

The Cost of Capital

Learning Objectives

 1 Understand the concepts underlying the firm's cost of capital	The Cost of Capital: Key Definitions and Concepts
 2 Evaluate the costs of the individual sources of capital	Determining the Costs of the Individual Sources of Capital
 3 Calculate a firm's weighted average cost of capital	The Weighted Average Cost of Capital
 4 Estimate divisional costs of capital	Calculating Divisional Costs of Capital

In the third quarter of 2011 ExxonMobil (XON) earned a record \$9.4 billion, which was almost double what it earned in the same quarter of 2008! But is ExxonMobil creating value for its shareholders? The key to answering this question rests not just on the level of the firm's earnings but also on (i) how large an investment has been made in the company in order to produce these earnings and (ii) how risky the firm's investors perceive the company's investments to be. In other words, we need to know two things: What *rate* of return did the company earn on its invested capital, and what is the *market's required rate of return* on that invested capital (the company's cost of capital)?

The firm's cost of capital provides an estimate of the rate of return the firm's combined investors expect from the company. Estimating a firm's cost of capital is very intuitive in theory but can be somewhat tedious in practice. In theory, what is required is the following: (i) identify all of the firm's sources of capital and their relative importance (that is, what fraction of the firm's invested capital comes from each source); (ii) estimate the market's required rate of return for each source of capital the firm has used; (iii) calculate an average of the required rates of return for each source of capital where the required rate of return for each source has been weighted by its contribution to the total capital invested in the firm.

The cost of capital is not only important when evaluating the company's overall performance but is also used when evaluating individual investment decisions made by the firm. For example, when ExxonMobil is considering the development of a new oil production property in Nigeria, the company needs to estimate just how much return is needed to justify the investment. Similarly, when it is considering a chemical plant in Southeast Asia the company's analysts need a benchmark return to compare to the investment's expected return. The cost of capital provides this benchmark.

Not to hold you in suspense any longer, in 2011 ExxonMobil Corporation earned a whopping 26.93 percent rate of return on the book value of the firm's equity and a 10 percent rate of return on the market value of the firm's total assets. Given that the firm had to earn less than 10 percent to satisfy all of its investors (both equity

and debt), it created a lot of value for its investors even in the midst of a worsening financial crisis. In this chapter, we investigate how to estimate the cost of funds to the firm. We will refer to the combined cost of borrowed money and money invested in the company by the firm's stockholders as the weighted average cost of capital or simply the firm's cost of capital.

Having studied the connection between risk and investor required rates of return (Chapter 6) and, specifically, investor required rates of return for bondholders and stockholders in Chapters 7 and 8, we are now ready to consider required rates of return for the firm as a whole. That is, just as the individuals that lend the firm money (bondholders) and those that invest in its stock have their individual required rates of return, we can also think about a combined required rate of return for the firm as a whole. This required rate of return for the firm is a blend of the required rates of return of all investors that we will estimate using a weighted average of the individual rates of return called the firm's **weighted average cost of capital** or simply the firm's cost of capital. Just like any cost of doing business, the firm must earn at least this cost if it is to create value for its owners.

In this chapter, we discuss the fundamental determinants of a firm's cost of capital and the rationale for its calculation and use. This entails developing the logic for estimating the cost of debt capital, preferred stock, and common stock. Chapter 12 takes up consideration of the impact of the firm's financing mix on the cost of capital.

The Cost of Capital: Key Definitions and Concepts

Opportunity Costs, Required Rates of Return, and the Cost of Capital

The firm's cost of capital is sometimes referred to as the firm's **opportunity cost** of capital. The term *opportunity cost* comes from the study of economics and is defined as the cost of making a choice in terms of the next best opportunity that is foregone. For example, the opportunity cost of taking a part-time job at Starbucks (SBUX) is the lost wages from the on-campus job you would have taken otherwise. Similarly, when a firm chooses to invest money it has raised from investors, it is in essence deciding not to return the money to the investors. Thus, the opportunity cost of investing the money is the cost the firm incurs by keeping the money and not returning it to the investors, which is the firm's cost of capital.

Is the investor's required rate of return the same thing as the cost of capital? Not exactly. Consequently, in this chapter we will use the symbol k to refer to the cost of financing, whereas in Chapters 7 and 8 we used r to refer to the investor's required rate of return. Two



weighted average cost of capital an average of the individual costs of financing used by the firm. A firm's weighted cost of capital is a function of (1) the individual costs of capital, and (2) the capital structure mix.

b¹ Understand the concepts underlying the firm's cost of capital.

opportunity cost the cost of making a choice defined in terms of the next best alternative that is foregone.

CAN YOU DO IT?

DETERMINING HOW FLOTATION COSTS AFFECT THE COST OF CAPITAL

McDonald's Corporation sold a portion of its ownership interest in its rapidly growing fast-food Mexican restaurant Chipotle in January of 2006 for \$22.00 per share. If the investor's required rate of return on these shares was 18 percent, and McDonald's incurred transaction costs totaling \$2.00 per share, what was the cost of capital to McDonald's after adjusting for the effects of the transaction costs? (The solution can be found on page 277.)

factors drive a wedge between the investor's required rate of return and the cost of capital to the firm.

- 1. Taxes.** When a firm borrows money to finance the purchase of an asset, the interest expense is deductible for federal income tax calculations. Consider a firm that borrows at 9 percent and then deducts its interest expense from its revenues before paying taxes at a rate of 34 percent. For each dollar of interest it pays, the firm reduces its taxes by \$0.34. Consequently, the actual cost of borrowing to the firm is only 5.94% [$0.09 - (0.34 \times 0.09) = 0.09(1 - 0.34) = 0.0594$, or 5.94%].
- 2. Flotation costs.** Here we are referring to the costs the firm incurs *when it raises funds by issuing a particular type of security*. As you learned in Chapter 2, these are sometimes called transaction costs. For example, if a firm sells new shares for \$25 per share but incurs transaction costs of \$5 per share, then the cost of capital for the new common equity is increased. Assume that the investor's required rate of return is 15 percent for each \$25 share; then $0.15 \times \$25 = \3.75 must be earned each year to satisfy the investor's required return. However, the firm has only \$20 to invest, so the cost of capital (k) is calculated as the rate of return that must be earned on the \$20 net proceeds that will produce a return of \$3.75; that is,

$$\begin{aligned} \$20k &= \$25 \times 0.15 = \$3.75 \\ k &= \frac{\$3.75}{\$20.00} = 0.1875, \text{ or } 18.75\% \end{aligned}$$

We will have more to say about both these considerations shortly when we discuss the costs of the individual sources of capital to the firm.

The Firm's Financial Policy and the Cost of Capital

A firm's **financial policy**—that is, *the policies regarding the sources of finances it plans to use and the particular mix (proportions) in which they will be used*—governs its use of debt and equity financing. The particular mixture of debt and equity that the firm uses can impact the firm's cost of capital. However, in this chapter, we assume that the firm maintains a fixed financial policy that is reflected in a fixed debt-equity ratio. Determining the target mix of debt and equity financing is the subject of Chapter 12.

Concept Check

1. How is an investor's required rate of return related to an opportunity cost?
2. How do flotation costs impact the firm's cost of capital?

financial policy the firm's policies regarding the sources of financing it plans to use and the particular mix (proportions) in which they will be used.

 Evaluate the costs of the individual sources of capital.

Determining the Costs of the Individual Sources of Capital

In order to attract new investors, companies have created a wide variety of financing instruments or securities. In this chapter, we stick to three basic types: debt, preferred stock, and common stock. In calculating the respective cost of financing using each of these types of securities, we estimate the investor's required rate of return after properly adjusting for any transaction or flotation costs. In addition, because we will be discounting after-tax cash

flows, we adjust our cost of capital for the effects of corporate taxes. In summary, the cost of a particular source of capital is equal to the investor's required rate of return after adjusting for the effects of both flotation costs and corporate taxes.

The Cost of Debt

In Chapter 7 we learned that the value of a bond can be described in terms of the present value of the bond's future interest and principal payments. For example, if the bond has 3 years until maturity and pays interest annually, its value can be expressed as follows:

$$\begin{aligned} \text{Bond market price} = & \frac{\text{interest paid in year 1}}{\left(1 + \frac{\text{bondholder's required rate of return } (r_d)}{\phantom{\text{rate of return } (r_d)}}\right)^1} + \frac{\text{interest paid in year 2}}{\left(1 + \frac{\text{bondholder's required rate of return } (r_d)}{\phantom{\text{rate of return } (r_d)}}\right)^2} \\ & + \frac{\text{interest paid in year 3}}{\left(1 + \frac{\text{bondholder's required rate of return } (r_d)}{\phantom{\text{rate of return } (r_d)}}\right)^3} + \frac{\text{principal}}{\left(1 + \frac{\text{bondholder's required rate of return } (r_d)}{\phantom{\text{rate of return } (r_d)}}\right)^3} \quad (9-1) \end{aligned}$$

In Chapter 7, we use the above bond price equation to estimate the bondholder's required rate of return. This required rate of return is commonly referred to as the bond's yield to maturity.

Since firms must pay **flotation costs** when they sell bonds, the net proceeds per bond received by the firm is less than the market price of the bond. Consequently, the cost of debt capital (k_d) is higher than the bondholder's required rate of return and is calculated using equation (9-2) as follows:

$$\begin{aligned} \text{Net proceeds per bond} = & \frac{\text{interest paid in year 1}}{\left(1 + \frac{\text{cost of debt capital or } k_d}{\phantom{\text{cost of debt capital or } k_d}}\right)^1} + \frac{\text{interest paid in year 2}}{\left(1 + \frac{\text{cost of debt capital or } k_d}{\phantom{\text{cost of debt capital or } k_d}}\right)^2} \\ & + \frac{\text{interest paid in year 3}}{\left(1 + \frac{\text{cost of debt capital or } k_d}{\phantom{\text{cost of debt capital or } k_d}}\right)^3} + \frac{\text{principal}}{\left(1 + \frac{\text{cost of debt capital or } k_d}{\phantom{\text{cost of debt capital or } k_d}}\right)^3} \quad (9-2) \end{aligned}$$

Note that the adjustment for flotation costs simply involves replacing the market price of the bond with the net proceeds per bond received by the firm after paying these costs. The result of this adjustment is that the discount rate that solves equation (9-2) is now the firm's cost of debt financing before adjusting for the effect of corporate taxes—that is, the before-tax cost of debt (k_d). The final adjustment we make is to account for the fact that interest is tax deductible. Thus, the after-tax cost of debt capital is simply the before-tax cost of debt (k_d) times 1 minus the corporate tax rate.

cost of debt the rate that has to be received from an investment in order to achieve the required rate of return for the creditors.

flotation costs the costs incurred by the firm when it issues securities to raise funds.

DID YOU GET IT?

DETERMINING HOW FLOTATION COSTS AFFECT THE COST OF CAPITAL

If the required rate of return on the shares was 18 percent, and the shares sold for \$22.00 with \$2.00 in transaction costs incurred per share, then the cost of equity capital for Chipotle Mexican Grill is found by grossing up the investor's required rate of return as follows:

$$\text{Cost of equity capital} = \frac{\text{investor's required rate of return}}{(1 - \% \text{ flotation costs})} = \frac{18\%}{1 - \left(\frac{\$2.00}{\$22.00}\right)} = 19.80\%$$

Incidentally, although the shares were sold to the public for \$22.00 per share, they doubled to \$44.00 by the end of the day after being traded in the secondary market.

CAN YOU DO IT?

