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## CHAPTER

# 10 The Cost of Capital

### *Creating Value at GE*

General Electric (GE) is one of the world's best-managed companies, and it has rewarded its shareholders with outstanding returns. GE creates shareholder value by investing in assets that earn more than the cost of the capital used to acquire them. For example, if a project earns 20% but the capital invested in it costs only 10%, taking on the project will increase the firm's value and thus its stock price.

Capital is obtained in three primary forms: debt, preferred stock, and common equity, with equity acquired by retaining earnings and by the issuance of new stock. The investors who provide capital to GE expect to earn at least their required rate of return on that capital, and the required return represents the firm's cost of capital.<sup>1</sup> A variety of factors influence the cost of capital. Some—including interest rates, state

and federal tax policies, and general economic conditions—are outside the firm's control. However, the firm's decisions regarding how it raises capital and how it invests those funds also have a profound effect on its cost of capital.

Estimating the cost of capital for a company such as GE is conceptually straightforward. GE's capital comes largely from debt plus common equity obtained by retaining earnings, so its cost of capital depends largely on the level of interest rates in the economy and the marginal stockholder's required rate of return on equity. However, GE operates many different divisions throughout the world; so the corporation is similar to a portfolio that contains a number of different stocks, each with a different risk. Recall that portfolio risk is a weighted average of the relevant risks of the different stocks in the portfolio.

<sup>1</sup>Recall from earlier chapters that expected and required returns as seen by the marginal investor must be equal; otherwise, the security will not be in equilibrium. Therefore, buying and selling will force this equality to hold, except for short periods immediately following the release of new information. Since expected and required returns are normally equal, we use the two terms interchangeably.

Similarly, each of GE's divisions has its own level of risk (hence, its own cost of capital). GE's overall cost of capital is an average of its divisions' costs. For example, GE's NBC subsidiary probably has a different cost of capital than its aircraft engine division; and even within divisions, some projects are riskier than others. Moreover, overseas projects

may have different risks and thus different costs of capital than similar domestic projects.

As we will see in this chapter, the cost of capital is an essential element in the capital budgeting process. This process is the primary determinant of the firm's long-run stock price.

## PUTTING THINGS IN PERSPECTIVE

In the last four chapters, we explained how risk influences prices and required rates of return on bonds and stocks. A firm's primary objective is to maximize its shareholders' value. The principal way value is increased is by investing in projects that earn more than their cost of capital. In the next two chapters, we will see that a project's future cash flows can be forecasted and that those cash flows can be discounted to find their present value. Then if the PV of the future cash flows exceeds the project's cost, the firm's value will increase if the project is accepted. However, we need a discount rate to find the PV of the future cash flows, and that discount rate is the firm's cost of capital. Finding the cost of the capital required to take on new projects is the primary focus of this chapter.<sup>2</sup>

Most formulas used in this chapter were developed earlier, when we examined the required rates of return on bonds and stocks. *Indeed, the rates of return that investors require on bonds and stocks represent the costs of those securities to the firm.* As we shall see, companies estimate the required returns on their securities, calculate a weighted average of the costs of their different types of capital, and use this average cost for capital budgeting purposes.

When you finish this chapter, you should be able to:

- Explain why the weighted average cost of capital (WACC) is used in capital budgeting.
- Estimate the costs of different capital components—debt, preferred stock, retained earnings, and common stock.
- Combine the different component costs to determine the firm's WACC.

These concepts are necessary to understand the firm's capital budgeting process.

### 10-1 AN OVERVIEW OF THE WEIGHTED AVERAGE COST OF CAPITAL (WACC)

Table 10-1 shows Allied Food Products' balance sheet as presented in Chapter 3, with two additions: (1) the actual capital supplied by investors (banks, bondholders, and stockholders) and (2) the capital structure that Allied plans to use in the future. Allied's overall cost of capital is an average of the costs of the various types of capital it uses. Allied's debt costs 10%, it currently uses no preferred stock

<sup>2</sup>If projects differ in risk, risk-adjusted costs of capital should be used, not one single corporate cost of capital. We discuss this point later in the chapter.

Table 10-1

## Allied Food Products: Capital Structure Used to Calculate the WACC

<b>REGULAR BALANCE SHEET: at 12/31/08</b>			<b>All Liabilities &amp; Equity</b>		<b>Actual Investor-Supplied Capital</b>		<b>Target Capital Structure</b>	
Cash	\$ 10	Accounts payable	\$ 60	3.0%				
Receivables	375	Accruals	140	7.0				
Inventories	615	Spontaneous debt	\$ 200	10.0%				
Total C.A.	\$1,000	Notes payable	110	5.5	\$ 110			
		Total C.L.	\$ 310	15.5%				
Net fixed assets	\$1,000	Long-term debt	750	37.5	750			
		Total debt	\$1,060	53.0%	\$ 860	47.8%	45.0%	
		Preferred stock	0	0.0	0	0.0	2.0	
		Common stock	130	6.5	130			
		Retained earnings	810	40.5	810			
		Total equity	\$ 940	47.0%	\$ 940	52.2	53.0	
Total	\$2,000	Total	\$2,000	100.0%	\$1,800	100.0%	100.0%	

but plans to use a small amount of preferred in the future, and its common equity costs about 13.5%. (This is the return that stockholders require on the stock.)<sup>3</sup> Now assume that Allied has made the decision to finance all of next year's projects with debt. The argument is sometimes made that the cost of capital for next year's projects will be 10% because only debt will be used to finance them. However, this position is incorrect. If Allied finances this set of projects with debt, it will be using up some of its future borrowing capacity. As expansion occurs in subsequent years, the firm will at some point have to raise more equity to prevent the debt ratio from getting too high.

Our concern is with capital that must be provided by *investors*—interest-bearing debt, preferred stock, and common equity. Accounts payable and accruals increase automatically when capital budgeting projects are taken on, so increases in these items are deducted from projects' costs. This point is discussed in detail in Chapter 12, but the result is that we are concerned only with investor-supplied capital when we calculate the cost of capital.

To illustrate, suppose Allied borrows heavily at 10% during 2009 and, in the process, uses up its capacity to borrow, to finance projects yielding 11%. In 2010, it has new projects available that yield 13% (well above the return on 2009 projects), but it could not accept them because they would have to be financed with 13.5% equity. *To avoid this problem, Allied and other firms take a long-run view; and the cost of capital is calculated as a weighted average, or composite, of the various types of funds used over time, regardless of the specific financing used in a given year.*

We explore the weights in more detail in the capital structure chapter, where we see how the optimal capital structure is estimated. As we will see, there is an optimal capital structure—one where the percentages of debt, preferred stock, and common equity maximize the firm's value. As shown in the last column of Table 10-1, Allied Foods has concluded that it should use 45% debt, 2% preferred stock, and 53% common equity; and it plans to raise capital in those proportions in

<sup>3</sup> We estimate this 13.5% later in the chapter. It differs slightly from the number we found in an earlier chapter. As you will see, there are several ways to estimate  $r_s$  and those methods generally produce different estimates. Allied concluded that its  $r_s$  is somewhere in the range of 13% to 14%, and it compromised by using 13.5%. The costs of debt and preferred stock are set by contract, so they can be estimated with relatively little error; but the cost of equity cannot be measured precisely.

the future. Therefore, we use those target weights when we calculate Allied's weighted average cost of capital.

### SELF TEST



Why should the cost of capital be calculated as a weighted average of the various types of funds that a firm generally uses, not as the cost of the specific type of capital used during a given year?

What is the riskiest and thus highest-cost type of capital? least-cost type?

Why can't a firm finance with only the lowest-cost type of capital?

## 10-2 BASIC DEFINITIONS

The investor-supplied items—debt, preferred stock, and common equity—are called **capital components**. Increases in assets must be financed by increases in these capital components. The cost of each component is called its *component cost*; for example, Allied can borrow money at 10%, so its component cost of debt is 10%.<sup>4</sup> These costs are then combined to form a weighted average cost of capital, which is used in the capital budgeting process. Throughout this chapter, we concentrate on the three major capital components. The following symbols identify the cost and weight of each:

### Capital Component

One of the types of capital used by firms to raise funds.

$r_d$  = interest rate on the firm's new debt = before-tax component cost of debt. It can be found in several ways, including calculating the yield to maturity on the firm's currently outstanding bonds.

$r_d(1 - T)$  = after-tax component cost of debt, where  $T$  is the firm's marginal tax rate.  $r_d(1 - T)$  is the debt cost used to calculate the weighted average cost of capital. As we shall see, the after-tax cost of debt is lower than its before-tax cost because interest is tax deductible.

$r_p$  = component cost of preferred stock, found as the yield investors expect to earn on the preferred stock. Preferred dividends are not tax-deductible; hence, the before- and after-tax costs of preferred are equal.

$r_s$  = component cost of common equity raised by retaining earnings, or *internal equity*. It is the  $r_s$  developed in Chapters 8 and 9 and defined there as the rate of return that investors require on a firm's common stock. Most firms, once they have become well established, obtain all of their new equity as retained earnings; hence,  $r_s$  is their cost of all new equity.

$r_e$  = component cost of *external equity*, or common equity raised by issuing new stock. As we will see,  $r_e$  is equal to  $r_s$  plus a factor that reflects the cost of issuing new stock. Note, though, that established firms such as Allied Foods rarely issue new stock; hence,  $r_e$  is rarely a relevant consideration except for very young, rapidly growing firms.

<sup>4</sup>We will see shortly that there is a before-tax and an after-tax cost of debt; for now, it is sufficient to know that 10% is the before-tax component cost of debt. Also, for simplicity, we assume that long- and short-term debt have the same cost; hence, we deal with just one type of debt.

$w_d, w_p, w_s, w_e$  = target weights of debt, preferred stock, retained earnings (internal equity), and new common stock (external equity). The weights are the percentages of the different types of capital the firm plans to use when it raises capital in the future. Target weights may differ from actual current weights.<sup>5</sup>

WACC = the firm's weighted average, or overall, cost of capital.

### Weighted Average Cost of Capital (WACC)

A weighted average of the component costs of debt, preferred stock, and common equity.

The target proportions of debt ( $w_d$ ), preferred stock ( $w_p$ ), and common equity ( $w_c$ ), along with the costs of those components, are used to calculate the firm's **weighted average cost of capital, WACC**. We assume at this point that all new common equity is raised as retained earnings, as is true for most companies; hence, the cost of common equity is  $r_s$ .

$$\begin{aligned} \text{WACC} &= \left( \begin{array}{l} \% \\ \text{of} \\ \text{debt} \end{array} \right) \left( \begin{array}{l} \text{After-tax} \\ \text{cost of} \\ \text{debt} \end{array} \right) + \left( \begin{array}{l} \% \text{ of} \\ \text{preferred} \\ \text{stock} \end{array} \right) \left( \begin{array}{l} \text{Cost of} \\ \text{preferred} \\ \text{stock} \end{array} \right) + \left( \begin{array}{l} \% \text{ of} \\ \text{common} \\ \text{equity} \end{array} \right) \left( \begin{array}{l} \text{Cost of} \\ \text{common} \\ \text{equity} \end{array} \right) \\ \text{10-1} \quad &= w_d r_d (1 - T) + w_p r_p + w_c r_s \end{aligned}$$

Note that only debt has a tax adjustment factor,  $(1 - T)$ . As discussed in the next section, this is because interest on debt is tax-deductible but preferred dividends and the returns on common stock (dividends and capital gains) are not.

