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Part III

Capital Budgeting and Business Valuation

Capital budgeting and business valuation concern two subjects near and dear to financial peoples' hearts: What should we do with the firm's money and how much is the company worth? The two subjects are closely related because the decision about what to do with the firm's money often affects the value of the firm. Chapter 9, "The Cost of Capital," begins this section with a discussion of how to estimate the minimum rate of return that the firm must seek when it makes investments. Chapter 10, "Capital Budgeting Decision Methods," explains how to decide if an investment meets the firm's requirements and how to rank order competing investments. Chapter 11, "Estimating Incremental Cash Flows," goes on to describe how to estimate the cash inflows and outflows associated with investments. Finally, Chapter 12, "Business Valuation," explains how to use the techniques in Chapters 9 through 11 (and those in Chapter 8) to estimate the market value of the firm.

CHAPTERS

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9 The Cost of Capital

"There's no such thing as a free lunch."

—Milton Friedman

You Can Almost Always Get Capital If Your Idea Is Good Enough

This chapter on the cost of capital and the ones that follow on capital budgeting are all interconnected. What return do the suppliers of capital to a firm expect? To answer this we must assess the risk these would-be suppliers of capital are facing. What expected return would be sufficient to compensate for this risk?

The suppliers of equity capital have a greater required rate of return on their investment than do the suppliers of debt capital because the former are taking a greater risk. Equity investors are paid after lenders.

If capital is invested in good value-adding projects the suppliers of that capital can be paid the rate of return they required to part with that capital. If funds are not already in hand they can be raised. Raising funds will not be difficult if the would-be suppliers of those funds expect to get a return on their investment that is sufficient to justify the risk of their investment.

If a company has a history of not delivering to its capital suppliers the returns they needed, considering the risk taken by these investors, then this company will probably have difficulty in the future raising funds at a reasonable cost.

Companies with good projects waiting to be financed will find it easier to raise the funds needed for those projects. The cost of this capital will be reasonable since would-be investors will want to be part of this successful venture.

Chapter Overview

In capital budgeting decisions, financial managers must analyze many factors to determine whether a project will add value to a firm, including estimated incremental cash flows, the timing of those cash flows, risk, and the project's required rate of return.

One of the key components of the capital budgeting decision is the cost of capital. **Capital** is the term for funds that firms use. Businesses, such as Amcor Ltd., raise capital from creditors and owners. All capital raised has a cost because the suppliers of capital demand compensation for the funds provided.

In this chapter we examine the costs of different types of capital. We see how to estimate the cost of capital from a particular source, as well as the overall cost of capital for a firm. We also see how estimating a firm's cost of capital affects a firm's financing and investment decisions.

Learning Objectives

After reading this chapter, you should be able to:

1. Describe the sources of capital and how firms raise capital.
2. Estimate the cost of capital for each financing source.
3. Estimate the weighted average cost of capital.
4. Use the marginal cost of capital (MCC) schedule to make capital budgeting decisions.
5. Explain the importance of the marginal cost of capital (MCC) schedule in financial decision making.

The Cost of Capital

To properly evaluate potential investments, firms must know how much their capital costs. Without a measure of the cost of capital, for example, a firm might invest in a new project with an expected return of 10 percent, even though the capital used for the investment costs 15 percent. If a firm's capital costs 15 percent, then the firm must seek investments that return at least that much. It is vital, then, that managers know how much their firm's capital costs before committing to investments.

Suppliers and users of capital use cost estimates before making short- or long-term financial decisions. Investors must determine their required rate of return, k, to value either a bond or stock before they invest. That required rate of return, k, for each type of security issued is the cost of capital for that source. Overall, the cost of capital is the compensation investors demand of firms that use their funds, adjusted for taxes and transaction costs in certain cases, as we will explain later in this chapter.

In Chapter 10, we will see that firms determine their required rate of return before deciding whether to accept a capital budgeting project. The discount rate or hurdle rate, k, is the firm's cost of capital for that project. Investors supply capital, so they require a return, and firms use capital, so they must pay suppliers of capital for the use of those funds.

Sources of Capital

A firm's capital is supplied by its creditors and owners. Firms raise capital by borrowing it (issuing bonds to investors or promissory notes to banks), or by issuing preferred or common stock. The overall cost of a firm's capital depends on the return demanded by each of these suppliers of capital.

To determine a firm's overall cost of capital, the first step is to determine the cost of capital from each category of supplier. The cost of capital from a particular source, such as bondholders or common stockholders, is known as the **component cost of capital**.

In the following sections, we estimate the cost of debt capital, k_d; the cost of capital raised through a preferred stock issue, k_p; and the cost of equity capital supplied by common stockholders, k_s for internal equity and k_n for new external equity.

The Cost of Debt

When a firm borrows money at a stated rate of interest, determining the cost of debt, k_d, is relatively straightforward. As shown in Figure 9-1, the lender's cost of capital is the required rate of return on either a company's new bonds or a promissory note. The firm's **cost of debt** when it borrows money by issuing bonds is the interest rate demanded by the bond investors. When borrowing money from an individual or financial institution, the interest rate on the loan is the firm's cost of debt.

The After-Tax Cost of Debt (AT k_d) The **after-tax cost of debt, AT k_d**, is the cost to the company of obtaining debt funds. Because the interest paid on bonds or bank loans is a tax-deductible expense for a business, a firm's AT k_d is less than the required rate of return of the suppliers of debt capital. For example, suppose Ellis Industries borrowed $100,000 for one year at 10 percent interest paid annually. The interest rate on the loan is 10 percent, so Ellis must pay the lender $10,000 in interest each year the loan is outstanding (10 percent of $100,000). However, look at what happens when Ellis takes its taxes for the year into account:

	Before Borrowing	After Borrowing
Operating Income	$50,000	$50,000
Interest Expense	0	10,000
Before-Tax Income	50,000	40,000
Income Tax (40% rate)	20,000	16,000
Net After-Tax Income	30,000	24,000

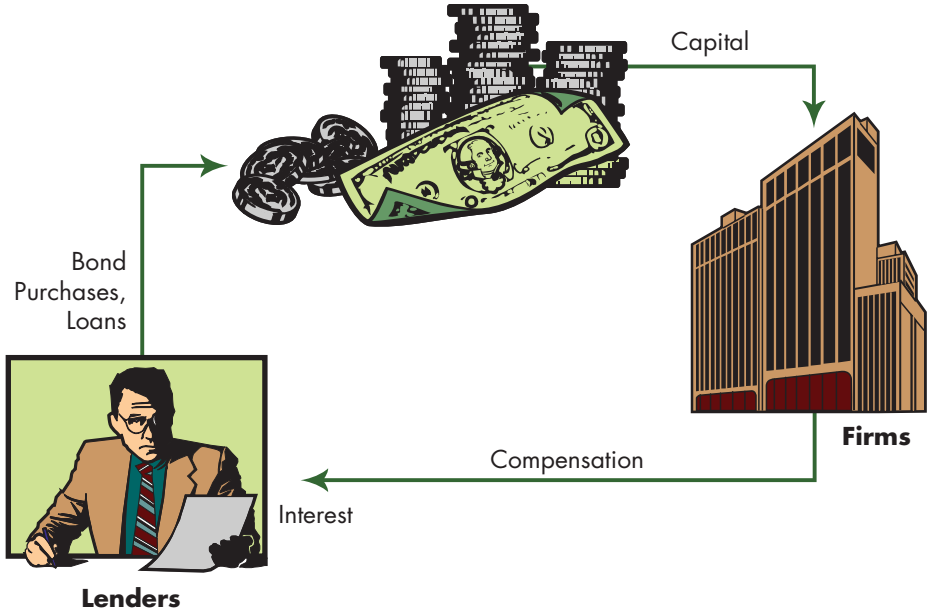

Figure 9-1 The Flow of Debt Capital from Investors to Firms

Figure 9-1 shows how debt investors supply capital to and receive interest from the firm.

The $10,000 interest charge caused a $6,000 decrease in Ellis's net after-tax income ($30,000 – $24,000 = $6,000). Therefore, assuming a tax rate of 40 percent, the true cost of the loan is only $6,000 (6 percent), not $10,000 (10 percent).

The following formula converts k_d into AT k_d, the true after-tax cost of borrowing:

Formula for the After-Tax Cost of Debt

$$AT\ k_d = k_d\ (1 - T) \tag{9-1}$$

where: k_d = The before-tax cost of debt

T = The firm's marginal tax rate[1]

To solve for AT k_d in our Ellis Industries example, recall that Ellis's before-tax cost of debt is 10 percent and its marginal tax rate is 40 percent. The after-tax cost of debt, according to Equation 9-1, follows:

$$\begin{aligned} AT\ k_d &= .10\ (1 - .40) \\ &= .10 \times .60 \\ &= .06, \text{ or } 6\% \end{aligned}$$

Our calculations show that for Ellis Industries the after-tax cost of debt on a $100,000 loan at a 10 percent rate of interest is 6 percent.

We have seen that the cost of using borrowed money is the interest rate charged by the lender. In addition, we discussed how the tax deductibility of interest lowers the firm's true cost of debt. Next, we turn to the cost of preferred stock and common stock equity.

[1]The tax rate used here should reflect the firm's total combined federal, state, and/or local income tax rate.

The Cost of Preferred and Common Stock Funds

When corporations raise capital by issuing preferred or common stock, these investors expect a return on their investments. If that return is not realized, investors will sell their stock, driving the stock price down. Although the claim of preferred and common stockholders may not be contractual, as it is for bondholders, there is a cost nonetheless. To calculate the cost of using preferred and common stockholders' money, then, the firm must estimate the rate of return that these investors demand. Figure 9-2 shows how firms raise capital from, and compensate, equity investors.