CALCULATING THE COST OF DEBT FINANCING

General Auto Parts Corporation recently issued a 2-year bond with a face value of \$20 million and a coupon rate of 5.5 percent per year (assume interest is paid annually). The subsequent cash flows to General Auto Parts were as follows:

	TODAY	YEAR 1	YEAR 2
Principal	\$18 million	(\$0.00 million)	(\$20 million)
Interest		(\$0.99 million)	(\$0.99 million)
Total	\$18 million	(\$0.99 million)	(\$20.99 million)

What was the cost of capital to General Auto Parts for the debt issue?
(The solution can be found on page 280.)

EXAMPLE 9.1

Calculating the after-tax cost of debt financing

Synopticom Inc. plans a bond issue for the near future and wants to estimate its current cost of debt capital. After talking with the firm's investment banker, the firm's chief financial officer has determined that a 20-year maturity bond with a \$1,000 face value and 8 percent coupon (paying $8\% \times \$1,000 = \80 per year in interest) can be sold to investors for net proceeds of \$908.32. If the Synopticom tax rate is 34 percent, what is the after-tax cost of debt financing to the firm?

STEP 1: FORMULATE A SOLUTION STRATEGY

The cost of debt financing is estimated as the bondholder's required rate of return, which we learned in Chapter 7 is the discount rate used to calculate the value of a bond, that is, using equation (9-1):

$$\begin{aligned} \text{Net proceeds per bond} = & \frac{\text{interest paid in year 1}}{\left(1 + \frac{\text{bondholder's required rate of return } (k_d)}{1}\right)^1} + \frac{\text{interest paid in year 2}}{\left(1 + \frac{\text{bondholder's required rate of return } (k_d)}{1}\right)^2} + \dots \\ & + \frac{\text{interest paid in year } N}{\left(1 + \frac{\text{bondholder's required rate of return } (k_d)}{1}\right)^N} + \frac{\text{principle paid in year } N}{\left(1 + \frac{\text{bondholder's required rate of return } (k_d)}{1}\right)^N} \end{aligned}$$

Note that we allow for N years of interest payments but omitted writing in the payments for years 3 through $N - 1$ for space considerations. Substituting what we know about the Synopticom bond into equation (9-1) above, we can then solve for the bondholder's required rate of return, k_d . Finally, we calculate the after-tax required rate of return by multiplying k_d by 1 minus the tax rate, T , or

$$\text{After-tax cost of debt} = \frac{\text{bondholder's required rate of return } (k_d)}{1} \times \left(1 - \frac{\text{tax rate}}{1}\right)$$

STEP 2: CRUNCH THE NUMBERS

Substituting the characteristics of Synopticom's bond issue into equation (9-1), we get the following:

$$\$908.32 = \frac{0.08 \times \$1,000}{(1 + k_d)^1} + \frac{0.08 \times \$1,000}{(1 + k_d)^2} + \dots + \frac{0.08 \times \$1,000}{(1 + k_d)^{20}} + \frac{\$1,000}{(1 + k_d)^{20}}$$

We can solve for r_d using the calculator, which equals 9 percent, as demonstrated in the margin. The after-tax cost of debt can now be calculated as follows:

$$\begin{aligned}\text{After-tax cost of debt} &= \text{bondholder's required rate of return } (k_d) \times \left(1 - \frac{\text{tax}}{\text{rate}}\right) \\ &= 0.09 \times (1 - 0.34) = 0.0594, \text{ or } 5.94\%\end{aligned}$$

STEP 3: ANALYZE YOUR RESULTS

It appears that Synopticom's bondholders require a 9 percent rate of return when they purchase the firm's bonds at their current market price of \$908.32. However, since Synopticom can deduct the interest it pays on its debt from its taxable income, the firm saves \$0.34 for each dollar of interest it pays. As a consequence, the 9 percent required return of the firm's bondholders only costs the firm 5.94 percent.

If Synopticom is issuing new bonds, then it will incur the costs of selling the new bonds (that is, flotation costs). If the firm estimates that it will net \$850 per new bond like the one described above since it must pay \$58.32 per bond in flotation costs, then we substitute \$850 for the bond price and compute the required rate of return (after flotation costs) to be 9.73 percent, and the corresponding after-tax cost of newly issued bonds is 6.422 percent.

CALCULATOR SOLUTION

Data Input	Function Key
20	N
-850	PV
80	PMT
1,000	FV
Function Key	Answer
CPT	
I/Y	9.73

The Cost of Preferred Stock

You may recall from Chapter 8 that the price of a share of preferred stock (**cost of preferred equity**) is equal to the present value of the constant stream of preferred stock dividends, that is,

$$\text{Price of a share of preferred stock} = \frac{\text{preferred stock dividend}}{\text{required rate of return of the preferred stockholder } (r_{ps})} \quad (9-3)$$

If we can observe the price of the share of preferred stock and we know the preferred stock dividend, we can calculate the preferred stockholder's required rate of return as follows:

$$\text{Required rate of return of the preferred stockholder } (r_{ps}) = \frac{\text{preferred stock dividend}}{\text{price of a share of preferred stock}} \quad (9-4)$$

Once again, because flotation costs are usually incurred when new preferred shares are sold, the investor's required rate of return is less than the cost of preferred capital to the firm. To calculate the cost of preferred stock, we must adjust the required rate of return to reflect these flotation costs. We replace the price of a preferred share in equation (9-4) with the net proceeds per share from the sale of new preferred shares. The resulting formula can be used to calculate the cost of preferred stock to the firm.

$$\text{Cost of preferred stock } (k_{ps}) = \frac{\text{preferred stock dividend}}{\text{net proceeds per preferred share}} \quad (9-5)$$

Note that the net proceeds per share are equal to the price per share of preferred stock minus flotation cost per share of newly issued preferred stock.

What about corporate taxes? In the case of preferred stock, no tax adjustment must be made because, unlike interest payments, preferred dividends are not tax deductible.

cost of preferred equity the rate of return that must be earned on the preferred stockholders' investment in order to satisfy their required rate of return.

CAN YOU DO IT?

CALCULATING THE COST OF PREFERRED STOCK FINANCING

Carson Enterprises recently issued \$25 million in preferred stock at a price of \$2.50 per share. The preferred shares carry a 10 percent dividend, or \$0.25 per share (assume that it is paid annually). After paying all the fees and costs associated with the preferred issue the firm realized \$2.25 per share issued.

What was the cost of capital to Carson Enterprises from the preferred stock issue? (The solution can be found on page 281.)

EXAMPLE 9.2**Calculating the cost of preferred stock financing**

San Antonio Edison has a preferred stock issue outstanding on which it pays an annual dividend of \$4.25 per share. On August 24, 2011, the stock price was \$58.50 per share. If the firm were to sell a new issue of preferred stock today with the same characteristics as its outstanding issue, it would incur flotation costs of \$1.375 per share. Based on the most recent closing price for the preferred stock, what would you estimate the cost of preferred stock financing to be for the firm?

STEP 1: FORMULATE A SOLUTION STRATEGY

The cost of preferred stock financing can be computed from the basic valuation equation for a share of preferred stock just like we estimate the cost of debt financing from the valuation equation for a bond. Specifically, solving for the cost of preferred stock we can be computed using equation (9-5) as follows:

$$\text{Cost of preferred stock } (k_{ps}) = \frac{\text{preferred stock dividend}}{\text{net proceeds per preferred share}}$$

Note that net proceeds per preferred share reflects the difference in the price for which each preferred share is sold and the flotation costs per share incurred to sell new shares.

STEP 2: CRUNCH THE NUMBERS

Substituting into equation (9-5), we compute the cost of a new preferred stock issue as follows:

$$\text{Cost of preferred stock } (k_{ps}) = \frac{\$4.25}{(\$58.50 - \$1.375)} = 0.0744, \text{ or } 7.44\%$$

STEP 3: ANALYZE YOUR RESULTS

If San Antonio Edison were to issue preferred stock today, it could sell the shares for \$58.50 per share (assuming the preferred stock paid the same dividend as the outstanding shares). However, in order to sell the shares it would have to pay an investment banker a fee to market the issue, and the cost of doing this is \$1.375 per share. Thus, after considering the costs of selling the issue, the firm would incur a cost of 7.44 percent in order to raise preferred stock financing.

DID YOU GET IT?**CALCULATING THE COST OF DEBT FINANCING**

General Auto Parts Corporation receives \$18 million from the sale of the bonds (after paying flotation costs) and is required to make principal plus interest payments at the end of the next 2 years. The total cash flows (both the inflow and the outflows) are summarized below:

	TODAY	YEAR 1	YEAR 2
Principal	\$18 million	(\$0.00 million)	(\$20 million)
Interest		(\$0.99 million)	(\$0.99 million)
Total	\$18 million	(\$0.99 million)	(\$20.99 million)

We can estimate the before-tax cost of capital from the bond issue by solving for k_d in the following bond valuation equation:

$$\begin{aligned} \text{Net bond proceeds}_{\text{today}} &= \frac{\text{interest paid in year 1}}{(1 + k_d)^1} + \frac{\text{interest paid in year 2}}{(1 + k_d)^2} + \frac{\text{principal paid in year 2}}{(1 + k_d)^2} \\ \$18,000,000 &= \frac{\$990,000}{(1 + k_d)^1} + \frac{\$990,000}{(1 + k_d)^2} + \frac{\$20,000,000}{(1 + k_d)^2} \\ k_d &= 10.77\% \end{aligned}$$

The Cost of Common Equity

Common equity is unique in two respects. First, the **cost of common equity** is more difficult to estimate than the cost of debt or cost of preferred stock because the common stockholders' required rate of return is not observable. For example, there is no stated coupon rate or set dividend payment they receive. This results from the fact that common stockholders are the residual owners of the firm, which means that their return is equal to what is left of the firm's earnings after paying the firm's bondholders their contractually set interest and principal payments and the preferred stockholders their promised dividends. Second, common equity can be obtained either from the retention and reinvestment of firm earnings or through the sale of new shares. The costs associated with each of these sources are different from one another because the firm does not incur any flotation costs when it retains earnings, but it does incur costs when it sells new common shares.

We discuss two methods for estimating the common stockholders' required rate of return, which is the foundation for our estimate of the firm's cost of equity capital. These methods are based on the dividend growth model and the capital asset pricing model, which were both discussed in Chapter 8 when we discussed stock valuation.

cost of common equity the rate of return that must be earned on the common stockholders' investment in order to satisfy their required rate of return.

The Dividend Growth Model

Recall from Chapter 8 that the value of a firm's common stock is equal to the present value of all future dividends. When dividends are expected to grow at a rate g forever, and g is less than the investor's required rate of return, k_{cs} , then the value of a share of common stock, P_{cs} , can be written as

$$P_{cs} = \frac{D_1}{k_{cs} - g} \quad (9-6)$$

where D_1 is the dividend expected to be received by the firm's common shareholders 1 year hence. The expected dividend is simply the current dividend (D_0) multiplied by 1 plus the annual rate of growth in dividends (that is, $D_1 = D_0(1 + g)$). The investor's required rate of return then is found by solving equation (9-6) for k_{cs} .

$$k_{cs} = \frac{D_1}{P_{cs}} + g \quad (9-7)$$

Note that k_{cs} is the investor's required rate of return for investing in the firm's stock. It also serves as our estimate of the cost of equity capital, where new equity capital is obtained by retaining a part of the firm's current-period earnings. Recall that common equity financing can come from one of two sources: the retention of earnings or the sale of new common shares. When the firm retains earnings, it doesn't incur any flotation costs; thus, the investor's required rate of return is the same as the firm's cost of new equity capital in this instance.

