INVESTING IN LONG-TERM ASSETS: CAPITAL BUDGETING

PART 4
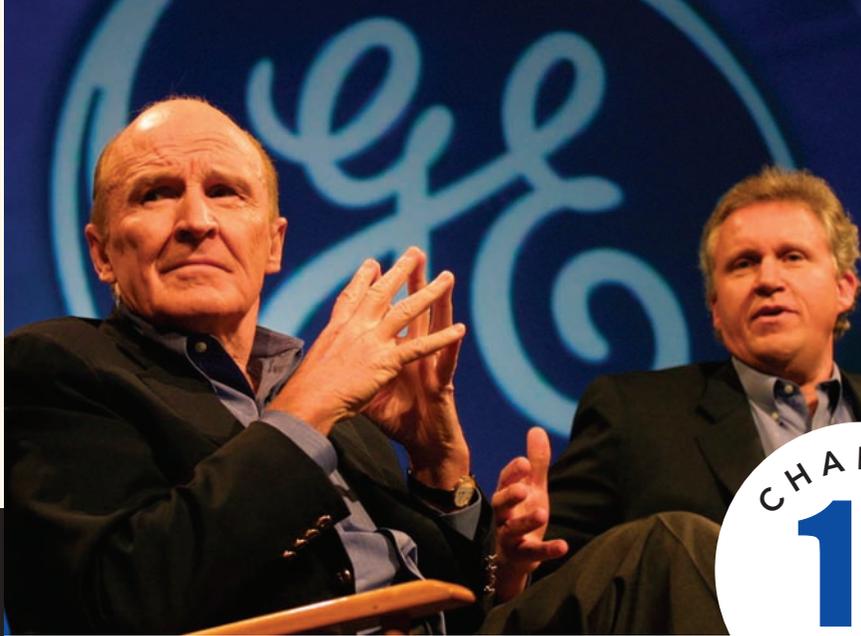
THE COST OF CAPITAL

Creating Value at GE

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

Capital is obtained in three primary forms: debt, preferred stock, and common equity, with equity coming from issuing new stock and by retaining earnings. The investors who provide that capital do so expecting to earn at least their required rate of return on that capital, and the required return represents the cost of capital to the firm.[1] A variety of factors influence the cost of capital. Some—including interest rates, state and federal tax policies, and the regulatory environment—are outside the firm's control. However, financing and investment policies, especially choices related to the types of capital the firm uses and the riskiness of the projects it undertakes, have a profound effect on its cost of capital.

Estimating the cost of capital for a company like GE is conceptually straightforward. GE's capital comes largely from debt and 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 it is similar to a portfolio that contains a number of different stocks, each with a different risk. Recall that the risk of the portfolio is a weighted average of the

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[1] Recall from earlier chapters that expected and required returns as seen by the marginal investor must be equal for a security to be in equilibrium, and buying and selling forces this equality to hold, except for short periods immediately following the release of new information. As expected and required returns are normally equal, we use the two terms interchangeably.

relevant risks of the different stocks in the portfolio. Similarly, each of GE's divisions has its own level of risk, hence its own cost of capital, and 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 otherwise similar domestic projects.

As we will see in this chapter, estimating projects' costs of capital is an essential element in the capital budgeting process, and managing this process effectively is essential to maximizing the firm's intrinsic stock price.

Putting Things In Perspective

In the last three chapters, we explained how risk influences the prices and required rates of return on bonds and stocks. The firm's primary objective is to maximize shareholder value, and a company can increase this value by investing in projects that earn more than the cost of capital. Capital is necessary to take on those projects, and like all factors of production, it has a cost that is equal to the marginal investor's required return. For this reason, the cost of capital is referred to as a *hurdle rate*—for a project to be accepted its expected return must exceed its hurdle rate.

Most of the formulas used in this chapter were developed in earlier chapters, where we examined the required rates of return on bonds and stocks. Indeed, the rates of return that marginal investors require on securities represent the costs of those securities to the firm. As we shall see, companies estimate the required returns on their securities, obtain a weighted average of the costs of the different types of securities they use, and then use this average in their capital budgeting analyses.

10.1 AN OVERVIEW OF THE WEIGHTED AVERAGE COST OF CAPITAL

Figure 10-1 shows the types of capital firms use. Debt is typically raised by issuing bonds or borrowing money from a financial institution such as a bank.[2] Some companies also finance with preferred stock. The third type of capital,

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[2] As we saw in Chapter 7, there are actually many different types of debt, and each type typically has a somewhat different cost. For the purpose of this chapter, assume that the firm's cost of debt is an average of the costs of its different types of debt.

FIGURE 10-1 *Types of Capital*
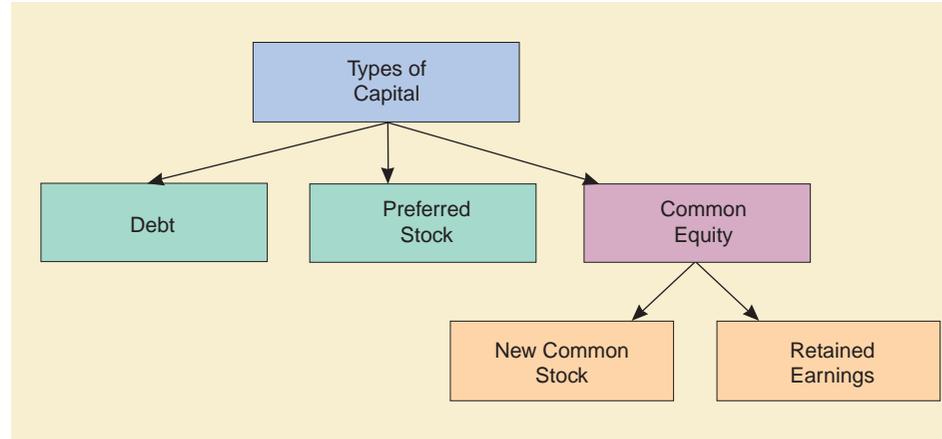
common equity, is provided by the company's common stockholders, and it is raised in two ways: (1) by issuing new common stock and (2) by retaining earnings (that is, by not paying out all of their earnings as dividends). Equity raised by selling newly issued stock is called *external equity*, while retained earnings are called *internal equity*. As we will discuss later, all equity has a cost, whether it is raised internally or externally, but the cost of newly issued shares exceeds the cost of retained earnings because of fees that must be paid to investment bankers for helping sell the new shares.

A firm's overall cost of capital is an average of the costs of the various types of funds it uses. Consider Allied Food Products, the firm we've been following throughout the text. Allied uses debt with a 10 percent cost, no preferred stock, and common equity whose cost is 13.4 percent, which is the return that stockholders require on the stock. Now assume that Allied has made the decision to finance next year's projects with debt. The argument is sometimes made that the cost of capital for these projects will be 10 percent because only debt will be used to finance them. However, this position is incorrect. If Allied finances a particular set of projects with debt, it will be using up some of its future capacity for borrowing. As expansion occurs in subsequent years, it will at some point have to raise more equity to prevent the debt ratio from getting too high.