The Cost of Preferred Stock (k_p) The **cost of preferred stock (k_p)** is the rate of return investors require on a company's new preferred stock, plus the cost of issuing the stock. Therefore, to calculate k_p, a firm's managers must estimate the rate of return that preferred stockholders would demand and add in the cost of the stock issue. Because preferred stock investors normally buy preferred stock to obtain the stream of constant preferred stock dividends associated with the preferred stock issue, their return on investment can normally be measured by dividing the amount of the firm's expected preferred stock dividend by the price of the shares. The cost of issuing the new securities, known as **flotation cost**, includes investment bankers' fees and commissions, and attorneys' fees. These costs must be deducted from the preferred stock price paid by investors to obtain the net price received by the firm. Equation 9-2 shows how to estimate the cost of preferred stock:

Formula for the Cost of Preferred Stock

$$k_p = \frac{D_p}{(P_p - F)} \tag{9-2}$$

where: k_p = The cost of the preferred stock issue; the expected return

D_p = The amount of the expected preferred stock dividend

P_p = The current price of the preferred stock

F = The flotation cost per share

The cost of using the company's preferred stock is k_p. The value of k_p, the expected return from the preferred stock issue, is the minimum return the firm's managers must earn when they use the money supplied by preferred stockholders. If they cannot earn this return, the preferred stockholders will sell their shares, causing the preferred stock's price to fall. This means the firm must issue more shares of the stock than before the stock price fell to raise the same amount of funds.

Suppose Ellis Industries has issued preferred stock that has been paying annual dividends of $2.50 and is expected to continue to do so indefinitely. The current price of Ellis's preferred stock is $22 a share, and the flotation cost is $2 per share. According to Equation 9-2, the cost of Ellis's preferred stock is as follows:

$$k_p = \frac{\$2.50}{(\$22 - \$2)}$$

$$= .125, \text{ or } 12.5\%$$

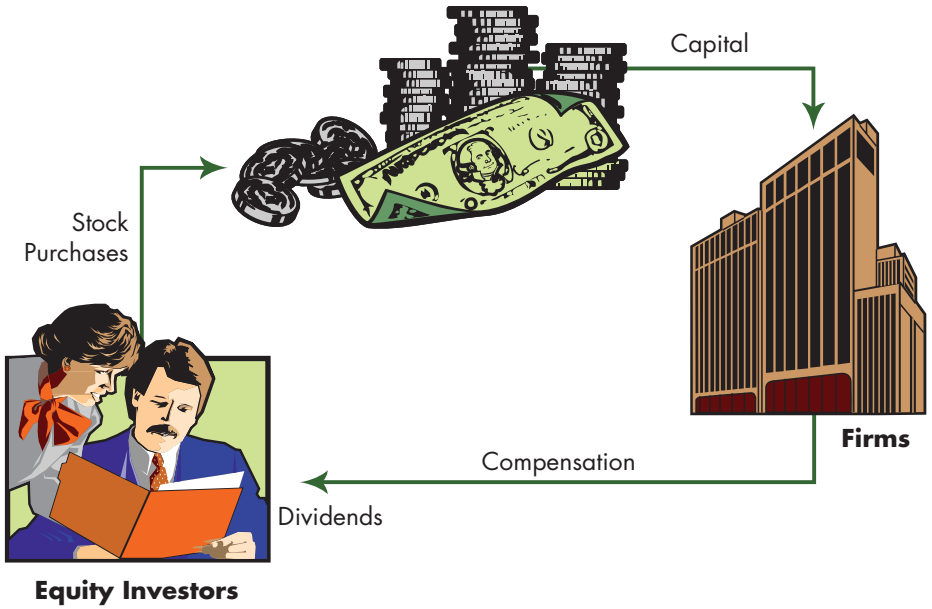

Figure 9-2 The Flow of Capital from Equity Investors to Firms

Figure 9-2 shows how equity investors supply capital to the firm and receive dividends from it.

We see that Ellis Industries' cost of new preferred stock, assuming that stock pays dividends of $2.50 per year and has a market price of $22, is 12.5 percent.

The cost of preferred stock, k_p, is higher than the before-tax cost of debt, k_d, because a company's bondholders and bankers have a prior claim on the earnings of the firm and on its assets in the event of a liquidation. Preferred stockholders, as a result, take a greater risk than bondholders or bankers and demand a correspondingly greater rate of return.

Take Note

There is no tax adjustment in the cost of preferred stock calculation. Unlike interest payments on debt, firms may not deduct preferred stock dividends on their tax returns. The dividends are paid out of after-tax profits.

The Cost of Internal Common Equity (k_s) The **cost of internal common equity (k_s)** is the required rate of return on funds supplied by existing common stockholders. The cost of equity depends on the rate of return the common stockholders demand for holding the company's common stock. Calculating k_s is more difficult than calculating k_p because common stockholders do not receive a constant stream of dividends. Instead, investors own the firm, including the corporate earnings left over after other claimants on the firm have been paid. Neither creditors nor preferred stockholders have a claim on these residual earnings. Corporations may either retain the residual earnings or return them in the form of common stock dividends. Retained earnings have a cost, however. The cost of retained earnings, another name for the cost of internal equity, is the rate of return that the company must earn to justify retaining the earnings instead of paying them as dividends. These are internally generated (within the firm) equity funds.

As noted, common stock dividend payments change from year to year or may not be paid at all. Ultimately, however, dividends are the only payments a corporation makes to its common stockholders. The corporation may pay regular dividends, or it may pay a liquidation dividend some time in the future. For companies that pay regular dividends that grow at a constant rate, the constant dividend growth model may be used to estimate the cost of equity. For companies that do not pay regular dividends, or when the market approach to risk is more appropriate, the CAPM may be used to estimate the cost of equity.

Using the Dividend Growth Model to Estimate k_s. The dividend growth model (sometimes called the Gordon Model after its developer, financial economist Myron Gordon) uses the time value of money concepts in Chapter 8 to calculate the present value of a continuing stream of future dividends:

$$P_0 = \frac{D_1}{k_s - g}$$

where: P_0 = The current price of the common stock

D_1 = The dollar amount of the common stock dividend expected one period from now

k_s = Required rate of return per period on this common stock investment

g = Expected constant growth rate per period of the company's common stock dividends[2]

Rearranging the terms in the dividend growth model to solve for k_s, we rewrite the formula as follows:

Formula for the Cost of Common Stock Equity (k_s)
(Dividend Growth Model Approach)

$$k_s = \frac{D_1}{P_0} + g \qquad (9\text{-}3)$$

By making use of Equation 9-3, we can solve for k_s, assuming we know the values of the terms P_0, D_1, and g. The term D_1/P_0 in Equation 9-3 represents the stock's dividend yield, and the g term represents dividend growth rate from year to year.

To apply Equation 9-3, suppose that Ellis Industries' common stock is selling for $40 a share. Next year's common stock dividend is expected to be $4.20, and the dividend is expected to grow at a rate of 5 percent per year indefinitely. Given these conditions, Equation 9-3 tells us that the expected rate of return on Ellis's common stock is as follows:

$$k_s = \frac{\$4.20}{\$40} + .05$$

$$= .105 + .05$$

$$= .155, \text{ or } 15.5\%$$

At a stock share price of $40, a dividend of $4.20, and an expected dividend growth rate of 5 percent, the expected return from Ellis' common stock is 15.5 percent. The expected return of 15.5 percent is the minimum return the firm's managers must earn when they use money supplied by common stockholders. If they cannot achieve this return, common stockholders will sell their shares, causing the stock's price to fall. This will make it necessary to sell more shares to raise the desired amount of funds. The

[2]This is the constant growth version of the dividend growth model. It assumes that the company's dividends grow at the same rate indefinitely.

cost of using money supplied by the company's common stockholders, then, is 15.5 percent. Because dividends paid are not tax deductible to the corporation, there is no tax adjustment to the k_s calculation.

The CAPM Approach to Estimating k_s. A firm may pay dividends that grow at a changing rate; it may pay no dividends at all; or the managers of the firm may believe that market risk is the relevant risk. In such cases, the firm may choose to use the capital asset pricing model (CAPM) to calculate the rate of return that investors require for holding common stock. The CAPM solves for the rate of return that investors demand for holding a company's common stock according to the degree of nondiversifiable risk[3] present in the stock. The CAPM formula, Equation 9-4, follows:

CAPM Formula for the Cost of Common Stock Equity (k_s)

$$k_s = k_{rf} + (k_m - k_{rf}) \times \beta \quad (9\text{-}4)$$

where: k_s = The required rate of return from the company's common stock equity

k_{rf} = The risk-free rate of return

k_m = The expected rate of return on the overall stock market

β = The beta of the company's common stock, a measure of the amount of nondiversifiable risk

Suppose Ellis Industries has a beta of 1.39, the risk-free rate as measured by the rate on short-term U.S. Treasury bills is 3 percent, and the expected rate of return on the overall stock market is 12 percent. Given those market conditions, according to Equation 9-4, the required rate of return for Ellis's common stock is as follows:

$$\begin{aligned} k_s &= .03 + (.12 - .03) \times 1.39 \\ &= .03 + (.09 \times 1.39) \\ &= .03 + .1251 \\ &= .1551, \text{ or about } 15.5\% \end{aligned}$$

According to the CAPM, we see that the cost of using money supplied by Ellis's common stockholders is about 15.5 percent, given a company beta of 1.39, a risk-free rate of 3 percent, and an expected market rate of return of 12 percent.