If the firm issues new shares to raise equity capital, then it incurs flotation costs. Once again we adjust the investor's required rate of return for flotation costs by substituting the net proceeds per share, NP_{cs} , for the stock price, P_{cs} , in equation (9-7) to estimate the cost of new common stock, k_{ncs} .

$$k_{ncs} = \frac{D_1}{NP_{cs}} + g \quad (9-8)$$

DID YOU GET IT?

CALCULATING THE COST OF PREFERRED STOCK FINANCING

Carson Enterprises sold its shares of preferred stock for net proceeds of \$2.25 a share, and each share entitles the holder to a \$0.25 cash dividend every year. Because the dividend payment is constant for all future years, we can calculate the cost of capital raised by the sale of preferred stock (k_{ps}) as follows:

$$\text{Cost of preferred stock } (k_{ps}) = \frac{\text{preferred stock dividend}}{\text{net proceeds per preferred share}} = \frac{\$0.25}{\$2.25} = 11.11\%$$

EXAMPLE 9.3**Calculating the cost of common stock financing**

The Talbot Corporation's common shareholders anticipate receiving a \$2.20 per share dividend next year, based on the fact that they received \$2 last year and expect dividends to grow 10 percent next year. Furthermore, analysts predict that dividends will continue to grow at a rate of 10 percent into the foreseeable future. If Talbot were to issue new common stock, the firm would incur a \$7.50 per share cost to sell the new shares. Based on the most recent closing price for the firm's common stock, what would you estimate the cost of a common stock to be for the firm? What is the cost of a new common stock issue?

STEP 1: FORMULATE A SOLUTION STRATEGY

The cost of common stock financing can be computed from the basic valuation equation for a share of common stock just like we estimate the cost of debt financing from the valuation equation for a bond. Specifically, solving for the cost of common stock, it can be computed using equation (9-7) as follows:

$$\text{Cost of common stock } (k_{cs}) = \frac{\text{common stock dividend}}{\text{price per common share}} + \text{growth rate } (g)$$

If Talbot were to issue new common stock, then the \$7.50 per share flotation costs would be incurred, such that the cost of a new common stock issue would be computed using equation (9-8) as follows:

$$\text{Cost of common stock } (k_{ncs}) = \frac{\text{common stock dividend}}{\text{net proceeds per common share}} + \text{growth rate } (g)$$

Note that net proceeds per common share reflects the difference in the price for which each common share is sold and the flotation costs per share incurred to sell new shares.

STEP 2: CRUNCH THE NUMBERS

Inputting the numbers into equation (9-7), we compute the cost of common stock as follows:

$$\text{Cost of common stock } (k_{cs}) = \frac{\$2.20}{\$50.00} + 0.10 = 0.144, \text{ or } 14.4\%$$

The cost of a new common stock issue is computed by substituting net proceeds per new common share issued for the firm's stock price, that is,

$$\text{Cost of common stock } (k_{ncs}) = \frac{\$2.20}{\$50.00 - \$7.50} + 0.10 = 0.1518, \text{ or } 15.18\%$$

STEP 3: ANALYZE YOUR RESULTS

The cost of common stock or common equity to Talbot is 14.4 percent; however, if the firm makes a new stock issue, it will incur an issue or flotation cost of \$7.50 such that the cost of a new common stock issue is 15.18 percent.

Issues in Implementing the Dividend Growth Model

The principal advantage of the dividend growth model as a basis for calculating the firm's cost of capital as it relates to common stock is the model's simplicity. To estimate an investor's required rate of return, the analyst needs only to observe the current dividend and stock price and to estimate the rate of growth in future dividends. The primary drawback relates to the applicability or appropriateness of the valuation model. That is, the dividend growth model is based on the fundamental assumption that dividends are expected to grow at a constant rate g forever. To avoid this assumption, analysts frequently utilize more complex valuation models in which dividends are expected to grow for, say, 5 years at one rate and then grow at a lower rate from year 6 forward. We do not consider these more complex models here.

Even if the constant growth rate assumption is acceptable, we must arrive at an estimate of that growth rate. We could estimate the rate of growth in historical dividends ourselves or go to published sources of growth rate expectations. Investment advisory services such as Value Line provide their own analysts' estimates of earnings growth rates (generally spanning up to 5 years), and the Institutional Brokers' Estimate System (I/B/E/S) collects and publishes earnings per share forecasts made by more than 1,000 analysts for a broad list of stocks. These estimates are helpful but still require the careful judgment of an analyst in their use because they relate to earnings (not dividends) and extend only 5 years into the future (not forever, as required by the dividend growth model). Nonetheless, these estimates provide a useful guide to making your initial dividend growth rate estimate.

The Capital Asset Pricing Model

Recall from Chapter 6 that the capital asset pricing model (CAPM) provides a basis for determining the investor's expected or required rate of return from investing in a firm's common stock. The model depends on three things:

1. The risk-free rate, r_f
2. The systematic risk of the common stock's returns relative to the market as a whole, or the stock's beta coefficient, β
3. The market-risk premium, which is equal to the difference in the expected rate of return for the market as a whole, that is, the expected rate of return for the "average security" minus the risk-free rate, or in symbols, $r_m - r_f$

Using the CAPM, the investor's required rate of return can be written as follows:

$$k_{cs} = r_f + \beta(r_m - r_f) \quad (9-9)$$

EXAMPLE 9.4

Calculating the cost of common stock financing using the CAPM

The Talbot Corporation's beta coefficient is estimated to be 1.40. Furthermore, the risk-free rate of interest is currently 3.75%, and the expected rate of return on a diversified portfolio of all common stocks is 12 percent. Use the capital asset pricing model (CAPM) to estimate the cost of equity capital for Talbot.

STEP 1: FORMULATE A SOLUTION STRATEGY

In Example 9.3 we estimated the cost of common stock using a constant rate of growth and the discounted cash-flow model. In this example, we estimate that same cost of common stock using the capital asset pricing model, or CAPM. Specifically, the cost of common stock can be estimated using equation (9-9) as follows:

$$\begin{array}{l} \text{Cost of common} \\ \text{stock } (k_{cs}) \end{array} = r_f + \beta(r_m - r_f)$$

STEP 2: CRUNCH THE NUMBERS

Inserting the values into equation (9-9), we compute the cost of a common stock as follows:

$$\begin{array}{l} \text{Cost of common} \\ \text{stock } (k_{cs}) \end{array} = r_f + \beta(r_m - r_f) = 0.0375 + 1.4(0.12 - 0.0375) = 0.153, \text{ or } 15.3\%$$

STEP 3: ANALYZE YOUR RESULTS

Our estimate of the cost of common stock or common equity to Talbot using the CAPM is 15.3 percent. Note that since no transaction costs are considered when using the CAPM, this estimate is for the cost of internal common equity or the retention of earnings.

CAN YOU DO IT?

CALCULATING THE COST OF NEW COMMON STOCK USING THE DIVIDEND GROWTH MODEL

In March of 2012 the Mayze Corporation sold an issue of common stock in a public offering. The shares sold for \$100 per share. Mayze's dividend in 2011 was \$8 per share, and analysts expect that the firm's earnings and dividends will grow at a rate of 6 percent per year for the foreseeable future. What is the common stock investor's required rate of return (and the cost of retained earnings)?

Although the shares sold for \$100 per share, Mayze received net proceeds from the issue of only \$95 per share. The difference represents the flotation cost paid to the investment banker.

What is your estimate of the cost of new equity for Mayze using the dividend growth model?
(The solution can be found on page 285.)

CAN YOU DO IT?

CALCULATING THE COST OF COMMON STOCK USING THE CAPM

The Mayze Corporation issued common stock in March 2012 for \$100 per share. However, before the issue was made, the firm's chief financial officer (CFO) asked one of his financial analysts to estimate the cost of the common stock financing using the CAPM. The analyst looked on Yahoo! Finance and got an estimate of 0.90 for the firm's beta coefficient. She also consulted online sources to get the current yield on a 10-year U.S. Treasury bond, which was 5.5 percent. The final estimate she needed to complete her calculation of the cost of equity using the CAPM was the market-risk premium, or the difference in the expected rate of return on all equity securities and the rate of return on the 10-year U.S. Treasury bond. After a bit of research she decided that the risk premium should be based on a 12 percent expected rate of return for the market portfolio and the 5.5 percent rate on the Treasury bond.

What is your estimate of the cost of common stock for Mayze using the CAPM?
(The solution can be found on page 286.)

Issues in Implementing the CAPM

The CAPM approach has two primary advantages when it comes to calculating a firm's cost of capital as it relates to common stock. First, the model is simple and easy to understand and implement. The model variables are readily available from public sources, with the possible exception of beta coefficients for small firms and/or privately held firms. Second, because the model does not rely on dividends or any assumption about the growth rate in dividends, it can be applied to companies that do not currently pay dividends or are not expected to experience a constant rate of growth in dividends.

Of course, using the CAPM requires that we obtain estimates of each of the three model variables— r_f , β , and $(r_m - r_f)$. Let's consider each in turn. First, the analyst has a wide range of U.S. government securities on which to base an estimate of the risk-free rate (r_f). Treasury securities with maturities from 30 days to 20 years are readily available. Unfortunately, the CAPM offers no guidance about the appropriate choice. In fact, the model itself assumes that there is but one risk-free rate, and it corresponds to a one-period return (the length of the period is not specified, however). Consequently, we are left to our own judgment about which maturity we should use to represent the risk-free rate. For applications of the cost of capital involving long-term capital expenditure decisions, it seems reasonable to select a risk-free rate of comparable maturity. So, if we are calculating the cost of capital to be used as the basis for evaluating investments that will provide returns over the next 20 years, it seems appropriate to use a risk-free rate corresponding to a U.S. Treasury bond of comparable maturity.

Second, estimates of security beta (β) coefficients are available from a wide variety of investment advisory services, including Merrill Lynch and Value Line, among others. Alternatively, we could collect historical stock market returns for the company of interest as well as a general market index (such as the Standard and Poor's 500 Index) and estimate the stock's beta as the slope of the relationship between the two return series—as we did

in Chapter 6. However, because beta estimates are widely available for a large majority of publicly traded firms, analysts frequently rely on published sources for betas.

Finally, estimating the market-risk premium can be accomplished by looking at the history of stock returns and the premium earned over (under) the risk-free rate of interest. In Chapter 6, we reported a summary of the historical returns earned on risk-free securities and common stocks in Figure 6-2. We saw that on average over the past 70 years, common stocks have earned a premium of roughly 5.5 percent over long-term government bonds. Thus, for our purposes, we will utilize this estimate of the market-risk premium ($r_m - r_f$) when estimating the investor's required rate of return on equity using the CAPM.

FINANCE AT WORK

IPOs: SHOULD A FIRM GO PUBLIC?

When a privately owned company decides to distribute its shares to the general public, it goes through a process known as an initial public offering (IPO). There are a number of advantages to having a firm's shares traded in the public equity market, including the following:

- **New capital is raised.** When the firm sells its shares to the public, it acquires new capital that can be invested in the firm.
- **The firm's owners gain liquidity of their share holdings.** Publicly traded shares are more easily bought and sold, so the owners can more easily liquidate all or part of their investment in the firm.
- **The firm gains future access to the public capital market.** Once a firm has raised capital in the public markets, it is easier to go back a second and third time.
- **Being a publicly traded firm can benefit the firm's business.** Public firms tend to enjoy a higher profile than their privately held counterparts. This may make it easier to make sales and attract vendors to supply goods and services to the firm.