To illustrate, suppose Allied borrows heavily at 10 percent during 2006, using up its debt capacity in the process, to finance projects yielding 11.5 percent. In 2007, it has new projects available that yield 13 percent, well above the return on 2006 projects, but it could not accept them because they would have to be financed with 13.4 percent 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 to fund projects in a given year*.

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

10.2 BASIC DEFINITIONS

The items on the right side of a firm's balance sheet—various types of debt, preferred stock, and common equity—are called **capital components.** Any increase in total assets must be financed by an increase in one or more of these capital components. The cost of each component is called the *component cost* of that particular type of capital; for example, if Allied can borrow money at 10 percent, its component cost of debt is 10 percent.[3] Throughout this chapter, we concentrate on the three major capital components—debt, preferred stock, and common equity—and the following symbols identify the cost 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.

$r_d(1 - T)$ = 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. The after-tax cost of debt is lower than the before-tax cost because interest is deductible for tax purposes.

r_p = component cost of preferred stock. Preferred dividends are not 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 identical to the r_s developed in Chapters 8 and 9 and defined there as the rate of return investors require on a firm's common stock. Most firms, once they have become established, obtain all of their new equity in the form of retained earnings, hence r_s is their cost of 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 like Allied Foods rarely issue new stock, hence r_e is rarely a relevant consideration except for very young firms.

As we shall see in the chapter on capital structure, each firm has an optimal capital structure, defined as the mix of debt, preferred, and common equity that causes its stock price to be maximized. Therefore, a value-maximizing firm will estimate its **optimal capital structure,** use it as a **target,** and then raise new capital in a manner designed to keep the actual capital structure on target over time. In this chapter, we assume that the firm has identified its optimal capital structure, that it uses this optimum as the target, and that it finances so as to remain on target.

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.

Target (Optimal) Capital Structure
The percentages of debt, preferred stock, and common equity that will maximize the firm's stock price.

Weighted Average Cost of Capital (WACC)
A weighted average of the component costs of debt, preferred stock, and common equity.

$$\text{WACC} = \begin{pmatrix} \% \\ \text{of} \\ \text{debt} \end{pmatrix} \begin{pmatrix} \text{After-tax} \\ \text{cost of} \\ \text{debt} \end{pmatrix} + \begin{pmatrix} \% \text{ of} \\ \text{preferred} \\ \text{stock} \end{pmatrix} \begin{pmatrix} \text{Cost of} \\ \text{preferred} \\ \text{stock} \end{pmatrix} + \begin{pmatrix} \% \text{ of} \\ \text{common} \\ \text{equity} \end{pmatrix} \begin{pmatrix} \text{Cost of} \\ \text{common} \\ \text{equity} \end{pmatrix}$$

$$= \quad w_d r_d(1 - T) \quad + \quad w_p r_p \quad + \quad w_c r_s \qquad \text{(10-1)}$$

[3] We will see shortly that there is both a before-tax and an after-tax cost of debt; for now, it is sufficient to know that 10 percent is the before-tax component cost of debt.

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 the mix of securities that minimizes the firm's cost of capital and maximizes its value.

SELF TEST

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

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

10.3 COST OF DEBT, $r_d(1 - T)$

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.

The **after-tax cost of debt, $r_d(1 - T)$,** is used to calculate the weighted average cost of capital, and it is the interest rate on debt, r_d, less the tax savings that result because interest is deductible.[4]

$$\text{After-tax cost of debt} = \text{Interest rate} - \text{Tax savings}$$
$$= r_d - r_dT$$
$$= r_d(1 - T) \qquad \textbf{(10-2)}$$

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

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

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 to take account of debt's preferential tax treatment.[5]

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[4] The federal tax rate for most large corporations is 35 percent. However, most corporations are also subject to state income taxes, so the marginal tax rate on most corporate income is about 40 percent. For illustrative purposes, we assume that the effective federal-plus-state tax rate on marginal income is 40 percent. Also, note that the cost of debt is considered in isolation. The effect of debt on the cost of equity, as well as the cost of future increments of debt, is ignored when the weighted cost of a combination of debt and equity is derived in this chapter. However, this will be addressed in the capital structure chapter.

[5] 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.

Strictly speaking, the after-tax cost of debt should reflect the *expected* cost of debt. While Allied's bonds have a promised return of 10 percent, there is some chance of default, so its bondholders' expected return (and consequently Allied's cost) is a bit less than 10 percent. For a relatively strong company such as Allied, this difference is quite small. As we discuss later in the chapter, Allied must also incur flotation costs when it issues debt, but like the difference between the

Note that the cost of debt is the interest rate on *new* debt, not that on already outstanding debt. We are interested in the cost of new debt because our primary concern with the cost of capital is to use it for 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—we need to know the cost of *new capital*.

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?

A company has outstanding long-term bonds with a face value of $1,000, an 11 percent coupon, and an 8 percent yield to maturity. If the company were 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 percent, what would its after-tax cost of debt be? (8.0%; 4.8%)

10.4 COST OF PREFERRED STOCK, r_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.

$$\text{Component cost of preferred stock} = r_p = \frac{D_p}{P_p} \qquad \textbf{(10-3)}$$

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.

Allied does not have any preferred stock outstanding, but suppose the company plans to issue some preferred in the future and therefore has included it in its target capital structure. Allied would sell this stock to a few large pension funds, the stock would have a $10 dividend per share, and it would be priced at $97.50 a share. Therefore, Allied's cost of preferred stock would be 10.3 percent:[6]

$$r_p = \$10/\$97.50 = 10.3\%$$

As we can see from Equation 10-3, calculating the cost of preferred stock is generally quite simple. 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, and that adds another layer of complexity to calculating the cost of preferred stock. We will leave these more

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(Footnote 5 continued)
promised and the expected rates of return, flotation costs for debt are generally small. Finally, note that these two factors tend to offset one another—not including the possibility of default leads to an overstatement of the cost of debt, but not including flotation costs leads to an understatement. For all these reasons, r_d is generally a good approximation of the before-tax cost of debt capital and $r_d(1 - T)$ of the after-tax cost.
[6] This preferred stock would be sold directly to a group of pension funds, so no flotation costs would be incurred. If significant flotation costs were involved, then the cost of the preferred would have to be adjusted upward like new common equity issues, as we explain in a later section.

Funny-Named Preferred-Like Securities

Wall Street's "financial engineers" are constantly developing new securities that will appeal to issuers and investors. One such new security is a special type of preferred stock created by Goldman Sachs in the mid-1990s. These securities trade under a variety of colorful names, including MIPS (modified income preferred securities), QUIPS (quarterly income preferred securities), and QUIDS (quarterly income debt securities). The corporation that wants to raise capital (the "parent") establishes a trust, which issues fixed-dividend preferred stock. The parent then sells bonds (or debt of some type) to the trust, and the trust pays for the bonds with cash raised by selling preferred stock. At that point, the parent has the cash it needs, the trust holds debt issued by the parent, and the investing public holds preferred stock issued by the trust. The parent then makes interest payments to the trust, and the trust uses that income to make the preferred dividend payments. Because the parent company has issued debt, its interest payments are tax deductible.

