from current liabilities. For this reason, the company's long-term debt and equity holders must invest additional amounts each year to "take up the slack." In the case of Abiomed, we will assume that your research indicates that the typical ratio of net working capital to sales in the medical equipment industry is 10 percent (see line 8 ). In other words, for every $\$ 10$ of new sales a company realizes, $\$ 1$ of new net working capital will be needed. In Figure $12-4$, line 28 , this is calculated by multiplying the difference in product revenue each year by .10. In 2007, for example, $(\$ 51,986-\$ 43,322) \times .10$, and rounded to even thousands $=\$ 866,000$ of new net working capital is needed. The remaining years are calculated similarly.

After all the calculations have been completed, the resulting figures on line 29 represent amounts that are free to be distributed to the suppliers of Abiomed's capital, either in the form of interest to the debt holders or dividends to the stockholders. These free cash flows range from negative $\$ 18.962$ million in 2007 to positive $\$ 71.750$ million in 2016.

In the previous paragraphs, we explicitly forecast the free cash flows for 2007 through 2016. But what about the years after that? After all, Abiomed is not expected to suddenly cease operating at the end of 2016 but to continue operating indefinitely into the future as a going concern.

To forecast the free cash flows in the years beyond 2016, we rely on a variation of the constant growth dividend valuation model, Equation 12-7. After 2016, Abiomed's free cash flows are expected to grow at a constant rate of 5 percent a year indefinitely. We adapt Equation 12-7 to value these constantly growing free cash flows as follows:

Constant Growth Free Cash Flow Valuation Model

$$
\begin{equation*}
V_{\text {feft }}=\frac{\mathrm{FCF}_{\mathrm{t}}(1+\mathrm{g})}{\mathrm{k}-\mathrm{g}} \tag{12-10}
\end{equation*}
$$

where: $V_{\text {feft }}=$ the value of future free cash flows at time $t$
$\mathrm{FCF}_{\mathrm{t}}=$ free cash flow at time t
$\mathrm{k}=$ the discount rate per period
$\mathrm{g}=$ the long-term constant growth rate per period of free cash flows
According to Equation 12-10, and assuming a discount rate of 20 percent (see line 11), ${ }^{5}$ the value as of the end of 2016 of Abiomed's free cash flows in years 2017 and beyond, in thousands, would be

$$
\begin{aligned}
\mathrm{V}_{\text {fef } 2016} & =\frac{\$ 71,750(1+.05)}{.20-.05} \\
& =\$ 502,250
\end{aligned}
$$

The value of the free cash flows at the end of 2016 and beyond is called the terminal value of the company's operations at the end of 2016. The amount is shown in Figure $12-4$ on line 30 .

On line 31, the present value of the free cash flows is calculated using Equation $8-2 \mathrm{a}$, assuming a discount rate of 20 percent. The present values are then summed up on line 32 to produce the total value of Abiomed's operations on April 1, 2006, which is $\$ 100.140$ million.

Let us say a few words about this value before proceeding. As we said earlier, the present value of the company's free cash flows ( $\$ 100.140$ million in the case of Abiomed) represents the market value of the firm's core income-producing operations. In the world of finance and investing, this is sometimes called the firm's enterprise value. It is NOT the total market value of the entire company, however, or the total market value of the company's assets, because the current, or nonoperating, assets of the company have not yet been accounted for.

We shall have more to say about this issue later in the chapter in the section on valuing complete businesses. For now, just remember that the present value of the company's free cash flows equals the market value of the firm's core income-producing operations (called enterprise value). The relationship is illustrated in Figure 12-5.

In the analysis in Figure 12-4, we have calculated the market value of Abiomed's operating, or income-producing assets, as shown in the lower-left portion of Figure 12-5. Observing Figure 12-5, it is clear that to obtain the value of Abiomed's common stock (which is our ultimate goal), we must take line 32 and add the value of the firm's current assets and then subtract the values of current liabilities, long-term debt, and preferred stock. In Figure 12-4, this is done on lines 33, 34, 35, and 36. The values for current assets, current liabilities, long-term debt, and preferred stock were taken from Abiomed's March 31, 2006, balance sheet. ${ }^{6}$

Line 37 of Figure 12-4 shows the final result after adding Abiomed's current assets ( $\$ 46.443$ million) and subtracting current liabilities ( $\$ 8.739$ million), long-term debt ( $\$ .310$ million), and preferred stock ( $\$ 0$ ) from the present value of the firm's operations

[^2]
## Take Note

Do not confuse the market value of Abiomed's common equity, as calculated here, with the actual price of the firm's common stock on the open market. The \$137.534 million is what the company's stock is worth to an investor with a required rate of return of 20 percent a year, given the assumptions in the model in Figure 12-4. Stock traders in the market may be making any number of different assumptions about Abiomed and may have different required rates of return. As a result, the actual price of Abiomed's stock in the market may be completely different than the intrinsic value shown here.?

Figure 12-5 Total Market Value of a Business

This figure is an extension of Figure 12-1, showing how total assets are made up of operating (income-producing) assets plus nonoperating (current) assets.

Total Market Value of a Business

| Market Value of <br> Nonoperating <br> (Current) Assets |  |
| :---: | :---: |
|  | Present Value of Current Liabilities |
| Market Value <br> of Operating <br> (Income-Producing) <br> Assets | Present Value of Long-Term Debt |
| Present Value of Preferred Stock | Present Value <br> of Common Stock |

( $\$ 100.140$ million). This final result, $\$ 137.534$ million, is the total market value of Abiomed's common equity as of April 1, 2006.

## The Yield on Common Stock

We calculate the yield for common stock by rearranging the terms in Equation 12-7 to arrive at the constant growth dividend model, as shown in Equation 12-11:

The Yield, or Total Return, on Common Stock

$$
\begin{equation*}
\mathrm{k}_{\mathrm{s}}=\frac{\mathrm{D}_{1}}{\mathrm{P}_{0}}+\mathrm{g} \tag{12-11}
\end{equation*}
$$

where: $D_{1}=$ Amount of the common stock dividend anticipated in one period
$\mathrm{P}_{0}=$ Current market price of the common stock
$\mathrm{g}=$ Expected constant growth rate of dividends per period
$\mathrm{k}_{\mathrm{s}}=$ Expected rate of return per period on this common stock investment

Equation 12-11 is also called the formula for an investor's total rate of return from common stock. The stock's dividend yield is the term $\mathrm{D}_{1} / \mathrm{P}_{0}$.

To demonstrate how Equation 12-11 works, suppose you found that the price of BP common stock today was $\$ 52$ per share. Then suppose you believe that BP will pay a common stock dividend next year of $\$ 4.80$ a share, and the dividend will grow each year at a constant annual rate of 4 percent. If you buy one share of BP common stock at the listed price of $\$ 52$, your expected annual percent yield on your investment will be

$$
\begin{aligned}
\mathrm{k}_{\mathrm{s}} & =\frac{\mathrm{D}_{1}}{\mathrm{P}_{0}}+\mathrm{g} \\
& =\frac{\$ 4.80}{\$ 52}+.04 \\
& =.0923+.04 \\
& =.1323, \text { or } 13.23 \%
\end{aligned}
$$

If your minimum required rate of return for BP common stock, considering its risk, were less than 13.23 percent, you would proceed with the purchase. Otherwise you would look for another stock that had an expected return appropriate for its level of risk.

## Valuing Complete Businesses

Up to this point in the chapter, we have dealt with the values of business components as shown in the right-hand "pillar" in Figure 12-1. Now we turn our attention to valuing the complete business all at once, or the total value of the business's assets as shown in the left-hand "pillar" in Figure 12-1.