However, all is not rosy as a publicly held firm. There are a number of potential disadvantages, including the following:

- **Reporting requirements can be onerous.** Publicly held firms are required to file periodic reports with the Securities and Exchange Commission (SEC). This is not only onerous in terms of the time and effort required but also some business owners feel they must reveal information to their competitors that could be potentially damaging.

- **The private equity investors now must share any new wealth with the new public investors.** Once the firm is a publicly held company, the new shareholders share on an equal footing with the company founders the good (and bad) fortune of the firm.
- **The private equity investors lose a degree of control over the organization.** Outsiders gain voting control over the firm to the extent that they own its shares.
- **An IPO is expensive.** A typical firm may spend 15 to 25 percent of the money raised on expenses directly connected to the IPO. This cost is increased further if we consider the cost of lost management time and disruption of business associated with the IPO process.
- **Exit of the company's owners is usually limited.** The company's founders may want to sell their shares through the IPO, but this is not allowed for an extended period of time following the IPO. Therefore, this is not usually a good mechanism for cashing out the company founders.
- **Everyone involved faces legal liability.** The IPO participants are jointly and severally liable for each others' actions. This means that they can be sued for any omissions from the IPO's prospectus should the market valuation fall below the IPO offering price.

Carefully weighing the financial consequences of each of these advantages and disadvantages can provide a company's owners (and managers) with some basis for answering the question of whether they want to become a public corporation.

Other Sources: Professor Ivo Welch's Web site, welch.som.yale.edu, provides a wealth of information concerning IPOs.

DID YOU GET IT?

CALCULATING THE COST OF NEW COMMON STOCK USING THE DIVIDEND GROWTH MODEL

We can estimate the cost of equity capital using the dividend growth model by substituting into the following equation:

$$\text{Cost of new common stock } (k_{ncs}) = \frac{\text{expected dividend next year } (D_1)}{\text{net proceeds per share } (NP_{cs})} + \text{dividend growth rate } (g) = \frac{\$8.00 (1.06)}{\$95.00} + 0.06 = 14.92\%$$

DID YOU GET IT?

CALCULATING THE COST OF COMMON STOCK USING THE CAPM

The CAPM can be used to estimate the investor's required rate of return as follows:

$$\text{Cost of common equity } (k_{cs}) = \left(\text{risk-free rate of interest } (r_f) \right) + \left(\text{Mayze's beta coefficient } (\beta) \right) \times \left[\text{expected market rate of return } (r_m) - \text{risk-free rate of interest } (r_f) \right]$$

Making the appropriate substitutions, we get the following estimate of the investor's required rate of return using the CAPM model:

$$\text{Cost of common equity } (k_{cs}) = 0.055 + 0.90 \times (0.12 - 0.055) = 0.1135, \text{ or } 11.35\%$$

In addition to the historical average market-risk premium, we can also utilize surveys of professional economists' opinions regarding future premiums.¹ For example, in a survey conducted in 1998 by Yale economist Ivo Welch, the median 30-year market-risk premium for all survey participants was 7 percent. When the survey was repeated in 2000, the corresponding market-risk premium had fallen to 5 percent. These results suggest two things. First, the market-risk premium is not fixed. It varies through time with the general business cycle. In addition, it appears that using a market-risk premium somewhere between 5 percent and 7 percent is reasonable when estimating the cost of capital using the capital asset pricing model.

Concept Check

1. Define the cost of debt, preferred equity, and common equity financing.
2. The cost of common equity financing is more difficult to estimate than the costs of debt and preferred equity. Explain why.
3. What is the dividend growth model, and how is it used to estimate the cost of common equity financing?
4. Describe the capital asset pricing model and how it can be used to estimate the cost of common equity financing.
5. What practical problems are encountered in using the CAPM to estimate common equity capital cost?

b³ Calculate a firm's weighted average cost of capital.

capital structure the mix of long-term sources of funds used by the firm. This is also called the firm's capitalization. The relative total (percentage) of each type of fund is emphasized.

The Weighted Average Cost of Capital

Now that we have calculated the individual costs of capital for each of the sources of financing the firm might use, we turn to the combination of these capital costs into a single weighted average cost of capital. To estimate the weighted average cost of capital, we need to know the cost of each of the sources of capital used and the capital structure mix. We use the term **capital structure** to refer to *the proportions of each source of financing used by the firm*. Although a firm's capital structure can be quite complex, we focus our examples on the three basic sources of capital: bonds, preferred stock, and common equity.

In words, we calculate the weighted average cost of capital for a firm that uses only debt and common equity using the following equation:

$$\text{Weighted average cost of capital} = \left(\text{after-tax cost of debt} \times \text{proportion of debt financing} \right) + \left(\text{cost of equity} \times \text{proportion of equity financing} \right) \quad (9-10)$$

¹The results reported here come from Ivo Welch, "Views of Financial Economists on the Equity Premium and on Professional Controversies," *Journal of Business* 73–74 (October 2000), pp. 501–537; and Ivo Welch, "The Equity Premium Consensus Forecast Revisited," Cowles Foundation Discussion Paper No. 1325 (September 2001).

For example, if a firm borrows money at 6 percent after taxes, pays 10 percent for equity, and raises its capital in equal proportions from debt and equity, its weighted average cost of capital is 8 percent, that is,

$$\text{Weighted average cost of capital} = [0.06 \times 0.5] + [0.10 \times 0.5] = 0.08, \text{ or } 8\%$$

In practice, the calculation of the cost of capital is more complex than this example. For one thing, firms often have multiple debt issues with different required rates of return, and they also use preferred equity as well as common equity financing. Furthermore, when common equity capital is raised, it is sometimes the result of retaining and reinvesting the firm's earnings, and at other times it involves a new stock offering. Of course, in the case of retained earnings, the firm does not incur the costs associated with selling new common stock. This means that equity from retained earnings is less costly than a new stock offering. In the examples that follow, we address each of these complications.

Capital Structure Weights

The reason we calculate a cost of capital is that it enables us to evaluate one or more of the firm's investment opportunities. Remember that the cost of capital should reflect the riskiness of the project being evaluated, so a firm should calculate multiple costs of capital when it makes investments in multiple divisions or business units having different risk characteristics. Thus, for the calculated cost of capital to be meaningful, it must correspond directly to the riskiness of the particular project being analyzed. That is, in theory the cost of capital should reflect the particular way in which the funds are raised (the capital structure used) and the systemic risk characteristics of the project. Consequently, the correct way to calculate capital structure weights is to use the actual dollar amounts of the various sources of capital actually used by the firm.²

In practice, *the mixture of financing sources used by a firm will vary from year to year*. For this reason, many firms find it expedient to use target capital structure proportions when calculating the firm's weighted average cost of capital. For example, a firm might use its target mix of 40 percent debt and 60 percent equity to calculate its weighted average cost of capital even though, in that particular year, it raised the majority of its financing requirements by borrowing. Similarly, it would continue to use the target proportions in the subsequent year, when it might raise the majority of its financing needs by reinvesting earnings or issuing new stock.

Calculating the Weighted Average Cost of Capital

The weighted average cost of capital, k_{wacc} , is simply a weighted average of all the capital costs incurred by the firm. Table 9-1 illustrates the procedure used to estimate k_{wacc} for a firm that has debt, preferred stock, and common equity in its target capital structure mix. Two possible scenarios are described in the two panels. First, in Panel A the firm is able to finance all of its target capital structure requirements for common equity using retained earnings. Second, in Panel B the firm must use a new equity offering to raise the equity capital it requires. For example, if the firm has set a 75 percent target for equity financing and has current earnings of \$750,000, then it can raise up to $\$750,000/0.75 = \$1,000,000$ in new financing before it has to sell new equity. For \$1,000,000 or less in capital spending, the firm's weighted average cost of capital would be calculated using the cost of equity from retained earnings (following Panel A of Table 9-1). For more than \$1,000,000 in new capital, the cost of capital would rise to reflect the impact of the higher cost of using new common stock (following Panel B of Table 9-1).

²There are instances when we will want to calculate the cost of capital for the firm as a whole. In this case, the appropriate weights to use are based on the market value of the various capital sources used by the firm. Market values rather than book values properly reflect the sources of financing used by a firm at any particular point in time. However, when a firm is privately owned, it is not possible to get market values of its securities, and book values are often used.

TABLE 9-1 Calculating the Weighted Average Cost of Capital

PANEL A: COMMON EQUITY RAISED BY RETAINED EARNINGS			
Capital Structure			
Source of Capital	Weights	× Cost of Capital	= Product
Bonds	w_d	$k_d(1 - T_c)$	$w_d \times k_d(1 - T_c)$
Preferred stock	w_{ps}	k_{ps}	$w_{ps} \times k_{ps}$
Common equity			
Retained earnings	$\frac{w_{cs}}{100\%}$	k_{cs}	$\frac{w_{cs} \times k_{cs}}{k_{wacc}}$
Sum =	100%	Sum =	k_{wacc}

PANEL B: COMMON EQUITY RAISED BY SELLING NEW COMMON STOCK			
Capital Structure			
Source of Capital	Weights	× Cost of Capital	= Product
Bonds	w_d	$k_d(1 - T_c)$	$w_d \times k_d(1 - T_c)$
Preferred stock	w_{ps}	k_{ps}	$w_{ps} \times k_{ps}$
Common equity			
Common stock	$\frac{w_{ncs}}{100\%}$	k_{ncs}	$\frac{w_{ncs} \times k_{ncs}}{k_{wacc}}$
Sum =	100%	Sum =	k_{wacc}

EXAMPLE 9.5**Calculating a firm's weighted average cost of capital**

Ash Inc.'s capital structure and estimated capital costs are found in Table 9-2. Note that the sum of the capital structure weights must equal 100 percent if we have properly accounted for all sources of financing and in the correct amounts. For example, Ash plans to invest a total of \$3 million in common equity to fund a \$5 million investment. Because Ash has earnings equal to the \$3,000,000 it needs in new equity financing, the entire amount of new equity will be raised by retaining earnings.

STEP 1: FORMULATE A SOLUTION STRATEGY

We calculate the weighted average cost of capital following the procedure described in Panel A of Table 9-1 and using the information found in Table 9-2. Note that the cost of capital for Ash Inc. varies with the amount of financing being considered. For example, for up to \$5 million in new capital the firm can use retained earnings to supply the needed common equity to make up 60 percent of the total. However, for each dollar over \$5 million Ash Inc. will have to issue new common shares, which carry a higher cost of financing than retained earnings since transaction costs are incurred to sell more common stock.

The formula used to calculate the weighted average cost of capital, k_{wacc} , is summarized in Table 9-1; however, we can write the equation down as follows:

$$k_{wacc} = w_d \times k_d \times (1 - T_c) + (w_{ps} \times k_{ps}) + (w_{cs} \times k_{cs})$$

Note that k_{wacc} is simply an average of the after-tax costs of debt, preferred stock, and common stock where these costs are weighted by their relative importance in the firm's capital structure. To compute the cost of raising more than \$5 million in total financing we simply substitute the cost of new common stock, k_{ncs} , for the cost of equity.

STEP 2: CRUNCH THE NUMBERS

Panel A of Table 9-3 computes an estimate of Ash Inc.'s weighted average cost of up to \$5 million in new capital, which is 12.7 percent. Should the firm need to raise more than \$5 million, then new shares of common stock will have to be issued and the cost of this equity capital is 18 percent (compared to 16 percent for internally generated common equity or retained earnings). The net result is that the firm's cost of capital for each dollar over \$5 million rises to 13.9 percent.

TABLE 9-2 Capital Structure and Capital Costs for Ash Inc.