Deciding How to Estimate k_s. Should you use the dividend growth model, Equation 9-3, or the CAPM, Equation 9-4, to estimate a firm's cost of common equity? The choice depends on the firm's dividend policy, available data, and management's view of risk. As a financial manager, if you were confident that your firm's dividends would grow at a fairly constant rate in the future, you could apply the dividend growth model to calculate k_s. If your firm's growth rate were erratic or difficult to determine, you might use the CAPM instead, assuming that you agreed with the CAPM's underlying hypothesis that

[3]According to the CAPM, common stockholders hold well-diversified portfolios, so the only relevant risk measure is nondiversifiable (market) risk.

common stockholders hold well-diversified portfolios and that nondiversifiable risk is what is priced in the market. When possible, practitioners apply both models and use their business judgment to reconcile differences between the two outcomes.

The Cost of Equity from New Common Stock (k_n) The cost incurred by a company when new common stock is sold is the **cost of equity from new common stock (k_n)**. In the preceding section, we discussed the cost of using funds supplied by the firm's existing stockholders. Capital from existing stockholders is internal equity capital. That is, the firm already has these funds. In contrast, capital from issuing new stock is external equity capital. The firm is trying to raise new funds from outside sources.

New stock is sometimes issued to finance a capital budgeting project. The cost of this capital includes not only stockholders' expected returns on their investment but also the **flotation costs** incurred to issue new securities. Flotation costs make the cost of using funds supplied by new stockholders slightly higher than using retained earnings supplied by the existing stockholders.

To estimate the cost of using funds supplied by new stockholders, we use a variation of the dividend growth model that includes flotation costs:

Formula for the Cost of New Common Stock Equity (k_n)

$$k_n = \frac{D_1}{P_0 - F} + g \tag{9-5}$$

where: k_n = The cost of new common stock equity

P_0 = The price of one share of the common stock

D_1 = The amount of the common stock dividend expected to be paid in one year

F = The flotation cost per share

g = The expected constant growth rate of the company's common stock dividends

Equation 9-5 shows mathematically how the cost of new common stock, k_n, is greater than the cost of existing common stock equity, k_s. By subtracting flotation costs, F, from the common stock price in the denominator, the k_n term becomes larger.

Let's look at the cost of new common stock for Ellis Industries. Suppose again that Ellis Industries' anticipated dividend next year is $4.20 a share, its growth rate is 5 percent a year, and its existing common stock is selling for $40 a share. New shares of stock can be sold to the public for the same price, but to do so Ellis must pay its investment bankers 5 percent of the stock's selling price, or $2 per share. Given these conditions, we use Equation 9-5 to calculate the cost of Ellis Industries' new common equity as follows:

$$k_n = \frac{\$4.20}{\$40 - \$2} + .05$$

$$= .1105 + .05$$

$$= .1605, \text{ or } 16.05\%$$

Because of $2 flotation costs, Ellis Industries keeps only $38 of the $40 per share paid by investors. As a result, the cost of new common stock is higher than the cost of existing equity—16.05 percent compared to 15.5 percent.

If the cost of new common equity is higher than the cost of internal common equity, the cost of preferred stock, and the cost of debt, why use it? Sometimes corporations have no choice.

Also, if the amount of debt a firm has incurred continues to increase, and internal equity funds have run out, it may be necessary to issue new common stock to bring the weight of debt and equity on the balance sheet into line.[4]

We have examined the sources of capital and the cost of each capital source. Next, we investigate how to measure the firm's overall cost of capital.

The Weighted Average Cost of Capital (WACC)

To estimate a firm's overall cost of capital, the firm must first estimate the cost for each component source of capital. The component sources include the after-tax cost of debt, AT k_d; the cost of preferred stock, k_p; the cost of common stock equity, k_s; and the cost of new common stock equity, k_n. In the following section, we first discuss all component sources except k_n, which we discuss separately.

To illustrate the first step in estimating a firm's overall cost of capital, let's review Ellis Industries' component costs of capital. From our previous calculations, we know the following costs of capital:

$$\text{AT } k_d = 6\%$$
$$k_p = 12.5\%$$
$$k_s = 15.5\%$$

The next step in finding a firm's overall cost of capital is assessing the firm's *capital structure*. In practice, the assets of most firms are financed with a mixture of debt, preferred stock, and common equity. The mixture of capital used to finance a firm's assets is called the **capital structure** of the firm. To analyze the capital structure of a business, we must find the percentage of each type of capital source.

To illustrate how to assess a firm's capital structure, assume that Ellis Industries finances its assets through a mixture of capital sources, as shown on its balance sheet:[5]

Total Assets	$1,000,000
Long- and Short-Term Debt	$ 400,000
Preferred Stock	100,000
Common Equity	500,000
Total Liabilities and Equity	$1,000,000

In percentage terms, then, the mixture of capital used to finance Ellis's $1 million worth of assets is as follows:

Debt: 400,000/1,000,000 = .40, or 40%
Preferred Stock: 100,000/1,000,000 = .10, or 10%
Common Equity: 500,000/1,000,000 = .50, or 50%

[4]This issue will be discussed in detail in Chapter 13.

[5]Ideally, the percentage of each component in the capital structure would be measured on the basis of market values instead of accounting values. For the sake of simplicity, we use accounting values here, as do many real-world companies.

Our calculations show that Ellis Industries' capital structure consists of 40 percent debt, 10 percent preferred stock, and 50 percent common equity. If Ellis Industries thinks that this mixture is optimal and wants to maintain it, then it will finance new capital budgeting projects with a mixture of 40 percent debt, 10 percent preferred stock, and 50 percent common equity. This mixture might not be used for each and every project. But in the long run, the firm is likely to seek this capital structure if it is believed to be optimal.

The final step in estimating a firm's overall cost of capital is to find the weighted average of the costs of each individual financing source. The **weighted average cost of capital (k_a or WACC)** is the mean of all component costs of capital, weighted according to the percentage of each component in the firm's optimal capital structure. We find the WACC by multiplying the individual source's cost of capital times its percentage of the firm's capital structure, then adding these results. For Ellis Industries, the weighted average of the financing sources follows:

$$\begin{aligned}&(.40 \times \text{AT } k_d) + (.10 \times k_p) + (.50 \times k_s)\\ &= (.40 \times .06) + (.10 \times .125) + (.50 \times .155)\\ &= .024 + .0125 + .0775\\ &= .114, \text{ or } 11.4\%\end{aligned}$$

Ellis Industries' weighted average cost of capital is 11.4 percent. The general formula for any firm's WACC is shown in Equation 9-6:

Formula for the Weighted Average Cost of Capital (WACC)

$$k_a = (WT_d \times \text{AT } k_d) + (WT_p \times k_p) + (WT_s \times k_s) \quad (9\text{-}6)$$

where:
k_a = The weighted average cost of capital (WACC)
WT_d = The weight, or proportion, of debt used to finance the firm's assets
AT k_d = The after-tax cost of debt
WT_p = The weight, or proportion, of preferred stock being used to finance the firm's assets
k_p = The cost of preferred stock
WT_s = The weight, or proportion, of common equity being used to finance the firm's assets
k_s = The cost of common equity

A firm must earn a return equal to the WACC to pay suppliers of capital the return they expect. In the case of Ellis Industries, for instance, its average-risk capital budgeting projects must earn a return of 11.4 percent to pay its capital suppliers the return they expect.

To illustrate how earning the WACC ensures that all capital suppliers will be paid their required cost of capital, let's return to our example. Suppose Ellis Industries undertakes a plant expansion program that costs $1 million and earns an annual return of 11.4 percent, equal to Ellis's WACC. Capital for the project is supplied as follows:

- 40 percent of the $1 million, or $400,000, is supplied by lenders expecting a return equal to before-tax k_d, 10 percent.
- 10 percent of the $1 million, or $100,000, is supplied by preferred investors at a cost equal to k_p, 12.5 percent.[6]

[6]In this example, the firm sold 5,000 shares of preferred stock at $22 a share for a total of $110,000; $2 a share, or $10,000, went to the investment bankers and attorneys in the form of flotation costs, leaving $100,000 for the capital budget.

- 50 percent of the $1 million, or $500,000, is supplied by common stockholders expecting a return equal to k_s, 15.5 percent.

If the project does in fact produce the expected 11.4 percent return, will all these suppliers of capital receive the return they expect? The computations that follow show how Ellis will pay its capital suppliers:

First-year return from the project:	$1,000,000 × .114 =	$114,000
Interest at 10 percent paid to the bondholders:	$400,000 × .10 =	$ 40,000
Less tax savings on interest expense:	$40,000 × firm's tax rate of 40% =	$ 16,000
Net interest cost to the firm:	$40,000 – $16,000 =	$ 24,000
Amount remaining to repay other sources of capital:	$114,000 – $24,000 =	$ 90,000
Preferred dividend paid to preferred stockholders:	5,000 shares × $2.50 =	$ 12,500
Amount remaining for common stockholders:	$90,000 – $12,500 =	$ 77,500

Summary:

Return realized by lenders	$40,000/$400,000 = .10 or 10%
Return realized by preferred stock investors	$12,500/$100,000 = .125 or 12.5%[7]
Return realized by common stockholders	$77,500/$500,000 = .155 or 15.5%

We see that Ellis was able to pay all its capital suppliers by earning an overall return of 11.4 percent, its WACC.

In the long run, companies generally try to maintain an optimal mixture of capital from different sources. In the short run, however, one project may be financed entirely from one source. Even if a particular project is financed entirely from one source, the WACC should still be used as the required rate of return for an average-risk project. Say, for instance, such a project is entirely financed with debt, a relatively cheap source of capital. The cost of debt should not be used as that project's cost of capital. Why? Because the firm's risk would increase with the increase in debt, and the costs of all sources of capital would increase.