## The Free Cash Flow DCF Model Applied to a Complete Business

As it turns out, using the Free Cash Flow Model to value a complete business is quite straightforward once you have learned how to use it to value common equity. This is because the Free Cash Flow Model values the complete business as a part of the procedure to value common equity. Refer again to Figure 12-5, which shows that the value of a complete business is the sum of the values of the operating, or income-producing, assets plus the value of the nonoperating, or current, assets. All that is necessary to use the Free Cash Flow Model to value a complete business is to add the value of the company's current assets, taken from the most recent balance sheet, ${ }^{8}$ to the value of the company's operations, calculated exactly the same way as in Figure 12-4 for Abiomed. Following this procedure, the complete business value for Abiomed would be

Present value of company operations (or enterprise value)
\$121.067 million

+ Value of current assets
$=$ Complete business value of Abiomed
$\frac{46.443 \text { million }}{\$ 167.510 \text { million }}$ (see Figure 12-4, lines 32 and 33)


## The Replacement Value of Assets Method

The replacement value of assets valuation method is similar to the liquidation model covered earlier in the chapter. According to the concept underlying the model, the market value of a complete business cannot exceed the amount it would take to buy all of the firm's assets on the open market. For example, you would not be willing to pay the owners of Abiomed $\$ 167.510$ million for the company if you could buy all the assets necessary to duplicate the company for $\$ 100$ million.

[^3]Although it is simple in concept, the replacement value of assets method is not often applied to complete business valuations for two reasons:

1. It is frequently very difficult to locate similar assets for sale on the open market.
2. Some of a business's assets are difficult to define and quantify (how do you
quantify a business's reputation, for example, or the strength of its brands?).
Although it is difficult to use the replacement value of assets method to value a complete business, the model can be quite useful for estimating the value of individual assets in a business. For example, the value of a company's nonproprietary software can be estimated by listing the various programs in use and then noting the prices of those programs in retail stores, catalogs, and on the Internet. The sum of the lowest prices at which the programs could be obtained is the replacement value of the company's software. In another example, it is possible to estimate the value of a company's machinery and equipment by calculating what it would cost to replace all the machinery and equipment. This is normally done by noting the prices for machinery and equipment of similar age and in similar condition on the open market. Alternatively, analysts sometimes note the prices of new machinery and equipment and adjust those prices to reflect the age and condition of the machinery and equipment belonging to the company.

Individual asset valuations of this type are most often employed when one business buys another and it is necessary to allocate the purchase price among the assets purchased. In such cases, the "fair market value" of the individual assets is estimated (using the replacement value of assets method, the discounted free cash flow method, or some other method), and any amounts remaining are assigned to "goodwill."

## What's Next

In this chapter we investigated valuation methods for bonds, preferred stock, common stock, and complete businesses. The valuation methods applied risk and return, and time value of money techniques learned in Chapters 7 and 8, respectively. In the next chapter, we will explore capital structure issues.

## Summary

1. Explain the importance of business valuation.

When corporations contemplate selling their businesses, they do not want to undervalue the businesses because they want to raise the most money possible. Likewise, would-be purchasers of businesses use valuation methods to avoid paying more than the businesses are worth.
2. Discuss the concept of business valuation.

To value any business, business asset, or security, we apply risk and return and time value of money techniques. In sum, the value of a business, asset, or security is the present value of the expected future cash flows. Bond cash flows are the periodic interest payments and the principal at maturity. Stock and business cash flows come from the future earnings that the assets produce for the firm, usually leading to cash dividend payments.

To value businesses, assets, and securities, investors and financial managers use a general valuation model to calculate the present value of the expected future cash flows. That model incorporates risk and return, and time value of money concepts.
3. Compute the market value and the yield to maturity of a bond.

The market value of a bond is the sum of the present values of the coupon interest payments plus the present value of the face value to be paid at maturity, given a market's required rate of return.

The yield to maturity of a bond (YTM) is the average annual rate of return that investors realize if they buy a bond for a certain price, receive the promised interest payments and principal on time, and reinvest the interest payments at the YTM rate.

A bond's market price and its YTM vary inversely. That is, when the YTM rises, the market price falls, and vice versa. When a bond has a YTM greater than its coupon rate, it sells at a discount to its face value. When the YTM is equal to the coupon rate, the market price equals the face value. When the YTM is less than the coupon rate, the bond sells at a premium over face value.
4. Compute the market value and expected yield of preferred stock.

The market value of preferred stock is the present value of the stream of preferred stock dividends, discounted at the market's required rate of return for that investment. Because the dividend cash flow stream is a perpetuity, we adapt the present value of a perpetuity formula, Equation 8-5, to value preferred stock.

The yield on preferred stock represents the annual rate of return that investors realize if they buy the stock for the current market price and then receive the promised dividend payments on time.
5. Compute the market value per share of common stock.

The market value of common stock is estimated in a number of ways, including (1) finding the present value of all the future dividends the stock is expected to pay, discounted at the market's required rate of return for that stock; and (2) finding the price implied, given the level of earnings per share and the appropriate $\mathrm{P} / \mathrm{E}$ ratio. The dividend growth model and the $\mathrm{P} / \mathrm{E}$ valuation approaches assume the firm will be a going concern. That is, the models value the future cash flows that a firm's assets are expected to produce. Two versions of the dividend growth model are commonly used, one for situations in which the future growth of the firm's dividends is expected to be constant, and the other for situations in which the future growth of the firm's dividends is expected to be nonconstant, or supernormal. Supernormal growth implies a period of high growth followed by a settling out at the long-term constant growth rate.
6. Compute the market value of total common equity.

The market value of total common equity is estimated in a number of ways, including (1) estimating common equity value based on the book value of the firm's assets as recorded on the balance sheet, less all liabilities and preferred stock (if any); (2) estimating the value of the firm's assets if they were to be liquidated on the open market and all claims on the firm were to be paid off; and (3) employing a discounted free cash flow model that calculates the present value of expected free cash flows to the suppliers of the firm's capital. The discounted free cash flow model is similar to the nonconstant dividend growth model in that it involves making a forecast of free cash flows during a specified period (usually 7 to 10 years). This is followed by the calculation of the value of the cash flows expected to be received after the forecast period (called the terminal
value). The present values of the free cash flows and the present value of the terminal value are summed to produce the total present value of the firm's operations. This figure, in turn, is adjusted by adding current assets and subtracting current liabilities, long-term debt, and preferred stock (if any) to produce the total value of common equity.
7. Compute the expected yield of common stock.

The yield on common stock is the percentage return investors can expect if they purchase the stock at the prevailing market price and receive the expected cash flows. It is calculated by solving for k in the constant growth dividend model.
8. Compute the value of a complete business.

The market value of a complete business can be found by applying the discounted free cash flow model used to estimate the value of common equity. In the complete business application, current assets are added to the present value of the firm's operations to produce the value of the complete business. Sometimes the value of complete businesses can also be found by calculating the amount that would be required to replace the firm's assets, but this method is usually more effective when applied to the valuation of individual business assets.

## Equations Introduced in This Chapter

Equation 12-1. The Discounted Cash Flow Valuation Model:

$$
\mathrm{V}_{0}=\frac{\mathrm{CF}_{1}}{(1+\mathrm{k})^{1}}+\frac{\mathrm{CF}_{2}}{(1+\mathrm{k})^{2}}+\frac{\mathrm{CF}_{3}}{(1+\mathrm{k})^{3}}+\ldots+\frac{\mathrm{CF}_{\mathrm{n}}}{(1+\mathrm{k})^{\mathrm{n}}}
$$

where: $\quad \mathrm{V}_{0}=$ Present value of the anticipated cash flows from the asset, its current value
$\mathrm{CF}_{1,2,3 \text {, and } \mathrm{n}}=$ Cash flows expected to be received one, two, three, and so on up to n periods in the future
$\mathrm{k}=$ Discount rate, the required rate of return per period
Equation 12-2. The Bond Valuation Formula (Algebraic Method):

$$
\mathrm{V}_{\mathrm{B}}=\mathrm{INT} \times\left[\frac{1-\frac{1}{\left(1+\mathrm{k}_{\mathrm{d}}\right)^{n}}}{\mathrm{k}_{\mathrm{d}}}\right]+\frac{\mathrm{M}}{\left(1+\mathrm{k}_{\mathrm{d}}\right)^{\mathrm{n}}}
$$

$$
\text { where: } \quad \begin{aligned}
\mathrm{V}_{\mathrm{B}}= & \text { Current market value of the bond } \\
\mathrm{INT} & =\text { Dollar amount of each periodic interest payment } \\
\mathrm{n}= & \text { Number of times the interest payment is received (which is } \\
& \text { also the number of periods until maturity) } \\
\mathrm{M}= & =\text { Principal payment received at maturity } \\
\mathrm{k}_{\mathrm{d}}= & \text { Required rate of return per period on the bond debt } \\
& \text { instrument }
\end{aligned}
$$

