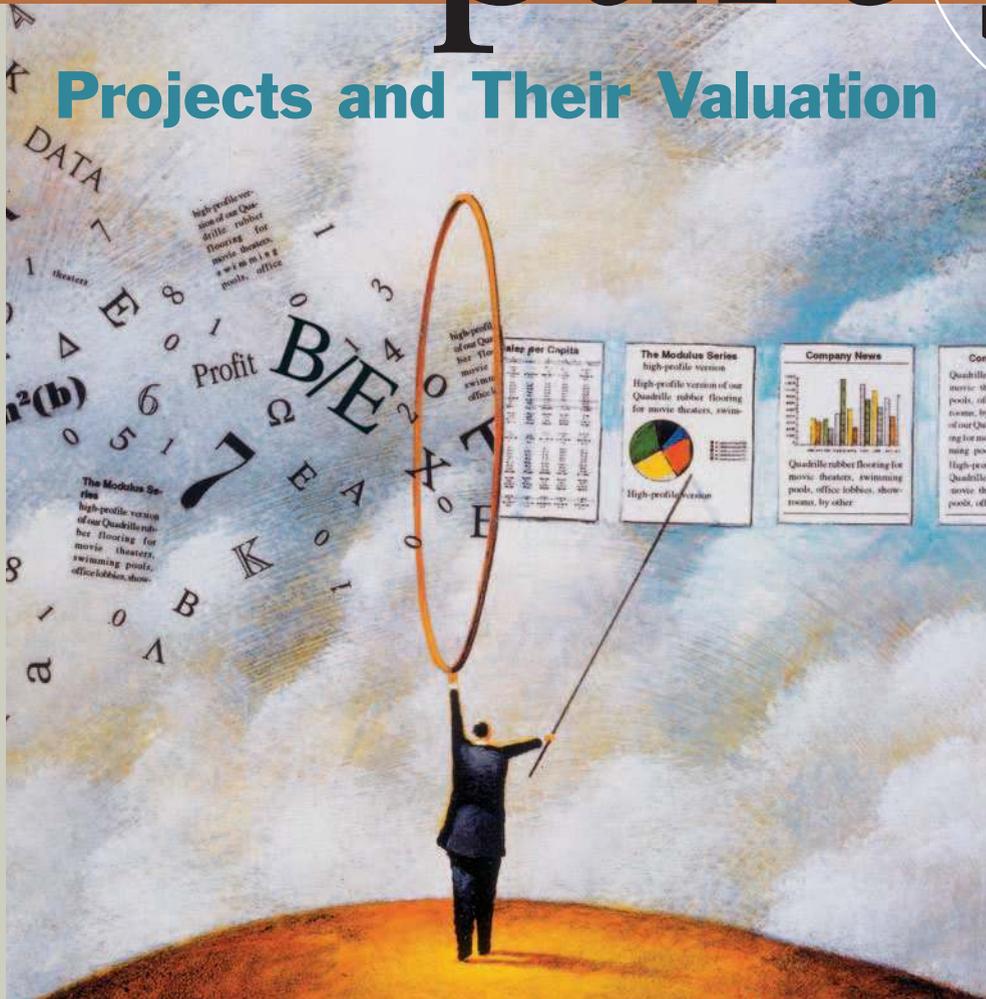
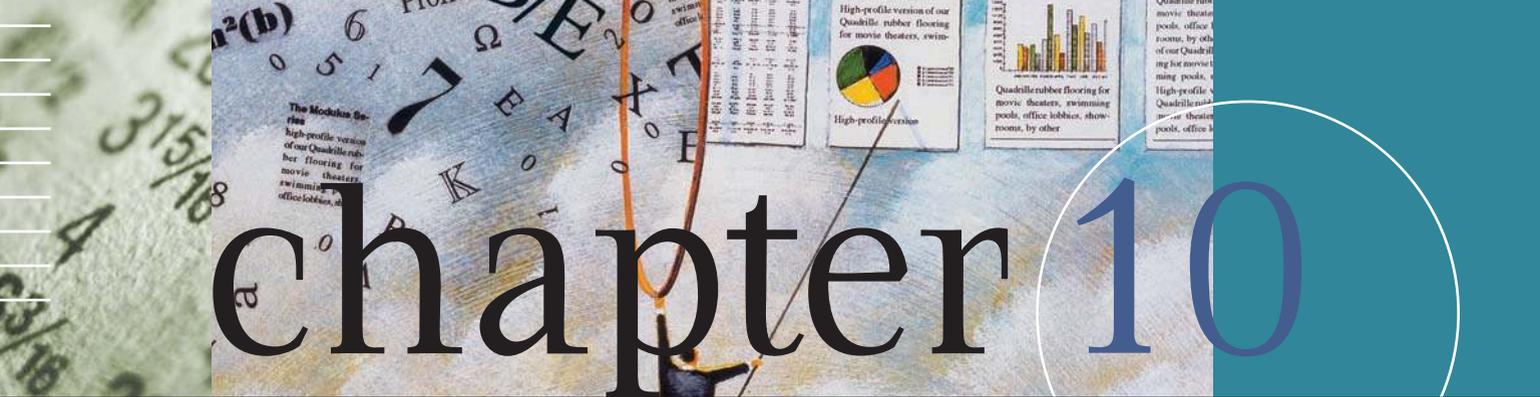