If the dividends could be excluded from taxable income by corporate investors, this preferred would really be a great deal—the issuer could deduct the interest, corporate investors could exclude most of the dividends, and the IRS would be the loser. The corporate parent can deduct the interest paid to the trust, but IRS regulations do not allow the dividends on these securities to be excluded from the recipient's taxable income.

Because there is only one deduction, why are these new securities attractive? The answer is as follows:

(1) Since the parent company gets to take the deduction, its cost of funds from the preferred is $r_p(1 - T)$, just as it would be if it used debt. (2) The parent generates a tax savings, and it can thus afford to pay a relatively high rate on trust-related preferred; that is, it can pass on some of its tax savings to investors to induce them to buy the new securities. (3) The primary purchasers of the preferred are low-tax-bracket individuals and tax-exempt institutions such as pension funds. For such purchasers, not being able to exclude the dividend from taxable income is not important. (4) Due to the differential tax rates, the arrangement results in a net tax savings. Competition in capital markets results in a sharing of the savings between investors and corporations.

A recent *SmartMoney Online* article argued that these hybrid securities are a good deal for individual investors in low tax brackets for the reasons set forth here and also because they are sold in small increments—often as small as $25. However, these securities are complex, which increases their risk and makes them hard to value. There is also risk to the issuing corporations, because the IRS has expressed concerns about these securities, and if at some point the IRS decides to disallow interest paid to the trusts, that would have a profound negative effect on the issuing corporations.

Sources: Kerry Capell, "High Yields, Low Cost, Funny Names," *BusinessWeek*, September 9, 1996, p. 122; and Leslie Haggin, "SmartMoney Online: MIPS, QUIDS, and QUIPS," *SmartMoney Interactive*, April 6, 1999.

complicated cases for advanced classes and deal only with "plain vanilla" preferred issues.

No tax adjustments are made when calculating r_p because preferred dividends, unlike interest on debt, are *not* deductible. Therefore, no tax savings are associated with the use of preferred stock. However, as we discuss in the accompanying box, "Funny-Named Preferred-Like Securities," some companies have devised ways to issue securities that are similar to preferred stock but are structured in ways that enable them to deduct the payments made on these securities.

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. If the company were to sell a new preferred issue, what would the cost of that capital be? Ignore flotation costs. (7.50%)

10.5 COST OF RETAINED EARNINGS, r_s

The costs of debt and preferred stock are based on the returns investors require on these securities. Similarly, the cost of common equity is based on the rate of return investors require on the company's common stock. Note, though, that new common equity is raised in two ways: (1) by retaining some of the current year's earnings and (2) by issuing new common stock. Equity raised by issuing stock has a somewhat higher cost than equity raised as retained earnings due to the flotation costs involved with new stock issues. Therefore, once they get beyond the startup stage, firms normally obtain all of their new equity by retaining earnings. We use the symbol r_s to designate the **cost of retained earnings** and r_e to designate the **cost of new stock,** or external equity.[7]

We might think that retained earnings are "free" because they represent money that is "left over" after paying dividends. While it is true that no direct costs are associated with capital raised as retained earnings, this capital still has a cost. The reasoning here involves the *opportunity cost principle*. The firm's after-tax earnings belong to its stockholders. Bondholders are compensated by interest payments and preferred stockholders by preferred dividends. All earnings remaining after interest and preferred dividends belong to the common stockholders, and these earnings serve to compensate stockholders for the use of their capital. Management can either pay out earnings in the form of dividends or retain earnings for reinvestment in the business. If management decides to retain earnings, 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. *Thus, the firm needs to earn on its retained earnings at least as much as the stockholders themselves 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 can expect to be able to earn r_s on their money. *Therefore, if the firm cannot invest retained earnings and earn at least r_s, it should pay those funds to its stockholders and let them invest directly in assets that do provide that return.*

Whereas debt and preferred stocks are contractual obligations whose costs are clearly stated on the contracts themselves, stocks have no comparable stated cost rate. That makes it difficult to measure r_s. However, we can employ techniques developed in Chapters 8 and 9 to produce reasonably good estimates of the cost of equity. 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 out the following equation and then estimate r_s using the left or the right term, or both:

<div style="text-align:center">

Required rate of return = Expected rate of return

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$$r_s = r_{RF} + RP \quad = \quad D_1/P_0 + g = \hat{r}_s \qquad \textbf{(10-4)}$$

In other words, we can estimate r_s as $r_s = r_{RF} + RP$ or as $\hat{r}_s = D_1/P_0 + g$.

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.

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[7] The term *retained earnings* can be interpreted to mean either 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 used 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.

The CAPM Approach

The most widely used approach to the cost of common equity is the Capital Asset Pricing Model (CAPM) as developed in Chapter 8, following these steps:

Step 1: Estimate the risk-free rate, r_{RF}. Many analysts use the 10-year Treasury bond rate as a measure of the risk-free rate. Others use a 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 to hold an average stock and the risk-free rate.[8]

Step 4: Substitute the preceding values into the CAPM equation to estimate the required rate of return on the stock in question:

$$r_s = r_{RF} + (RP_M)b_i$$
$$= r_{RF} + (r_M - r_{RF})b_i \qquad (10\text{-}5)$$

Equation 10-5 shows that 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 exposure as measured by its beta coefficient.

Assume that in today's market, $r_{RF} = 6\%$ and the market risk premium $RP_M = (r_M - r_{RF}) = 5\%$, and Allied's beta is 1.48. Using the CAPM approach, Allied's cost of equity is estimated as follows:

$$r_s = 6\% + (5\%)(1.48)$$
$$= 13.4\%$$

Although the CAPM appears to yield 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 method 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 other approaches.

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 go on indefinitely, the cash flows are the dividends, while if investors expect the firm to be acquired by some other firm or to

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[8] Note that your estimate of the market risk premium (RP_M, or $r_M - r_{RF}$) depends on the measure used for the risk-free rate. In the common situation where the yield curve is upward sloping, the 10-year Treasury bond rate will exceed the short-term Treasury bill rate—and it follows that you will have a lower estimate of the market risk premium if you select the higher longer-term rate as the risk-free rate.

be liquidated, then the cash flows would be dividends for some time plus a terminal price when the firm is acquired or liquidated. For simplicity, we assume that the firm is expected to go on indefinitely, in which case the following equation applies:

$$P_0 = \frac{D_1}{(1 + r_s)^1} + \frac{D_2}{(1 + r_s)^2} + \cdots + \frac{D_\infty}{(1 + r_s)^\infty}$$

$$= \sum_{t=1}^{\infty} \frac{D_t}{(1 + r_s)^t} \qquad \text{(10-6)}$$

Here P_0 is the current price of the stock; 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, then, as we saw in Chapter 9, Equation 10-6 reduces to this important formula:[9]

$$P_0 = \frac{D_1}{r_s - g} \qquad \text{(10-7)}$$

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:

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

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, and we will use the terms r_s and $\hat{r}_s$ interchangeably.

It is easy to determine the dividend yield, but it is difficult to establish the proper growth rate. If past growth rates in earnings and dividends have been relatively stable, and if investors appear to be projecting a continuation of past trends, then g may be based on the firm's historic growth rate. *However, if the company's past growth has been abnormally high or low, either because of its own unique situation or because of general economic fluctuations, then investors will not project the past growth rate into the future.* In this case, g must be estimated in some other manner.