Interactive Module

Go to the Interactive Spreadsheets you downloaded for chapter 9. Follow the instructions there. Note how the cost of a particular source of capital depends on the risk being taken by the supplier of that capital.

The Marginal Cost of Capital (MCC)

A firm's weighted average cost of capital will change if one component cost of capital changes. Often, a change in WACC occurs when a firm raises a large amount of capital. For example, lenders may increase the interest rate they charge, k_d, if they think the firm's debt load will be too heavy after new funds are borrowed. Or a firm's cost of equity may increase when new stock is issued after new retained earnings run out. This is because of the flotation costs incurred when new stock is issued.

Firms, then, must consider how increasing component costs of capital affect the WACC. The weighted average cost of the next dollar of capital to be raised is the **marginal cost of capital (MCC)**. To find the MCC, financial managers must (1) assess at what point a firm's cost of debt or equity will change the firm's WACC, (2) estimate how much the change will be, and (3) calculate the cost of capital up to and after the points of change.

[7]To be precise, 12.5 percent is the return to the preferred stockholders plus the investment bankers' and attorneys' fees for issuing the stock ($2). The net return realized by the preferred stock investors is the preferred dividend they receive ($2.50) divided by the price they paid for the stock ($22), which is 11.36 percent.

The Firm's MCC Schedule

The marginal cost of the *first* dollar of capital a firm raises is the same as the firm's basic WACC. However, as the firm raises more capital, a point is reached at which the marginal cost of capital changes. Why? Because one of the component sources of capital changes. This point is the *break point* in the firm's MCC schedule. Capital above the break point can only be raised at a higher cost.

Finding the Break Points in the MCC Schedule To find break points in the MCC schedule, financial managers determine what limits, if any, there are on the firm's ability to raise funds from a given source at a given cost. Break points in the MCC Schedule consist of one or more *debt break points* and an *equity break point*.

Debt Break Points Suppose that Ellis Industries' financial managers, after consulting with bankers, determined that the firm can borrow up to $300,000 at an interest rate of 10 percent, but any money borrowed above that amount will cost 12 percent. To calculate Ellis Industries' after-tax cost of debt, assume the firm's tax rate is 40 percent. We apply Equation 9-1 as follows:

$$\begin{aligned} \text{AT } k_d &= k_d (1 - T) \\ &= .10 \times (1 - .40) \\ &= .06, \text{ or } 6\% \end{aligned}$$

We see that at an interest rate of 10 percent and a tax rate of 40 percent, Ellis's after-tax cost of debt is 6 percent. However, if Ellis Industries borrows more than $300,000, then its interest rate increases to 12 percent. At a tax rate of 40 percent and an interest rate of 12 percent, the firm's after-tax k_d for amounts borrowed over $300,000 is

$$\begin{aligned} \text{AT } k_d \text{ (for over \$300,000 borrowed)} &= .12 (1 - .40) \\ &= .072, \text{ or } 7.2\% \end{aligned}$$

Because Ellis's AT k_d increases when it borrows more than $300,000, its MCC will also increase when it borrows more than $300,000. (We'll see how much it increases in the next section.) The financial managers at Ellis Industries want to know how much total capital they can raise before the debt portion reaches $300,000, causing an increase in the AT k_d and the MCC.

Ellis Industries' marginal cost of capital break point is not $300,000 because the firm's capital structure is 40 percent debt, 10 percent preferred stock, and 50 percent common stock. At $300,000, then, only 40 percent of that capital is debt. Instead, the financial managers of Ellis Industries must figure out at what point the firm will use $300,000 of debt capital.

To find a firm's marginal cost of capital break point, we use Equation 9-7:

Formula for the Marginal Cost of Capital (MCC) Break Point

$$\text{BP} = \frac{\text{Limit}}{\text{Proportion of Total}} \qquad (9\text{-}7)$$

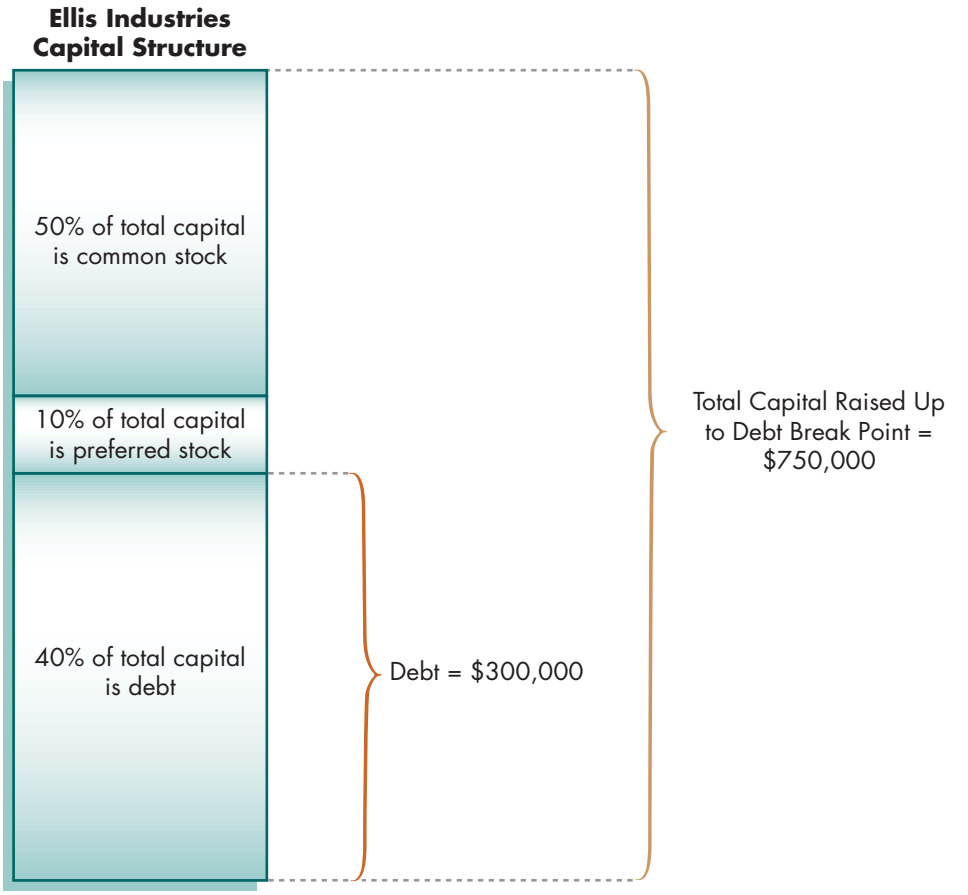

Figure 9-3 Ellis Industries Debt Break Point

Figure 9-3 shows how Ellis Industries can raise up to $750,000 of total capital before the $300,000 of lower-cost debt is exhausted.

where:

BP = The capital budget size at which the MCC changes (break point)

Limit = The point at which the cost of the source of capital changes

Proportion of Total = The percentage of this source of capital in the firm's capital structure

In our Ellis Industries example, we know that the firm has a $300,000 debt limit before its after-tax cost of debt will increase and that debt is 40 percent of the firm's capital structure. Applying Equation 9-7 to our Ellis example, we see that its debt break point is the following:

$$BP_d = \frac{\$300,000}{.40}$$

$$= \$750,000$$

We find that Ellis Industries' break point is $750,000. By applying Equation 9-7, Ellis's financial managers know that they may raise up to $750,000 in capital before their borrowing costs will rise from 6 percent to 7.2 percent. Any capital raised over $750,000 will reflect the higher cost of borrowing, as shown in Figure 9-3.

Notice we used subscript $_d$ with BP in Equation 9-7. That was to identify the break point as a *debt break point*. There could be other debt break points for Ellis Industries. If, for instance, the company's lenders set additional limits on the company's borrowing, the debt break points would be denoted as BP_{d1}, BP_{d2}, and so on. For our example, let's assume that Ellis's bankers will lend the firm an unlimited amount of money over $300,000 at 7.2 percent, so there are no further debt break points.

The Equity Break Point The equity break point is the point at which the MCC changes because the cost of equity changes. Equity costs may change because firms exhaust the supply of funds from the firm's existing common stockholders—that is, they exhaust additions to retained earnings. After firms exhaust their supply of internal equity, which has a capital cost of k_s, they will have to raise additional equity funds by issuing new stock, which has a higher cost, k_n. This additional equity is external equity capital. The MCC increases accordingly.

Let's illustrate how the MCC increases because of changes in the cost of equity. We'll assume that Ellis Industries expects to realize $600,000 in income this year after it pays preferred stockholders their dividends. The $600,000 in earnings belong to the common stockholders. The firm may either pay dividends or retain the earnings. Let's assume Ellis retains the $600,000. The finite supply of capital from the existing common stockholders is the $600,000 addition to retained earnings. To find the equity break point, then, Ellis's managers must know at what point the firm will exhaust the common equity capital of $600,000, assuming existing common stock equity is 50 percent of the firm's capital budget. Figure 9-4 graphically depicts the Ellis equity break point analysis.

To find the equity break point, we apply Equation 9-7, the MCC break point formula. We know that the existing common stock capital limit is $600,000 and that common equity finances 50 percent of the total capital budget. Using Equation 9-7, we solve for the equity break point, BP_e, as follows:

$$BP_e = \frac{\$600,000}{.50}$$

$$= \$1,200,000$$

Our calculations show that the Ellis equity break point is $1,200,000. If the capital budget exceeds $1,200,000, the portion financed with common equity will exceed $600,000. At that point, Ellis will need to issue new common stock to raise the additional capital. The new common stock's cost, k_n, will be greater than the cost of internal common equity, k_s, so the MCC will rise when the capital budget exceeds $1,200,000, as shown in Figure 9-4.