These definitions and concepts are discussed in the remainder of the chapter, using Allied Foods for illustrative purposes. Later in the capital structure chapter, we extend the discussion to show how the optimal mix of securities minimizes the firm's cost of capital and maximizes its value.



Identify the firm's three major capital structure components and give their respective component cost and weight symbols.

Why might there be two different component costs for common equity? Which one is generally relevant, and for what type of firm is the second one likely to be relevant?

If a firm now has a debt ratio of 50% but plans to finance with only 40% debt in the future, what should it use as  $w_d$  when it calculates its WACC?

## 10-3 COST OF DEBT, $r_d(1 - T)$

### Before-Tax Cost of Debt, $r_d$

The interest rate the firm must pay on new debt.

The interest rate a firm must pay on its *new* debt is defined as its **before-tax cost of debt,  $r_d$** . Firms can estimate  $r_d$  by asking their bankers what it will cost to borrow or by finding the yield to maturity (or yield to call if the debt is likely to be

<sup>5</sup>We should also note that the weights could be based on the book values of the capital components or on their market values. The market value of the equity is found by multiplying the stock's price by the number of shares outstanding. Market value weights are theoretically superior; but accountants show assets on a book-value basis, bond rating agencies and security analysts generally focus on book values, and market value weights are quite unstable because stock prices fluctuate widely. If a firm's book and market values differ widely, the firm may set its *target* weights as a blend of book and market weights. We will discuss this at greater length in the capital structure chapter; but for now, just take the target weights provided in this chapter as management determined.

called) on their currently outstanding debt (see Chapter 7).<sup>6</sup> However, the **after-tax cost of debt**,  $r_d(1 - T)$ , should be used to calculate the weighted average cost of capital. This is the interest rate on new debt,  $r_d$ , less the tax savings that result because interest is tax deductible.<sup>7</sup>

$$\begin{aligned}\text{After-tax cost of debt} &= \text{Interest rate on new debt} - \text{Tax savings} \\ &= r_d - r_d T \\ &= r_d(1 - T)\end{aligned}$$

10-2

In effect, the government pays part of the cost of debt because interest is tax deductible. Therefore, if Allied can borrow at an interest rate of 10% and its marginal federal-plus-state tax rate is 40%, its after-tax cost of debt will be 6%.<sup>8</sup>

$$\begin{aligned}\text{After-tax cost of debt} &= r_d(1 - T) = 10\%(1.0 - 0.4) \\ &= 10\%(0.6) \\ &= 6.0\%\end{aligned}$$

We use the after-tax cost of debt in calculating the WACC because we are interested in maximizing the value of the firm's stock, and the stock price depends on *after-tax* cash flows. Because we are concerned with after-tax cash flows and because cash flows and rates of return should be calculated on a comparable basis, we adjust the interest rate downward due to debt's preferential tax treatment.

Note that the cost of debt is the interest rate on *new* debt, not on already outstanding debt. We are interested in the cost of new debt because our primary concern with the cost of capital is its use in capital budgeting decisions. For example, would a new machine earn a return greater than the cost of the capital needed to acquire the machine? The rate at which the firm has borrowed in the past is irrelevant when answering this question because we need to know the cost of *new* capital.<sup>9</sup>

## SELF TEST



Why is the after-tax cost of debt rather than the before-tax cost used to calculate the WACC?

Why is the relevant cost of debt the interest rate on *new* debt, not that on already outstanding, or *old*, debt?

How can the yield to maturity on a firm's outstanding debt be used to estimate its before-tax cost of debt?

<sup>6</sup>If the yield curve is sharply upward- or downward-sloping, the costs of long- and short-term debt will differ. In this case, the firm should calculate an average of its debt costs based on the proportions of long- and short-term debt that it plans to use.

<sup>7</sup>If Allied borrowed \$100,000 at 10%, it would have to write a check for \$10,000 to pay interest charges for a year. However, that \$10,000 would be a tax deduction, which at a 40% tax rate would save \$4,000 in taxes.

<sup>8</sup>Note that in 2008, the federal tax rate for most large corporations is 35%. However, most corporations are also subject to state income taxes; so for illustrative purposes, we assume that the effective federal-plus-state tax rate on marginal income is 40%.

<sup>9</sup>Three additional points should also be noted: (1) The tax rate is zero for a firm with losses. Therefore, for a company that does not pay taxes, the cost of debt is not reduced. That is, in Equation 10-2, the tax rate equals zero; so the after-tax cost of debt is equal to the interest rate. (2) Strictly speaking, the after-tax cost of debt should reflect the *expected* cost of debt, which is very slightly below the promised 10% yield. (3) Allied raises most of its debt from commercial banks and sells bonds directly to financial institutions; but if it sold new bonds through investment bankers, a flotation cost would be incurred. We can adjust for flotation costs by deducting the dollar flotation costs from the issue price (par value) of the bond and calculating an adjusted YTM. If the bonds had a flotation cost of 0.5% (or \$5 per \$1,000 bond), an annual interest rate of 10%, and a 20-year maturity, the calculated YTM would be 10.06% versus 10.00% with no flotation costs. Because the difference is so small, most firms ignore bond flotation costs.

### After-Tax Cost of Debt, $r_d(1 - T)$

The relevant cost of new debt, taking into account the tax deductibility of interest; used to calculate the WACC.

A company has outstanding 20-year non-callable bonds with a face value of \$1,000, an 11% annual coupon, and a market price of \$1,294.54. If the company was to issue new debt, what would be a reasonable estimate of the interest rate on that debt? If the company's tax rate is 40%, what is its after-tax cost of debt? **(8.0%; 4.8%)**

## 10-4 COST OF PREFERRED STOCK, $r_p$

### Cost of Preferred Stock, $r_p$

The rate of return investors require on the firm's preferred stock.  $r_p$  is calculated as the preferred dividend,  $D_p$ , divided by the current price,  $P_p$ .

The component **cost of preferred stock** used to calculate the weighted average cost of capital,  $r_p$ , is the preferred dividend,  $D_p$ , divided by the current price of the preferred stock,  $P_p$ .

10-3

$$\text{Component cost of preferred stock} = r_p = \frac{D_p}{P_p}$$

Allied does not have any preferred stock outstanding, but the company plans to issue some in the future and therefore has included it in its target capital structure. Allied would sell this stock to a few large hedge funds, the stock would have a \$10.00 dividend per share, and it would be priced at \$97.50 a share. Therefore, Allied's cost of preferred stock would be 10.3%.<sup>10</sup>

$$r_p = \$10.00 / \$97.50 = 10.3\%$$

As we can see from Equation 10-3, calculating the cost of preferred stock is easy. This is particularly true for traditional "plain vanilla" preferred that pays a fixed dividend in perpetuity. However, in Chapter 9, we noted that some preferred issues have a specified maturity date and we described how to calculate the expected return on these issues. Also, preferred stock may include an option to convert to common stock, which adds another layer of complexity. We leave these more complicated situations for advanced classes. Finally, note that no tax adjustments are made when calculating  $r_p$  because preferred dividends, unlike interest on debt, are *not* tax deductible; so no tax savings are associated with preferred stock.

### SELF TEST



Is a tax adjustment made to the cost of preferred stock? Why or why not?

A company's preferred stock currently trades at \$80 per share and pays a \$6 annual dividend per share. Ignoring flotation costs, what is the firm's cost of preferred stock? **(7.50%)**

## 10-5 THE COST OF RETAINED EARNINGS, $r_s$

The costs of debt and preferred stock are based on the returns that investors require on these securities. Similarly, the cost of common equity is based on the rate of return that investors require on the company's common stock. Note, though, that new common equity is raised in two ways: (1) by retaining some of

<sup>10</sup>This preferred stock would be sold directly to a group of hedge funds, so no flotation costs would be incurred. If significant flotation costs were involved, the cost of the preferred should be adjusted upward, as we explain in a later section.

the current year's earnings and (2) by issuing new common stock.<sup>11</sup> We use the symbol  $r_s$  to designate the **cost of retained earnings** and  $r_e$  to designate the **cost of new common stock**, or external equity. Equity raised by issuing stock has a higher cost than equity from retained earnings due to the flotation costs required to sell new common stock. Therefore, once firms get beyond the startup stage, they normally obtain all of their new equity by retaining earnings.

Some have argued that retained earnings should be “free” because they represent money that is “left over” after dividends are paid. While it is true that no direct costs are associated with retained earnings, this capital still has a cost, an *opportunity cost*. The firm's after-tax earnings belong to its stockholders. Bondholders are compensated by interest payments; preferred stockholders, by preferred dividends. But the net earnings remaining after interest and preferred dividends belong to the common stockholders, and these earnings serve to compensate them for the use of their capital. The managers, who work for the stockholders, can either pay out earnings in the form of dividends or retain earnings for reinvestment in the business. When managers make this decision, they should recognize that there is an opportunity cost involved—stockholders could have received the earnings as dividends and invested this money in other stocks, in bonds, in real estate, or in anything else. *Therefore, the firm needs to earn at least as much on any earnings retained as the stockholders could earn on alternative investments of comparable risk.*

What rate of return can stockholders expect to earn on equivalent-risk investments? First, recall from Chapter 9 that stocks are normally in equilibrium, with expected and required rates of return being equal:  $\hat{r}_s = r_s$ . Thus, Allied's stockholders expect to be able to earn  $r_s$  on their money. *Therefore, if the firm cannot invest retained earnings to earn at least  $r_s$ , it should pay those funds to its stockholders and let them invest directly in stocks or other assets that will provide that return.*

Whereas debt and preferred stocks are contractual obligations whose costs are clearly stated on the contracts, stocks have no comparable stated cost rate. That makes it difficult to measure  $r_s$ . However, we can employ the techniques developed in Chapters 8 and 9 to produce reasonably good estimates of the cost of equity from retained earnings. To begin, recall that if a stock is in equilibrium, its *required rate of return*,  $r_s$ , must be equal to its *expected rate of return*,  $\hat{r}_s$ . Further, its *required return* is equal to a risk-free rate,  $r_{RF}$ , plus a risk premium, RP, whereas the expected return on the stock is its dividend yield,  $D_1/P_0$ , plus its expected growth rate,  $g$ . Thus, we can write the following equation and estimate  $r_s$  using the left term, the right term, or both terms:

**Required rate of return = Expected rate of return**

$$r_s = r_{RF} + RP = D_1/P_0 + g = \hat{r}_s$$

10-4

The left term is based on the Capital Asset Pricing Model (CAPM) as discussed in Chapter 8, and the right term is based on the discounted dividend model as developed in Chapter 9. We discuss these two procedures, in addition to one based on the firm's own cost of debt, in the following sections.