Security analysts regularly make earnings and dividend growth forecasts, looking at such factors as projected sales, 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, Smith Barney, and other organizations make similar forecasts. Therefore, someone estimating a firm's cost of equity can obtain several analysts' forecasts, average them, use the average as a proxy for the growth expectations of investors in general, and then combine this g with the current dividend yield to estimate $\hat{r}_s$ as follows:

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

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[9] If the growth rate is not expected to be constant, the DCF procedure can still be used to estimate r_s, but in this case it is necessary to calculate an average growth rate using the procedures described in this chapter's *Excel* model.

Again, note that this estimate of $\hat{r}_s$ is based on the assumption that g is expected to remain constant in the future or else we must use an average of expected future rates.[10]

Another method for estimating g involves first forecasting the firm's average future dividend payout ratio and its complement, the *retention rate*, and then multiplying the retention rate by the company's average expected future rate of return on equity (ROE):

$$g = (\text{Retention rate})(\text{ROE}) = (1.0 - \text{Payout rate})(\text{ROE}) \quad \textbf{(10-9)}$$

Intuitively, we know that profitable firms that retain a larger portion of their earnings for reinvestment will tend to have higher growth rates than firms that are less profitable or else pay out a higher percentage of their earnings as dividends. Security analysts often use Equation 10-9 when they estimate growth rates. For example, suppose a company is expected to have a constant ROE of 13.4 percent, and it is expected to pay out 40 percent of its earnings and to retain 60 percent. In this case, its forecasted growth rate would be g = (0.60)(13.4%) = 8.0%.

To illustrate the DCF approach, suppose Allied's stock sells for $23; its next expected dividend is $1.24; and its expected growth rate is 8 percent. Allied's expected and required rate of return, hence its cost of retained earnings, would then be 13.4 percent:

$$\hat{r}_s = r_s = \frac{\$1.24}{\$23} + 8.0\%$$

$$= 5.4\% + 8.0\%$$

$$= 13.4\%$$

This 13.4 percent is the minimum rate of return that management should expect to earn on retained earnings to justify plowing earnings back in the business rather than paying them out to stockholders as dividends. Put another way, since investors have an *opportunity* to earn 13.4 percent if earnings are paid to them as dividends, then the *opportunity cost* of equity from retained earnings is 13.4 percent.

In this example, Allied's estimated cost of equity, 13.4 percent, is the same using both the CAPM and DCF approaches. Consequently, we would use 13.4 percent as Allied's estimated cost of equity from retained earnings. In most cases, however, these two approaches will not produce exactly the same estimate, which requires managers to use judgment when deciding on the proper value for r_s. In some cases, an average of the two estimates will be used, while in other cases managers will rely solely on the approach they believe is most appropriate. For example, if a company doesn't pay a dividend, it will probably rely on the CAPM approach, while if it does pay steady dividends but has a beta that appears to be out of line with other firms in its industry, it may rely primarily on the DCF approach.[11]

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[10] Analysts' growth rate forecasts are usually for five years into the future, and the rates provided represent the average growth rate over that five-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 then publish the averages. The IBES and Zacks data are available over the Internet through online computer data services.

[11] 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 percent of the surveyed firms used the CAPM approach, whereas only about 15 percent used the DCF approach. 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.

People experienced in estimating the cost of equity recognize that both careful analysis and sound judgment are required. It would be nice to pretend that judgment is unnecessary and to specify an easy, precise way of determining the cost of equity. Unfortunately, this is not possible—finance is in large part a matter of judgment, and we simply must face that fact.

Bond-Yield-plus-Risk-Premium Approach

In situations where reliable inputs for neither the CAPM nor the DCF approaches are available, analysts often use a somewhat more subjective procedure to estimate the cost of equity. Both surveys of portfolio managers and empirical studies suggest that the risk premium on a firm's stock over its own bonds generally ranges from 3 to 5 percentage points.[12] Based on this evidence, the analysts simply add a judgmental risk premium of 3 to 5 percent 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 readily observable debt cost utilizes this logic. For example, given that Allied's bonds yield 10 percent, its cost of equity might be estimated as follows:

$$r_s = \text{Bond yield} + \text{Risk premium} = 10\% + 4\% = 14\%$$

The bonds of a riskier company might yield 12 percent, in which case its estimated cost of equity would be 16 percent:

$$r_s = 12\% + 4\% = 16\%$$

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

SELF TEST ?

Why must a cost be assigned to retained earnings?

What three approaches are used to estimate the cost of common equity?

Identify some problems with the CAPM approach.

Which of the two components of the DCF formula, the dividend yield or the growth rate, 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: $r_{RF} = 5.5\%$; $r_M - r_{RF} = 6\%$; $b = 0.8$; $D_1 = \$1.00$; $P_0 = \$25.00$; $g = 6\%$; $r_d = $ 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 mid-range of the judgmental risk premium for the bond-yield-plus-risk-premium approach. (CAPM = 10.3%; DCF = 10%; Bond yield + RP = 10.5%)

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[12] Some security analysts send out questionnaires to portfolio managers asking this question: "If a given firm's bonds yield 8 percent, what is the minimum rate of return you would have to earn on its equity in order to induce you to buy its common stock?" The answers are generally in the 3 to 5 percent range. The reports that we have seen were proprietary, so the studies are not generally available. Also, analysts have calculated the historical returns on common stocks and on corporate bonds and then used the differential as an estimate of the equity risk premium over a firm's own bonds. The best known of these studies is by Ibbotson Associates. The historical results vary from year to year, but again, a range of 3 to 5 percent is quite common.

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 here.

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 percent of gross proceeds for common equity if the amount raised in the IPO is less than $10 million and about 6 percent 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, and there 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.

10.6 COST OF NEW COMMON STOCK, r_e [13]

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

For most firms at most times, flotation costs are not high enough to worry about because (1) most equity comes from retained earnings, (2) most debt is raised from banks and in private placements and hence involves no flotation costs, and (3) preferred stock is rarely used. Therefore, in our discussion thus far we have simply ignored flotation costs. However, as you can see in the

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[13] This section is relatively technical, but it can be omitted without loss of continuity if time pressures necessitate.

accompanying box, flotation costs can be substantial, and they vary depending on the size of the issue and the type of capital raised. We now describe two approaches that can be used to account for these flotation costs when firms use investment bankers to raise capital.[14]

Add Flotation Costs to a Project's Cost

With the first approach we add the estimated dollar amount of flotation costs for each project to the project's up-front cost. In the next chapter, we will see that capital budgeting projects typically involve an initial cash outlay followed by a series of cash inflows. We can add any required flotation costs, found as the sum of the flotation costs for the debt, preferred, and common stock used to finance the project, to the initial investment cost. Because of the now-higher investment cost, the project's expected rate of return and NPV will be decreased. For example, consider a one-year project with an up-front cost (not including flotation costs) of $100 million. After one year, the project is expected to produce an inflow of $115 million. Therefore, its expected return is $115/$100 − 1 = 0.15 = 15.0%. However, if the project requires the company to raise $100 million of new capital with an estimated $2 million of flotation costs, the total up-front cost will rise to $102 million and the expected rate of return will fall to $115/$102 − 1 = 0.1275 = 12.75%.