Calculating the Amount the MCC Changes To calculate MCC changes, we must first identify the break points. In our Ellis Industries example, we identified two break points at which the firm's MCC will change:

$$\text{Debt Break Point, } BP_d = \$750,000$$

$$\text{Equity Break Point, } BP_e = \$1,200,000$$

The next step in the MCC analysis is to estimate how much the change in the MCC will be for varying amounts of funds raised.

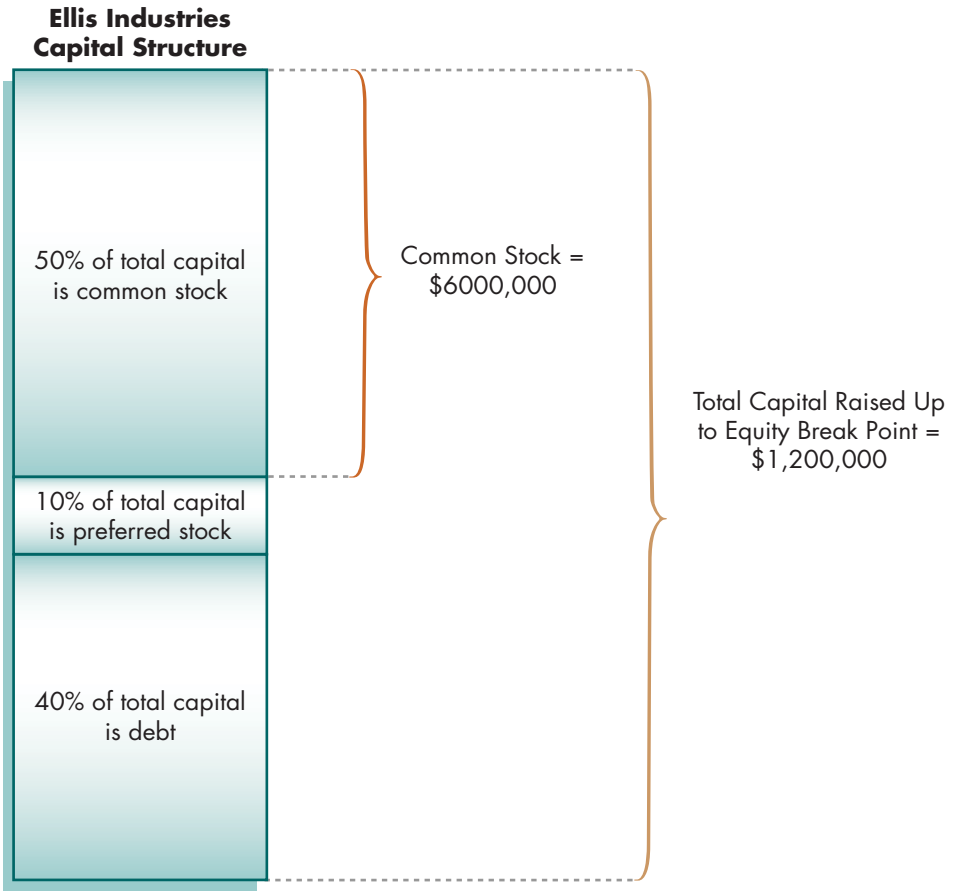

Figure 9-4
Ellis Industries Equity Break point

Figure 9-4 shows how Ellis Industries can raise up to $1,200,000 of total capital before the $600,000 of lower-cost internal equity is exhausted.

The MCC Up to the First Break Point Because the MCC is simply the weighted average cost of the next dollar of capital to be raised, we can use the WACC formula, Equation 9-6, to calculate the MCC as well.

We assume that Ellis Industries wants to maintain its current capital structure of 40 percent debt, 10 percent preferred stock, and 50 percent common equity. We assume further that its after-tax cost of debt, AT k_d, is 6 percent; its cost of preferred stock, k_p, is 12.5 percent; and its cost of internal common equity, k_s, is 15.5 percent. With these values, we use Equation 9-6 to find the Ellis MCC for capital raised up to the first break point, BP_d, as follows:

$$\begin{aligned}\text{MCC up to } BP_d\ (\$750{,}000) &= (.40 \times \text{AT } k_d) + (.10 \times k_p) + (.50 \times k_s) \\ &= (.40 \times .06) + (.10 \times .125) + (.50 \times .155) \\ &= .024 + .0125 + .0775 \\ &= .114, \text{ or } 11.4\%\end{aligned}$$

We see from our calculations that up to the first break point, the Ellis MCC is 11.4 percent—the WACC we calculated earlier. We know, however, that the Ellis lenders will raise the interest rate to 12 percent if the firm raises more than $750,000, at which point the AT k_d increases from 6 percent to 7.2 percent. So between the first break point, BP_d, and the second break point, BP_e, the MCC is

$$\begin{aligned}\text{MCC between } BP_d (\$750{,}000) \text{ and } BP_e (\$1{,}200{,}000) &= (.40 \times \text{AT } k_d) + (.10 \times k_p) + (.50 \times k_s) \\ &= (.40 \times .072) + (.10 \times .125) + (.50 \times .155) \\ &= .0288 + .0125 + .0775 \\ &= .1188, \text{ or } 11.88\%\end{aligned}$$

Our calculations show that the MCC between the first and second break points, $750,000 and $1,200,000, is 11.88 percent.

At the second break point, BP_e, we know from our earlier Ellis discussion that k_s of 15.5 percent changes to k_n, which has a value of 16.05 percent. Applying Equation 9-6, the MCC for amounts raised over $1,200,000 follows:

$$\begin{aligned}\text{MCC over } BP_e (\$1{,}200{,}000) &= (.40 \times \text{AT } k_d) + (.10 \times k_p) + (.50 \times k_s) \\ &= (.40 \times .072) + (.10 \times .125) + (.50 \times .1605) \\ &= .0288 + .0125 + .08025 \\ &= .1216, \text{ or } 12.16\%\end{aligned}$$

We find that the Ellis MCC with a capital budget exceeding $1,200,000 is 12.16 percent. A graph of Ellis Industries' marginal cost of capital is shown in Figure 9-5.

Now that we have learned to estimate the MCC for a firm, we examine how MCC estimates affect capital budgeting decisions.

The MCC Schedule and Capital Budgeting Decisions

Firms use the MCC schedule to identify which new capital budgeting projects should be selected for further consideration and which should be rejected. For example, assume that Ellis Industries has identified the following projects for possible adoption:

Project	Initial Investment Required	Project's Expected Rate of Return
A	$500,000	18.00%
B	$300,000	14.00%
C	$200,000	12.05%
D	$300,000	11.50%
E	$700,000	9.00%

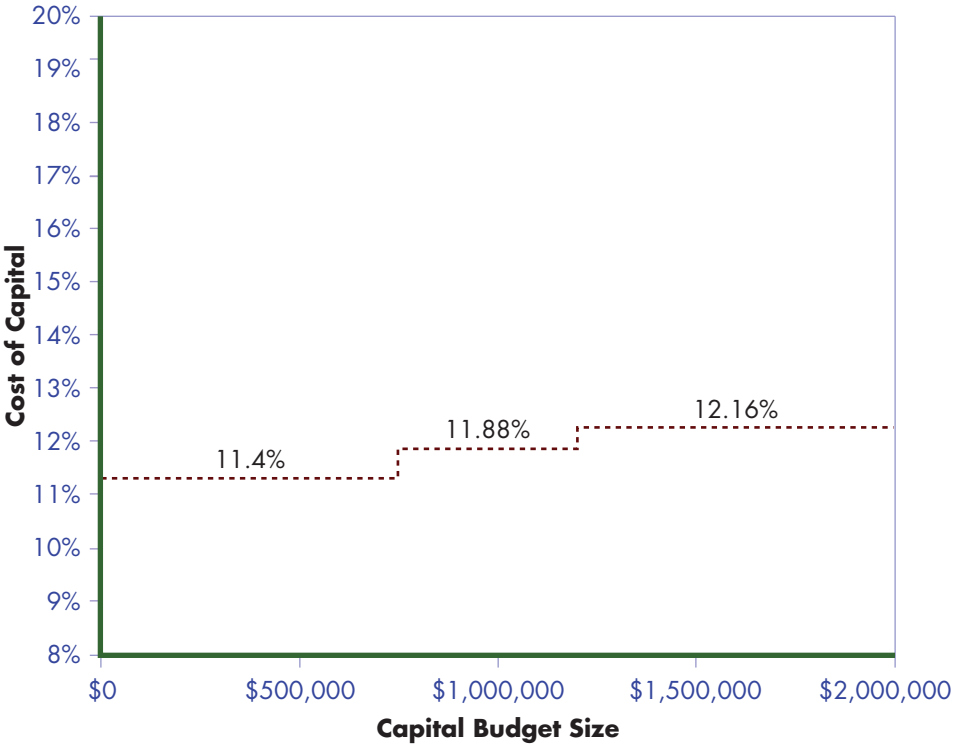

Figure 9-5 Ellis Industries Marginal Cost of Capital Schedule

Figure 9-5 shows the marginal cost of capital (MCC) schedule that reflects the cost of debt and cost of equity break points.

The projects are ranked from highest to lowest expected rate of return. The list of proposed capital budgeting projects ranked by expected rate of return is the firm's investment opportunity schedule (IOS). To determine which proposed projects should be accepted, the Ellis financial managers determine which projects have expected rates of return that exceed their respective costs of capital. To compare the projects' expected rates of return to the firm's cost of capital, the financial managers plot the IOS on the same graph as the MCC. Figure 9-6 shows this technique.