Equation 12-3. The Bond Valuation Formula (Table Method):

$$
\mathrm{V}_{\mathrm{B}}=\left(\mathrm{INT} \times \mathrm{PVIFA}_{\mathrm{k}, \mathrm{n}}\right)+\left(\mathrm{M} \times \mathrm{PVIF}_{\mathrm{k}, \mathrm{n}}\right)
$$

where: PVIFA $_{\mathrm{k}, \mathrm{n}}=$ Present Value Interest Factor for an Annuity from Table IV
$\mathrm{PVIF}_{\mathrm{k}, \mathrm{n}}=$ Present Value Interest Factor for a single amount from Table II

Equation 12-4. The Formula for the Present Value of Preferred Stock:

$$
\mathrm{V}_{\mathrm{P}}=\frac{\mathrm{D}_{\mathrm{p}}}{\mathrm{k}_{\mathrm{p}}}
$$

where: $\quad V_{\mathrm{P}}=$ Current market value of the preferred stock
$D_{p}=$ Amount of the preferred stock dividend per period
$\mathrm{k}_{\mathrm{p}}=$ Required rate of return for this issue of preferred stock
Equation 12-5. Formula for the Yield on Preferred Stock:

$$
\mathrm{k}_{\mathrm{p}}=\frac{\mathrm{D}_{\mathrm{p}}}{\mathrm{~V}_{\mathrm{P}}}
$$

where: $\quad \mathrm{k}_{\mathrm{p}}=$ Yield per period on investment that an investor can expect if the shares are purchased at the current market price, $\mathrm{P}_{\mathrm{p}}$ and if the preferred dividend, $D_{p}$, is paid forever
$D_{p}=$ Amount of the preferred stock dividend per period
$\mathrm{V}_{\mathrm{P}}=$ Current market value of the preferred stock
Equation 12-6. The DCF Valuation Model Applied to Common Stock:

$$
P_{0}=\frac{D_{1}}{\left(1+k_{s}\right)^{1}}+\frac{D_{2}}{\left(1+k_{s}\right)^{2}}+\frac{D_{3}}{\left(1+k_{s}\right)^{3}}+\ldots+\frac{P_{n}}{\left(1+k_{s}\right)^{n}}
$$

where: $\quad P_{0}=$ Present value of the expected dividends, the current price of the common stock
$\mathrm{D}_{1}, \mathrm{D}_{2}, \mathrm{D}_{3}$, etc. $=$ Common stock dividends expected to be received at the end of periods $1,2,3$, and so on until the stock is sold
$\mathrm{P}_{\mathrm{n}}=$ Anticipated selling price of the stock in n periods
$\mathrm{k}_{\mathrm{s}}=$ Required rate of return per period on this common stock investment

Equation 12-7. The Constant Growth Version of the Dividend Valuation Model:

$$
P_{0}=\frac{D_{1}}{k_{s}-g}
$$

where: $\quad \mathrm{P}_{0}=$ Current price of the common stock
$\mathrm{D}_{1}=$ Dollar amount of the common stock dividend expected one period from now
$\mathrm{k}_{\mathrm{s}}=$ Required rate of return per period on this common stock investment
$g$ = Expected constant growth rate per period of the company's common stock dividends

Equation 12-8. The P/E Model for Valuing Common Stock:
Appropriate Stock Price $=$ Industry P/E Ratio $\times$ EPS
Equation 12-9. The Book Value of Common Stock:
Book Value of Common Stock $=$ Total Assets - Total Liabilities - Preferred Stock
Equation 12-10. The Constant Growth Free Cash Flow Valuation Model

$$
\mathrm{V}_{\text {feft }}=\frac{\mathrm{FCF}_{\mathrm{t}}(1+\mathrm{g})}{\mathrm{k}-\mathrm{g}}
$$

where: $\quad V_{\text {feft }}=$ the value of future free cash flows at time $t$ $\mathrm{FCF}_{\mathrm{t}}=$ free cash flow at time t
$\mathrm{k}=$ the discount rate per period
$\mathrm{g}=$ the long-term constant growth rate per period of free cash flows

Equation 12-11. The Yield, or Total Return, on Common Stock:

$$
\mathrm{k}_{\mathrm{s}}=\frac{\mathrm{D}_{1}}{\mathrm{P}_{0}}+\mathrm{g}
$$

where: $\quad D_{1}=$ Amount of the common stock dividend anticipated in one period
$\mathrm{P}_{0}=$ Current market price of the common stock
$\mathrm{g}=$ Expected constant growth rate of dividends per period
$\mathrm{k}_{\mathrm{s}}=$ Expected rate of return per period on this common stock investment

## Self-Test

ST-1. The DaimlerChrysler Corporation has issued a 10.95 percent annual coupon rate bond that matures December 31, 2027. The face value is $\$ 1,000$. If the required rate of return on bonds of similar risk and maturity is 9 percent, and assuming the time now is January 1, 2007, what is the current value of DaimlerChrysler's bond?

ST-2. DaimlerChrysler's 10.95 percent coupon rate, 2027 bond is currently selling for $\$ 1,115$. At this price, what is the yield to maturity of the bond? Assume the time is January 1, 2007.

ST-3. McDonald's is offering preferred stock that pays a dividend of $\$ 1.93$ a share. The dividend is expected to continue indefinitely. If your required rate of return for McDonald's preferred stock is 8 percent, what is the value of the stock?

ST-4. Pepsico's next annual dividend is expected to be $\$ 1.14$ a share. Dividends have been growing at a rate of 6 percent a year, and you expect this rate to continue indefinitely. If your required rate of return for this stock is 9 percent, what is the maximum price you should be willing to pay for it?

ST-5. Goodyear Corporation stock is currently selling for $\$ 38$. The company's next annual dividend is expected to be $\$ 1.00$ a share. Dividends have been growing at a rate of 5 percent a year, and you expect this rate to continue indefinitely. If you buy Goodyear at the current price, what will be your yield, or total return?

## Review Questions

1. Describe the general pattern of cash flows from a bond with a positive coupon rate.
2. How does the market determine the fair value of a bond?
3. What is the relationship between a bond's market price and its promised yield to maturity? Explain.
4. All other things held constant, how would the market price of a bond be affected if coupon interest payments were made semiannually instead of annually?
5. What is the usual pattern of cash flows for a share of preferred stock? How does the market determine the value of a share of preferred stock, given these promised cash flows?
6. Name two patterns of cash flows for a share of common stock. How does the market determine the value of the most common cash flow pattern for common stock?
7. Define the P/E valuation method. Under what circumstances should a stock be valued using this method?
8. Compare and contrast the book value and liquidation value methods for common stock. Is one method more reliable? Explain.
9. Answer the following questions about the discounted free cash flow model illustrated in Figure 12-4:
a. What are "free cash flows"?
b. Explain the terminal-value calculation at the end of the forecast period. Why is it necessary?
c. Explain the term present value of the firm's operations (also known as enterprise value). What does this number represent?
d. Explain the adjustments necessary to translate enterprise value to the total present value of common equity.
10. Explain the difference between the discounted free cash flow model as it is applied to the valuation of common equity and as it is applied to the valuation of complete businesses.
11. Why is the replacement value of assets method not generally used to value complete businesses?

## Build Your Communication Skills

CS-1. Check the current price of Texas Instruments Corporation stock or a stock of your choice in the financial press. Then research financial information from last year predicting how Texas Instruments stock (or the stock you chose) would fare and analyze what valuation methods the analysts used. Next, compare the current price with the analysts' price predictions. Prepare a brief oral report that you present to the class discussing your assessment of the analysts' stock valuation.

CS-2. Choose a stock in the financial press. Check its current price. Then estimate the value of the stock using the dividend growth model, Equation 12-7. Compare the value of the stock with its current price and prepare a short memo in which you explain why the two figures might differ.