Increase the Cost of Capital

The second approach involves adjusting the cost of capital rather than increasing the project's cost. If the firm plans to continue using the capital in the future, as is generally true for equity, then this second approach is theoretically better. The adjustment process is based on the following logic. If there are flotation costs, the issuing company 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, given that less money is available to the company than the amount the investors put up, then each dollar received must "work harder," that is, it must earn a higher rate of return than the investors required on the funds they put up. For example, suppose investors require a 10 percent return on their investment, but the firm actually gets to keep and invest only 90 percent of the amount investors put up. In that case, the firm would have to earn about 11 percent on the available funds in order to provide investors with a 10 percent return on their investment. This higher rate of return is the flotation-adjusted cost of equity.

The DCF approach can be adapted to account for flotation costs, using the following equation for the *cost of new common stock, r_e:*[15]

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

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.

Flotation Cost, F
The percentage cost of issuing new common stock.

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[14] A more complete discussion of flotation cost adjustments can be found in Brigham and Daves, *Intermediate Financial Management*, and other advanced texts.
[15] Equation 10-10 is derived in Brigham and Daves, *Intermediate Financial Management*, 8th ed., p. 319.

Assuming that Allied has a flotation cost of 10 percent, its cost of new common equity, r_e, is computed as follows:

$$r_e = \frac{\$1.24}{\$23(1 - 0.10)} + 8.0\%$$

$$= \frac{\$1.24}{\$20.70} + 8.0\%$$

$$= 6.0\% + 8.0\% = 14.0\%$$

Investors require a return of $r_s = 13.4\%$ on the stock. However, because of flotation costs the company must earn *more* than 13.4 percent on the net funds it receives in order to give investors a 13.4 percent return on their money. Specifically, if the firm earns 14 percent on funds obtained by issuing new stock, then earnings per share will remain at the previously expected level, the firm's expected dividend can be maintained, and the stock price will not decline. If the firm earns less than 14 percent, then earnings, dividends, and growth will fall below expectations and the stock price will decline. If the firm earns more than 14 percent, the stock price will rise.

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 extent possible. However, if a firm has more good investment opportunities than can be financed with retained earnings plus debt supported by those retained earnings, it may need to issue new common stock. The total amount of capital raised beyond which 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.

$$\text{Retained earnings breakpoint} = \frac{\text{Addition to retained earnings}}{\text{Equity fraction}} \quad \textbf{(10-11)}$$

Allied's addition to retained earnings in 2006 is expected to be $68 million, and its target capital structure consists of 45 percent debt, 2 percent preferred, and 53 percent equity. Therefore, its retained earnings breakpoint is

$$\text{Retained earnings breakpoint} = \$68/0.53 = \$128 \text{ million}$$

If Allied's capital budget called for spending any amount up to $128 million, then 0.45($128) = $57.6 million would be financed with debt, 0.02($128) = $2.6 million with preferred stock, and 0.53($128) = $67.8 million with equity raised from retained earnings. However, if the capital budget exceeded $128 million, the company would have to obtain equity by issuing new, high-cost common stock.[16]

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[16] It's important to recognize that 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 increasing its debt ratio), or it might increase its additions 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 breakpoints. All of this is discussed in more detail in Brigham and Daves, *Intermediate Financial Management*, 8th ed., Chapter 9.

Explain briefly the two approaches that can be used to adjust for flotation costs.

Would firms that have many good investment opportunities be likely to have higher or lower dividend payout ratios than firms with few good investment opportunities? Explain.

A firm has common stock with $D_1 = \$1.50$; $P_0 = \$30$; $g = 5\%$; and $F = 4\%$. If the firm must issue new stock, what is its cost of issuing new external equity? (10.21%)

10.7 COMPOSITE, OR WEIGHTED AVERAGE, COST OF CAPITAL, WACC

Allied's target capital structure calls for 45 percent debt, 2 percent preferred stock, and 53 percent common equity. Earlier we saw that Allied's before-tax cost of debt is 10 percent; its after-tax cost of debt is $r_d(1 - T) = 10\%(0.6) = 6.0\%$; its cost of preferred stock is 10.3 percent; its cost of common equity from retained earnings is 13.4 percent; and its marginal tax rate is 40 percent. Equation 10-1, presented earlier, can be used to calculate the WACC when all of the new common equity comes from retained earnings:

$$
\begin{aligned}
\text{WACC} &= w_d r_d (1 - T) + w_p r_p + w_c r_s \\
&= 0.45(10\%)(0.6) + 0.02(10.3\%) + 0.53(13.4\%) \\
&= 10.0\%
\end{aligned}
$$

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 percent, 2 cents of preferred stock with a cost of 10.3 percent, and 53 cents of common equity (all from additions to retained earnings) with a cost of 13.4 percent. The average cost of each whole dollar, or the WACC, would be 10 percent.[17]

As long as Allied keeps its capital structure on target, its debt has an after-tax cost of 6 percent, its preferred stock has a cost of 10.3 percent, and its common equity comes from retained earnings at a cost of 13.4 percent, then its WACC will be 10 percent. Each dollar raised will consist of some debt, some preferred stock, and some common equity, and the cost of the whole dollar will be 10 percent.

Our estimate of Allied's WACC assumed that Allied's common equity comes exclusively from retained earnings. If Allied were to instead issue new common stock its WACC would be slightly higher because of the additional flotation costs. In the Web Appendix 10A we discuss in more detail the connection between the WACC and the costs of issuing new common stock.

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[17] The WACC is the cost of investor-supplied capital used to finance new projects. The debt component of the target capital structure includes only interest-bearing, investor-supplied debt—long-term bonds and bank notes payable. It does not include accounts payable and accruals because those items are not provided by investors.

Write out the equation for the WACC.

Is short-term debt included in the capital structure used to calculate WACC? Why or why not?

Why does the WACC at every amount of capital raised represent the marginal cost of that capital?

A firm has the following data: Target capital structure of 46 percent debt, 3 percent preferred, and 51 percent common equity; Tax rate = 40%; r_d = 7%; r_p = 7.5%; and r_s = 11.5%. Assume the firm will not be issuing new stock. What is this firm's WACC? (8.02% ≈ 8%)

10.8 FACTORS THAT AFFECT THE WACC

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

Factors the Firm Cannot Control

The two most important factors that are beyond a firm's direct control are *interest rates* and *tax rates*. If interest rates in the economy rise, the cost of debt increases because firms will have to pay bondholders more when they borrow. Also, recall from our discussion of the CAPM that higher interest rates increase the costs of common and preferred equity. In recent years inflation, and consequently, interest rates, have been trending down. This has reduced the costs of capital for all firms, and that has encouraged corporate investment.

Tax rates are used in the calculation of the component cost of debt and thus they have an important effect on the cost of capital. Taxes also affect the cost of capital in other less apparent ways. For example, the recent lowering of tax rates on dividends and capital gains relative to rates on interest income makes stocks relatively attractive, and that reduces the relative cost of equity and thus the WACC. Also, as we will see in the capital structure chapter, lower dividend and capital gains taxes have led to a change in the optimal capital structure—toward less debt and more equity.