The projects with the highest expected rates of return are plotted first. The Ellis financial managers should start with Project A, which has an expected rate of return of 18 percent. That project requires a capital investment of $500,000. Next, they should add Project B, a project with an expected rate of return of 14 percent and an investment of $300,000. The total capital budget with Projects A and B is $800,000. Then Project C, with an expected rate of return of 12.05 percent, should be added. Project C's investment requirement of $200,000 increases the capital budget to $1,000,000.

The addition of Project D, a project with an expected rate of return of 11.5 percent and investment of $300,000, results in a capital budget of $1,300,000. Notice, however, that Project D's expected rate of return is less than the marginal cost of capital at the point at which it is added. If Project D were adopted, Figure 9-6 shows that it would have to be financed with capital that costs 11.88 percent, even though the project's expected rate of return is only 11.5 percent. The Ellis financial managers, then, should reject Project D. Project E has a lower expected rate of return of 9 percent and requires a capital investment of $700,000. Project E is also rejected. Combining the IOS and MCC schedules is an effective tool to see whether a firm should accept or reject a project.

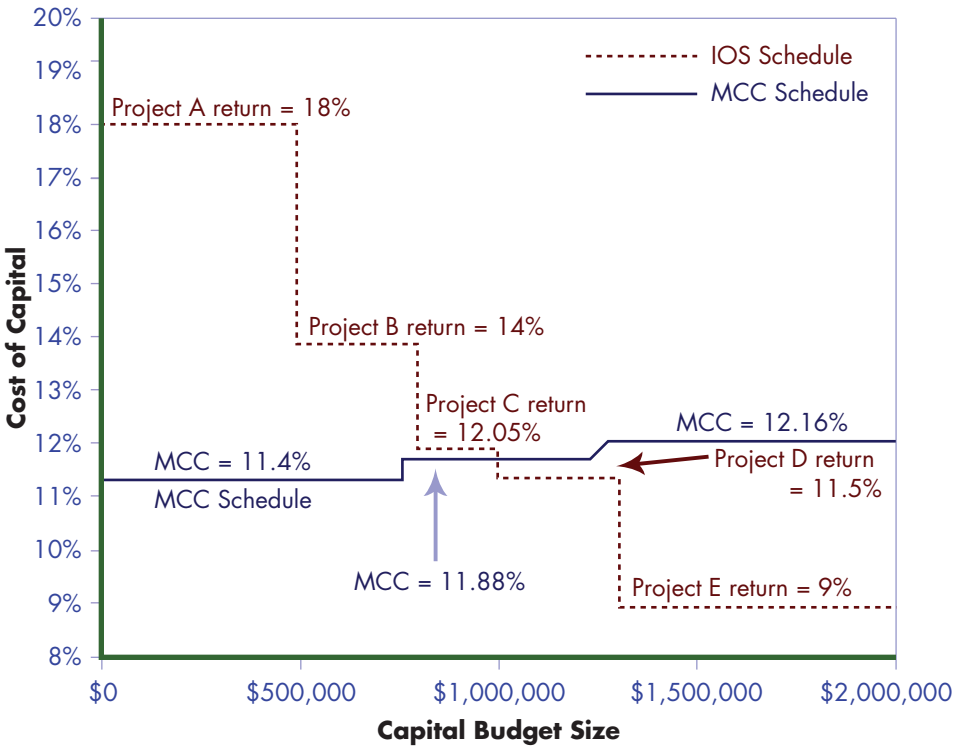

Figure 9-6 Ellis Industries MCC and IOS Schedules

Figure 9-6 shows the MCC and IOS schedules. Those projects on the IOS schedule above the MCC schedule are accepted.

The Optimal Capital Budget

When we integrate the IOS and the MCC schedules, as shown in Figure 9-6, we see that Ellis Industries' optimal capital budget is $1 million, consisting of Projects A, B, and C. The **optimal capital budget** is the list of all accepted projects and the total amount of initial cash outlays for these projects. All projects on the IOS schedule that are above the MCC schedule are accepted; the rest are rejected.

Table 9-1 summarizes the seven steps to calculate the optimal capital budget.

The Importance of MCC to Capital Budgeting Decisions

Analyzing the combined IOS and MCC schedules allows financial managers to examine many projects at once, rather than each project in isolation. This way they choose the best projects.

To demonstrate how important the MCC schedule is to capital budgeting decisions, look at Figure 9-6 again. Notice that Project D is rejected because it is below the MCC line. The graph shows us that if Project D is accepted, it will have to be financed in part with capital costing 11.88 percent and in part with capital costing 12.16 percent. Because Project D's expected rate of return is only 11.5 percent, it's a poor investment. However, this statement is only true because Projects A, B, and C were already considered before Project D. Together, Projects A, B, and C require $1 million of capital investment. Given that $1 million has already been spent for Projects A, B, and C, the $300,000 required for Project D can only be raised at costs of 11.88 percent (the first $200,000) and 12.16 percent (the last $100,000).

Table 9-1 Determining the Optimal Capital Budget

STEPS	ACTIONS
Step 1	Calculate the costs of the firm's sources of capital, AT k_d, k_p, k_s, and k_n. Record any borrowing limits and the resulting changes in AT k_d with those limits.
Step 2	Calculate the break points in the capital budget size at which the MCC will change. There will always be an equity break point, BP_e, and there may be one or more debt break points, BP_{d1}, BP_{d2}, and so on.
Step 3	Calculate the MCC up to, between, and above all the break points. The MCC increases at each break point. Record the MCC values before and after each break point.
Step 4	Plot the MCC values on a graph with the capital budget size on the X axis and cost of capital/IRR on the Y axis.
Step 5	Identify the firm's potential investment projects. Record each investment project's initial investment requirement and expected rate of return. Make an investment opportunity schedule (IOS) by lining up the projects from highest return to lowest.
Step 6	Plot the IOS on the same graph with the MCC.
Step 7	Note the point where the IOS and MCC schedules cross. Projects on the IOS line above the MCC line should be accepted, and those below the MCC line rejected.

If Project D were considered by itself, as if it were Ellis Industries' only capital budgeting project, then the $300,000 investment the project requires could have been raised at the company's initial WACC of 11.4 percent. Because the project's expected rate of return of 11.5 percent exceeds that WACC rate by .1 percent, the project looks like a good investment. But because its expected rate of return was lower than those of Projects A, B, and C, Project D is not a good investment, given the changes in Ellis's cost of capital due to the MCC break points.

This example illustrates the importance of using a firm's MCC, not the firm's initial WACC, to evaluate investments. If all investment projects are treated in isolation and evaluated using the firm's initial WACC, then some of them may be overvalued. The discrepancy will become apparent when the firm tries to raise the entire amount of capital to support the complete capital budget and finds that the cost of the last dollar raised exceeds the expected rate of return of the last project adopted.

What's Next

In this chapter we learned how to calculate a firm's individual component costs of capital and how to calculate its WACC and its MCC. In Chapter 10, we discuss the decision techniques that firms use to select projects.

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Summary

1. Describe the sources of capital and how firms raise capital.

Firms raise debt capital from lenders or bondholders. They also raise funds from preferred stockholders, from current stockholders, and from investors who buy newly issued shares of common stock. All suppliers of capital expect a rate of return proportionate to the risk they take. To ensure a supply of capital to meet their capital budgeting needs, firms must pay that return to capital suppliers. To compensate creditors, firms must pay the interest and principal on loans. For bondholders, firms must pay the market required interest rate. For preferred stockholders, the dividend payments serve as compensation. To compensate common stock investors, firms pay dividends or reinvest the stockholders' earnings.

2. Estimate the cost of capital for each financing source.

To find a firm's overall cost of capital, a firm must first estimate how much each source of capital costs. The after-tax cost of debt, AT k_d, is the market's required rate of return on the firm's debt, adjusted for the tax savings realized when interest payments are deducted from taxable income. The before-tax cost of debt, k_d, is multiplied by one minus the tax rate (1 – T) to arrive at the firm's after-tax cost of debt.

The cost of preferred stock, k_p, is the investor's required rate of return on that security. The cost of common stock equity, k_s, is the opportunity cost of new retained earnings, the required rate of return on the firm's common stock. The cost of new common stock, k_n (external equity), is the required rate of return on the firm's common stock, adjusted for the flotation costs incurred when new common stock is sold in the market.

3. Estimate the weighted average cost of capital.

The weighted average cost of capital, k_a or WACC, is the overall average cost of funds considering each of the component capital costs and the weight of each of those components in the firm's capital structure. To estimate WACC, we multiply the individual source's cost of capital times its percentage of the firm's capital structure and then add the results.

4. Use the MCC schedule to make capital budgeting decisions.

A firm's WACC changes as the cost of debt or equity increases as more capital is raised. Financial managers calculate the break points in the capital budget size at which the MCC will change. There will always be an equity break point, BP_e, and there may be one or more debt break points, BP_{d1}, BP_{d2}, and so on. Financial managers then calculate the MCC up to, between, and above all the break points and plot the MCC values on a graph showing how the cost of capital changes as capital budget size changes.

Financial managers create an IOS by ranking all potential capital budgeting projects from the highest internal rate of return to the lowest and then plotting the IOS on the same graph with the MCC. To increase the value of the firm, projects on the IOS line above the MCC line should be accepted and those below the MCC line rejected.

5. Explain the importance of the MCC schedule in financial decision making.

The MCC schedule forces financial managers to match a project's rate of return with the cost of funds for that specific project. This marginal analysis prevents financial managers from estimating a project's value incorrectly because of faulty cost of capital estimates that fail to consider how a larger capital budget increases capital costs.