## Problems

$\$ 1,000$ and an annual coupon rate of 12 percent. The maturity period is 15 years. The interest is to be paid annually. The annual YTM for similar bonds in the market is currently 8 percent.
a. What is the amount of interest to be paid annually for each bond?
b. What is the value of this $\$ 1,000$ bond today?
c. What would be the present value of the interest and principal paid to holders of one of their bonds if the interest payments were made semiannually instead of annually?

## Bond Valuation

## Bond Valuation

12-1. Owen Meany is considering the purchase of a $\$ 1,000$ Amity Island Municipal Bond. The city is raising funds for a much needed advertising campaign to promote its East Coast resort community. The stated coupon campaign to promote its East Coast resort community. The stated coupon
rate is 6 percent, paid annually. The bond will mature in 10 years. The YTM for similar bonds in the market is 8 percent.
a. How much will the annual interest payments be?
b. What is the market price of the bond today?
c. Is the interest received on a municipal bond generally tax free?

12-2. Assume Disney Studios is offering a corporate bond with a face value of

12-3. After a major earthquake, the San Francisco Opera Company is offering zero coupon bonds to fund the needed structural repairs to its historic building. Buster Norton is considering the purchase of several of these bonds. The bonds have a face value of $\$ 2,000$ and are scheduled to mature in 10 years. Similar bonds in the market have an annual YTM of 12 percent. If Mr. Norton purchases three of these bonds today, how much money will he receive 10 years from today at maturity?

12-4. Two best friends, Thelma and Louise, are making long-range plans for a road trip vacation to Mexico. They will embark on this adventure in five years and want to invest during the five-year period to earn money for the trip. They decide to purchase a $\$ 1,000$ Grand Canyon Oil Company bond with an annual coupon rate of 10 percent with interest to be paid semiannually. The bond will mature in five years. The YTM of similar bonds is 8 percent. How much should they be willing to pay for the bond if they purchase it today?

12-5. Assume that Intel Corporation's $\$ 1,000$ face value 9 percent coupon rate bond matures in 10 years and sells for $\$ 1,100$. If you purchase the bond for $\$ 1,100$ and hold it to maturity, what will be your average annual rate of return on the investment?

12-6. Clancy Submarines, Inc. is offering $\$ 1,000$ par value bonds for sale. The bonds will mature 10 years from today. The annual coupon interest rate is 12 percent, with payments to be made annually. James Hobson just purchased one bond at the current market price of $\$ 1,125$.
a. Will the YTM of this bond be greater than or less than the coupon interest rate? Answer this part without doing any calculations.
b. To the nearest whole percent, what is the YTM of Mr. Hobson's bond? You'll need to crunch some numbers for this part.
c. What would the YTM have to be to make the market price of the bond equal to the face value? No number crunching is needed to answer.

12-7. A corporate bond has a face value of $\$ 1,000$ and an annual coupon interest rate of 7 percent. Interest is paid annually. Of the original 20 years to maturity, only 10 years of the life of the bond remain. The current market price of the bond is $\$ 872$. To the nearest whole percent, what is the YTM of the bond today?

12-8. The new Shattuck Corporation will offer its preferred stock for sale in the very near future. These shares will have a guaranteed annual dividend of $\$ 10$ per share. As you research the market, you find that similar preferred stock has an expected rate of return of 12 percent. If this preferred stock could be purchased today, what price per share would you expect to pay for it?

12-9. Lucky Jackson knows that one share of Grand Prix Enterprises preferred stock sells for $\$ 20$ per share on the open market. From its annual reports, he sees that Grand Prix pays an annual dividend of $\$ 1.75$ per share on this preferred stock. What is the market's required rate of return on Grand Prix's stock?

## Bonds with Semiannual Interest Payments

## - Expected Rate of Return on a Corporate Bond

## Bond YTM

 and Pricing$=2 \mathrm{C}=1$
SPREADSHEET

- Bond YTM
$3 \mathrm{x}=\mathrm{c}=7$
SPREADSHEET
- Preferred Stock Valuation


## - Preferred Stock k

## Preferred Stock

 ValuationCommon Stock Valuation per Share

Yield on Common Stock

## Common Stock Valuation per Share

## Bond Valuation

## Bond Valuation (Semiannual Interest)

12-10. Tiny Shipping Corporation is planning to sell preferred stock that will pay an annual dividend of $\$ 8$ per share. The current expected rate of return from similar preferred stock issues is 13 percent.
a. What price per share would you expect to have to pay to purchase this stock?
b. If the stock is actually selling for $\$ 50$ per share, what is the market's required rate of return for this stock?

12-11. China S. Construction, Inc., is in the business of building electrical power plants in the eastern United States. Jack Godell and the rest of the board members of the firm have just announced a $\$ 4$ per share dividend on the corporation's common stock to be paid in one year. Because the quality of some of its recent projects is under attack by investigative television reporters, the expected constant dividend growth rate is only estimated to be 1 percent. The required rate of return for similar stocks in this industry is 16 percent.
a. What is the present value of the expected dividends from one share of China S. Construction's common stock?
b. What is the stock's dividend yield $\left(\mathrm{D}_{1} / \mathrm{P}_{0}\right)$ ?

12-12. The current listed price per share of a certain common stock is $\$ 15$. The cash dividend expected from this corporation in one year is $\$ 2$ per share. All market research indicates that the expected constant growth rate in dividends will be 4 percent per year in future years. What is the rate of return on this investment that an investor can expect if shares are purchased at the current listed price?

12-13. Golden Manufacturing Company is expected to pay a dividend of $\$ 8$ per share of common stock in one year. The dollar amount of the dividends is expected to grow at a constant 3 percent per year in future years. The required rate of return from shares of similar common stock in the present environment is 14 percent.
a. What would you expect the current market price of a share of Golden common stock to be?
b. Assuming the cash dividend amount and the growth rate are accurate, what is the annual rate of return on your investment in Golden common stock if you purchased shares at the stock's actual listed price of $\$ 65$ per share?

12-14. Micron issues a 9 percent coupon bond with a maturity of 5 years. The face value of the bond, payable at maturity, is $\$ 1,000$. What is the value of this bond if your required rate of return is 12 percent?

12-15. Sam wants to purchase a bond that has a par value of $\$ 1,000$, an annual coupon rate of 7 percent, and a maturity of 10 years. The bond's interest is paid semiannually. Sam's annual required rate of return is 11 percent. What should Sam be willing to pay for this particular bond?

12-16. What is the value of a security that entitles you to receive the following payments if your required rate of return for this type of security is 23 percent?
$\$ 80$-end of year 1
$\$ 150$-end of year 2
$\$ 1,500$-end of year 3

12-17. Tom expects the issue of InVest preferred stock to pay an annual dividend of $\$ 3$ per share. He also has researched the company and feels that 12 percent is a fair rate of return for this investment. Calculate the value of each share of stock.

12-18. Analysts forecast that Dixie Chicks, Inc. (DCI) will pay a dividend of $\$ 2.20$ a share at the end of this year, continuing a long-term growth trend of 9 percent a year. If this trend is expected to continue indefinitely and investors' required rate of return for DCI is 18 percent, what is the market value per share of DCI's common stock?

12-19. PepsiCo (NYSE: PEP) paid a dividend of $\$ 0.58$ per share this year. Dividends at the end of each of the next five years are expected to be as follows:

| Year 1 | $\$ 0.70$ |
| :--- | :--- |
| Year 2 | $\$ 0.83$ |
| Year 3 | $\$ 0.96$ |
| Year 4 | $\$ 1.09$ |
| Year 5 | $\$ 1.22$ |

After year 5, dividends are expected to grow indefinitely at 10 percent a year. If your required rate of return for PepsiCo common stock is 12 percent, what is the most that you would pay per share for PepsiCo today?

12-20. Regis knows that CRS stock sells for $\$ 82$ per share, has a growth rate of 7 percent, and a dividend that was just paid of $\$ 3.82$. What can Regis expect as an annual percent yield if he purchases a share of CRS stock?

12-21. Gwenyth just purchased a bond for $\$ 1,250$ that has a maturity of 10 years and a coupon interest rate of 8.5 percent, paid annually. What is the YTM of the $\$ 1,000$ face value bond that she purchased?