Source of Capital	Amount of Funds Raised (\$)	Percentage of Total	After-Tax Cost of Capital
Bonds	1,750,000	35%	7%
Preferred stock	250,000	5%	13%
Retained earnings	<u>3,000,000</u>	<u>60%</u>	16%
Total	5,000,000	100%	

TABLE 9-3 The Weighted Average Cost of Capital for Ash Inc.

PANEL A: COST OF CAPITAL FOR \$0 TO \$5,000,000 IN NEW CAPITAL			
Capital Structure			
Source of Capital	Weights	Cost of Capital	Product
Bonds	35%	7%	2.45%
Preferred stock	5%	13%	0.65%
Retained earnings	<u>60%</u>	16%	<u>9.60%</u>
Total	100%	$k_{wacc} =$	12.70%

PANEL B: COST OF CAPITAL FOR MORE THAN \$5,000,000			
Capital Structure			
Source of Capital	Weights	Cost of Capital	Product
Bonds	35%	7%	2.45%
Preferred stock	5%	13%	0.65%
New common stock	<u>60%</u>	18%	<u>10.80%</u>
Total	100%	$k_{wacc} =$	13.90%

STEP 3: ANALYZE YOUR RESULTS

The firm's weighted average cost of capital is an estimate of the blend of sources of capital the firm has used. For Ash Inc., the cost of raising up to \$5 million is 12.70 percent, whereas raising more than \$5 million requires the firm to issue new shares of common stock and incur flotation costs such that the overall weighted average cost of capital rises to 13.9 percent.

CAUTIONARY TALE**FORGETTING PRINCIPLE 3: RISK REQUIRES A REWARD**

What happens to a firm's cost of capital when the capital market that the firm depends on for financing simply stops working? Investment banking firm Goldman Sachs discovered the answer to this question the hard way. In 2008, as potential lenders became very nervous about the future of the economy, the credit markets from which Goldman Sachs borrowed money on a regular basis simply stopped functioning. The effect of this shutdown was that Goldman Sachs no longer had access to cheap short-term debt financing. And this meant the firm was at greater risk of financial distress. This high risk of firm failure caused its equity holders to demand a much higher rate of return and thus, Goldman Sachs's cost of equity financing skyrocketed.

Ultimately, faced with a crisis, Goldman arranged for a \$10 billion loan from the U.S. Government's Troubled Asset Relief

Fund (TARP) and obtained a \$5 billion equity investment from famed investor Warren Buffett. The combined effects of these actions stabilized the firm's financial situation and lowered the firm's cost of capital dramatically. Goldman Sachs and Morgan Stanley are the only two large investment banking firms to survive the financial crisis.

So what can Goldman Sachs learn from this experience? Debt financing, and in particular short-term debt financing, may offer higher returns in the short run, but this use of financial leverage comes with a significant increase in risk to the equity holders, and this translates to higher costs of equity financing for the firm.

Concept Check

1. A firm's capital structure and its target capital structure proportions are important determinants of a firm's weighted average cost of capital. Explain.
2. Explain in words the calculation of a firm's weighted average cost of capital. What exactly are we averaging and what do the weights represent?

4 Estimate divisional costs of capital

divisional WACC the cost of capital for a specific business unit or division.

Calculating Divisional Costs of Capital

Estimating Divisional Costs of Capital

Firms that have multiple operating divisions where each division's risk is unique and different from that of the firm as a whole often use different costs of capital for each division in an effort to properly account for risk. The idea here is that the divisions take on investment projects with unique levels of risk and, consequently, the WACC used in each division is potentially unique to that division. Generally, divisions are defined either by geographical regions (for example, the Latin American division) or industry (for example, exploration and production, pipelines, and refining for a large integrated oil company).

The advantages of using a **divisional WACC** include the following:

- ◆ It provides different discount rates that reflect differences in the systematic risk of the projects evaluated by the different divisions.
- ◆ It entails only one cost of capital estimate per division (as opposed to unique discount rates for each project), thereby minimizing the time and effort of estimating the cost of capital.
- ◆ The use of a common discount rate throughout the division limits managerial latitude and the attendant influence costs as managers would otherwise be tempted to lobby for a lower cost of capital for pet projects.

Using Pure Play Firms to Estimate Divisional WACCs

One approach that can be taken to deal with differences in the costs of capital for each of the firm's business units involves identifying what we will call "pure play" comparison firms (or "comps") that operate in only one of the individual business areas (where possible). For example, Valero Energy Corporation (VLO) is a Fortune 500 manufacturer and marketer of transportation fuels headquartered in San Antonio, Texas. The firm owns 14 refineries and is one of the largest U.S. retail operators with over 5,800 retail stores. Specifically, the firm's operations are concentrated in the "downstream" segment of the petroleum industry, which involves refining crude oil into gasoline and other transportation fuels and the sale of those products to the public.

To estimate the cost of capital for each of these different types of activities, we use the WACCs for comparison firms that are not fully integrated and operate in only one of Valero's business segments. For example, to estimate the WACC for its business unit engaged in refining crude oil, Valero might use a WACC estimate for firms that operate in the refinery industry (SIC industry 2911) to estimate the relevant WACC for this division.³ To estimate the WACC for the retail component of Valero's operations, we could use firms that operate primarily in the retail convenience store industry, which is SIC 5411.

Divisional WACC Example Table 9-4 contains hypothetical estimates of the divisional WACC for the refining and retail (convenience store) industries.

Panel A contains estimates of the after-tax cost of debt financing to the refining and retailing industries where the firm's marginal income tax rate is assumed to be 38 percent. Note that the borrowing costs are slightly different, which reflects both the amount of money borrowed (see Panel C) and the risk differences perceived by lenders to the two industries. Panel B contains the after-tax cost of equity capital based on the capital asset

³SIC is the four-digit Standard Industrial Classification code that is widely used to identify different industries.

TABLE 9-4 Divisional WACC Computations

PANEL A. AFTER-TAX COST OF DEBT							
	Pre-Tax Cost of Debt		×		(1 − Tax Rate)		After-Tax Cost of Debt
Refining	9.00%		×		0.62		0.0558
Retailing—Convenience Stores	7.50%		×		0.62		0.0465
PANEL B. AFTER-TAX COST OF EQUITY							
	Risk-Free Rate	+	Beta	×	Market-Risk Premium	=	Cost of Equity
Refining	0.02	+	1.1	×	0.07	=	0.097
Retailing—Convenience Stores	0.02	+	0.8	×	0.07	=	0.076
PANEL C. TARGET DEBT RATIOS							
	Target Debt Ratio						
Refining	10%						
Retailing—Convenience Stores	50%						
PANEL D. DIVISIONAL WACC FOR REFINING							
	Capital Structure Weight	×	After-Tax Cost of Capital	=			Product
Debt	0.10	×	0.0558	=			0.0056
Equity	0.90	×	0.0970	=			0.0873
WACC				=			0.0929 or 9.29%
PANEL E. DIVISIONAL WACC FOR RETAIL (CONVENIENCE STORES)							
	Capital Structure Weight	×	After-Tax Cost of Capital	=			Product
Debt	0.50	×	0.0465	=			0.0233
Equity	0.50	×	0.0760	=			0.03580
WACC				=			0.0613 or 6.13%

pricing model. The only difference in the cost of equity for the two industries corresponds to the beta estimates. Finally, in Panels D and E we estimate the WACCs for the two industry segments. The refining industry has a 9.29 percent WACC estimate, while the retail industry has a 6.13 percent WACC. If the firm were to use a composite of the two WACC estimates to evaluate new projects, the WACC would be somewhere between these two industry estimates. This would mean that the firm would take on too many refining projects and too few retail investments.

Divisional WACC—Estimation Issues and Limitations Although the divisional WACC is generally a significant improvement over the single, company-wide WACC, the way that it is often implemented using industry-based comparison firms has a number of potential limitations:

- ◆ The sample of those in a given industry may include those that are not good matches for the firm or one of its divisions. For example, the Valero company analyst may select two or three firms whose risk profiles more nearly match their refining division as opposed to using a composite made of all firms found in the petroleum refining industry (SIC 2911). The firm's management can easily address this problem by selecting appropriate comparison firms with similar risk profiles from among the many firms included in these industries.
- ◆ The division being analyzed may not have a capital structure that is similar to the sample of firms in the industry data. The division may be more or less leveraged than the

firms whose costs of capital are used to proxy for the divisional cost of capital. For example, ExxonMobil raised only 4 percent of its capital using debt financing, whereas Valero Energy (VLO) has raised 35 percent of its capital with debt at the end of 2011⁴.

- ◆ The firms in the chosen industry that are used to proxy for divisional risk may not be good reflections of project risk. Firms, by definition, are engaged in a variety of activities, and it can be very difficult to identify a group of firms that are predominantly engaged in activities that are truly comparable to a given project. Even within divisions, individual projects can have very different risk profiles. This means that even if we are able to match divisional risks very closely, there may still be significant differences in risk across projects undertaken within a division. For example, some projects may entail extensions of existing production capabilities, while others involve new-product development. Both types of investments take place within a given division, but they have very different risk profiles.
- ◆ Good comparison firms for a particular division may be difficult to find. Most publicly traded firms report multiple lines of business, yet each company is classified into a single industry group. In the case of Valero we found two operating divisions (refining and retail) and identified an industry proxy for each.

The preceding discussion suggests that although the use of divisional WACCs to determine project discount rates may represent an improvement over the use of a company-wide WACC, this methodology is far from perfect. However, if the firm has investment opportunities with risks that vary principally with industry-risk characteristics, the use of a divisional WACC has clear advantages over the use of the firm's WACC. It provides a methodology that allows for different discount rates, and it avoids some of the influence costs associated with giving managers complete leeway to select project-specific discount rates. Table 9-5 summarizes the cases for using a single-firm WACC and divisional WACCs to evaluate investment opportunities.

TABLE 9-5 Choosing the Right WACC—Discount Rates and Project Risk

There are good reasons for using a single, company-wide WACC to evaluate the firm's investments even where there are differences in the risks of the projects the firm undertakes. The most common practice among firms that use a variety of discount rates to evaluate new investments in an effort to accommodate risk differences is the divisional WACC. The latter represents something of a compromise that minimizes some of the problems encountered when attempting to estimate both the project-specific costs of capital and the costs that arise where a single discount rate is used that is equal to the firm's WACC.

Method	Description	Advantages	Disadvantages	When to Use
WACC	Estimated WACC for the firm as an entity; used as the discount rate on <i>all</i> projects.	- Familiar concept to most business executives. - Minimizes estimation costs, as there is only one cost of capital calculation for the firm. - Reduces the problem of influence cost issues.	- Does not adjust discount rates for differences in project risk. - Does not provide for flexibility in adjusting for differences in project debt in the capital structure.	- Projects are similar in risk to the firm as a whole. - Using multiple discount rates creates significant problems with influence costs.
Divisional WACC	Estimated WACC for individual business units or divisions within the firm; used as the only discount rates within each division.	- Uses division-level risk to adjust discount rates for individual projects. - Reduces influence costs to the competition among division managers to lower their division's cost of capital.	- Does not capture intra-division risk differences in projects. - Does not account for differences in project debt capacities within divisions. - Potential influence costs associated with the choice of discount rates across divisions. - Difficult to find single-division firms to proxy for divisions.	- Individual projects within each division have similar risks and debt capacities. - Discount rate discretion creates significant influence costs within divisions but not between divisions.

⁴This estimate is based on year-end 2011 financial statements, using book values of interest-bearing short- and long-term debt and the market value of the firm's equity on March 30, 2012.