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Equations Introduced in This Chapter

Equation 9-1. Formula for the After-Tax Cost of Debt (AT k_d):

$$AT\ k_d = k_d\ (1 - T)$$

where: k_d = The before-tax cost of debt

T = The firm's marginal tax rate

Equation 9-2. Formula for the Cost of Preferred Stock (k_p):

$$k_p = \frac{D_p}{(P_p - F)}$$

where: k_p = The cost of the preferred stock issue; the expected return

D_p = The amount of the expected preferred stock dividend

P_p = The current price of the preferred stock

F = The flotation cost per share

Equation 9-3. Formula for the Cost of Common Stock Equity (k_s) (Dividend Growth Model Approach):

$$k_s = \frac{D_1}{P_0} + g$$

where: P_0 = The current price of the common stock

D_1 = The amount of the common stock dividend expected one period from now

g = The expected constant growth rate of the company's common stock dividends

Equation 9-4. CAPM Formula for the Cost of Common Equity (k_s):

$$k_s = k_{rf} + (k_m - k_{rf}) \times \beta$$

where: k_s = The required rate of return from the company's common stock equity

k_{rf} = The risk-free rate of return

k_m = The expected rate of return on the overall stock market

β = The beta of the company's common stock, a measure of the amount of nondiversifiable risk

Equation 9-5. Formula for the Cost of New Common Equity (k_n):

$$k_n = \frac{D_1}{P_0 - F} + g$$

where: k_n = The cost of new common stock equity

P_0 = The price of one share of the common stock

D_1 = The amount of the common stock dividend expected to be paid in one year

F = The flotation cost per share

g = The expected constant growth rate of the company's common stock dividends

Equation 9-6. Formula for the Weighted Average Cost of Capital (WACC):

$$k_a = (WT_d \times AT\ k_d) + (WT_p \times k_p) + (WT_s \times k_s)$$

where: k_a = The weighted average cost of capital (WACC)

WT_d = The weight, or proportion, of debt used to finance the firm's assets

$AT\ k_d$ = The after-tax cost of debt

WT_p = The weight, or proportion, of preferred stock being used to finance the firm's assets

k_p = The cost of preferred stock

WT_s = The weight, or proportion, of common equity being used to finance the firm's assets

k_s = The cost of common equity

Equation 9-7. Formula for the Marginal Cost of Capital (MCC) Break Point:

$$BP = \frac{\text{Limit}}{\text{Proportion of Total}}$$

where: BP = The capital budget size at which the MCC changes (break point)

Limit = The point at which the cost of the source of capital changes

Proportion of Total = The percentage of this source of capital in the firm's capital structure

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Self-Test

ST-1. Jules' Security Company can issue new bonds with a market interest rate of 14 percent. Jules' marginal tax rate is 32 percent. Compute the after-tax cost of debt, AT k_d, for this company.

ST-2. Mr. White's company, The Problem Solvers, wants to issue new preferred stock. The preferred dividend is $3.00 per share, the stock can be sold for $30, and the flotation costs are $1. What is the cost of preferred stock, k_p?

ST-3. Vincent's Dance Studio, Inc., has a beta of 1.9. The risk-free rate of interest is 4 percent. The market portfolio has an expected rate of return of 10 percent. What is the cost of internal equity, k_s, for this company using the CAPM approach?

ST-4. Marsalis's Entertainment Corporation has an after-tax cost of debt of 8 percent, a cost of preferred stock of 12 percent, and a cost of equity of 16 percent. What is the WACC, k_a, for this company? The capital structure of Marsalis's company contains 20 percent debt, 10 percent preferred stock, and 70 percent equity.

ST-5. Quinten's Movie Company has been told by its investment banking firm that it could issue up to $8 million in bonds at an after-tax cost of debt of 10 percent. But after that, additional bonds would have a 12 percent after-tax cost. Quinten's company uses 40 percent debt and 60 percent equity for major projects. How much money could this company raise, maintaining its preferred capital structure, before the after-tax cost of debt would jump to 12 percent?

Review Questions

1. Which is lower for a given company: the cost of debt or the cost of equity? Explain. Ignore taxes in your answer.

2. When a company issues new securities, how do flotation costs affect the cost of raising that capital?

3. What does the "weight" refer to in the weighted average cost of capital?

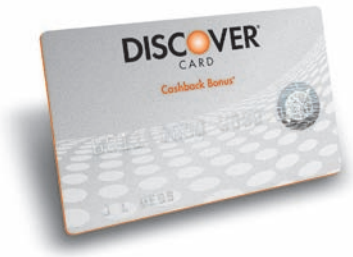
4. How do tax considerations affect the cost of debt and the cost of equity?

5. If dividends paid to common stockholders are not legal obligations of a corporation, is the cost of equity zero? Explain your answer.

6. What is the investment opportunity schedule (IOS)? How does it help financial managers make business decisions?

7. What is a marginal cost of capital (MCC) schedule? Is the schedule always a horizontal line? Explain.

8. For a given IOS and MCC, how do financial managers decide which proposed capital budgeting projects to accept and which to reject?



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Build Your Communication Skills

CS-1. Prepare a brief paper in which you explain to the CEO of a fictional company why the cost of equity is greater than either the cost of debt or the cost of preferred stock. Be sure to explain why equity funds have a cost even though those costs are not reflected on the income statement. Finally, discuss why it is important for a firm to know its cost of capital.

CS-2. Write a short report that analyzes the role of the MCC schedule in making capital budgeting decisions. In your report, explain how the IOS affects this decision-making process. Be sure to explain your rationale for choosing some proposed projects while rejecting others.

Problems

Cost of Debt ☛ **9-1.** **a.** What would be the after-tax cost of debt for a company with the following yields to maturity for its new bonds, if the applicable tax rate were 40 percent?

(i) YTM = 7%

(ii) YTM = 11%

(iii) YTM = 13%

b. How would the cost of debt change if the applicable tax rate were 34 percent?

Cost of Debt ☛ **9-2.** Calculate the after-tax cost of debt for loans with the following effective annual interest rates and corporate tax rates.

a. Interest rate, 10%; tax rate, 0%.

b. Interest rate, 10%; tax rate, 22%.

c. Interest rate, 10%; tax rate, 34%.

Cost of Debt ☛ **9-3.** What would be the cost of debt for the following companies given their yields to maturity (YTM) for new bonds and the applicable corporate tax rates?

Company	YTM	Tax Rate
A	8%	34%
B	11%	40%
C	14%	30%

Cost of Debt ☛ **9-4.** Mary Lynn Eatenton is the chief financial officer of Magnolia Steel, Inc. She has asked Trudy Jones, one of the financial analysts, to calculate the after-tax cost of debt based on different bond yield to maturity rates. Magnolia Steel's current tax rate is 34 percent, but increasing sales and profits will put them in the 40 percent tax bracket by the end of the year. Calculate the after-tax cost-of-debt figures that will be shown in Ms. Jones's report at each tax rate for the following YTM rates.

a. Yield to maturity, 8%.

b. Yield to maturity, 14%.

c. Yield to maturity, 16%.

9-5. A firm is issuing new bonds that pay 8 percent annual interest. The market required annual rate of return on these bonds is 13 percent. The firm has a tax rate of 40 percent.

a. What is the before-tax cost of debt?

b. What is the after-tax cost of debt?

Cost of Debt

9-6. A company's creditors charge 9.5 percent annual interest on loans to the company. The company's combined federal and state tax rate is 35 percent. What is the company's after-tax cost of debt?

After-Tax Cost of Debt

9-7. A company can sell preferred stock for $26 per share, and each share of stock is expected to pay a dividend of $2. If the flotation cost per share of stock is $0.75, what would be the estimate of the cost of capital from this source?

Cost of Preferred Stock

9-8. Leo Bloom, the treasurer of a manufacturing company, thinks that debt (YTM = 11%, tax rate = 40%) will be a cheaper option for acquiring funds compared to issuing new preferred stock. The company can sell preferred stock at $61 per share and pay a yearly preferred dividend of $8 per share. The cost of issuing preferred stock is $1 per share. Is Leo correct?

Cost of Debt and Preferred Stock

9-9. One-Eyed Jacks Corporation needs money to fund a new production line of playing cards. Rio Longworth, manager of the finance department, suggests they sell preferred stock for $50 per share. They expect to pay $6 per share annual dividends. What is the estimate of the cost of preferred stock if the flotation cost is $2.25 per share?

Cost of Preferred Stock

9-10. El Norte Industries will issue $100 par, 12 percent preferred stock. The market price for the stock is expected to be $89 per share. El Norte must pay flotation costs of 5 percent of the market price. What is El Norte's cost of preferred stock?

Cost of Preferred Stock

9-11. A company's investment bankers say that a proposed new issue of 7.5 percent cumulative preferred stock with a par value of $10 a share can be sold to the public for $27 a share. The transaction costs will be $1 a share. What is the company's cost of preferred stock financing?

Cost of Preferred Stock Financing

9-12. Twister Corporation is expected to pay a dividend of $7 per share one year from now on its common stock, which has a current market price of $143. Twister's dividends are expected to grow at 13 percent.

a. Calculate the cost of the company's retained earnings.

b. If the flotation cost per share of new common stock is $4, calculate the cost of issuing new common stock.

Cost of Equity

9-13. Amy Jolly is the treasurer of her company. She expects the company will grow at 4 percent in the future, and debt securities (YTM = 14%, tax rate = 30%) will always be a cheaper option to finance the growth. The current market price per share of its common stock is $39, and the expected dividend in one year is $1.50 per share. Calculate the cost of the company's retained earnings and check if Amy's assumption is correct.

Cost of Retained Earnings

Cost of Equity CAPM Approach

9-14. Free Willy, Inc., (Nasdaq: FWIC) has a beta of 1.4. If the rate on U.S. Treasury bills is 4.5 percent and the expected rate of return on the stock market is 12 percent, what is Free Willy's cost of common equity financing?