<sup>11</sup>The term *retained earnings* can be interpreted to mean the balance sheet item *retained earnings*, consisting of all the earnings retained in the business throughout its history or the income statement item *addition to retained earnings*. The income statement item is relevant in this chapter; for our purpose, *retained earnings* refers to that part of the current year's earnings not paid as dividends (hence, available for reinvestment in the business this year). If this is not clear, look back at Allied's balance sheet shown in Table 3-1 and note that at the end of 2007, Allied had \$750 million of retained earnings; but that figure rose to \$810 million by the end of 2008. Then look at the 2008 income statement, where you will see that Allied retained \$60 million of its 2008 income. This \$60 million was the new equity from retained earnings that was used, along with some additional debt, to fund the 2008 capital budgeting projects. Also, you can see from the 2007 and 2008 balance sheets that Allied had \$130 million of common stock at the end of both years. This indicates that it did not sell any new common stock to raise capital during 2008.

### Cost of Retained Earnings, $r_s$

*The rate of return required by stockholders on a firm's common stock.*

### Cost of New Common Stock, $r_e$

*The cost of external equity based on the cost of retained earnings but increased for flotation costs.*

### 10-5a The CAPM Approach

The most widely used method for estimating the cost of common equity is the Capital Asset Pricing Model (CAPM) as developed in Chapter 8.<sup>12</sup> Here are the steps used to find  $r_s$ :

- Step 1:** Estimate the risk-free rate,  $r_{RF}$ . We generally use the 10-year Treasury bond rate as the measure of the risk-free rate, but some analysts use the short-term Treasury bill rate.
- Step 2:** Estimate the stock's beta coefficient,  $b_i$ , and use it as an index of the stock's risk. The  $i$  signifies the  $i$ th company's beta.
- Step 3:** Estimate the expected market risk premium. Recall that the market risk premium is the difference between the return that investors require on an average stock and the risk-free rate.<sup>13</sup>
- Step 4:** Substitute the preceding values in the CAPM equation to estimate the required rate of return on the stock in question:

$$\begin{aligned} r_s &= r_{RF} + (RP_M)b_i \\ &= r_{RF} + (r_M - r_{RF})b_i \end{aligned}$$

Thus, the CAPM estimate of  $r_s$  is equal to the risk-free rate,  $r_{RF}$ , plus a risk premium that is equal to the risk premium on an average stock,  $(r_M - r_{RF})$ , scaled up or down to reflect the particular stock's risk as measured by its beta coefficient.

Assume that in today's market,  $r_{RF} = 5.6\%$ , the market risk premium is  $RP_M = 5.0\%$ , and Allied's beta is 1.48. Using the CAPM approach, Allied's cost of equity is estimated to be 13.0%:

$$\begin{aligned} r_s &= 5.6\% + (5.0\%)(1.48) \\ &= 13.0\% \end{aligned}$$

Although the CAPM appears to produce an accurate, precise estimate of  $r_s$ , several potential problems exist. First, as we saw in Chapter 8, if a firm's stockholders are not well diversified, they may be concerned with *stand-alone risk* rather than just market risk. In that case, the firm's true investment risk would not be measured by its beta and the CAPM estimate would understate the correct value of  $r_s$ . Further, even if the CAPM theory is valid, it is hard to obtain accurate estimates of the required inputs because (1) there is controversy about whether to use long-term or short-term Treasury yields for  $r_{RF}$ , (2) it is hard to estimate the beta that investors expect the company to have in the future, and (3) it is difficult to estimate the proper market risk premium. As we indicated earlier, the CAPM approach is used most often; but because of the just-noted problems, analysts also estimate the cost of equity using the other approaches discussed in the following sections.

<sup>12</sup>A recent survey by John Graham and Campbell Harvey indicates that the CAPM approach is most often used to estimate the cost of equity. More than 70% of the surveyed firms used the CAPM approach. In some cases, they used beta from the CAPM as one determinant of  $r_s$ , but they also added other factors thought to improve the estimate. For more details, see John R. Graham and Campbell R. Harvey, "The Theory and Practice of Corporate Finance: Evidence from the Field," *Journal of Financial Economics*, Vol. 60, nos. 2 and 3 (May–June 2001), pp. 187–243, for the survey and Eugene F. Fama and Kenneth R. French, "Common Risk Factors in the Return on Stocks and Bonds," *Journal of Financial Economics*, 1993, pp. 3–56.

<sup>13</sup>It is important to be consistent in the use of a long-term versus a short-term rate for  $r_{RF}$  and for the market risk premium. The market risk premium ( $RP_M = r_M - r_{RF}$ ) depends on the measure used for the risk-free rate. The yield curve is normally upward-sloping, so the 10-year Treasury bond rate normally exceeds the short-term Treasury bill rate. In this case, it follows that one will obtain a lower estimate of the market risk premium if the higher longer-term bond rate is used as the risk-free rate. At any rate, the  $r_{RF}$  used to find the market risk premium should be the same as the  $r_{RF}$  used as the first term in the CAPM equation.

### 10-5b Bond-Yield-plus-Risk-Premium Approach

In situations where reliable inputs for the CAPM approach are not available, as would be true for a closely held company, analysts often use a somewhat subjective procedure to estimate the cost of equity. Empirical studies suggest that the risk premium on a firm's stock over its own bonds generally ranges from 3 to 5 percentage points.<sup>14</sup> Based on this evidence, one might simply add a judgmental risk premium of 3% to 5% to the interest rate on the firm's own long-term debt to estimate its cost of equity. Firms with risky, low-rated, and consequently high-interest-rate debt also have risky, high-cost equity; and the procedure of basing the cost of equity on the firm's own readily observable debt cost utilizes this logic. For example, given that Allied's bonds yield 10%, its cost of equity might be estimated as follows:

$$r_s = \text{Bond yield} + \text{Risk premium} = 10.0\% + 4.0\% = 14.0\%$$

The bonds of a riskier company might have a higher yield, 12%, in which case the estimated cost of equity would be 16%:

$$r_s = 12.0\% + 4.0\% = 16.0\%$$

Because the 4% risk premium is a judgmental estimate, the estimated value of  $r_s$  is also judgmental. Therefore, one might use a range of 3% to 5% for the risk premium and obtain a range of 13% to 15% for Allied. While this method does not produce a precise cost of equity, it should "get us in the right ballpark."

### 10-5c Dividend-Yield-plus-Growth-Rate, or Discounted Cash Flow (DCF), Approach

In Chapter 9, we saw that both the price and the expected rate of return on a share of common stock depend, ultimately, on the stock's expected cash flows. For companies that are expected to remain in business indefinitely, the cash flows are the dividends; on the other hand, if investors expect the firm to be acquired by some other company or to be liquidated, the cash flows will be dividends for some number of years plus a terminal price when the firm is expected to be acquired or liquidated. Like most firms, Allied is expected to continue indefinitely, in which case the following equation applies:

$$\begin{aligned} P_0 &= \frac{D_1}{(1+r_s)^1} + \frac{D_2}{(1+r_s)^2} + \cdots + \frac{D_\infty}{(1+r_s)^\infty} \\ &= \sum_{t=1}^{\infty} \frac{D_t}{(1+r_s)^t} \end{aligned} \quad \text{10-6}$$

Here  $P_0$  is the current stock price,  $D_t$  is the dividend expected to be paid at the end of Year  $t$ , and  $r_s$  is the required rate of return. If dividends are expected to grow at a constant rate, as we saw in Chapter 9, Equation 10-6 reduces to this important formula:<sup>15</sup>

$$P_0 = \frac{D_1}{r_s - g} \quad \text{10-7}$$

<sup>14</sup>Ibbotson Associates, a well-known research firm, has calculated the historical returns on common stocks and on corporate bonds and used the differential as an estimate of the *historical risk premium* of stocks over corporate bonds. Historical risk premiums vary from year to year, but a range of 3% to 5% is common. Also, analysts have calculated the CAPM-required return on equity for publicly traded firms in a given industry, averaged them, subtracted those firms' average bond yield, and used the differential as an *expected risk premium*. Again, these risk premium estimates are often generally in the 3% to 5% range.

<sup>15</sup>If the growth rate is not expected to be constant, the DCF procedure can still be used to estimate  $r$ ; but in this case, it is necessary to calculate an average growth rate using the procedures described in this chapter's Excel model.

We can solve for  $r_s$  to obtain the required rate of return on common equity, which for the marginal investor is also equal to the expected rate of return:

$$10-8 \quad r_s = \hat{r}_s = \frac{D_1}{P_0} + \text{Expected } g$$

Thus, investors expect to receive a dividend yield,  $D_1/P_0$ , plus a capital gain,  $g$ , for a total expected return of  $\hat{r}_s$ ; and in equilibrium, this expected return is also equal to the required return,  $r_s$ . This method of estimating the cost of equity is called the *discounted cash flow*, or *DCF, method*. Henceforth, we will assume that equilibrium exists, which permits us to use the terms  $r_s$  and  $\hat{r}_s$  interchangeably.

It is easy to calculate the dividend yield; but since stock prices fluctuate, the yield varies from day to day, which leads to fluctuations in the DCF cost of equity. Also, it is difficult to determine the proper growth rate. If past growth rates in earnings and dividends have been relatively stable and if investors expect a continuation of past trends,  $g$  may be based on the firm's historic growth rate. *However, if the company's past growth has been abnormally high or low because of its own unique situation or because of general economic fluctuations, investors will not project historical growth rates into the future.* In this case, which applies to Allied,  $g$  must be obtained in some other manner.