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*, and (3) by *altering its capital budgeting decision rules* to accept projects with more or less risk than in the past.

Regarding capital structure, we have assumed that firms have given target capital structures, and we used those target weights to calculate their WACCs. However, if a firm changes its target capital structure, then the weights used to calculate the WACC will change. Because the after-tax cost of debt is lower than the cost of equity, an increase in the target debt ratio will tend to lower the WACC, and vice versa if the debt ratio is lowered. However, 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 offset the effects of the change in the weights and leave the WACC unchanged or even higher. In the capital structure chapter, we will discuss these effects in more detail.

GLOBAL PERSPECTIVES

Global Variations in the Cost of Capital

For U.S. firms to be competitive in world markets, they must have costs of capital similar to that faced by their international competitors. 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 thus 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 possible 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 primarily affects smaller firms that do not have access to global capital markets, and even these differences are becoming less important as time goes by. What matters most is the risk of the individual firm, not the market in which it raises capital.

Dividend policy affects the amount of retained earnings available to the firm, and thus the possible need to sell new stock and thus 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 want the firm to pay out more dividends, and thus a reduction in the payout ratio might lead to an increase in the required rate of return on equity. As we will see in the chapter on dividends, the optimal dividend policy is a complicated issue but one with a potentially important effect on the cost of capital.

The firm's capital budgeting decisions can also affect its cost of capital. When we estimate the cost of capital, we use as the starting point the required rates of return on the firm's outstanding stock and bonds. Those cost rates reflect the riskiness of the firm's existing assets. Therefore, we have been implicitly assuming that new capital will be invested in the same types of assets and with the same degrees of risk as the existing assets. This assumption is generally correct, as most firms do invest in assets similar to those they currently operate. However, if the firm decides to invest in an entirely new and risky line of business, then its component costs of debt and equity, and thus the WACC, will increase. To illustrate, ITT Corporation recently sold off its finance company and purchased Caesar's World, which operates gambling casinos. This dramatic shift in corporate focus almost certainly affected ITT's cost of capital. The effect of investment decisions on capital costs is discussed in detail in the next section.

SELF TEST

What two factors that affect the cost of capital are generally 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 each component of the WACC?

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 10-2 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 percent, whereas Firm H's business is exposed to greater risk and consequently it has a WACC of 12 percent. Thus, Firm L will accept a typical project if its expected return is above 8 percent, whereas the corresponding hurdle rate for Firm H is 12 percent.

It is important to remember that the costs of capital at points L and H in Figure 10-2 represent the overall, or composite, WACCs for the two firms, and thus apply to only "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 itself, not the risk associated with the firm's average project as reflected in its composite WACC. For example, assume that Firms L and H are both considering Project A. This project has more risk than a typical Firm L project, but less risk than a typical Firm H project. As shown in Figure 10-2, Project A has a 10.5 percent expected return. At first, we might be

**FIGURE 10-2** *Risk and the Cost of Capital*
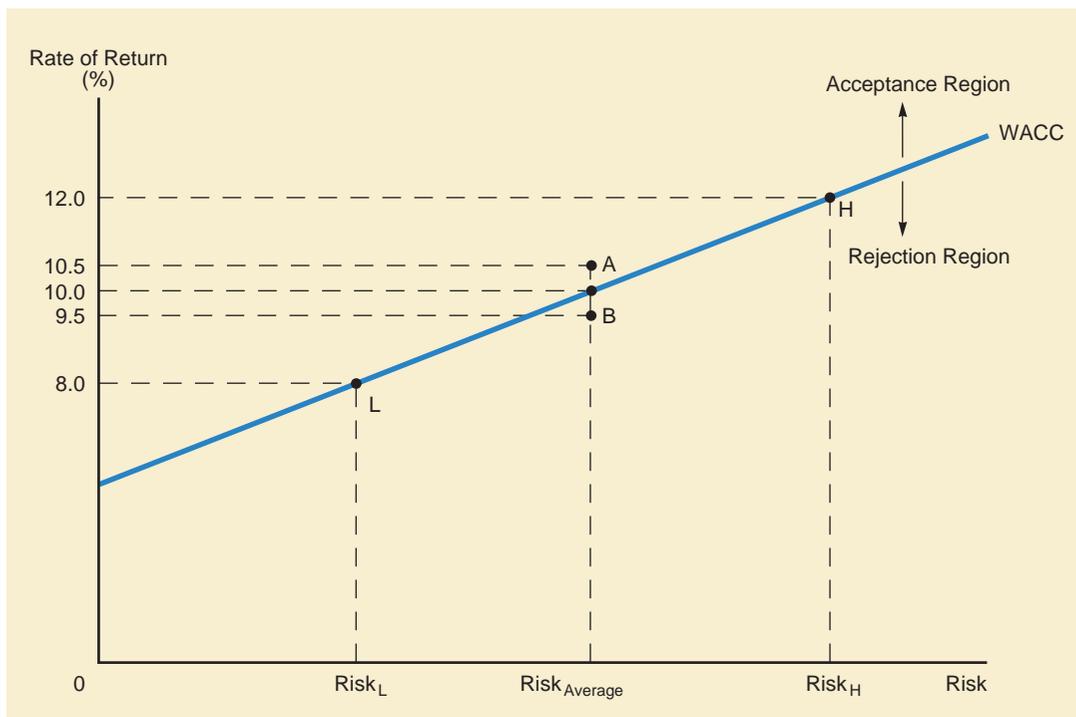
tempted to conclude that Firm L should accept Project A because its 10.5 percent return is above L's 8 percent WACC, while H should turn the project down because its return is less than H's 12 percent WACC. However, this would be wrong. The relevant hurdle rate is the *project's WACC*, which is 10 percent, as read from the WACC line in Figure 10-2. Since the project's return exceeds its 10 percent cost, it should be acceptable to *both* Firms L and H.

Next, consider Project B. It has the same risk as Project A, but its expected return is 9.5 percent versus its 10 percent hurdle rate. Both firms should reject Project B because its return is not high enough to justify its risk.

We see, then, that the hurdle rate applied to each project should reflect the project's own risk, not necessarily the firm's overall risk as reflected in its WACC. Empirical studies do indicate that firms take account of individual projects' risks, but they 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, then the WACC will be adjusted up or down to account for this difference. We will discuss this point in more detail in Chapter 12.