12-22. Analysts forecast that free cash flows from Dixie Chicks, Inc. (DCI) will be $\$ 2.1$ million in the coming year, continuing a long-term growth trend of 9 percent a year. If this trend is expected to continue indefinitely and investors' required rate of return for DCI is 18 percent, what will be the total enterprise value of DCI?

## - Discounted Cash Flows (DCF)

- Preferred Stock Valuation
- Common Stock Valuation, Constant Growth
- Common Stock Valuation, Nonconstant Growth
- Common Stock Yield
- Yield to Maturity (YTM)
- Enterprise Value, Constant Growth


## Enterprise Value, Nonconstant Growth

## Book Value

Book Value Liquidation Value, and P/E Methods

12-23. The free cash flow for PepsiCo (NYSE: PEP) this year was $\$ 1,026,600,000$. Free cash flows at the end of each of the next five years are expected to be as follows:

| Year 1 | $\$ 1,231,920,000$ |
| :--- | :--- |
| Year 2 | $\$ 1,453,665,600$ |
| Year 3 | $\$ 1,686,252,096$ |
| Year 4 | $\$ 1,922,327,389$ |
| Year 5 | $\$ 2,153,006,676$ |

After year 5, free cash flows are expected to grow indefinitely at 10 percent a year.

If the weighted average cost of capital (WACC) for PepsiCo is 12 percent, what is the enterprise value of the company today?
12-24. Jack and Frank Baker know their piano renditions of lounge songs have limited appeal on the night club circuit, so they work part-time as investment consultants. They are researching relatively unknown corporations, one of which is Susie Diamond Enterprises. To get a quick idea of the value of SDE's common stock, they have taken the following numbers from the most recent financial statements.

| Total Assets | $\$ 675,000$ |
| :--- | ---: |
| Total Liabilities | $\$ 120,000$ |
| 250,000 Shares of Common Stock Issued |  |
| 100,000 Shares of Common Stock Outstanding |  |

What is the book value (net worth) of Susie Diamond Enterprises?
$\mathbf{1 2 - 2 5}$. The most recent balance sheet of Free Enterprise, Inc., follows.

## Free Enterprise, Inc., Balance Sheet December 31, 2009 (thousands of dollars) <br> Assets Liabilities + Equity

| Cash | $\$ 4,000$ | Accounts Payable | $\$ 4,400$ |
| :--- | ---: | :--- | ---: |
| Accounts Receivable | 10,000 | Notes Payable | 4,000 |
| Inventory | 13,000 | Accrued Expenses | 5,000 |
| Prepaid Expenses | 400 | Total Current Liabilities | 13,400 |
| Total Current Assets | 27,400 | Bonds Payable | 6,000 |
| Fixed Assets | $\underline{11,000}$ | Common Equity | $\underline{19,000}$ |
| Total Assets | $\underline{\$ 38,400}$ | Total Liabilities + Equity | $\underline{\underline{\$ 38,400}}$ |

a. What was Free Enterprise's book value (net worth) at the beginning of 2010 ?
b. If the company had 750,000 shares of common stock authorized and 500,000 shares outstanding, what was the book value per share of common stock at the beginning of 2010 ?
c. Net income of Free Enterprise, Inc. was $\$ 5,610,000$ in 2009. Calculate the earnings per share of Free Enterprise's common stock.
d. The P/E ratio for a typical company in Free Enterprise, Inc.'s industry is estimated to be 6 . Using the EPS from part c) above, calculate the price of one share of common stock at the beginning of 2007, assuming that Free Enterprise commands a P/E ratio value equal to that of an average company in its industry.
e. What would you infer about the company's total assets shown on the balance sheet when comparing this calculated stock price with the company's book value per share?
f. Calculate the liquidation value of Free Enterprise's common stock assuming the market value of the total assets is $\$ 50$ million and the market value of total liabilities is $\$ 20$ million, as estimated by your analyst.

12-26. Lucky Jackson is trying to choose from among the best of the three investment alternatives recommended to him by his full-service investment broker. The alternatives are
a. The corporate bond of Star Mining Company has a face value of $\$ 1,000$ and an annual coupon interest rate of 13 percent. The bond is selling in the market at $\$ 1,147.58$. Of the original 20 years to maturity, only 16 years of the life of the bond remain.
b. The preferred stock of Supernova Minerals Company has a par value of $\$ 100$ per share and it offers an annual dividend of $\$ 14$ per share. The market price of the stock is $\$ 140$ per share.
c. The common stock of White Dwarf Ores Company sells in the market at $\$ 300$ per share. The company paid a dividend of $\$ 39$ per share yesterday. The company is expected to grow at 3 percent per annum in the future.
Which of the three alternatives should Lucky choose? Remember the priority of claims for bondholders, preferred stockholders, and common stockholders from Chapters 1 and 4.

12-27. Suppose Flash in the Pan Corporation is expected to pay an annual dividend of $\$ 3$ per share one year from now and that this dividend will grow at the following rates during each of the following four years (to the end of year 5): Year 2, 20 percent; Year 3, 30 percent; Year 4, 20 percent; Year 5, 10 percent. After this supernormal growth period, the dividend will grow at a sustainable 5 percent rate each year beyond year 5 .
a. What is the present value of the dividends to be paid during the supernormal growth period? Assume that the required rate of return, $\mathrm{k}_{\mathrm{s}}$, is 15 percent.
b. What is the present value of the dividends to be paid during the normal growth period (from year 6 through infinity)?
c. What is the total present value of one share of Flash in the Pan's common stock?

## Comprehensive Problem

 Dividend Growth Model| Discounted Free Cash Flow Model for Total Common Equity (Challenge Problem) | Assume that you are the owner of a pet foods company and you are interested in acquiring the stock of Hardi-Pets, an up-and-coming company that markets a new type of dog food that causes pets that eat it to never get sick and to never need shots. Selected financial data for Hardi-Pets is shown. <br> Hardi-Pets, Inc., Selected Financial Data for 2009 |  |  |
| :---: | :---: | :---: | :---: |
|  | Total Revenue |  | 1,000,000 |
|  | Cost of Goods Sold |  | 500,000 |
|  | Gross Profit |  | 500,000 |
|  | Selling, General and Administrative Expenses |  | 200,000 |
|  | Earnings before Interest, Taxes, Depr. \& Amort. (EBITDA) |  | 300,000 |
|  | Depreciation and Amortization |  | 100,000 |
|  | Earnings before Interest and Taxes (EBIT) |  | 200,000 |
|  | Capital Expenditures | \$ | 15,000 |
|  | Combined Federal and State Income Tax Rate |  | 40\% |
|  | Current Assets, Dec. 31, 2009 | \$ | 100,000 |
|  | Current Liabilities, Dec. 31, 2009 |  | 80,000 |
|  | Long-Term Debt, Dec. 31, 2009 |  | 500,000 |
|  | Preferred Stock Outstanding, Dec. 31, 2009 |  | 0 |

Prepare a valuation analysis of Hardi-Pets total common equity using the discounted free cash flow model. Use a spreadsheet format similar to the example shown in Figure 12-4. The following forecasting variables apply. Assume that the time now is January 1, 2010.

|  | $\mathbf{2 0 1 0}$ | $\mathbf{2 0 1 1}$ | $\mathbf{2 0 1 2}$ | $\mathbf{2 0 1 3}$ | $\mathbf{2 0 1 4}$ | $\mathbf{2 0 1 5}$ | $\mathbf{2 0 1 6}$ | $\mathbf{2 0 1 7}$ | $\mathbf{2 0 1 8}$ | $\mathbf{2 0 1 9}$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | ---: | ---: |
| Revenue Growth Factor | $10 \%$ | $15 \%$ | $20 \%$ | $25 \%$ | $30 \%$ | $25 \%$ | $20 \%$ | $15 \%$ | $10 \%$ | $5 \%$ |
| Expected Gross Profit Margin | $50 \%$ | $50 \%$ | $50 \%$ | $50 \%$ | $50 \%$ | $50 \%$ | $50 \%$ | $50 \%$ | $50 \%$ | $50 \%$ |
| S, G, \& A Exp \% of Revenue | $20 \%$ | $20 \%$ | $20 \%$ | $20 \%$ | $20 \%$ | $20 \%$ | $20 \%$ | $20 \%$ | $20 \%$ | $20 \%$ |
| Depr. \& Amort. \% of Revenue | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ |
| Capital Expend. Growth Factor | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $-10 \%$ | $-10 \%$ | $-10 \%$ | $-10 \%$ | $-10 \%$ | $-10 \%$ |
| Net Working Cap to Sales Ratio | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ |
| Income tax rate = 40\% |  |  |  |  |  |  |  |  |  |  |

Assumed long-term sustainable growth rate $=5 \%$ per year after 2019
Discount rate $=20 \%$

Discounted Free Cash Flow Model for Complete Business Valuation (Challenge Problem)


12-29. The Great Expectations Company just finished its first year of operations in which the company realized $\$ 2$ million in revenue. Company managers are looking forward to a number of years of rapid growth ahead, and to this end they are seeking $\$ 10$ million in long-term debt financing from the Capital 4 U Financing Company. However, before the loan can be approved, an independent appraisal of Great Expectations is required to establish the fair market value of the company.
Assume that you are a financial analyst working for Value Plus, Independent Appraisers. Capital 4 U has engaged your firm to estimate the fair market value of Great Expectations as a complete business. Selected financial data for Great Expectations is shown.