Security analysts regularly forecast growth rates for earnings and dividends, looking at such factors as projected sales, net profit margins, and competition. For example, *Value Line*, which is available in most libraries, provides growth rate forecasts for 1,700 companies; and Merrill Lynch, Citi Smith Barney, and other organizations make similar forecasts. Averages of these forecasts are available on Yahoo Finance and other web sites. Therefore, someone estimating a firm's cost of equity can obtain analysts' forecasts and use them as a proxy for the growth expectations of investors in general. Then they can combine this  $g$  with the current dividend yield to estimate  $\hat{r}_s$ :

$$\hat{r}_s = \frac{D_1}{P_0} + \text{Growth rate as projected by security analysts}$$

Again, note that this estimate of  $\hat{r}_s$  is based on the assumption that  $g$  is expected to remain constant in the future. Otherwise, we must use an average of expected future rates.<sup>16</sup>

To illustrate the DCF approach, Allied's stock sells for \$23.06, its next expected dividend is \$1.25, and analysts expect its growth rate to be 8.3%. Thus, Allied's expected and required rates of return (hence, its cost of retained earnings) are estimated to be 13.7%:

$$\begin{aligned} \hat{r}_s = r_s &= \frac{\$1.25}{\$23.06} + 8.3\% \\ &= 5.4\% + 8.3\% \\ &= 13.7\% \end{aligned}$$

Based on the DCF method, 13.7% is the minimum rate of return that should be earned on retained earnings to justify plowing earnings back into the business

<sup>16</sup>Analysts' growth rate forecasts are usually for 5 years into the future, and the rates provided represent the average growth rate over that 5-year horizon. Studies have shown that analysts' forecasts represent the best source of growth rate data for DCF cost of capital estimates. See Robert Harris, "Using Analysts' Growth Rate Forecasts to Estimate Shareholder Required Rates of Return," *Financial Management*, Spring 1986.

Two organizations—IBES and Zacks—collect the forecasts of leading analysts for most larger companies, average these forecasts, and publish the averages. The IBES and Zacks data are available through online computer data services.

rather than paying them out as dividends. Put another way, since investors are thought to have an *opportunity* to earn 13.7% if earnings are paid out as dividends, the *opportunity cost* of equity from retained earnings is 13.7%.

### 10-5d Averaging the Alternative Estimates

In our examples, Allied's estimated cost of equity was 13.0% by the CAPM, 14.0% by the bond-yield-plus-risk premium method, and 13.7% by the DCF method. Which method should the firm use? If management is highly confident of one method, it would probably use that method's estimate. Otherwise, it might use an average of the three methods, which for Allied is 13.6%:

$$\text{Average} = (13.0\% + 13.7\% + 14.0\%)/3 = 13.6\%$$

One could, of course, give different weights to the different methods and thus calculate a weighted average.

As consultants, we have estimated companies' costs of capital on numerous occasions. We generally use all three methods and average them, but we rely most heavily on the method that seems best under the circumstances. Judgment is important and comes into play here, as is true for most of finance. Also, we recognize that our final estimate will almost certainly be incorrect to some extent.<sup>17</sup> Therefore, we always provide a range and state that in our judgment, the cost of equity is within that range. For Allied, we used a range of 13% to 14%; the company then used 13.5% as the cost of retained earnings when it calculated its WACC:

**Final estimate of  $r_s$  used to calculate the WACC: 13.5%.**

#### SELF TEST



Why must a cost be assigned to retained earnings?

What three approaches are used to estimate the cost of common equity? Which approach is most commonly used in practice?

Identify some potential problems with the CAPM.

Which of the two components of the DCF formula, the dividend yield or the growth rate, do you think is more difficult to estimate? Why?

What's the logic behind the bond-yield-plus-risk-premium approach?

Suppose you are an analyst with the following data:  $r_{RF} = 5.5\%$ ,  $r_M - r_{RF} = 6\%$ ,  $b = 0.8$ ,  $D_1 = \$1.00$ ,  $P_0 = \$25.00$ ,  $g = 6\%$ , and  $r_d = \text{firm's bond yield} = 6.5\%$ . What is this firm's cost of equity using the CAPM, DCF, and bond-yield-plus-risk-premium approaches? Use the midrange of the judgmental risk premium for the bond-yield-plus-risk-premium approach. **(CAPM = 10.3%; DCF = 10%; Bond yield + RP = 10.5%)**

<sup>17</sup>Investment bankers are generally regarded as experts on concepts such as the cost of capital, and they are paid big salaries for their analysis. But those investment bankers aren't always too accurate. To illustrate, the stock price of the fifth-largest investment bank, Bear Stearns, closed on Friday, March 14, 2008, at \$30. Its employees owned 33% of the stock. On Sunday, in a special meeting, its board of directors agreed to sell the company to JP Morgan for \$2 per share. Even investment bankers don't always get it right, so don't expect too much precision unless you are given a set of numbers and told to do some relatively simple calculations. As of this writing, JP Morgan has since increased its offer for Bear Stearns to \$10 per share.

## 10-6 COST OF NEW COMMON STOCK, $r_e$

Companies generally use an investment banker when they issue new common stock and sometimes when they issue preferred stock or bonds. In return for a fee, investment bankers help the company structure the terms, set a price for the issue, and sell the issue to investors. The bankers' fees are called *flotation costs*, and the total cost of the capital raised is the investors' required return plus the flotation cost.

For most firms at most times, equity flotation costs are not an issue because most equity comes from retained earnings. Therefore, in our discussion to this point, we have ignored flotation costs. However, as you can see in "How Much Does It Cost to Raise External Capital," which follows, flotation costs can be substantial. So if a firm does plan to issue new stock, these costs should not be ignored. When firms use investment bankers to raise capital, two approaches can be used to account for flotation costs.<sup>18</sup> We describe them next.

### 10-6a Add Flotation Costs to a Project's Cost

In the next chapter, we show that capital budgeting projects typically involve an initial cash outlay followed by a series of cash inflows. One approach to handling flotation costs, found as the sum of the flotation costs for the debt, preferred, and common stock used to finance the project, is to add this sum to the initial investment cost. Because the investment cost is increased, the project's expected rate of return is reduced. For example, consider a 1-year project with an initial cost (not including flotation costs) of \$100 million. After 1 year, the project is expected to produce an inflow of \$115 million. Therefore, its expected rate of return is  $\$115/\$100 - 1 = 0.15 = 15.0\%$ . However, if the project requires the company to raise \$100 million of new capital and incur \$2 million of flotation costs, the total up-front cost will rise to \$102 million, which will lower the expected rate of return to  $\$115/\$102 - 1 = 0.1275 = 12.75\%$ .

### 10-6b Increase the Cost of Capital

The second approach involves adjusting the cost of capital rather than increasing the project's investment cost. If the firm plans to continue using the capital in the future, as is generally true for equity, this second approach theoretically will be better. The adjustment process is based on the following logic. If there are flotation costs, the issuing firm receives only a portion of the capital provided by investors, with the remainder going to the underwriter. To provide investors with their required rate of return on the capital they contributed, each dollar the firm actually receives must "work harder"; that is, each dollar must earn a higher rate of return than the investors' required rate of return. For example, suppose investors require a 13.7% return on their investment, but flotation costs represent 10% of the funds raised. Therefore, the firm actually keeps and invests only 90% of the amount that investors supplied. In that case, the firm must earn about 14.3% on the available funds in order to provide investors with a 13.7% return on their investment. This higher rate of return is the flotation-adjusted cost of equity.

The DCF approach can be used to estimate the effects of flotation costs. Here is the equation for the *cost of new common stock*,  $r_e$ :

$$10-9 \quad \text{Cost of equity from new stock} = r_e = \frac{D_1}{P_0(1 - F)} + g$$

<sup>18</sup>A more complete discussion of flotation cost adjustments can be found in Brigham and Daves, *Intermediate Financial Management*, 9th ed. (Mason, OH: Thomson/South-Western, 2007), and other advanced texts.

## HOW MUCH DOES IT COST TO RAISE EXTERNAL CAPITAL?

A study by four professors provides some insights into how much it costs U.S. corporations to raise external capital. Using information from the Securities Data Company, they found the average flotation cost for equity and debt as presented below.

The common stock flotation costs are for established firms, not for firms raising funds in IPOs. Costs associated with IPOs are much higher—flotation costs are about 17%

of gross proceeds for common equity if the amount raised in the IPO is less than \$10 million and about 6% if more than \$500 million is raised. The data shown include both utility and nonutility companies. If utilities were excluded, flotation costs would be somewhat higher. Also, the debt costs are for debt raised using investment bankers. Most debt is actually obtained from banks and other creditors, in which case flotation costs are generally quite small or nonexistent.

Amount of Capital Raised (Millions of Dollars)	Average Flotation Cost for Common Stock (% of Total Capital Raised)	Average Flotation Cost for New Debt (% of Total Capital Raised)
2–9.99	13.28	4.39
10–19.99	8.72	2.76
20–39.99	6.93	2.42
40–59.99	5.87	1.32
60–79.99	5.18	2.34
80–99.99	4.73	2.16
100–199.99	4.22	2.31
200–499.99	3.47	2.19
500 and up	3.15	1.64

Source: Inmoo Lee, Scott Lochhead, Jay Ritter, and Quanshui Zhao, "The Costs of Raising Capital," *The Journal of Financial Research*, Vol. XIX, no. 1 (Spring 1996), pp. 59–74. Reprinted with permission.

Here  $F$  is the percentage **flotation cost** required to sell the new stock, so  $P_0(1 - F)$  is the net price per share received by the company.

Assuming that Allied has a flotation cost of 10%, its cost of new common equity,  $r_e$ , would be computed as follows:

$$\begin{aligned} r_e &= \frac{\$1.25}{\$23.06(1 - 0.10)} + 8.3\% \\ &= \frac{\$1.25}{\$20.75} + 8.3\% \\ &= 6.0\% + 8.3\% = 14.3\% \end{aligned}$$

This is 0.6% higher than the previously estimated 13.7% DCF cost of equity, so the **flotation cost adjustment** is 0.6%:

$$\text{Flotation adjustment} = \text{Adjusted DCF cost} - \text{Pure DCF cost} = 14.3\% - 13.7\% = 0.6\%$$

The 0.6% adjustment factor can be added to the previously estimated  $r_s = 13.5\%$  (Allied management's estimate), resulting in a cost of equity from new common stock, or external equity, of 14.1%:

$$\text{Cost of external equity} = r_s + \text{Adjustment factor} = 13.5\% + 0.6\% = 14.1\%$$

If Allied earns 14.1% on funds obtained from selling new stock, the investors who purchased that stock will end up earning 13.5%, their required rate of return, on

### Flotation Cost, $F$

The percentage cost of issuing new common stock.