FINANCE AT WORK

THE PILLSBURY COMPANY ADOPTS EVA WITH A GRASSROOTS EDUCATION PROGRAM

A key determinant of the success of any incentive-based program is employee buy-in. If employees simply view a new performance measurement and reward system as “just another” reporting requirement, the program will have little impact on their behavior and, consequently, little effect on the firm’s operating performance. In addition, if a firm’s employees do not understand the measurement system, it is very likely that it will be distrusted and may even have counterproductive effects on the firm’s performance.

So how do you instill in your employees the notion that your performance measurement and reward system does indeed lead to the desired result? Pillsbury took a unique approach to the problem by using a simulation exercise in which the value of applying the principles of Economic Value Added (EVA®) could be learned by simulating the operations of a hypothetical factory. Employees used the simulation to follow the value-creation process from the factory’s revenue, to net operating profit after taxes, to the weighted average cost of capital. The results were gratifying. One Pillsbury manager noted, “you saw the lights go on in people’s eyes” as employees realized, “Oh, this really does impact my work environment.”

Briggs and Stratton used a similar training program to instill the basic principles of EVA in its employees. Its business-simulation

example was even more basic than the Pillsbury factory. Briggs and Stratton used a convenience store’s operations to teach line workers the importance of controlling waste, utilizing assets fully, and managing profit margins. Stern Stewart and Company, which coined the term EVA, has also developed a training tool, the EVA Training Tutor.™ The EVA Training Tutor addresses four basic issues using CD-ROM technology:

- Why is creating shareholder wealth an important corporate and investor goal?
- What is the best way to measure wealth and business success?
- Which business strategies have created wealth, and which have failed?
- What can you do to create wealth and increase the stock price of your company?

The educational programs described briefly here are examples of how major corporations are seeing the need to improve the financial literacy of their employees to make the most of their human and capital resources.

Sources: Adapted from George Donnelly, “Grassroots EVA,” CFO.com (May 1, 2000), www.cfo.com and The EVA Training Tutor™ (Stern Stewart and Company).

CAN YOU DO IT?

CALCULATING THE WEIGHTED AVERAGE COST OF CAPITAL

In the fall of 2009, Grey Manufacturing was considering a major expansion of its manufacturing operations. The firm has sufficient land to accommodate the doubling of its operations, which will cost \$200 million. To raise the needed funds Grey’s management has decided to simply mimic the firm’s present capital structure as follows:

SOURCE OF CAPITAL	AMOUNT OF FUNDS RAISED (\$)	PERCENTAGE OF TOTAL	AFTER-TAX COST OF CAPITAL*
Debt	\$ 80,000,000	40%	5.20%
Common stock	120,000,000	60%	14.50%
Total	\$200,000,000	100%	

What is your estimate of Grey’s weighted average cost of capital?

*You may assume that these after-tax costs of capital have been appropriately adjusted for any transaction costs incurred when raising the funds. (The solution appears below.)

DID YOU GET IT?

CALCULATING THE WEIGHTED AVERAGE COST OF CAPITAL

The weighted average cost of capital (WACC) for Grey Manufacturing can be calculated using the following table:

SOURCE OF CAPITAL	PERCENTAGE OF TOTAL CAPITAL	AFTER-TAX COST OF CAPITAL	PRODUCT
Debt	40%	5.20%	2.0800%
Common stock	60%	14.50%	8.7000%
			WACC = 10.7800%

Consequently, we estimate Grey’s WACC to be 10.78 percent.

Calculating a firm's cost of capital involves using a number of financial decision tools. Specifically, the analyst must estimate the after-tax cost of debt, the cost of preferred stock financing, the cost of common equity financing, and the weighted average cost of capital itself.

FINANCIAL DECISION TOOLS

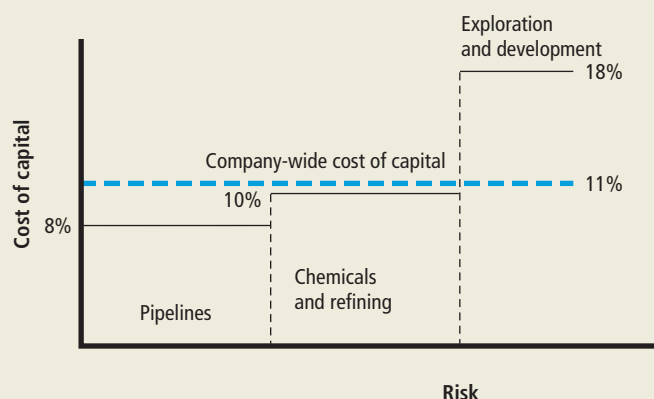
Name of Tool	Formula	What It Tells You
After-tax cost of debt	Step 1: The cost of debt (before taxes) is calculated as follows: $\frac{\text{Net Proceeds}}{(NP_d)} = \frac{\text{interest (year 1)}}{(1 + k_d)^1} + \frac{\text{interest (year 2)}}{(1 + k_d)^2} + \dots$ $+ \frac{\text{principal}}{(1 + k_d)^2}$ Step 2: The after-tax cost of debt is calculated as follows: $k_d(1 - T_c)$ Where T_c is the corporate tax rate.	The cost of borrowed funds to the firm after considering the tax deductibility of interest expense
Cost of preferred stock	The ratio of the present value of the future free cash flows to the initial outlay: $k_{ps} = \frac{\text{preferred stock dividend}}{\text{net proceeds per share of preferred stock } (NP_{ps})}$	The cost of raising funds by selling new shares of preferred stock
Cost of common equity (dividend growth model)	Cost of raising common equity by retaining and reinvesting firm earnings: $k_{cs} = \frac{\text{common stock dividend in year 1}}{\text{current price of common stock } (P_{cs})} + \frac{\text{dividend growth rate } (g)}{\text{rate } (g)}$ Cost of raising external equity funding by selling new shares of common stock: $k_{cs} = \frac{\text{common stock dividend in year 1}}{\text{net proceeds per share of preferred stock } (NP_{cs})} + \frac{\text{dividend growth rate } (g)}{\text{rate } (g)}$	The cost of raising common equity funds
Cost of common equity (capital asset pricing model)	$k_{cs} = \text{risk-free rate } (r_f) + \text{equity beta } (\beta) \left(\text{market return } (r_m) - \text{risk-free rate } (r_f) \right)$	The cost of raising common equity funds
Weighted average cost of capital (WACC)	$\text{WACC} = \left(\text{after-tax cost of debt} \times \text{proportion of debt financing} \right) + \left(\text{cost of equity} \times \text{proportion of equity financing} \right)$	- The opportunity cost of money invested in the firm - Projects that earn higher rates of return than the WACC create shareholder wealth

Using a Firm's Cost of Capital to Evaluate New Capital Investments

If a firm has traditionally used a single cost of capital for all projects undertaken within each of several operating divisions (or companies) with very different risk characteristics, then the company will likely encounter resistance from the high-risk divisions if it changes to a divisional cost of capital structure. Consider the case of the hypothetical firm Global Energy, whose divisional costs of capital are illustrated in Figure 9-1. Global Energy is an integrated oil company that engages in a wide range of hydrocarbon-related businesses, including exploration and development, pipelines, and refining. Each of these businesses has its unique set of risks. In Figure 9-1 we see that the overall, or enterprise-wide, cost of capital for Global Energy is 11 percent, reflecting an average of the firm's divisional costs of capital, ranging from a low of 8 percent for pipelines up to 18 percent for exploration and development.

At present, Global Energy is using a cost of capital of 11 percent to evaluate its new investment proposals from all three operating divisions. This means that exploration and development projects earning as little as 11 percent are being accepted even though the capital market dictates that projects of this risk should earn 18 percent. Thus, Global Energy overinvests in high-risk projects. Similarly, the company will underinvest in its two lower-risk divisions, where the company-wide cost of capital is used.

FIGURE 9-1 Global Energy Divisional Costs of Capital
Using a company-wide cost of capital for a multidivisional firm results in systematic overinvestment in high-risk projects and underinvestment in low-risk projects.



Now consider the prospect of moving to division costs of capital and the implications this might have for the three divisions. Specifically, the managers of the exploration and development division are likely to see this as an adverse move for them because it will surely cut the level of new investment capital flowing into their operations. In contrast, the managers of the remaining two divisions will see the change as good news because, under the company-wide cost of capital system, they have been rejecting projects earning more than their market-based costs of capital (8 percent and 10 percent for pipelines and refining, respectively) but less than the company's 11 percent cost of capital.

Concept Check

1. What are the implications for a firm's capital investment decisions of using a company-wide cost of capital when the firm has multiple operating divisions that each have unique risk attributes and capital costs?
2. If a firm has decided to move from a situation in which it uses a company-wide cost of capital to divisional costs of capital, what problems is it likely to encounter?

Chapter Summaries

Understand the concepts underlying the firm's cost of capital. (pgs. 275–276)



SUMMARY: A firm's cost of capital is equal to a weighted average of the opportunity costs of each source of capital used by the firm, including debt, preferred stock, and common equity. To properly capture the cost of all these sources of capital, the individual costs are based on current market conditions and not historical costs.

KEY TERMS

Weighted average cost of capital, page 275
an average of the individual costs of financing used by the firm.

Opportunity cost, page 275 The cost of making a choice defined in terms of the next best alternative that is foregone.

Financial policy, page 276 the firm's policies regarding the sources of financing it plans to use and the particular mix (proportions) in which they will be used.



Evaluate the costs of the individual sources of capital. (pgs. 276–286)

SUMMARY: The after-tax cost of debt is typically estimated as the yield-to-maturity of the promised principal and interest payments for an outstanding debt agreement. This means that we solve for the rate of interest that makes the present value of the promised interest and principal payments equal to the current market value of the debt security. We then adjust this cost of debt for the effect of taxes by multiplying it by 1 minus the firm's tax rate. The cost of preferred stock financing is estimated in a manner very similar to debt but with two differences. First, since preferred stock typically does not mature, the present-value equation for valuing the preferred stock involves solving for the value of a level perpetuity. Second, since preferred dividends are not tax deductible, there is no adjustment to the cost of preferred stock for taxes.

The cost of common equity is somewhat more difficult to estimate than either debt or preferred stock since the common stockholders do not have a contractually specified return on their investment. Instead, the common stockholders receive the residual earnings of the firm or what's left over after all other claims have been paid.

Two approaches are widely used to estimate the cost of common equity financing. The first is based on the dividend growth model, which is used to solve for the rate that will equate the present value of future dividends with the current price of the firm's shares of stock. The second uses the capital asset pricing model.

KEY TERMS

Cost of debt, page 277 The rate that has to be received from an investment in order to achieve the required rate of return for the creditors. This rate must be adjusted for the fact that an increase in interest payments will result in lower taxes. The cost is based on the debt holders' opportunity cost of debt in the capital markets.

Flotation costs, page 277 The costs incurred by the firm when it issues securities to raise funds.

Cost of preferred equity, page 279 The rate of return that must be earned on the

preferred stockholders' investment in order to satisfy their required rate of return. The cost is based on the preferred stockholders' opportunity cost of preferred stock in the capital markets.

Cost of common equity, page 281 The rate of return that must be earned on the common stockholders' investment in order to satisfy their required rate of return. The cost is based on the common stockholders' opportunity cost of common stock in the capital markets.