Challenge Problem

9-15. Pedro Muzquiz and Tita de la Garza are the CEOs of a large bakery chain, Chocolates, Inc. The common stock sells on the NASDAQ with a current market price of $65 per share. A $7 dividend is planned for one year from now. Business has been good and they expect the dividend growth rate of 10 percent to continue.

a. Calculate the cost of the corporation's retained earnings.

b. At the beginning of the year, 1 million shares were authorized, with 500,000 issued and outstanding. They plan to issue another 200,000 shares. Calculate the cost of capital of the new common stock if the flotation cost per share is $3. Do you expect the cost of new common equity (external) to be higher than the cost of the internal equity? Why?

Cost of Equity CAPM Approach

9-16. Margo Channing, the financial analyst for Eve's Broadway Production Company, has been asked by management to estimate a cost of equity for use in the analysis of a project under consideration. In the past, dividends declared and paid have been very sporadic. Because of this, Ms. Channing elects to use the CAPM approach to estimate the cost of equity. The rate on the short-term U.S. Treasury bills is 3 percent, and the expected rate of return on the overall stock market is 11 percent. Eve's Broadway Production Company has a beta of 1.6. What will Ms. Channing report as the cost of equity?

Cost of Common Equity Financing

9-17. African Queen River Tours, Inc. has capitalized on the renewed interest in riverboat travel. Charlie Allnut, the lone financial analyst, estimates the firm's earnings, dividends, and stock price will continue to grow at the historical 5 percent rate. AQRT's common stock is currently selling for $30 per share. The dividend just paid was $2. They pay dividends every year. The rate of return expected on the overall stock market is 12 percent.

a. What is AQRT's cost of equity?

b. If they issue new common stock today and pay flotation costs of $2 per share, what is the cost of new common equity?

c. If AQRT has a risk-free rate of 3 percent and a beta of 1.4, what will be AQRT's cost of equity using the CAPM approach?

Weighted Average Cost of Capital

9-18. Alvin C. York, the founder of York Corporation, thinks that the optimal capital structure of his company is 30 percent debt, 15 percent preferred stock, and the rest common equity. If the company is in the 40 percent tax bracket, compute its weighted average cost of capital given that:

- YTM of its debt is 10 percent.
- New preferred stock will have a market value of $31, a dividend of $2 per share, and flotation costs of $1 per share.
- Price of common stock is currently $100 per share, and new common stock can be issued at the same price with flotation costs of $4 per share. The expected dividend in one year is $4 per share, and the growth rate is 6 percent.

Assume the addition to retained earnings for the current period is zero.

Weighted Average Cost of Capital

9-19. A company has an optimal capital structure as follows:

Weighted Average Cost of Capital

Total Assets	$600,000
Debt	$300,000
Preferred Stock	$100,000
Common Equity	$200,000

What would be the minimum expected return from a new capital investment project to satisfy the suppliers of the capital? Assume the applicable tax rate is 40 percent, YTM of its debt is 11 percent, flotation cost per share of preferred stock is $0.75, and flotation cost per share of common stock is $4. The preferred and common stocks are selling in the market for $26 and $143 a share, respectively, and they are expected to pay a dividend of $2 and $7, respectively, in one year. The company's dividends are expected to grow at 13 percent per year. The firm would like to maintain the foregoing optimal capital structure to finance the new project.

Weighted Average Cost of Capital

9-20. Great Expectations, a wedding and maternity clothing manufacturer, has a cost of equity of 16 percent and a cost of preferred stock of 14 percent. Its before-tax cost of debt is 12 percent, and its marginal tax rate is 40 percent. Assume that the most recent balance sheet shown here reflects the optimal capital structure. Calculate Great Expectations' after-tax WACC.

Great Expectations Balance Sheet
Dec. 31, 2006

Assets		**Liabilities and Equity**	
Cash	$ 50,000		
Accounts Receivable	90,000	Long-Term Debt	$ 600,000
Inventories	300,000	Preferred Stock	250,000
Plant and Equipment, net	810,000	Common Stock	400,000
Total Assets	$1,250,000	Total Liabilities and Equity	$1,250,000

Weighted Average Cost of Capital

9-21. Puppet Masters is considering a new capital investment project. The company has an optimal capital structure and plans to maintain it. The yield to maturity on Puppet Masters' debt is 10 percent, and its tax rate is 35 percent. The market price of the new issue of preferred stock is $25 per share, with an expected per share dividend of $2 at the end of this year. Flotation costs are set at $1 per share. The new issue of common stock has a current market price of $140 per share, with an expected dividend in one year of $5. Flotation costs for issuing new common stock are $4 per share. Puppet Masters' dividends are growing at 10 percent per year, and this growth is expected to continue for the foreseeable future. Selected figures from last year's balance sheet follow:

Total Assets	$1,000,000
Long-Term Debt	300,000
Preferred Stock	100,000
Common Stock	600,000

Calculate the minimum expected return from the new capital investment project needed to satisfy the suppliers of the capital.

Weighted Average Cost of Capital

9-22. Jay Lo Enterprises finances its assets with 60 percent debt, 10 percent preferred stock, and 30 percent common stock. Jay Lo's after-tax cost of debt is 5 percent, its cost of preferred stock is 8 percent, and its cost of common equity financing is 12 percent. Given these conditions, what is Jay Lo's WACC?

Weighted Average Cost of Capital

9-23. The law firm of Dewey, Cheatem, and Howe (DCH) has the following balance sheet:

Assets		**Liabilities and Equity**	
Cash	$ 110,000	Accounts Payable	$ 70,000
Receivables	240,000	Long-Term Debt	160,000
Office Equipment	80,000	Preferred Stock	100,000
Total Assets	$ 430,000	Common Equity	100,000
		Total Liabilities and Equity	$430,000

DCH's creditors charge 9.5 percent annual interest on loans to the company. It can sell preferred stock with a $10 per share dividend to the public for $50 a share (net to the company after commissions). The company's combined federal and state tax rate is 35 percent, its beta is 1.1, the risk-free rate is 4 percent, and the expected rate of return on the stock market is 12 percent. Given these conditions, what is DCH's WACC?

9-24. Fans By Fay Company has a capital structure of 60 percent debt and 40 percent common equity. The company expects to realize $200,000 in net income this year and will pay no dividends. The effective annual interest rate on its new borrowings increases by 3 percent for amounts over $500,000.

Marginal Cost of Capital Schedule

a. At what capital budget size will Fans By Fay's cost of equity increase? In other words, what is its equity break point?

b. At what capital budget size will its cost of debt increase (debt break point)?

9-25. Babe's Dog Obedience School, Inc., wants to maintain its current capital structure of 50 percent common equity, 10 percent preferred stock, and 40 percent debt. Its cost of common equity is 13 percent, and the cost of preferred stock is 12 percent. The bank's effective annual interest rate is 11 percent for amounts borrowed that are less than or equal to $1 million and 13 percent for amounts between $1 million and $2 million. If more than $2 million is borrowed, the effective annual interest rate charged is 15 percent. Babe's tax rate is 40 percent. The firm expects to realize $2,750,000 in net income this year after preferred dividends have been paid.

Marginal Cost of Capital Schedule

a. Calculate the MCC if $900,000 is needed for an upcoming project.

b. Calculate the MCC if $3,000,000 is needed for the project instead.

c. If a different project is adopted and $5,005,000 is needed for it, what is the MCC?

9-26. Stone Wood Products has a capital structure of 35 percent debt and 65 percent common equity. The managers consider this mix to be optimal and want to maintain it in the future. Net income for the coming year is expected to be $1.2 million dollars. Duke Mantee, the loan officer at the local bank, has set up the following schedule for Stone Wood Products' borrowings. There are 40,000 shares of common stock outstanding. The firm's tax rate is 40 percent.

Comprehensive Problem

Loan Amount	Interest Rate
$0 to $750,000	10%
> $750,000	12%

The market price per share of Stone Wood Products' common stock is $50 per share. They have declared a $5 dividend to be paid in one year. The company's expected growth rate is 9 percent. The flotation costs for new common stock issued are set at 8 percent of the market price.

The managers are considering several investment opportunities for the upcoming year. They have asked the senior financial analyst, Gabrielle Maple, to recommend which of the following projects the firm should undertake. Because you are the newest member of her team and need the experience, she has passed this management request on to you.

Investment Opportunities

Project	Initial Investment (in millions)	Rate of Return
A	$0.5	16%
B	$1.6	12%
C	$0.6	15%
D	$1.5	18%

a. Calculate all of Stone Wood Products' component costs of capital (after-tax cost of debt, cost of equity, and cost of new equity).

b. Calculate all of the MCC break points.

c. Calculate all of the MCC figures.

d. Make an IOS by listing the projects from the highest to the lowest internal rates of return.

e. Plot the MCC values and the IOS values on the same graph.

f. Which projects will you recommend management adopt for the next year?

Answers to Self-Test

ST-1. $.14 \times (1 - .32) = .0952 = 9.52\%$ AT k_d

ST-2. Using Equation 9-7, $k_p = D_p/(P_p - F) =$ $\$3/(\$30 - \$1) = .1034$, or 10.34%

ST-3. $.04 + (.10 - .04) \times 1.9 = .154 = 15.4\%$ k_s

ST-4. $(.08 \times .2) + (.12 \times .10) + (.16 \times .70) = .14 = 14\%$ k_a

ST-5. The break point in the MCC schedule caused by the increase in the cost of debt, BP_d, after $8,000,000 is borrowed, equals $8,000,000 ÷ .40 = $20,000,000.

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