### Flotation Cost Adjustment

The amount that must be added to  $r_s$  to account for flotation costs to find  $r_e$ .

the money they invested. If Allied earns more than 14.1%, its stock price should rise; but the price should fall if Allied earns less than 14.1%.<sup>19</sup>

### 10-6c When Must External Equity Be Used?

Because of flotation costs, dollars raised by selling new stock must “work harder” than dollars raised by retaining earnings. Moreover, because no flotation costs are involved, retained earnings cost less than new stock. Therefore, firms should utilize retained earnings to the greatest extent possible. However, if a firm has more good investment opportunities than can be financed with retained earnings plus the debt and preferred stock supported by those retained earnings, it may need to issue new common stock. The total amount of capital that can be raised before new stock must be issued is defined as the **retained earnings breakpoint**, and it can be calculated as follows:

#### Retained Earnings Breakpoint

The amount of capital raised beyond which new common stock must be issued.

$$\text{10-10} \quad \text{Retained earnings breakpoint} = \frac{\text{Addition to retained earnings for the year}}{\text{Equity fraction}}$$

Allied’s addition to retained earnings in 2009 is expected to be \$66 million; and its target capital structure consists of 45% debt, 2% preferred, and 53% equity. Therefore, its retained earnings breakpoint for 2009 is as follows:

$$\text{Retained earnings breakpoint} = \$66 / 0.53 = \$124.5 \text{ million}$$

To prove that this is correct, note that a capital budget of \$124.5 million could be financed as  $0.45(\$124.5) = \$56$  million of debt,  $0.02(\$124.5) = \$2.5$  million of preferred stock, and  $0.53(\$124.5) = \$66$  million of equity raised from retained earnings. Up to a total of \$124.5 million of new capital, equity would have a cost of  $r_s = 13.5\%$ . However, if the capital budget exceeded \$124.5 million, Allied would have to obtain equity by issuing new common stock at a cost of  $r_e = 14.1\%$ .<sup>20</sup>

#### SELF TEST



What are the two approaches that can be used to adjust for flotation costs?

Would a firm that has many good investment opportunities be likely to have a higher or a lower dividend payout ratio than a firm with few good investment opportunities? Explain.

A firm’s common stock has  $D_1 = \$1.50$ ,  $P_0 = \$30.00$ ,  $g = 5\%$ , and  $F = 4\%$ . If the firm must issue new stock, what is its cost of new external equity? **(10.21%)**

Suppose Firm A plans to retain \$100 million of earnings for the year. It wants to finance using its current target capital structure of 46% debt, 3% preferred, and 51% common equity. How large could its capital budget be before it must issue new common stock? **(\$196.08 million)**

<sup>19</sup>Flotation costs for preferred stock and bonds are handled similarly to common stock. In both cases, the dollars of flotation costs are deducted from the price of the security,  $P_p$  for preferred stock and \$1,000 for bonds issued at par. Then for preferred, the cost is found using Equation 10-9 with  $g = 0$ . For bonds, we find the YTM based on  $\$1,000 - \text{Flotation costs}$  (say, \$970 if flotation costs are 3% of the issue price).

<sup>20</sup>This breakpoint is only suggestive—it is not written in stone. For example, rather than issuing new common stock, the company could use more debt (hence, increase its debt ratio) or it could increase its addition to retained earnings by reducing its dividend payout ratio. Both actions would change the retained earnings breakpoint. Also, breakpoints could occur due to increases in the costs of debt and preferred. Indeed, all manner of changes could occur; and the end result would be a large number of potential breakpoints. All of this is discussed in more detail in Brigham and Ehrhardt, *Financial Management Theory and Practice*, 12th ed. (Mason, OH: Thomson/South-Western, 2008), Web Extension 11B.

## 10-7 COMPOSITE, OR WEIGHTED AVERAGE, COST OF CAPITAL, WACC

Allied's target capital structure calls for 45% debt, 2% preferred stock, and 53% common equity. Earlier we saw that its before-tax cost of debt is 10.0%, its after-tax cost of debt is  $r_d(1 - T) = 10\%(0.6) = 6.0\%$ , its cost of preferred stock is 10.3%, its cost of common equity from retained earnings is 13.5%, and its marginal tax rate is 40%. Equation 10-1, presented earlier, can be used to calculate its WACC when all of the new common equity comes from retained earnings:

$$\begin{aligned} \text{WACC} &= w_d r_d(1 - T) + w_p r_p + w_c r_s \\ &= 0.45(10\%)(0.6) + 0.02(10.3\%) + 0.53(13.5\%) \\ &= 10.1\% \text{ if equity comes from retained earnings} \end{aligned}$$

Under these conditions, every dollar of new capital that Allied raises would consist of 45 cents of debt with an after-tax cost of 6%, 2 cents of preferred stock with a cost of 10.3%, and 53 cents of common equity from additions to retained earnings with a cost of 13.5%. The average cost of each whole dollar, or the WACC, would be 10.1%.

This estimate of Allied's WACC assumes that common equity comes exclusively from retained earnings. If, instead, Allied was to issue new common stock, its WACC would be slightly higher because of the additional flotation costs.

$$\begin{aligned} \text{WACC} &= w_d r_d(1 - T) + w_p r_p + w_c r_e \\ &= 0.45(10\%)(0.6) + 0.02(10.3\%) + 0.53(14.1\%) \\ &= 10.4\% \text{ with equity raised by selling new stock} \end{aligned}$$

In the Web Appendix 10A, we discuss in more detail the connection between the WACC and the costs of issuing new common stock.

### SELF TEST



Write the equation for the WACC.

Firm A has the following data: Target capital structure of 46% debt, 3% preferred, and 51% common equity; Tax rate = 40%;  $r_d = 7\%$ ;  $r_p = 7.5\%$ ;  $r_s = 11.5\%$ ; and  $r_e = 12.5\%$ . What is the firm's WACC if it does not issue any new stock? **(8.02%)**

What is Firm A's WACC if it issues new common stock? **(8.53%)**

Firm A has 11 equally risky capital budgeting projects, each costing \$19.608 million and each having an expected rate of return of 8.25%. Firm A's retained earnings breakpoint is \$196.08 million. How much capital should Firm A raise and invest? Why? **(\$196.08 million; the 11th project would have a higher WACC than its expected rate of return. This question anticipates some of the analysis in Chapter 11.)**

## 10-8 FACTORS THAT AFFECT THE WACC

The cost of capital is affected by a number of factors. Some are beyond the firm's control, but others can be influenced by its financing and investment decisions.

### 10-8a Factors the Firm Cannot Control

The three most important factors that the firm cannot directly control are *interest rates in the economy*, *the general level of stock prices*, and *tax rates*. If interest rates in

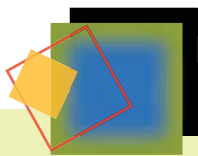
the economy rise, the cost of debt increases because the firm must pay bondholders more when it borrows. Similarly, if stock prices in general decline, pulling the firm's stock price down, its cost of equity will rise. Also, since tax rates are used in the calculation of the component cost of debt, they have an important effect on the firm's cost of capital. Taxes also affect the cost of capital in other less apparent ways. For example, when tax rates on dividends and capital gains were lowered relative to rates on interest income, stocks became relatively more attractive than debt; consequently, the cost of equity and WACC declined.

### 10-8b Factors the Firm Can Control

A firm can directly affect its cost of capital in three primary ways: (1) by changing its *capital structure*, (2) by changing its *dividend payout ratio*, and (3) by *altering its capital budgeting decision rules* to accept projects with more or less risk than projects previously undertaken.

Capital structure impacts a firm's cost of capital. So far we have assumed that Allied has a given target capital structure, and we used the target weights to calculate its WACC. However, if the firm changes its target capital structure, the weights used to calculate the WACC will change. Other things held constant, an increase in the target debt ratio tends to lower the WACC (and vice versa if the debt ratio is lowered) because the after-tax cost of debt is lower than the cost of equity. However, other things are not likely to remain constant. An increase in the use of debt will increase the riskiness of both the debt and the equity, and these increases in component costs might more than offset the effects of the changes in the weights and raise the WACC. In the capital structure chapter, we will discuss how a firm can try to balance these effects to reach its optimal capital structure.

Dividend policy affects the amount of retained earnings available to the firm and thus the need to sell new stock and incur flotation costs. This suggests that the higher the dividend payout ratio, the smaller the addition to retained earnings and thus the higher the cost of equity and therefore the WACC. However, investors may prefer dividends to retained earnings, in which case reducing dividends



## GLOBAL PERSPECTIVES

### GLOBAL VARIATIONS IN THE COST OF CAPITAL

For U.S. firms to be competitive in world markets, they must have capital costs similar to those their international competitors face. In the past, many experts argued that U.S. firms were at a disadvantage. In particular, Japanese firms enjoyed lower costs of capital, which lowered their total costs and made it harder for U.S. firms to compete. Recent events, however, have considerably narrowed cost of capital differences between U.S. and Japanese firms. In particular, despite its recent decline, the U.S. stock market has outperformed the Japanese market over the past decade, which has made it relatively easy for U.S. firms to raise equity capital.

As capital markets become increasingly integrated, cross-country differences in the costs of capital are disappearing. Today most large corporations raise capital throughout the world; hence, we are moving toward one global capital market rather than distinct capital markets in each country. Although government policies and market conditions can affect the costs of capital within a given country, this affects primarily smaller firms that do not have access to global capital markets. However, even these differences are becoming less important as time goes by. What matters most to investors is the risk of the individual firm, not the market in which it raises capital.

might lead to an increase in both  $r_s$  and  $r_e$ . As we will see in the dividend chapter, the optimal dividend policy is a complicated issue, but one that can have an important effect on the cost of capital.

The firm's capital budgeting decisions can also affect its cost of capital. When we estimate the firm's cost of capital, we use as the starting point the required rates of return on its outstanding stock and bonds. These cost rates reflect the riskiness of the firm's existing assets. Therefore, we have been implicitly assuming that new capital will be invested in assets that have the same risk as existing assets. This assumption is generally correct, as most firms do invest in assets similar to ones they currently operate. However, if the firm decides to invest in an entirely new and risky line of business, its component costs of debt and equity (and thus its WACC) will increase. To illustrate, in 1996 when ITT Corporation sold off its finance company and purchased Caesar's World, which operates gambling casinos, its dramatic shift in corporate focus almost certainly affected ITT's cost of capital. (Subsequently, ITT's hospitality and entertainment division has become part of Starwood Hotels & Resorts.) The effects of such investment decisions are discussed in Chapter 12.

### SELF TEST



Name three factors that affect the cost of capital and that are beyond the firm's control.

What are three factors under the firm's control that can affect its cost of capital?

Suppose interest rates in the economy increase. How would such a change affect the costs of both debt and common equity based on the CAPM?