## Great Expectations, Inc., Selected Financial Data for 2009

| Total Revenue | $\$ 2,000,000$ |
| :--- | ---: |
| Cost of Goods Sold | $1,200,000$ |
| Gross Profit | 800,000 |
| Selling, General and Administrative Expenses | $1,200,000$ |
| Earnings before Interest, Taxes, Depr. \& Amort. (EBITDA) | $200,000)$ |
| Depreciation and Amortization | $(600,000)$ |
| Earnings before Interest and Taxes (EBIT) | $\$ 1,000,000$ |
| Capital Expenditures | $40 \%$ |
| Combined Federal and State Income Tax Rate | $\$ 500,000$ |

Prepare a valuation analysis of Great Expectations as a complete business using the discounted free cash flow model. Use a spreadsheet format similar to the example shown in Figure 12-4, modified for a complete business. The following forecasting variables apply. Assume that the time now is January 1, 2007.

|  | $\mathbf{2 0 1 0}$ | $\mathbf{2 0 1 1}$ | $\mathbf{2 0 1 2}$ | $\mathbf{2 0 1 3}$ | $\mathbf{2 0 1 4}$ | $\mathbf{2 0 1 5}$ | $\mathbf{2 0 1 6}$ | $\mathbf{2 0 1 7}$ | $\mathbf{2 0 1 8}$ | $\mathbf{2 0 1 9}$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | ---: |
| Revenue Growth Factor | $20 \%$ | $30 \%$ | $40 \%$ | $50 \%$ | $60 \%$ | $50 \%$ | $40 \%$ | $30 \%$ | $20 \%$ | $\mathbf{1 0 \%}$ |
| Expected Gross Profit Margin | $50 \%$ | $51 \%$ | $52 \%$ | $53 \%$ | $54 \%$ | $55 \%$ | $56 \%$ | $57 \%$ | $58 \%$ | $59 \%$ |
| S, G, \& A Exp \% of Revenue | $50 \%$ | $40 \%$ | $30 \%$ | $29 \%$ | $28 \%$ | $27 \%$ | $26 \%$ | $25 \%$ | $24 \%$ | $23 \%$ |
| Depr. \& Amort. \% of Revenue | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ | $10 \%$ |
| Capital Expend. Growth Factor | $40 \%$ | $35 \%$ | $30 \%$ | $25 \%$ | $20 \%$ | $-10 \%$ | $-15 \%$ | $-20 \%$ | $-25 \%$ | $-30 \%$ |
| Net Working Cap to Sales Ratio | $19 \%$ | $18 \%$ | $17 \%$ | $16 \%$ | $15 \%$ | $14 \%$ | $13 \%$ | $12 \%$ | $11 \%$ | $10 \%$ |

Income tax rate = 40\%
Assumed long-term sustainable growth rate = 5\% per year after 2019
Discount rate $=20 \%$

## Answers to Self-Test

ST-1. The present value of DaimlerChrysler's 10.95 percent 2027 bond can be found using Equation 12-2:

$$
V_{B}=I N T \times\left[\frac{1-\frac{1}{\left(1+k_{d}\right)^{n}}}{k_{d}}\right]+\frac{M}{\left(1+k_{d}\right)^{n}}
$$

Face value is $\$ 1,000$
The coupon interest payment is 10.95 percent of $\$ 1,000$, or $\$ 109.50$.
$\mathrm{n}=21$
$\mathrm{k}_{\mathrm{d}}=9 \%$

$$
\begin{aligned}
V_{B} & =\$ 109.50 \times\left[\frac{1-\frac{1}{(1+.09)^{21}}}{.09}\right]+\frac{\$ 1,000}{(1+.09)^{21}} \\
& =(\$ 109.50 \times 9.29224)+\left(\frac{\$ 1,000}{6.108801}\right) \\
& =\$ 1,017.50+\$ 163.70 \\
& =\$ 1,181.20
\end{aligned}
$$

So the present value of the bond is $\$ 1,181.20$.
ST-2. The bond's YTM is found by trial and error. We know that the bond has a price of $\$ 1,115$; face value of $\$ 1,000$; coupon interest payment of $\$ 109.50$ ( $10.95 \%$ of $\$ 1,000$ ); and matures in 21 years. Now we can find that value of $\mathrm{k}_{\mathrm{d}}$ that produces a $\mathrm{V}_{\mathrm{B}}$ of $\$ 1,115$. Use Equation 12-2 and solve for $\mathrm{V}_{\mathrm{B}}$.

First try $\mathrm{k}_{\mathrm{d}}=9 \%$ :

$$
\begin{aligned}
\mathrm{V}_{B} & =\$ 109.50 \times\left[\frac{1-\frac{1}{(1+.09)^{21}}}{.09}\right]+\frac{\$ 1,000}{(1+.09)^{21}} \\
& =(\$ 109.50 \times 9.29224)+\left(\frac{\$ 1,000}{6.108801}\right) \\
& =\$ 1,017.50+\$ 163.70 \\
& =\$ 1,181.20>\$ 1,115
\end{aligned}
$$

$\$ 1,181.20$ is too high. Try again using a higher yield (remember, bond prices and yields vary inversely).

Second try at $\mathrm{k}_{\mathrm{d}}=10 \%$ :

$$
\begin{aligned}
V_{\text {B }} & =\$ 109.50 \times\left[\frac{1-\frac{1}{(1+.10)^{21}}}{.10}\right]+\frac{\$ 1,000}{(1+.10)^{21}} \\
& =(\$ 109.50 \times 8.64869)+\left(\frac{\$ 1,000}{7.40025}\right) \\
& =\$ 947.03+\$ 135.13 \\
& =\$ 1,082.16<\$ 1,115
\end{aligned}
$$

$\$ 1,082.16$ is too low. Try again using a lower yield.
Third try at $\mathrm{k}_{\mathrm{d}}=9.65 \%$ :

$$
\begin{aligned}
\mathrm{V}_{\mathrm{B}} & =\$ 109.50 \times\left[\frac{1-\frac{1}{(1+.0965)^{21}}}{.0965}\right]+\frac{\$ 1,000}{(1+.0965)^{21}} \\
& =(\$ 109.50 \times 8.86545)+\left(\frac{\$ 1,000}{6.92120}\right) \\
& =\$ 970.77+\$ 144.48 \\
& =\$ 1,115.25
\end{aligned}
$$

At $\mathrm{k}_{\mathrm{d}}=9.65 \%$ the calculated value of $\mathrm{V}_{\mathrm{B}}$ is within $\$ .25$ of the current market price. We conclude the bond's YTM is 9.65 percent. ${ }^{9}$

ST-3. Equation 12-5 is used to find the value of preferred stock as follows:

$$
\mathrm{V}_{\mathrm{p}}=\frac{\mathrm{D}_{\mathrm{p}}}{\mathrm{k}_{\mathrm{p}}}
$$

$D_{p}$ is $\$ 1.93$ and $\mathrm{k}_{\mathrm{p}}$ is 8 percent.