KEY EQUATIONS

The cost of debt financing can be calculated as follows:

$$\begin{aligned} \text{Net proceeds per bond} = & \frac{\text{interest paid in year 1}}{\left(1 + \frac{\text{cost of debt}}{\text{financing } (k_d)}\right)^1} + \frac{\text{interest paid in year 2}}{\left(1 + \frac{\text{cost of debt}}{\text{financing } (k_d)}\right)^2} \\ & + \frac{\text{interest paid in year 3}}{\left(1 + \frac{\text{cost of debt}}{\text{financing } (k_d)}\right)^3} + \frac{\text{principal paid in year 3}}{\left(1 + \frac{\text{cost of debt}}{\text{financing } (k_d)}\right)^3} \end{aligned}$$

This equation works for a 3-year bond. Longer-term bonds include more interest payments. The result is an estimate of the before-tax cost of debt financing to the firm. To adjust for taxes, we multiply this rate of return by 1 minus the corporate tax rate.

The cost of preferred stock is calculated by solving for k_{ps} :

$$\text{Net proceeds per preferred share} = \frac{\text{preferred dividend}}{\text{cost of preferred stock } (k_{ps})}$$

The cost of common stock—discounted cash-flow method is calculated using the following equation:

$$\text{Cost of common stock } (k_{cs}) = \frac{\text{common stock dividend for year 1}}{\text{market price of common stock}} + \left(\frac{\text{growth rate in dividends}}{\text{dividends}} \right)$$

The cost of common stock—capital asset pricing method is calculated as follows:

$$\text{Cost of common stock } (k_{cs}) = \text{risk-free rate} + \text{equity beta coefficient} \left(\text{expected return on the market portfolio} - \text{risk-free rate} \right)$$

Calculate a firm's weighted average cost of capital. (pgs. 286–290)



SUMMARY: The firm's WACC is defined as follows:

$$\begin{aligned} \text{Weighted average cost of capital (WACC)} = & \left[\left(\text{after-tax cost of debt } (k_d) \right) \times \left(\text{proportion of debt financing } (w_d) \right) \right] \\ & + \left[\left(\text{cost of equity } (k_{cs}) \right) \times \left(\text{proportion of equity financing } (w_{cs}) \right) \right] \end{aligned}$$

where k_d , k_{ps} , and k_{cs} are the cost of capital for the firm's debt, preferred stock, and common equity, respectively. Note that the costs of these sources of capital must be properly adjusted for the effect of issuance or flotation costs. T is the marginal corporate tax rate and w_d , w_{ps} , and w_{cs} are the fractions of the firm's total financing (weights) that are comprised of debt, preferred stock, and common equity, respectively. The weights used to calculate WACC should theoretically reflect the market values of each capital source as a fraction of the total market value of all capital sources (that is, the market value of the firm). In some cases, market values are not observed and analysts use book values instead.

KEY TERM

capital structure, 286 The mix of long-term sources of funds used by the firm. This is also called the firm's capitalization. The relative total (percentage) of each type of fund is emphasized.

Estimate divisional costs of capital. (pgs. 290–295)



SUMMARY: Finance theory is very clear about the appropriate rate at which the cash flows of investment projects should be discounted. The appropriate discount rate should reflect the opportunity cost of capital, which in turn reflects the risk of the investment being evaluated.

However, an investment evaluation policy that allows managers to use different discount rates for different investment opportunities may be difficult to implement. First, coming up with discount rates for individual projects can be time-consuming and difficult and may simply not be worth the effort. In addition, when firms allow the cost of capital to vary for each project, overzealous managers may waste corporate resources lobbying for a lower discount rate to help ensure the approval of their pet projects.

To reduce these estimation and lobbying costs, most firms have either just one corporate cost of capital or a single cost of capital for each division of the company. Divisional WACCs are generally determined by using information from publicly traded single-segment firms.

KEY TERM

Divisional WACC, page 290 The cost of capital for a specific business unit or division.

Review Questions

All Review Questions are available in [MyFinanceLab](#).

9-1. Define the term *cost of capital*.

9-2. In 2009, ExxonMobil (XOM) acquired XTO Energy for \$41 billion. The acquisition provided ExxonMobil an opportunity to engage in the development of shale and unconventional natural gas resources within the continental United States. This acquisition added to ExxonMobil's

existing upstream (exploration and development) activities. In addition to this business segment, ExxonMobil was also engaged in chemicals and downstream operations related to the refining of crude oil into a variety of consumer and industrial products. How do you think the company should approach the determination of its cost of capital for making new capital investment decisions?

9-3. Why do firms calculate their weighted average cost of capital?

9-4. In computing the cost of capital, which sources of capital should be considered?

9-5. How does a firm's tax rate affect its cost of capital? What is the effect of the flotation costs associated with a new security issue on a firm's weighted average cost of capital?

9-6. a. Distinguish between internal common equity and new common stock.

b. Why is there a cost associated with internal common equity?

c. Describe two approaches that could be used in computing the cost of common equity.

9-7. What might we expect to see in practice in the relative costs of different sources of capital?

Study Problems

All Study Problems are available in [MyFinanceLab](#).



9-1. (*Terminology*) Match the following terms with their definitions:

TERMS	DEFINITIONS
Opportunity cost	The target mix of sources of funds that the firm uses when raising new money to invest in the firm.
Financial policy	A weighted average of the required rates of return of the firm's sources of capital (after adjusting for flotation costs and tax considerations).
Cost of capital	The cost of making a choice in terms of the next best alternative that must be foregone.
Transaction costs	The expenses that a firm incurs when raising funds by issuing a particular type of security.



9-2. (*Individual or component costs of capital*) Compute the cost of the following:

- A bond that has \$1,000 par value (face value) and a contract or coupon interest rate of 11 percent. A new issue would have a flotation cost of 5 percent of the \$1,125 market value. The bonds mature in 10 years. The firm's average tax rate is 30 percent and its marginal tax rate is 34 percent.
- A new common stock issue that paid a \$1.80 dividend last year. The par value of the stock is \$15, and earnings per share have grown at a rate of 7 percent per year. This growth rate is expected to continue into the foreseeable future. The company maintains a constant dividend-earnings ratio of 30 percent. The price of this stock is now \$27.50, but 5 percent flotation costs are anticipated.
- Internal common equity when the current market price of the common stock is \$43. The expected dividend this coming year should be \$3.50, increasing thereafter at a 7 percent annual growth rate. The corporation's tax rate is 34 percent.
- A preferred stock paying a 9 percent dividend on a \$150 par value. If a new issue is offered, flotation costs will be 12 percent of the current price of \$175.
- A bond selling to yield 12 percent after flotation costs, but before adjusting for the marginal corporate tax rate of 34 percent. In other words, 12 percent is the rate that equates the net proceeds from the bond with the present value of the future cash flows (principal and interest).

9-3. (*Cost of equity*) Salte Corporation is issuing new common stock at a market price of \$27. Dividends last year were \$1.45 and are expected to grow at an annual rate of 6 percent forever. Flotation costs will be 6 percent of market price. What is Salte's cost of equity?

9-4. (*Cost of debt*) Belton is issuing a \$1,000 par value bond that pays 7 percent annual interest and matures in 15 years. Investors are willing to pay \$958 for the bond. Flotation costs will be 11 percent of market value. The company is in an 18 percent tax bracket. What will be the firm's after-tax cost of debt on the bond?

9-5. (Cost of preferred stock) The preferred stock of Julian Industries sells for \$36 and pays \$3.00 in dividends. The net price of the security after issuance costs is \$32.50. What is the cost of capital for the preferred stock?

9-6. (Cost of debt) The Zephyr Corporation is contemplating a new investment to be financed 33 percent from debt. The firm could sell new \$1,000 par value bonds at a net price of \$945. The coupon interest rate is 12 percent, and the bonds would mature in 15 years. If the company is in a 34 percent tax bracket, what is the after-tax cost of capital to Zephyr for bonds?

9-7. (Cost of preferred stock) Your firm is planning to issue preferred stock. The stock sells for \$115; however, if new stock is issued, the company would receive only \$98. The par value of the stock is \$100, and the dividend rate is 14 percent. What is the cost of capital for the stock to your firm?

9-8. (Cost of internal equity) Pathos Co.'s common stock is currently selling for \$23.80. Dividends paid last year were \$0.70. Flotation costs on issuing stock will be 10 percent of market price. The dividends and earnings per share are projected to have an annual growth rate of 15 percent. What is the cost of internal common equity for Pathos?

9-9. (Cost of equity) The common stock for the Bestsold Corporation sells for \$58. If a new issue is sold, the flotation costs are estimated to be 8 percent. The company pays 50 percent of its earnings in dividends, and a \$4 dividend was recently paid. Earnings per share 5 years ago were \$5. Earnings are expected to continue to grow at the same annual rate in the future as during the past 5 years. The firm's marginal tax rate is 34 percent. Calculate the cost of (a) internal common equity and (b) external common equity.

9-10. (Growth rate in stock dividends and the cost of equity) Clearview Productions is a publicly held company whose common stock has recently been selling for \$50.00 a share. The firm is expected to pay an annual cash dividend of \$5.00 a share next year, and the firm's investors anticipate an annual rate of return of 15%.

- If the firm is expected to provide a constant annual rate of growth in dividends, what is that growth rate?
- If the risk-free rate of interest is 3% and the market risk premium is 6%, what must the firm's beta be to warrant a 15% expected rate of return on the firm's stock?

9-11. (Individual or component costs of capital) Compute the cost for the following sources of financing:

- A \$1,000 par value bond with a market price of \$970 and a coupon interest rate of 10 percent. Flotation costs for a new issue would be approximately 5 percent. The bonds mature in 10 years and the corporate tax rate is 34 percent.
- A preferred stock selling for \$100 with an annual dividend payment of \$8. The flotation cost will be \$9 per share. The company's marginal tax rate is 30 percent.
- Retained earnings totaling \$4.8 million. The price of the common stock is \$75 per share, and dividend per share was \$9.80 last year. The dividend is not expected to change in the future.
- New common stock when the most recent dividend was \$2.80. The company's dividends per share should continue to increase at an 8 percent growth rate into the indefinite future. The market price of the stock is currently \$53; however, flotation costs of \$6 per share are expected if the new stock is issued.

9-12. (Cost of debt) Sincere Stationery Corporation needs to raise \$500,000 to improve its manufacturing plant. It has decided to issue a \$1,000 par value bond with a 14 percent annual coupon rate and a 10-year maturity. The investors require a 9 percent rate of return.

- Compute the market value of the bonds.
- What will the net price be if flotation costs are 10.5 percent of the market price?
- How many bonds will the firm have to issue to receive the needed funds?
- What is the firm's after-tax cost of debt if its average tax rate is 25 percent and its marginal tax rate is 34 percent?

9-13. (Cost of debt)

- Rework Problem 9-12 as follows: Assume an 8 percent coupon rate. What effect does changing the coupon rate have on the firm's after-tax cost of capital?
- Why is there a change?

9-14. (Capital structure weights) Caraway Seeds estimated its weighted average cost of capital to be 9.2% based on the fact that its after-tax cost of debt financing was 6 percent and its cost of equity was 10 percent. What are the firm's capital structure weights (that is, the proportion of financing that came from debt and equity)?



9-15. (Weighted average cost of capital) Crawford Enterprises is a publicly held company located in Arnold, Kansas. The firm began as a small tool and die shop but grew over its 35-year life to become a leading supplier of metal fabrication equipment used in the farm tractor industry. At the close of 2009 the firm's balance sheet appeared as follows:

Cash	\$ 540,000		
Accounts receivable	4,580,000		
Inventories	7,400,000	Long-term debt	\$12,590,000
Net property, plant, and equipment	18,955,000	Common equity	18,885,000
Total assets	<u>\$31,475,000</u>	Total debt and equity	<u>\$31,475,000</u>

At present the firm's common stock is selling for a price equal to its book value, and the firm's bonds are selling at par. Crawford's managers estimate that the market requires a 15 percent return on its common stock, the firm's bonds command a yield to maturity of 8 percent, and the firm faces a tax rate of 34 percent.