## 10-9 ADJUSTING THE COST OF CAPITAL FOR RISK

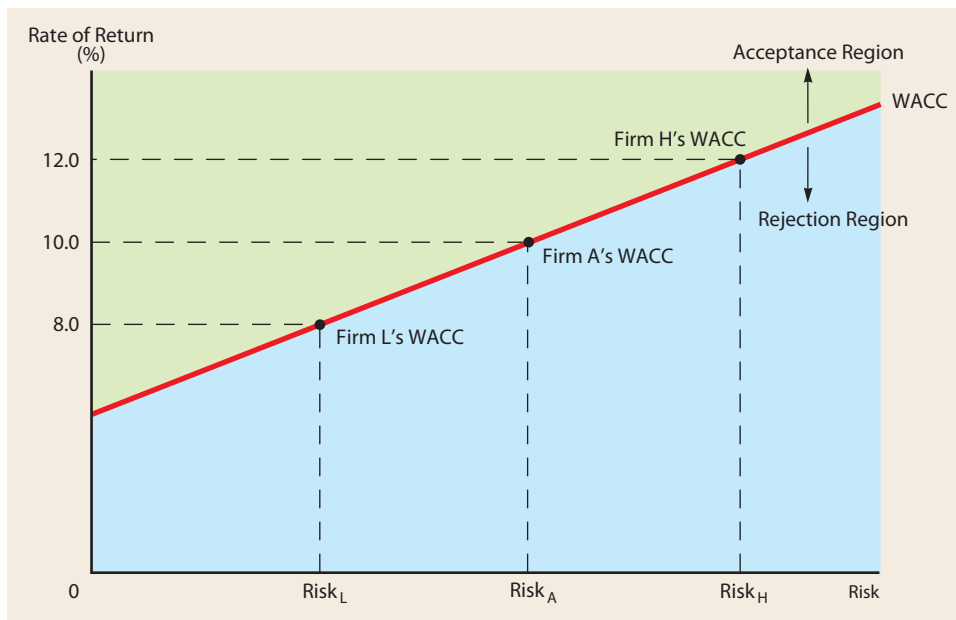
As you will see in the chapters on capital budgeting that follow, the cost of capital is a key element in the capital budgeting process. Projects should be accepted if and only if their estimated returns exceed their costs of capital. Thus, the cost of capital is a "hurdle rate"—a project's expected rate of return must "jump the hurdle" for it to be accepted. Moreover, investors require higher returns on riskier investments. Consequently, companies that are raising capital to take on risky projects will have higher costs of capital than companies that are investing in safer projects.

Figure 10-1 illustrates the trade-off between risk and the cost of capital. Firm L is in a low-risk business and has a WACC of 8%. Firm A is an average-risk business with a WACC of 10%, while Firm H's business is exposed to greater risk and consequently has a WACC of 12%. Thus, Firm L will accept a typical project if its expected return is above 8%. Firm A's hurdle rate is 10%, while the corresponding hurdle rate for Firm H is 12%.

It's important to remember that the costs of capital for Firms L, A, and H in Figure 10-1 represent the overall, or composite, WACCs for the three firms and thus apply only to "typical" projects for each firm. However, different projects often have different risks, even for a given firm. *Therefore, each project's hurdle rate should reflect the risk of the project, not the risk associated with the firm's average project as reflected in its composite WACC.* Empirical studies do indicate that firms consider the risks of individual projects, but the studies also indicate that most firms regard most projects as having about the same risk as the firm's average existing assets. Therefore, the WACC is used to evaluate most projects; but if a project has an especially high or low risk, the WACC will be adjusted up or down to account for the risk differential.

FIGURE 10-1

## Risk and the Cost of Capital



For example, assume that Firm A (the average-risk firm with a composite WACC of 10%) has two divisions, L and H. Division L has relatively little risk; and if it were operated as a separate firm, its WACC would be 7%. Division H has higher risk, and its divisional cost of capital is 13%. Since the two divisions are of equal size, Firm A's composite WACC is calculated as  $0.50(7\%) + 0.50(13\%) = 10\%$ . However, it would be a mistake to use this 10% WACC for either division. To see this point, assume that Division L is considering a relatively low-risk project with an expected return of 9%, while Division H is considering a higher-risk project with an expected return of 11%. As shown in Figure 10-2, Division L's project should be accepted because its return is above its risk-based cost of capital, whereas Division H's project should be rejected. If the 10% corporate WACC was used by each division, the decision would be reversed: Division H would incorrectly accept its project, and Division L would incorrectly reject its project. In general, failing to adjust for differences in risk would lead the firm to accept too many risky projects and reject too many safe ones. Over time, the firm would become riskier, its WACC would increase, and its shareholder value would suffer. We will return to these issues in Chapter 12, when we consider different approaches for measuring project risk.

## SELF TEST



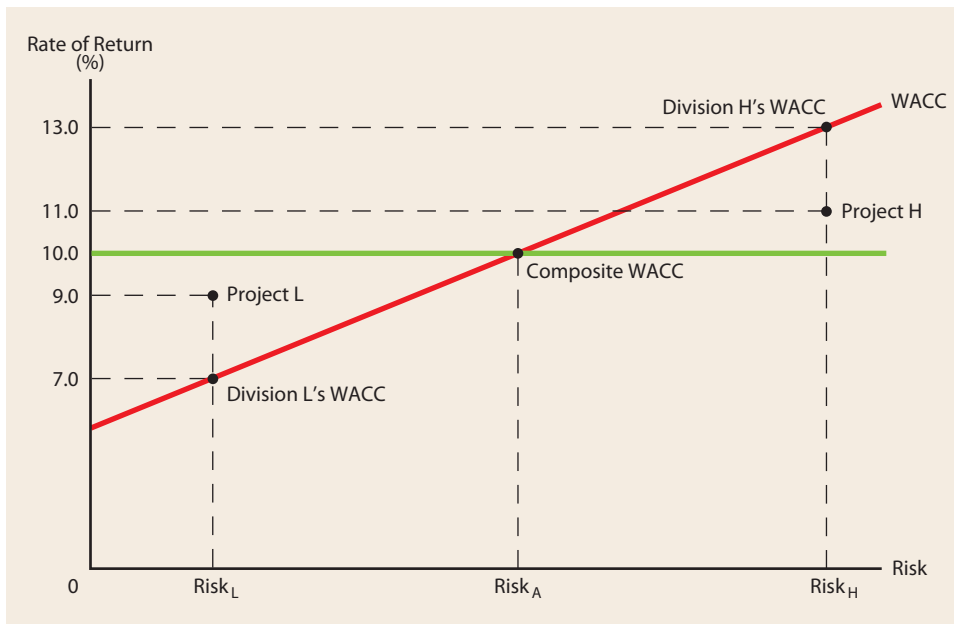
Why is the cost of capital sometimes referred to as a "hurdle rate"?

How should firms evaluate projects with different risks?

Should all divisions within the same firm use the firm's composite WACC for evaluating all capital budgeting projects? Explain.

FIGURE 10-2

Divisional Cost of Capital



## 10-10 SOME OTHER PROBLEMS WITH COST OF CAPITAL ESTIMATES

A number of issues related to the cost of capital have not been mentioned or were glossed over in this chapter. These topics are covered in advanced finance courses, but they deserve mention now to alert you to potential dangers and to provide a preview of some matters covered in advanced courses.

1. *Depreciation-generated funds.*<sup>21</sup> The largest single source of capital for many firms is depreciation, yet we have not discussed how the cost of this capital is determined. In brief, depreciation cash flows can either be reinvested or returned to investors (stockholders *and* creditors). The cost of depreciation-generated funds is thus an opportunity cost; and it is approximately equal to the WACC from retained earnings, preferred stock, and debt. Therefore, we can ignore it in our estimate of the WACC.
2. *Privately owned firms.* Our discussion of the cost of equity focused on publicly owned corporations, and we have concentrated on the rate of return required by public stockholders. However, there is a serious question about how to measure the cost of equity for a firm whose stock is not traded. Tax issues are also especially important in these cases. As a general rule, the same principles of cost of capital estimation apply to both privately held

<sup>21</sup>See Table 3-3, the statement of cash flows, for an illustration of the cash flows provided from depreciation. Refer to advanced finance textbooks for a discussion on the treatment of depreciation-generated funds.

and publicly owned firms, but the problems of obtaining input data are somewhat different.

3. *Measurement problems.* We cannot overemphasize the practical difficulties encountered when estimating the cost of equity. It is very difficult to obtain good input data for the CAPM, for  $g$  in the formula  $\hat{r}_s = D_1/P_0 + g$ , and for the risk premium in the formula  $r_s = \text{Bond yield} + \text{Risk premium}$ . As a result, we can never be sure of the accuracy of our estimated cost of capital.
4. *Costs of capital for projects of differing risk.* We touched briefly on the fact that different projects can differ in risk and, thus, in their required rates of return. However, it is difficult to measure a project's risk (hence, to adjust the cost of capital for capital budgeting projects with different risks).
5. *Capital structure weights.* In this chapter, we took as given the target capital structure and used it to calculate the WACC. As we shall see in the capital structure chapter, establishing the target capital structure is a major task in itself.

Although this list of problems appears formidable, the state of the art in cost of capital estimation is not in bad shape. The procedures outlined in this chapter can be used to obtain costs of capital estimates that are sufficiently accurate for practical purposes, so the problems listed previously merely indicate the desirability of refinements. The refinements are not unimportant, but the problems noted do not invalidate the usefulness of the procedures outlined in this chapter.



Identify some problem areas in cost of capital analysis. Do these problems invalidate the cost of capital procedures discussed in this chapter? Explain.

## TYING IT ALL TOGETHER

We began this chapter by discussing the concept of the weighted average cost of capital. We then discussed the four capital components (debt, preferred stock, retained earnings, and new common equity) and the procedures used to estimate each component's cost. Next, we calculated the WACC, which is a key element in capital budgeting. A key issue here is the weights that should be used to find the WACC. In general, companies consider a number of factors, then establish a target capital structure that is used to calculate the WACC. We discuss the target capital structure and its affect on the WACC in more detail in the capital structure chapter.

The cost of capital is a key element in capital budgeting decisions, our focus in the following chapters. Indeed, capital budgeting as it should be done is impossible without a good estimate of the cost of capital; so you need to have a good understanding of cost of capital concepts before you move on.

## SELF-TEST QUESTIONS AND PROBLEMS (Solutions Appear in Appendix A)

**ST-1 KEY TERMS** Define the following terms:

- a. Capital components
- b. Before-tax cost of debt,  $r_d$ ; after-tax cost of debt,  $r_d(1 - T)$
- c. Cost of preferred stock,  $r_p$
- d. Cost of retained earnings,  $r_s$ ; cost of new common stock,  $r_e$
- e. Weighted average cost of capital, WACC
- f. Flotation cost,  $F$ ; flotation cost adjustment; retained earnings breakpoint

**ST-2 WACC** Lancaster Engineering Inc. (LEI) has the following capital structure, which it considers to be optimal:

Debt	25%
Preferred stock	15
Common equity	<u>60</u>
	<u>100%</u>

LEI's expected net income this year is \$34,285.72; its established dividend payout ratio is 30%; its federal-plus-state tax rate is 40%; and investors expect future earnings and dividends to grow at a constant rate of 9%. LEI paid a dividend of \$3.60 per share last year, and its stock currently sells for \$54.00 per share.