These same arguments apply to the cost of capital for multidivisional firms. Consider Firm A in Figure 10-3. It 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 percent. Division H has higher risk, and its divisional cost of capital is 13 percent. If the two divisions were of equal size, Firm A's composite WACC would be 0.50(7%) + 0.50(13%) = 10.0%. However, it would be a mistake to use this 10 percent 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 percent, while Division H is considering a higher-risk project with an expected return of

FIGURE 10-3 *Divisional Cost of Capital*
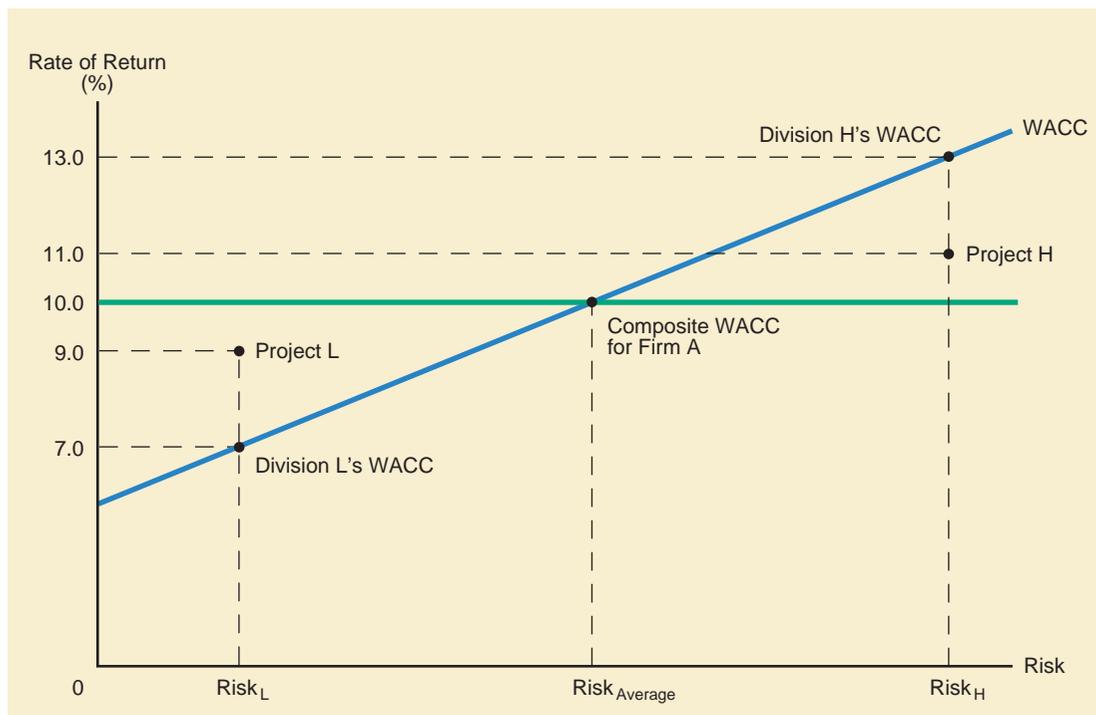
11 percent. As shown in Figure 10-3, Division L's project should be accepted because its return is above its risk-based cost of capital, whereas Division H's project should be rejected. If the 10 percent corporate WACC were used by each division, the decision would be reversed: Division H would incorrectly 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 more risky, its WACC would increase, and its shareholder value would suffer. Actually measuring project risk and then deciding exactly how to account for it is discussed in Chapter 12.

SELF TEST ?

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

How should firms evaluate projects with different risks?

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

10.10 SOME OTHER PROBLEMS WITH COST OF CAPITAL ESTIMATES

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

1. *Depreciation-generated funds.* The largest single source of capital for many firms is depreciation, yet we have not discussed the cost of funds from this source. In brief, depreciation cash flows can either be reinvested or returned to investors (stockholders *and* creditors). The cost of depreciation-generated funds is approximately equal to the WACC from retained earnings, preferred stock, and debt.[18]
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. Still, as a general rule, the same principles of cost of capital estimation apply to both privately held 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 = $ Bond yield + Risk premium. As a result, we can never be sure just how accurate our estimated cost of capital is.
4. *Costs of capital for projects of differing riskiness.* It is difficult to measure projects' risks, hence to adjust costs of capital to capital budgeting projects of differing degrees of riskiness.
5. *Capital structure weights.* In this chapter, we took as given the target capital structure and then 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.

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[18] See Brigham and Daves, *Intermediate Financial Management*, 8th ed., Chapter 9, for a discussion.

Although this list of problems may appear formidable, the state of the art in cost of capital estimation is really not in bad shape. The procedures outlined in this chapter can be used to obtain cost of capital estimates that are sufficiently accurate for practical purposes, and the problems listed here merely indicate the desirability of refinements. The refinements are not unimportant, but the problems we have listed do not invalidate the usefulness of the procedures outlined in the chapter.

SELF TEST

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

Tying It All Together

We began this chapter by discussing the concept of the weighted average cost of capital. We then discussed the three capital components (debt, preferred stock, and common equity) and procedures used to estimate their component costs. Next, we calculated the WACC, which is a key element in capital budgeting. We assumed that the target capital structure has been specified, and we used the given target weights to calculate the WACC. However, changes in the target capital structure can affect the WACC, so we discuss capital structure in detail in a later chapter.

We also noted that the corporate WACC is based on the riskiness of the entire firm, and it should be used as the hurdle rate in capital budgeting if and only if the project under consideration has about the same risk as the firm's existing assets. If the project is judged to be more risky than average, the WACC should be increased, and vice versa if the project has less than average risk. The amount by which to increase or decrease the WACC to adjust for differential project risk is somewhat subjective, but as we discuss in Chapter 12, techniques are available that help us measure a project's risk.

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

ST-1 **Key terms** Define each of the following terms:

a. Capital components
b. 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. Target (optimal) capital structure; target weights (w_d, w_p, w_c)
f. Weighted average cost of capital, WACC
g. Flotation cost, F; 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	60
	100%

LEI's expected net income this year is $34,285.72, its established dividend payout ratio is 30 percent, its federal-plus-state tax rate is 40 percent, and investors expect earnings and dividends to grow at a constant rate of 9 percent in the future. LEI paid a dividend of $3.60 per share last year, and its stock currently sells for $54 per share.

LEI can obtain new capital in the following ways:

- *Preferred*: New preferred stock with a dividend of $11 can be sold to the public at a price of $95 per share.
- *Debt*: Debt can be sold at an interest rate of 12 percent.

a. Determine the cost of each capital component.
b. Calculate the WACC.
c. LEI has the following investment opportunities that are average-risk projects for the firm:

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 affect a firm's cost of debt, $r_d(1 - T)$; its cost of equity, r_s; and its WACC? Indicate by a plus (+), a minus (−), or a zero (0) if the factor would raise, lower, or 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.	_____	_____	_____
i.	Investors become more risk averse.	_____	_____	_____

		EFFECT ON	
	$r_d(1 - T)$	r_s	WACC

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 percent. Should the WACC be used to eval-
uate all of its potential projects, even if they vary in risk? If not, what might be "reason-
able" 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 will all come 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 percent coupon and a 12 percent 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 percent, 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 percent debt and
60 percent common equity, with no preferred stock. The yield to maturity on the com-
pany's outstanding bonds is 9 percent, and its tax rate is 40 percent. Percy's CFO esti-
mates that the company's WACC is 9.96 percent. 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 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 percent 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 were to issue new stock, it would incur a 10 percent flotation cost.
What would the cost of equity from new stock be?