$$
\begin{aligned}
V_{P} & =\frac{\$ 1.93}{.08} \\
& =\$ 24.125
\end{aligned}
$$

ST-4. The maximum price you are willing to pay for Pepsico is what it is worth to you, or its value. Because the characteristics of the stock fit the constant dividend growth model, use Equation 12-7 to compute the value.

$$
P_{0}=\frac{D_{1}}{k_{s}-g}
$$

$D_{1}$ is $\$ 1.14, \mathrm{k}_{\mathrm{s}}$ is 9 percent, and g is 6 percent.
Given these conditions, the value of Quaker Oats stock is

$$
\begin{aligned}
P_{0} & =\frac{\$ 1.14}{.09-.06} \\
& =\frac{\$ 1.14}{.03} \\
& =\$ 38
\end{aligned}
$$

ST-5. The yield on common stock can be found using Equation 12-11.

$$
\mathrm{k}_{\mathrm{s}}=\frac{\mathrm{D}_{1}}{\mathrm{P}_{0}}+\mathrm{g}
$$

$D_{1}$ is $\$ 1.00, P_{0}$ is $\$ 38$, and $g$ is 5 percent. Given these conditions, the yield on Goodyear common stock is as follows:

$$
\begin{aligned}
\mathrm{k}_{\mathrm{s}} & =\frac{\$ 1.00}{\$ 38}+.05 \\
& =.0263+.05 \\
& =.0763, \text { or } 7.63 \%
\end{aligned}
$$

## The Challenge

This fifth edition of Financial Management: Principles and Practice is coming out at the perfect time. All books of this type currently on the market are hopelessly out of date in light of the financial crisis that has changed the financial world in ways that cannot be understated. In this new edition the events related to the financial crisis are examined and explained. It also addresses the many ways that financial decisions will be made differently in light of these important events. There are also "lessons learned" described.

This fifth edition is also the first one to appear without the name of my long-time co-author, Joe Andrew, on the cover. Joe's many contributions, of course, remain in many ways throughout this book. We worked together on the first, second, and third editions of this book when it was published by Prentice Hall Publishing Company. He was also there when in the fifth edition we took the leap to Freeload Press and its business model that presents a solution to the hopelessly broken business model of traditional publishers who continue to jack up the prices they charge to levels fewer and fewer students can afford. Joe has earned the retirement he has chosen. Thanks Joe.

Finance scares some students. There is the fear of numbers that some students have and the mistaken belief that the introductory finance course requires highlevel mathematics. Also, some students mistakenly believe finance is an area in which they will not need competency. Finance concepts often seem far removed from daily life. In spite of this, almost every major in a college of business, and many majors in other colleges, require the "Principles of Finance" course. As a result, many of the students who find themselves sitting in finance class on the first day of the semester do not want to be there.

This does not need to be the case. Finance is important, dynamic, interesting, and fun. The challenge we take head-on in Financial Management: Principles and Practice is to convince students of this. In order to learn, students must want to learn. If they can see the usefulness of what is presented to them, they will work hard and they will learn. Students also demand relevancy. This fifth edition tackles head on the changes we must face in the financial world and the new information that must be digested before making financial decisions in the new world we find ourselves in. There are also mistake made by financial decision makers from which we must learn.

Many years of teaching experience has taught me that the introductory financial management course can be one that students enjoy and that they see as having added considerable value to their educational experiences. Finance is, after all, central to any business entity. More CEOs have come up through the
finance ranks than any other discipline. Students need to know that the principles and practices of financial management apply to any business unit-from the very large multinational corporation to the very smallest proprietorship, including the family. Financial ratios tell a story; they are not numbers to be calculated as an end unto itself. Risk is important and can be managed. Time value of money has meaning and is understood as the central tool of valuation. Funds have a cost and different sources of funds have different costs. Financial performance and condition can be assessed. Amortized loan payments, rates of return on investment, future value of investment programs, and present value of payments to be received from bonds and stocks can be calculated. The opportunities and special challenges of international operations can be understood.

## Our Approach

Students should walk out of the room after taking the final exam for a finance course believing that they have learned something useful. They should see a direct benefit to themselves personally, rather than just the belief that some set of necessary job skills has been mastered, although the latter will be true if the material is mastered.

In Financial Management: Principles and Practice, we start with the student in mind and then package the finance material so that the students (1) want to learn and (2) learn the necessary material. We do this because finance is not medicine, and it cannot be administered as such. Instead, we believe students must be engaged in such a way that they develop the desire to learn. There are those who approach the task of teaching finance with the philosophy, "Here is the finance knowledge you need. Learn it!" These are not the people we had in mind when we wrote this book.

In the fifth edition we have further integrated the text with the Internet and with multimedia material. We did this to facilitate the learning experience, not to have bells and whistles we could point to. There are Interactive Modules that directly tie material in the text to visually rich interactive material on the Web. These are not just links.

Two key characteristics of Financial Management: Principles and Practice, fifth edition, are currency and relevance. This book was very successful in its first three editions with Prentice Hall as its publisher and again in its fifth edition with Freeload Press. Textbooks have become too expensive for students. The new business model of Freeload Press blazes the trail to the future where affordable quality textbooks are made available to students and professors.

## Distinctive Focus

Although there are many other introductory financial management books on the market, none contains the unique style and content of Financial Management: Principles and Practice, fifth edition. Many texts focus mostly on accounting with little presentation of the economic theory that underlies the financial techniques presented. Others assume that the students remember all that was learned in the accounting course that is usually a prerequisite for this course. Still others claim to take a "valuation approach" but
present their topics in a straight accounting framework. In this book we are serious about focusing on what creates value. We are consistent in this approach throughout the book, addressing issues such as what creates value, what destroys it, how value is measured, and how value and risk are related. In so doing we maximize the value of the finance course to the student.

## Organization of the Text

The book is organized into six major parts as follows:
Part I. The World of Finance contains chapters on the structure and goals of firm, the role of financial managers, and an examination of the financial environment. Special attention is given to how the Financial Crisis affected nonfinancial companies, financial markets, and financial instiutions.

Part II. Essential Concepts in Finance presents chapters on accounting statements and their interpretation, forecasting, risk and return, the time value of money, and security valuation. Special attention is given to systematic risk and its role in the Financial Crisis.

Part III. Capital Budgeting and Business Valuation contains chapters on measuring a firm's cost of capital, capital budgeting decision methods, incremental cash flow estimation, and business valuation.

Part IV. Long-Term Financing Decisions contains chapters on capital structure basics, corporate bonds, preferred stock, leasing, common stock, and dividend policy. The turmoil in the stock and bond markets during the Financial Crisis is examined.

Part V. Short-Term Financial Management Decisions includes chapters on working capital policy, cash and marketable securities, accounts receivable and inventory, and short-term financing.

Part VI. Finance in a Global Economy is where international finance topics are covered, in addition to those international topics that are woven throughout the book. The contagion of the Financial Crisis around the world is examined.

## Special Features in the Text

## Downloads of Interactive Material

After downloading, students can move seamlessly between the text and these Interactive Modules. This process enables learning that is simply not possible from a printed page alone.

## Real-World Examples

Each chapter in Financial Management: Principles and Practice begins with a realworld example that illustrates the concept to be addressed in that chapter. This serves to give the student a reason to learn this material and to show its practical application. Learning objectives are clear.

## Calculator Solutions

Financial calculator solutions to all general time value of money and specific security valuation problems are included. This material is presented in such a way that professors' differing preferences as to the use of financial calculators can be accommodated.

## Summaries

The summary for each chapter specifically describes how the learning objectives have been achieved and it also provides a bridge to the next chapter.

## Key Terms

Each chapter has bolded key terms that are defined in the chapter and in the glossary. There are self-test questions and problems at the end of chapters, along with their solutions, so that students can check their grasp of the material presented.

## Practice Questions and Problems

Study questions and an abundant number of end-of-chapter problems are included in the appropriate chapters.

## Computer Spreadsheet Supported Problems

A number of end-of-chapter problems are marked with the special computer problem logo shown here. This indicates that a downloadable Excel spreadsheet template is available at www.textbookmedia.com.

## Communication Skills

Suggested assignments to build students' written and oral communication skills are included in each chapter.