- What is Crawford's weighted average cost of capital?
- If Crawford's stock price were to rise such that it sold at 1.5 times book value, causing the cost of equity to fall to 13 percent, what would the firm's cost of capital be (assuming the cost of debt and tax rate do not change)?

9-16. (Weighted average cost of capital) The capital structure for the Carion Corporation is provided here. The company plans to maintain its debt structure in the future. If the firm has a 5.5 percent after-tax cost of debt, a 13.5 percent cost of preferred stock, and an 18 percent cost of common stock, what is the firm's weighted average cost of capital?

CAPITAL STRUCTURE (\$000)	
Bonds	\$1,083
Preferred stock	268
Common stock	<u>3,681</u>
	<u>\$5,032</u>

9-17. (Weighted average cost of capital) ABBC Inc. operates a very successful chain of yogurt and coffee shops spread across the southwestern part of the United States and needs to raise funds for its planned expansion into the Northwest. The firm's balance sheet at the close of 2009 appeared as follows:

Cash	\$ 2,010,000		
Accounts receivable	4,580,000		
Inventories	1,540,000	Long-term debt	\$ 8,141,000
Net property, plant, and equipment	32,575,000	Common equity	32,564,000
Total assets	<u>\$40,705,000</u>	Total debt and equity	<u>\$40,705,000</u>

At present the firm's common stock is selling for a price equal to 2.5 times its book value, the firm's investors require an 18 percent return, the firm's bonds command a yield to maturity of 8 percent, and the firm faces a tax rate of 35 percent. At the end of the previous year ABBC's common stock was selling for a price of 2.5 times its book value, and its bonds were trading near their par value.

- What does ABBC's capital structure look like?
- What is ABBC's weighted average cost of capital?
- If ABBC's stock price were to rise such that it sold at 3.5 times its book value and the cost of equity fell to 15 percent, what would the firm's weighted average cost of capital be (assuming the cost of debt and tax rate do not change)?

9-18. (Determining a firm's capital budget) Newcomb Vending Company manages soft drink dispensing machines in western Tennessee for several of the major bottling companies in the area. When a machine malfunctions the company sends out a repair technician, and if he cannot repair it on the spot he puts in a replacement machine so that the broken one can be taken to the firm's

repair facility in Murfreesboro, Tennessee. Betsy Newcomb recently completed her BBA from a nearby university and has been trying to incorporate as much of what she learned as possible into the operations of her family business. Specifically, Betsy recently reviewed the firm's capital structure and estimated that the firm's weighted average cost of capital is approximately 12%. She hopes to help her father determine which of several major capital expenditures he should make in the current year based on a comparison of the rates of return she estimated for each project (that is, the internal rate of return) and the firm's cost of capital. Specifically, the firm is considering the following projects (ranked by their internal rate of return):

PROJECT	INVESTED CAPITAL	INTERNAL RATE OF RETURN
A	\$ 450,000	18%
B	1,200,000	16%
C	800,000	13%
D	600,000	10%
E	1,450,000	8%

If all five of the investments being considered by Newcomb are of similar risk and that risk is very similar to that of the company as a whole, which project(s) should Betsy recommend the firm undertake? You may assume that the firm can raise all the capital it needs to fund its investments at the cost of capital of 12%. Explain your answer.

9-19. (Divisional costs of capital) LPT Inc. is an integrated oil company headquartered in Dallas, Texas. The company has three operating divisions: oil exploration and production (commonly referred to as E&P), pipelines, and refining. Historically, LPT did not spend a great deal of time thinking about the opportunity costs of capital for each of its divisions and used a company-wide weighted average cost of capital of 14 percent for all new capital investment projects. Recent changes in its businesses have made it abundantly clear to LPT's management that this is not a reasonable approach. For example, investors demand a much higher expected rate of return for exploration and production ventures than for pipeline investments. Although LPT's management agrees, in principle at least, that different operating divisions should face an opportunity cost of capital that reflects their individual risk characteristics, they are not in agreement about whether a move toward divisional costs of capital is a good idea based on practical considerations.



- Pete Jennings is the chief operating officer for the E&P division, and he is concerned that going to a system of divisional costs of capital may restrain his ability to undertake very promising exploration opportunities. He argues that the firm really should be concerned about finding those opportunities that offer the highest possible rate of return on invested capital. Pete contends that using the firm's scarce capital to take on the most promising projects would lead to the greatest increase in shareholder value. Do you agree with Pete? Why or why not?
- The pipeline division manager, Donna Selma, has long argued that charging her division the company-wide cost of capital of 14 percent severely penalizes her opportunities to increase shareholder value. Do you agree with Donna? Explain.

9-20. (Divisional costs of capital and investment decisions) In May of this year Newcastle Mfg. Company's capital investment review committee received two major investment proposals. One of the proposals was put forth by the firm's domestic manufacturing division, and the other came from the firm's distribution company. Both proposals promise internal rates of return equal to approximately 12 percent. In the past Newcastle has used a single firm-wide cost of capital to evaluate new investments.

However, managers have long recognized that the manufacturing division is significantly more risky than the distribution division. In fact, comparable firms in the manufacturing division have equity betas of about 1.6, whereas distribution companies typically have equity betas of only 1.1. Given the size of the two proposals, Newcastle's management feels it can undertake only one, so it wants to be sure that it is taking on the more promising investment. Given the importance of getting the cost of capital estimate as close to correct as possible, the firm's chief financial officer has asked you to prepare cost of capital estimates for each of the two divisions. The requisite information needed to accomplish your task is contained here:

- ♦ The cost of debt financing is 8 percent before taxes of 35 percent. You may assume this cost of debt is after any flotation costs the firm might incur.
- ♦ The risk-free rate of interest on long-term U.S. Treasury bonds is currently 4.8 percent, and the market-risk premium has averaged 7.3 percent over the past several years.

- ◆ Both divisions adhere to target debt ratios of 40 percent.
- ◆ The firm has sufficient internally generated funds such that no new stock will have to be sold to raise equity financing.
 - a. Estimate the divisional costs of capital for the manufacturing and distribution divisions.
 - b. Which of the two projects should the firm undertake (assuming it cannot do both due to labor and other nonfinancial restraints)? Discuss.

9-21. (Divisional costs of capital and investment decisions) Belton Oil and Gas Inc. is a Houston-based independent oil and gas firm. In the past Belton's managers have used a single firmwide cost of capital of 13 percent to evaluate new investments. However, the firm has long recognized that its exploration and production division is significantly more risky than the pipeline and transportation division. In fact, comparable firms to Belton's E&P division have equity betas of about 1.7, whereas distribution companies typically have equity betas of only 0.8. Given the importance of getting the cost of capital estimate as close to correct as possible, the firm's chief financial officer has asked you to prepare cost of capital estimates for each of the two divisions. The requisite information needed to accomplish your task is contained here:

- ◆ The cost of debt financing is 7 percent before taxes of 35 percent. However, if the E&P division were to borrow based on its projects alone, the cost of debt would probably be 9 percent, and the pipeline division could borrow at 5.5 percent. You may assume these costs of debt are after any flotation costs the firm might incur.
- ◆ The risk-free rate of interest on long-term U.S. Treasury bonds is currently 4.8 percent, and the market-risk premium has averaged 7.3 percent over the past several years.
- ◆ The E&P division adheres to a target debt ratio of 10 percent, whereas the pipeline division utilizes 40 percent borrowed funds.
- ◆ The firm has sufficient internally generated funds such that no new stock will have to be sold to raise equity financing.
 - a. Estimate the divisional costs of capital for the E&P and pipeline divisions.
 - b. What are the implications of using a company-wide cost of capital to evaluate new investment proposals in light of the differences in the costs of capital you estimated previously?

Mini Cases

These Mini Cases are available in MyFinanceLab.

9-1. Nealon Energy Corporation engages in the acquisition, exploration, development, and production of natural gas and oil in the continental United States. The company has grown rapidly over the last 5 years as it has expanded into horizontal drilling techniques for the development of the massive deposits of both gas and oil in shale formations. The company's operations in the Haynesville shale (located in northwest Louisiana) have been so significant that it needs to construct a natural gas gathering and processing center near Bossier City, Louisiana, at an estimated cost of \$70 million.

To finance the new facility Nealon has \$20 million in profits that it will use to finance a portion of the expansion and plans to sell a bond issue to raise the remaining \$50 million. The decision to use so much debt financing for the project was largely due to the argument by company CEO (Douglas Nealon Sr.) that debt financing is relatively cheap relative to common stock (which the firm has used in the past). Company CFO Doug Nealon Jr. (son of the company founder) did not object to the decision to use all debt but pondered the issue of what cost of capital to use for the expansion project. There is no doubt but that the out-of-pocket cost of financing was equal to the new interest that must be paid on the debt. However, the CFO also knew that by using debt for this project the firm would eventually have to use equity in the future if it wanted to maintain the balance of debt and equity it had in its capital structure and not become overly dependent on borrowed funds.

The following balance sheet reflects the mix of capital sources that Nealon has used in the past. Although the percentages would vary over time, the firm tended to manage its capital structure back toward these proportions:

SOURCE OF FINANCING	TARGET CAPITAL STRUCTURE WEIGHTS
Bonds	40%
Common Stock	60%

The firm currently has one issue of bonds outstanding. The bonds have a par value of \$1,000 per bond, carry an 8 percent coupon rate of interest, have 16 years to maturity, and are selling for \$1,035. Nealon's common stock has a current market price of \$35 and the firm paid a \$2.50 dividend last year that is expected to increase at an annual rate of 6 percent for the foreseeable future.

- a. What is the yield to maturity for Nealon's bonds under current market conditions?
- b. What is the cost of new debt financing to Nealon based on current market prices after both taxes (you may use a 34 percent marginal tax rate for your estimate) and flotation costs of \$30 per bond have been considered?
- c. What is the investor's required rate of return for Nealon's common stock? If Nealon were to sell new shares of common stock, it would incur a cost of \$2.00 per share. What is your estimate of the cost of new equity financing raised from the sale of common stock?
- d. Compute the weighted average cost of capital for Nealon's investment using the weights reflected in the actual financing mix (that is, \$20 million in retained earnings and \$50 million in bonds).
- e. Compute the weighted average cost of capital for Nealon where the firm maintains its target capital structure by reducing its debt offering to 40 percent of the \$70 million in new capital, or \$28 million, using \$20 million in retained earnings and raising \$22 million through a new equity offering.
- f. If you were the CFO for the company, would you prefer to use the calculation of the cost of capital in part (d) or (e) to evaluate the new project? Why?

9-2. ExxonMobil (XOM) is one of the half-dozen major oil companies in the world. The firm has four primary operating divisions (upstream, downstream, chemical, and global services) as well as a number of operating companies that it has acquired over the years. A recent major acquisition was XTO Energy, which was acquired in 2009 for \$41 billion. The XTO acquisition gave ExxonMobil a significant presence in the development of domestic unconventional natural gas resources, including the development of shale gas formations, which was booming at the time.

Assume that you have just been hired to be an analyst working for ExxonMobil's chief financial officer. Your first assignment was to look into the proper cost of capital for use in making corporate investments across the company's many business units.

- a. Would you recommend that ExxonMobil use a single company-wide cost of capital for analyzing capital expenditures in all its business units? Why or why not?
- b. If you were to evaluate divisional costs of capital, how would you go about estimating these costs of capital for ExxonMobil? Discuss how you would approach the problem in terms of how you would evaluate the weights to use for various sources of capital as well as how you would estimate the costs of individual sources of capital for each division.