LEI can obtain new capital in the following ways:

- Preferred: New preferred stock with a dividend of \$11.00 can be sold to the public at a price of \$95.00 per share.
  - Debt: Debt can be sold at an interest rate of 12%.
- a. Determine the cost of each capital component.
  - b. Calculate the WACC.
  - c. LEI has the following investment opportunities that are average-risk projects:

Project	Cost at $t = 0$	Rate of Return
A	\$10,000	17.4%
B	20,000	16.0
C	10,000	14.2
D	20,000	13.7
E	10,000	12.0

Which projects should LEI accept? Why?

## QUESTIONS

**10-1** How would each of the following scenarios affect a firm's cost of debt,  $r_d(1 - T)$ ; its cost of equity,  $r_s$ ; and its WACC? Indicate with a plus (+), a minus (-), or a zero (0) if the factor would raise, would lower, or would have an indeterminate effect on the item in question. Assume for each answer that other things are held constant even though in some instances this would probably not be true. Be prepared to justify your answer but recognize that several of the parts have no single correct answer. These questions are designed to stimulate thought and discussion.

	EFFECT ON		
	$r_d(1 - T)$	$r_s$	WACC
a. The corporate tax rate is lowered.	_____	_____	_____
b. The Federal Reserve tightens credit.	_____	_____	_____
c. The firm uses more debt; that is, it increases its debt/assets ratio.	_____	_____	_____
d. The dividend payout ratio is increased.	_____	_____	_____
e. The firm doubles the amount of capital it raises during the year.	_____	_____	_____
f. The firm expands into a risky new area.	_____	_____	_____
g. The firm merges with another firm whose earnings are countercyclical both to those of the first firm and to the stock market.	_____	_____	_____
h. The stock market falls drastically, and the firm's stock price falls along with the rest of the stocks.	_____	_____	_____
i. Investors become more risk-averse.	_____	_____	_____
j. The firm is an electric utility with a large investment in nuclear plants. Several states are considering a ban on nuclear power generation.	_____	_____	_____

- 10-2** Assume that the risk-free rate increases. What impact would this have on the cost of debt? What impact would it have on the cost of equity?
- 10-3** How should the capital structure weights used to calculate the WACC be determined?
- 10-4** Suppose a firm estimates its WACC to be 10%. Should the WACC be used to evaluate all of its potential projects, even if they vary in risk? If not, what might be "reasonable" costs of capital for average-, high-, and low-risk projects?
- 10-5** The WACC is a weighted average of the costs of debt, preferred stock, and common equity. Would the WACC be different if the equity for the coming year came solely in the form of retained earnings versus some equity from the sale of new common stock? Would the calculated WACC depend in any way on the size of the capital budget? How might dividend policy affect the WACC?

## PROBLEMS

Easy  
Problems  
1–5

- 10-1 AFTER-TAX COST OF DEBT** The Heuser Company's currently outstanding bonds have a 10% coupon and a 12% yield to maturity. Heuser believes it could issue new bonds at par that would provide a similar yield to maturity. If its marginal tax rate is 35%, what is Heuser's after-tax cost of debt?
- 10-2 COST OF PREFERRED STOCK** Tunney Industries can issue perpetual preferred stock at a price of \$47.50 a share. The stock would pay a constant annual dividend of \$3.80 a share. What is the company's cost of preferred stock,  $r_p$ ?
- 10-3 COST OF COMMON EQUITY** Percy Motors has a target capital structure of 40% debt and 60% common equity, with no preferred stock. The yield to maturity on the company's outstanding bonds is 9%, and its tax rate is 40%. Percy's CFO estimates that the company's WACC is 9.96%. What is Percy's cost of common equity?
- 10-4 COST OF EQUITY WITH AND WITHOUT FLOTATION** Javits & Sons' common stock currently trades at \$30.00 a share. It is expected to pay an annual dividend of \$3.00 a share at the end of the year ( $D_1 = \$3.00$ ), and the constant growth rate is 5% a year.
- a. What is the company's cost of common equity if all of its equity comes from retained earnings?

- b. If the company issued new stock, it would incur a 10% flotation cost. What would be the cost of equity from new stock?

**10-5 PROJECT SELECTION** Midwest Water Works estimates that its WACC is 10.5%. The company is considering the following capital budgeting projects:

Project	Size	Rate of Return
A	\$1 million	12.0%
B	2 million	11.5
C	2 million	11.2
D	2 million	11.0
E	1 million	10.7
F	1 million	10.3
G	1 million	10.2

Assume that each of these projects is just as risky as the firm's existing assets and that the firm may accept all the projects or only some of them. Which set of projects should be accepted? Explain.

Intermediate  
Problems  
6–13

**10-6 COST OF COMMON EQUITY** The future earnings, dividends, and common stock price of Carpetto Technologies Inc. are expected to grow 7% per year. Carpetto's common stock currently sells for \$23.00 per share; its last dividend was \$2.00; and it will pay a \$2.14 dividend at the end of the current year.

- Using the DCF approach, what is its cost of common equity?
- If the firm's beta is 1.6, the risk-free rate is 9%, and the average return on the market is 13%, what will be the firm's cost of common equity using the CAPM approach?
- If the firm's bonds earn a return of 12%, based on the bond-yield-plus-risk-premium approach, what will be  $r_s$ ? Use the midpoint of the risk premium range discussed in Section 10-5 in your calculations.
- If you have equal confidence in the inputs used for the three approaches, what is your estimate of Carpetto's cost of common equity?

**10-7 COST OF COMMON EQUITY WITH AND WITHOUT FLOTATION** The Evanec Company's next expected dividend,  $D_1$ , is \$3.18; its growth rate is 6%; and its common stock now sells for \$36.00. New stock (external equity) can be sold to net \$32.40 per share.

- What is Evanec's cost of retained earnings,  $r_s$ ?
- What is Evanec's percentage flotation cost,  $F$ ?
- What is Evanec's cost of new common stock,  $r_e$ ?

**10-8 COST OF COMMON EQUITY AND WACC** Patton Paints Corporation has a target capital structure of 40% debt and 60% common equity, with no preferred stock. Its before-tax cost of debt is 12%, and its marginal tax rate is 40%. The current stock price is  $P_0 = \$22.50$ . The last dividend was  $D_0 = \$2.00$ , and it is expected to grow at a 7% constant rate. What is its cost of common equity and its WACC?

**10-9 WACC** The Patrick Company's cost of common equity is 16%, its before-tax cost of debt is 13%, and its marginal tax rate is 40%. The stock sells at book value. Using the following balance sheet, calculate Patrick's WACC.

Assets		Liabilities and Equity	
Cash	\$ 120		
Accounts receivable	240		
Inventories	360	Long-term debt	\$1,152
Plant and equipment, net	<u>2,160</u>	Common equity	<u>1,728</u>
Total assets	<u>\$2,880</u>	Total liabilities and equity	<u>\$2,880</u>

- 10-10 WACC** Klose Outfitters Inc. believes that its optimal capital structure consists of 60% common equity and 40% debt, and its tax rate is 40%. Klose must raise additional capital to fund its upcoming expansion. The firm will have \$2 million of new retained earnings with a cost of  $r_s = 12\%$ . New common stock in an amount up to \$6 million would have a cost of  $r_e = 15\%$ . Furthermore, Klose can raise up to \$3 million of debt at an interest rate of  $r_d = 10\%$  and an additional \$4 million of debt at  $r_d = 12\%$ . The CFO estimates that a proposed expansion would require an investment of \$5.9 million. What is the WACC for the last dollar raised to complete the expansion?
- 10-11 WACC AND PERCENTAGE OF DEBT FINANCING** Hook Industries' capital structure consists solely of debt and common equity. It can issue debt at  $r_d = 11\%$ , and its common stock currently pays a \$2.00 dividend per share ( $D_0 = \$2.00$ ). The stock's price is currently \$24.75, its dividend is expected to grow at a constant rate of 7% per year, its tax rate is 35%, and its WACC is 13.95%. What percentage of the company's capital structure consists of debt?
- 10-12 WACC** Midwest Electric Company (MEC) uses only debt and common equity. It can borrow unlimited amounts at an interest rate of  $r_d = 10\%$  as long as it finances at its target capital structure, which calls for 45% debt and 55% common equity. Its last dividend was \$2, its expected constant growth rate is 4%, and its common stock sells for \$20. MEC's tax rate is 40%. Two projects are available: Project A has a rate of return of 13%, while Project B's return is 10%. These two projects are equally risky and about as risky as the firm's existing assets.
- What is its cost of common equity?
  - What is the WACC?
  - Which projects should Midwest accept?
- 10-13 COST OF COMMON EQUITY WITH FLOTATION** Ballack Co.'s common stock currently sells for \$46.75 per share. The growth rate is a constant 12%, and the company has an expected dividend yield of 5%. The expected long-run dividend payout ratio is 25%, and the expected return on equity (ROE) is 16%. New stock can be sold to the public at the current price, but a flotation cost of 5% would be incurred. What would be the cost of new equity?
- 10-14 COST OF PREFERRED STOCK INCLUDING FLOTATION** Trivoli Industries plans to issue perpetual preferred stock with an \$11.00 dividend. The stock is currently selling for \$97.00; but flotation costs will be 5% of the market price, so the net price will be \$92.15 per share. What is the cost of the preferred stock, including flotation?
- 10-15 WACC AND COST OF COMMON EQUITY** Kahn Inc. has a target capital structure of 60% common equity and 40% debt to fund its \$10 billion in operating assets. Furthermore, Kahn Inc. has a WACC of 13%, a before-tax cost of debt of 10%, and a tax rate of 40%. The company's retained earnings are adequate to provide the common equity portion of its capital budget. Its expected dividend next year ( $D_1$ ) is \$3, and the current stock price is \$35.
- What is the company's expected growth rate?
  - If the firm's net income is expected to be \$1.1 billion, what portion of its net income is the firm expected to pay out as dividends? (Hint: Refer to Equation 9-4 in Chapter 9.)
- 10-16 COST OF COMMON EQUITY** The Bouchard Company's EPS was \$6.50 in 2008, up from \$4.42 in 2003. The company pays out 40% of its earnings as dividends, and its common stock sells for \$36.00.
- Calculate the past growth rate in earnings. (Hint: This is a 5-year growth period.)
  - The last dividend was  $D_0 = 0.4(\$6.50) = \$2.60$ . Calculate the next expected dividend,  $D_1$ , assuming that the past growth rate continues.
  - What is Bouchard's cost of retained earnings,  $r_s$ ?
- 10-17 CALCULATION OF g AND EPS** Sidman Products' common stock currently sells for \$60.00 a share. The firm is expected to earn \$5.40 per share this year and to pay a year-end dividend of \$3.60, and it finances only with common equity.
- If investors require a 9% return, what is the expected growth rate?
  - If Sidman reinvests retained earnings in projects whose average return is equal to the stock's expected rate of return, what will be next years' EPS? (Hint: Refer to Equation 9-4 in Chapter 9.)