10-5   **Project selection** Midwest Water Works estimates that its WACC is 10.5 percent. 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 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 earnings, dividends, and common stock price of Carpetto
Technologies Inc. are expected to grow at 7 percent per year in the future. Carpetto's

common stock sells for $23 per share, its last dividend was $2.00, and it will pay a dividend of $2.14 at the end of the current year.

a.   Using the DCF approach, what is its cost of common equity?
b.   If the firm's beta is 1.6, the risk-free rate is 9 percent, and the average return on the market is 13 percent, what will be the firm's cost of common equity using the CAPM approach?
c.   If the firm's bonds earn a return of 12 percent, what will r_s be based on the bond-yield-plus-risk-premium approach, using the midpoint of the risk premium range?
d.   Assuming 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 percent; and its common stock now sells for $36. New stock (external equity) can be sold to net $32.40 per share.

a.   What is Evanec's cost of retained earnings, r_s?
b.   What is Evanec's percentage flotation cost, F?
c.   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 percent debt and 60 percent common equity, with no preferred stock. Its before-tax cost of debt is 12 percent, and its marginal tax rate is 40 percent. 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 constant rate of 7 percent. What is its cost of common equity and its WACC?

10-9   **WACC** The Patrick Company's cost of common equity is 16 percent, its before-tax cost of debt is 13 percent, and its marginal tax rate is 40 percent. 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	2,160	Common equity	1,728
Total assets	$2,880	Total liabilities and equity	$2,880

10-10   **WACC** Klose Outfitters Inc. believes that its optimal capital structure consists of 60 percent common equity and 40 percent debt, and its tax rate is 40 percent. 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 $2 dividend per share ($D_0 = \$2$). The stock's price is currently $24.75; its dividend is expected to grow at a constant rate of 7 percent per year; its tax rate is 35 percent; and its WACC is 13.95 percent. 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 percent debt and 55 percent common equity. Its last dividend was $2, its expected constant growth rate is 4 percent, and its common stock sells for $20. MEC's tax rate is 40 percent. Two projects are available: Project A has a rate of return of 13 percent, while Project B's return is 10 percent. These two projects are equally risky and also about as risky as the firm's existing assets.

a.   What is its cost of common equity?
b.   What is the WACC?
c.   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 percent, and the company has an expected dividend yield of 5 percent. The expected long-run dividend payout ratio is 25 percent, and the expected return on equity (ROE) is 16 percent. New stock can be sold to the public at the current price, but a flotation cost of 5 percent would be incurred. What would the cost of new equity be?

Challenging Problems 14–20

10-14   **Cost of preferred stock including flotation** Trivoli Industries plans to issue a $100 par perpetual preferred stock with an 11 percent dividend. It is currently selling for $97.00,

but flotation costs will be 5 percent 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 percent common equity and 40 percent debt to fund its $10 billion in operating assets. Furthermore, Kahn Inc. has a WACC of 13 percent, a before-tax cost of debt of 10 percent, and a tax rate of 40 percent. 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.

    a. What is the company's expected growth rate?
    b. 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: Use Equation 10-9.)

10-16 **Cost of common equity** The Bouchard Company's EPS was $6.50 in 2005, up from $4.42 in 2000. The company pays out 40 percent of its earnings as dividends, and its common stock sells for $36.

    a. Calculate the past growth rate in earnings. (Hint: This is a 5-year growth period.)
    b. 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.
    c. 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 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.

    a. If investors require a 9 percent return, what is the expected growth rate?
    b. If Sidman reinvests retained earnings in projects whose average return is equal to the stock's expected rate of return, what will be next year's EPS? [Hint: $g = (1 - \text{Payout rate})(\text{ROE})$.]

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 percent. It can issue preferred stock that pays a constant dividend of $5 per year at $49 per share. Also, its common stock currently sells for $36 per share, the next expected dividend, D_1, is $3.50, and the dividend is expected to grow at a constant rate of 6 percent per year. The target capital structure consists of 75 percent common stock, 15 percent debt, and 10 percent preferred stock.

    a. What is the cost of each of the capital components?
    b. What is Adams's WACC?
    c. 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 percent, but it adjusts for risk by adding 2 percent to the WACC for high-risk projects and subtracting 2 percent for low-risk projects.

    a. Which projects should Ziege accept if it faces no capital constraints?
    b. If Ziege can only invest a total of $13 million, which projects should it accept, and what would the dollar size of its capital budget be?

    c.   Suppose that 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 percent. Assuming 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 (1/1/06) selling for $65 per share, and the expected dividend at the end of the current year (12/31/06) is 55 percent of the 2005 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
1996	$3.90	2001	$5.73
1997	4.21	2002	6.19
1998	4.55	2003	6.68
1999	4.91	2004	7.22
2000	5.31	2005	7.80

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

Debt	$104,000,000
Common equity	156,000,000
Total liabilities and equity	$260,000,000

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

COMPREHENSIVE/SPREADSHEET PROBLEM

10-21 **Calculating the WACC** Here is the condensed 2005 balance sheet for Skye Computer Company (in thousands of dollars):

	2005
Current assets	$2,000
Net fixed assets	3,000
Total assets	$5,000
Current liabilities	$ 900
Long-term debt	1,200
Preferred stock	250
Common stock	1,300
Retained earnings	1,350
Total common equity	$2,650
Total liabilities and equity	$5,000

Skye's earnings per share last year were $3.20, the common stock sells for $55, last year's dividend was $2.10, and a flotation cost of 10 percent would be required to sell new common stock. Security analysts are projecting that the common dividend will grow at a rate of 9 percent 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 per share. The firm can issue long-term debt at an interest rate (or before-tax cost) of 10 percent, and its marginal tax rate is 35 percent. The market risk premium is 5 percent, the risk-free rate is 6 percent, 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.

    a.   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.
    b.   Now calculate the cost of common equity from retained earnings using the CAPM method.
    c.   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.)

d.   If Skye continues to use the same capital structure, what is the firm's WACC
     assuming (1) that it uses only retained earnings for equity and (2) that 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 percent.
(2) The current price of Coleman's 12 percent 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 percent, $100 par value, quarterly dividend, perpetual preferred stock is
     $111.10.
(4) Coleman's common stock is currently selling for $50 per share. Its last dividend (D_0) was $4.19, and divi-
     dends are expected to grow at a constant rate of 5 percent in the foreseeable future. Coleman's beta is 1.2,
     the yield on T-bonds is 7 percent, and the market risk premium is estimated to be 6 percent. For the bond-
     yield-plus-risk-premium approach, the firm uses a risk premium of 4 percent.
(5) Coleman's target capital structure is 30 percent debt, 10 percent preferred stock, and 60 percent 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 percent. Coleman
          incorporates the flotation costs into the DCF approach. What is the estimated cost of newly issued com-
          mon 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.

**Please go to the ThomsonNOW Web site to access the
Cyberproblems.**

cyberproblem

THOMSON ONE | Business School Edition

Access the Thomson ONE problems though the ThomsonNOW 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 immediately from the balance sheet the amount of MMM's long-term debt and common equity (as of mid-2004, MMM had no preferred stock). Alternatively, you can click on FUNDAMENTAL RATIOS in the next row of tabs below and then select WORLDSCOPE'S BALANCE SHEET RATIOS. Here, you will also 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 will see that we might arrive at different estimates for these weights if we instead assume that MMM bases its target capital structure on the market values of debt and equity, rather than 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 for Chapter 8 for more details.) What is your estimate for the 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 lot 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*, 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 37 percent 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.