## Color

Color is used for pedagogic effect, not just for looks.

## Changes in the Fifth Edition

- The few errors in the fourth edition have been corrected.
- Special material has been added that explains the financial crisis including its causes and the implications for future financial decision making.
- Material presented in the fourth edition has been expanded where appropriate to show how this material was related to events of the Financial Crisis and how we can make better decisions in the future in these areas due to the lessons learned.
- References and examples were updated throughout. End of Chapter questions and problems have been edited for clarity and a few errors found in the fourth edition have been corrected.
- The PowerPoint ${ }^{\circledR}$ slides accompanying the text were enhanced and updated
- A multi-level quality control program was implemented for the text and supplements. The program is designed to eliminate any and all errors.


## Features Retained from the Fourth Edition

- The book is still written in the student-friendly style that was extremely popular in the first and second editions. The concise, easy-to-understand presentation loved by student users is maintained.
- The book provides the level of rigor professors demand. When professors get past the friendly style, they find all the rigor and all the mainstream topics they expect in a book of this type. For example, if you are not already a Financial Management: Principles and Practice user, does your book:
- Address extensively the ramifications of the financial crisis on the world of finance, the business world in general, and individuals?
- Cover real options?
- Cover EVA, MVA, and EBITDA?
- Use a value-added (NPV) approach to the inventory and accounts receivable investment coverage rather than the outmoded return on investment ratio approach?
- Have supplements that were not "farmed out" to subcontractors but that instead have the authors' hands-on participation?
- Attempts to expand the book, and to make it longer, have been resisted. The topics that professors actually teach are here. Those that are most likely to be taught in the second course in financial management are left out. Students don't have to buy more than what they need.


## The Learning Package

Financial Management: Principles and Practice is one component of a complete learning package carefully put together by the Freeload Press team. This package includes a computerized test bank, a study guide/workbook, an instructor's manual, PowerPoint slides, and downloadable Excel ${ }^{\circledR}$ spreadsheets.

## For the Student-Downloadable Material

- Excel Spreadsheet Templates-There are Excel spreadsheet files available to the student for downloading that contain templates for selected end-of-chapter problems. Such problems, which lend themselves to an Excel solution, are marked with a special icon in the book. These Excel templates will reduce the amount of data entry needed to solve these designated problems. These Excel template files are available for downloading at www.textbookmedia.com.
- Study Guide/Workbook—A Study Guide/Workbook is available to students for downloading at www.textbookmedia.com. It provides an outline of key terms, key elements, and an overview of each chapter. Practice problems and questions, along with answers, are also provided for each chapter.
- Lecture Notes-Lecture Notes-PowerPoint files may be downloaded from www. textbookmedia.com and used as lecture notes so that students can focus on what their professor is saying without having to simultaneously take copious notes. These have been carefully updated and enhanced.


## For the Professor-Material Provided on CD to Adopting Professors

- Instructor's Manual-This provides the professor with chapter outlines and suggestions for alternative ways to present the material. Key points are identified and a variety of types of assistance for class preparation are presented.
- Solutions Manual—Detailed solutions, not just final answers, are presented for each end-of-chapter question and problem. These have all been personally checked by the author for accuracy.
- Excel Spreadsheet Solutions-The professor is provided with full Excel spreadsheet solutions to selected end-of-chapter problems in the book. Such problems, that lend themselves to an Excel solution, are marked with a special icon. Students have access to Excel templates for solving these problems. The professor is provided with the full solution.
- Test Item File-Multiple-choice, short-answer, and essay questions reflect all the material in the chapter. The program allows for complete customization of an exam according to chapters covered, type of problem, and level of difficulty.
- PowerPoint Slides—Animated slides covering all main topic areas in the text are available to assist the professor during class. These have been expanded, triplechecked for accuracy, and have special features added since the previous edition PowerPoint slides were prepared.
- Author Access-The author is accessible to respond to individual questions that may come up. Tim Gallagher may be reached at tim@gallagher.com.
- For the Professor-Material Provided on CD to Adopting Professors" section. It should read, "Adopting professors should contact Ed Laube at elaube@freeloadpress. com to request a copy of the special professor materials available on CD. After verifying professor status the CD will be quickly sent to the adopting professor.


## In Conclusion

We believe that students will understand the very important finance concepts, and master necessary problem-solving skills, when they complete the course in which this text is used. "Students first" is our philosophy at Freeload Press and this belief shows up throughout the text. Professors who have more enthusiastic students and who grasp the important content, both conceptual and problem solving, will find their classroom experiences more rewarding too. If we have helped to make this happen, we have succeeded in achieving our vision for Financial Management: Principles and Practice, fifth edition.

## Acknowledgements

The authors gratefully acknowledge the contributions of the many people who contributed to this endeavor. Without their expertise and talent, this book and the supplemental materials would not have been possible.

We send our thanks to a number of colleagues and key reviewers who contributed to this and previous editions. They are Dianne Morrison (University of WisconsinLaCrosse), Zhenhu Jin (Illinois Wesleyan University), Denise Letterman (Robert Morris College), Gary Greene (Manatee Community College), John Armstrong (Dominican College), Atul K. Saxena (Mercer University), William Hudson (St. Cloud State University), Charles W. Strang (Western New Mexico University), James D. Keys (Florida International University), Vickie Bajtelsmit (Colorado State University), Sue Hine (Colorado State University), Rob Schwebach (Colorado State University), Sriram Villupuram (Colorado State University), Chris Stein (Colorado State Univeristy), Joe Brocato (Tarleton State University), Susan Myrick (Allegheny County Community College), Clark Maxam (Montana State University), Gary Walker (Myers University), Ron Filante (Pace University), Andrew Adkinson (University of Nebraska-Kearney), Mark Sunderman (University of Wyoming), Wendy Pirie (Wesleyan University), Frenando Arellano (University of Dallas), and S. R. Das Gupta.

We are also indebted to many people at Prentice Hall who helped with the first three editions. These include: Mickey Cox, PJ Boardman, and Maureen Riopelle. We'd especially like to thank Paul Donnelly and Jill Lectka, who were there from the beginning. These people have made their marks on this book in lasting ways.

For this fifth edition we are particularly indebted to our editor, Ed Laube, of Freeload Press. Ed and his partners Tom Doran and Peggy Morgan had the courage to start a company that redefines textbook publishing. We are excited to be a part of it. This is the future of college textbook publishing. The old model doesn't work anymore and these people and the others who have created Freeload Press are doing something about it. We'd also like to thank Victoria Putman and Daphne Loecke for their excellent work on the production side of this project. Joe Andrew, my former co-author, has left an indellible mark on this book.

Last, but not least, I am most especially grateful for the assistance and support of our family members: Susan Shattuck, Emily, Justin, and little Ellie Peddicord.


[^0]:    ${ }^{2}$ We were lucky to find the bond's exact YTM in only two guesses. Often the trial-and-error method requires more guesses. In fact, we almost always use a financial calculator to compute the YTM.

[^1]:    ${ }^{4}$ Source: the "Edgar" database at www.sec.gov.

[^2]:    ${ }^{5}$ The discount rate represents the weighted average required rates of return of Abiomed's debt holders and common stockholders. Calculating this weighted average return was discussed in detail in Chapter 9.
    ${ }^{6}$ To be precise, we should have calculated the market values of Abiomed's current assets, current liabilities, and long-term debt before making the adjustments. In practice, however, the book values from the balance sheet are often used instead, because the process of valuing the items is difficult and the market values often do not differ materially from the book values.
    ${ }^{7}$ In fact, Abiomed's stock closed at $\$ 12.90$ on Friday, March 31, 2006, the day before our valuation date. $\$ 12.90$ per share equates to a total common equity value of $\$ 341.438$ million, not including a control premium. This is almost $\$ 204$ million higher than the $\$ 137.534$ million estimated by our model. Could investors have been overcome by speculative fever on that date? We leave that for you to decide.

[^3]:    ${ }^{8}$ As we said earlier, to be precise, one should use the market value of the current assets, rather than the book value from the balance sheet. However, because estimating the market value of the current assets is time-consuming and the results are often not materially different from the book value, many analysts simply use the book value in their complete business valuations.