- 10-18 WACC AND OPTIMAL CAPITAL BUDGET** Adams Corporation is considering four average-risk projects with the following costs and rates of return:

Project	Cost	Expected Rate of Return
1	\$2,000	16.00%
2	3,000	15.00
3	5,000	13.75
4	2,000	12.50

The company estimates that it can issue debt at a rate of  $r_d = 10\%$ , and its tax rate is 30%. It can issue preferred stock that pays a constant dividend of \$5.00 per year at \$49.00 per share. Also, its common stock currently sells for \$36.00 per share; the next expected dividend,  $D_1$ , is \$3.50; and the dividend is expected to grow at a constant rate of 6% per year. The target capital structure consists of 75% common stock, 15% debt, and 10% preferred stock.

- What is the cost of each of the capital components?
- What is Adams' WACC?
- Only projects with expected returns that exceed WACC will be accepted. Which projects should Adams accept?

- 10-19 ADJUSTING COST OF CAPITAL FOR RISK** Ziege Systems is considering the following independent projects for the coming year:

Project	Required Investment	Rate of Return	Risk
A	\$4 million	14.0%	High
B	5 million	11.5	High
C	3 million	9.5	Low
D	2 million	9.0	Average
E	6 million	12.5	High
F	5 million	12.5	Average
G	6 million	7.0	Low
H	3 million	11.5	Low

Ziege's WACC is 10%, but it adjusts for risk by adding 2% to the WACC for high-risk projects and subtracting 2% for low-risk projects.

- Which projects should Ziege accept if it faces no capital constraints?
- If Ziege can only invest a total of \$13 million, which projects should it accept and what would be the dollar size of its capital budget?
- Suppose Ziege can raise additional funds beyond the \$13 million, but each new increment (or partial increment) of \$5 million of new capital will cause the WACC to increase by 1%. Assuming that Ziege uses the same method of risk adjustment, which projects should it now accept and what would be the dollar size of its capital budget?

- 10-20 WACC** The following table gives Foust Company's earnings per share for the last 10 years. The common stock, 7.8 million shares outstanding, is now (1/1/09) selling for \$65.00 per share. The expected dividend at the end of the current year (12/31/09) is 55% of the 2008 EPS. Because investors expect past trends to continue,  $g$  may be based on the historical earnings growth rate. (Note that 9 years of growth are reflected in the 10 years of data.)

Year	EPS	Year	EPS
1999	\$3.90	2004	\$5.73
2000	4.21	2005	6.19
2001	4.55	2006	6.68
2002	4.91	2007	7.22
2003	5.31	2008	7.80

The current interest rate on new debt is 9%; Foust's marginal tax rate is 40%; and its capital structure, considered to be optimal, is as follows:

Debt	\$104,000,000
Common equity	<u>156,000,000</u>
Total liabilities and equity	<u>\$260,000,000</u>

- Calculate Foust's after-tax cost of debt and common equity. Calculate the cost of equity as  $r_s = D_1/P_0 + g$ .
- Find Foust's WACC.

## COMPREHENSIVE/SPREADSHEET PROBLEM

**10-21 CALCULATING THE WACC** Here is the condensed 2008 balance sheet for Skye Computer Company (in thousands of dollars):

	<b>2008</b>
Current assets	\$2,000
Net fixed assets	<u>3,000</u>
Total assets	<u>\$5,000</u>
Current liabilities	\$ 900
Long-term debt	1,200
Preferred stock	250
Common stock	1,300
Retained earnings	<u>1,350</u>
Total common equity	<u>\$2,650</u>
Total liabilities and equity	<u>\$5,000</u>

Skye's earnings per share last year were \$3.20, the common stock sells for \$55.00, last year's dividend was \$2.10, and a flotation cost of 10% would be required to sell new common stock. Security analysts are projecting that the common dividend will grow at a rate of 9% per year. Skye's preferred stock pays a dividend of \$3.30 per share, and new preferred could be sold at a price to net the company \$30.00 per share. The firm can issue long-term debt at an interest rate (or before-tax cost) of 10%, and its marginal tax rate is 35%. The market risk premium is 5%, the risk-free rate is 6%, and Skye's beta is 1.516. In its cost of capital calculations, the company considers only long-term capital; hence, it disregards current liabilities.

- Calculate the cost of each capital component, that is, the after-tax cost of debt, the cost of preferred stock, the cost of equity from retained earnings, and the cost of newly issued common stock. Use the DCF method to find the cost of common equity.
- Now calculate the cost of common equity from retained earnings using the CAPM method.
- What is the cost of new common stock based on the CAPM? (Hint: Find the difference between  $r_e$  and  $r_s$  as determined by the DCF method and add that differential to the CAPM value for  $r_s$ .)
- If Skye continues to use the same capital structure, what is the firm's WACC assuming that (1) it uses only retained earnings for equity? (2) If it expands so rapidly that it must issue new common stock?

## INTEGRATED CASE

### COLEMAN TECHNOLOGIES INC.

**10-22 COST OF CAPITAL** Coleman Technologies is considering a major expansion program that has been proposed by the company's information technology group. Before proceeding with the expansion, the company must estimate its cost of capital. Assume that you are an assistant to Jerry Lehman, the financial vice president. Your first task is to estimate Coleman's cost of capital. Lehman has provided you with the following data, which he believes may be relevant to your task.

- (1) The firm's tax rate is 40%.
- (2) The current price of Coleman's 12% coupon, semiannual payment, noncallable bonds with 15 years remaining to maturity is \$1,153.72. Coleman does not use short-term interest-bearing debt on a permanent basis. New bonds would be privately placed with no flotation cost.
- (3) The current price of the firm's 10%, \$100.00 par value, quarterly dividend, perpetual preferred stock is \$111.10.
- (4) Coleman's common stock is currently selling for \$50.00 per share. Its last dividend ( $D_0$ ) was \$4.19, and dividends are expected to grow at a constant rate of 5% in the foreseeable future. Coleman's beta is 1.2, the yield on T-bonds is 7%, and the market risk premium is estimated to be 6%. For the bond-yield-plus-risk-premium approach, the firm uses a risk premium of 4%.
- (5) Coleman's target capital structure is 30% debt, 10% preferred stock, and 60% common equity.

To structure the task somewhat, Lehman has asked you to answer the following questions.

- a.
  - (1) What sources of capital should be included when you estimate Coleman's WACC?
  - (2) Should the component costs be figured on a before-tax or an after-tax basis?
  - (3) Should the costs be historical (embedded) costs or new (marginal) costs?
- b. What is the market interest rate on Coleman's debt and its component cost of debt?
- c.
  - (1) What is the firm's cost of preferred stock?
  - (2) Coleman's preferred stock is riskier to investors than its debt, yet the preferred's yield to investors is lower than the yield to maturity on the debt. Does this suggest that you have made a mistake? (Hint: Think about taxes.)
- d.
  - (1) Why is there a cost associated with retained earnings?
  - (2) What is Coleman's estimated cost of common equity using the CAPM approach?
- e. What is the estimated cost of common equity using the DCF approach?
- f. What is the bond-yield-plus-risk-premium estimate for Coleman's cost of common equity?
- g. What is your final estimate for  $r_s$ ?
- h. Explain in words why new common stock has a higher cost than retained earnings.
- i.
  - (1) What are two approaches that can be used to adjust for flotation costs?
  - (2) Coleman estimates that if it issues new common stock, the flotation cost will be 15%. Coleman incorporates the flotation costs into the DCF approach. What is the estimated cost of newly issued common stock, considering the flotation cost?
- j. What is Coleman's overall, or weighted average, cost of capital (WACC)? Ignore flotation costs.
- k. What factors influence Coleman's composite WACC?
- l. Should the company use the composite WACC as the hurdle rate for each of its projects? Explain.

## THOMSON ONE | Business School Edition

Access the Thomson ONE problems through the CengageNOW™ web site. Use the Thomson ONE—Business School Edition online database to work this chapter's questions.

### Calculating 3M's Cost of Capital

In this chapter, we described how to estimate a company's WACC, which is the weighted average of its costs of debt, preferred stock, and common equity. Most of the data we need to do this can be found in Thomson ONE. Here we walk through the steps used to calculate Minnesota Mining & Manufacturing's (MMM) WACC.

#### Discussion Questions

1. As a first step, we need to estimate what percentage of MMM's capital comes from long-term debt, preferred stock, and common equity. If we click on "FINANCIALS," we can see from the balance sheet the amount of MMM's long-term debt and common equity. (As of year-end 2007, MMM had no preferred stock.) Alternatively, under "Financial Ratios," you can click on "WORLDSCOPE" and "ANNUAL BALANCE SHEET RATIOS." Here you will find a recent measure of long-term debt as a percentage of total capital. Recall that the weights used in the WACC are based on the company's target capital structure. If we assume that the company wants to maintain the same mix of capital that it currently has on its balance sheet, what weights should you use to estimate the WACC for MMM? (In the capital structure and leverage chapter, we might arrive at different estimates for these weights if we assume that MMM bases its target capital structure on the market values of debt and equity rather than on the book values.)
2. Once again we can use the CAPM to estimate MMM's cost of equity. Thomson ONE provides various estimates of beta—select the measure that you believe is best and combine this with your estimates of the risk-free rate and the market risk premium to obtain an estimate of its cost of equity. (See the Thomson ONE exercise in Chapter 8 for more details.) What is your estimate for MMM's cost of equity? Why might it not make much sense to use the DCF approach to estimate MMM's cost of equity?
3. Next, we need to calculate MMM's cost of debt. Unfortunately, Thomson ONE doesn't provide a direct measure of the cost of debt. However, we can use different approaches to estimate it. One approach is to take the company's long-term interest expense and divide it by the amount of long-term debt. This approach only works if the historical cost of debt equals the yield to maturity in today's market (that is, if MMM's outstanding bonds are trading at close to par). This approach may produce misleading estimates in years in which MMM issues a significant amount of new debt. For example, if a company issues a great deal of debt at the end of the year, the full amount of debt will appear on the year-end balance sheet, yet we still may not see a sharp increase in interest expense on the annual income statement because the debt was outstanding for only a small portion of the entire year. When this situation occurs, the estimated cost of debt will likely understate the true cost of debt. Another approach is to try to find this number in the notes to the company's annual report by accessing the company's home page and its Investor Relations section. Alternatively, you can go to other external sources, such as [www.bondsonline.com](http://www.bondsonline.com), for corporate bond spreads, which can be used to find estimates of the cost of debt. Remember that you need the after-tax cost of debt to calculate a firm's WACC, so you will need MMM's tax rate (which has averaged about 32% in recent years). What is your estimate of MMM's after-tax cost of debt?
4. Putting all this information together, what is your estimate of MMM's WACC? How confident are you in this estimate? Explain your answer.