part 3

Projects and Their Valuation



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chapter 10

The Cost of Capital

General Electric has long been recognized as one of the world's best-managed companies, and it has rewarded its shareholders with outstanding returns. During its corporate life, GE has raised a cumulative \$109 billion in capital from its stockholders, but it has turned that \$109 billion into stock worth more than \$346 billion. Its Market Value Added (MVA), which is the difference between its stock's market capitalization and the amount shareholders originally put up, is a whopping \$237 billion! Not surprisingly, GE is always at or near the top of all companies in MVA.

When investors provide a corporation with funds, they expect the company to generate an appropriate return on that capital. From the company's perspective, the investors' expected return is a cost of using the capital, and it is called the "cost of capital." A variety of factors influence a firm's cost of capital. Some, such as the level of interest rates, state and federal tax policies, and the regulatory environment, are outside the firm's control. However, both the degree of risk in the projects it undertakes and the types of funds it raises are under the company's control, and both have a profound effect on its cost of capital.

GE's overall cost of capital (the weighted average cost of its debt and equity) has been estimated to be about 8%. Therefore, to

satisfy its investors, GE must generate a return on an average project of at least 8%. Some of GE's projects are "home grown" in the sense that the company has developed a new product or entered a new geographic market. For example, GE's appliance division introduced the Advantium speed-cooking oven and the ultra-quiet Triton dishwasher, and GE began Lexan® polycarbonate production at a new plastics plant in Cartagena, Spain. Sometimes GE creates completely new lines of business, as when it began providing e-commerce services. When GE evaluates potential projects such as these, it must determine whether the return on the capital it must invest in the project will exceed the cost of that capital.

GE also invests by acquiring other companies. Since 2002, GE has spent over \$65 billion to acquire hundreds of companies, such as its acquisition of Everest VIT, a company specializing in remote visual inspection technology. Again, GE must estimate the expected return on capital, and the cost of that capital, for each of these acquisitions, and then make the investment only if the expected return is greater than the cost.

How has GE done with its investments? We estimate that it has a 17.7% return on capital, well above its 8% estimated cost of capital. With such a large differential, it's no wonder GE has created a great deal of value for its investors.

Most important business decisions require capital, including decisions to develop new products, build factories and distribution centers, install information technology, expand internationally, and acquire other companies. For each of these decisions, a company must estimate the total investment that is required and decide whether the expected rate of return exceeds the cost of the capital. The cost of capital is also used in many compensation plans, with bonuses dependent on whether the company's return on invested capital exceeds the cost of capital. The cost of capital is also a key factor in choosing the mixture of debt and equity used to finance the firm and in decisions to lease rather than buy assets. As these examples illustrate, the cost of capital is a critical element in business decisions.¹



e-resource

The textbook's Web site contains an *Excel* file that will guide you through the chapter's calculations. The file for this chapter is **FM12 Ch 10 Tool Kit.xls**, and we encourage you to open the file and follow along as you read the chapter.

10.1 The Weighted Average Cost of Capital

What precisely do the terms “cost of capital” and “weighted average cost of capital” mean? To begin, note that it is possible to finance a firm entirely with common equity. However, most firms employ several types of capital, called **capital components**, with common and preferred stock, along with debt, being the three most frequently used types. All capital components have one feature in common: The investors who provided the funds expect to receive a return on their investment.

If a firm's only investors were common stockholders, then the cost of capital would be the required rate of return on equity. However, most firms employ different types of capital, and, due to differences in risk, these different securities have different required rates of return. The required rate of return on each capital component is called its **component cost**, and the cost of capital used to analyze capital budgeting decisions should be a *weighted average* of the various components' costs. We call this weighted average just that, the **weighted average cost of capital**, or **WACC**.

Corporate Valuation and the Cost of Capital

In Chapter 1, we told you that managers should strive to make their firms more valuable and that the value of a firm is determined by the size, timing, and risk of its free cash flows (FCF). In particular, a firm's value is the present value of its FCFs, discounted at

the weighted average cost of capital (WACC). In the previous chapters, we examined the major sources of financing (stocks, bonds, and preferred stock) on an individual basis. In this chapter, we put those pieces together and estimate the WACC.

$$\text{Value} = \frac{\text{FCF}_1}{(1 + \text{WACC})^1} + \frac{\text{FCF}_2}{(1 + \text{WACC})^2} + \frac{\text{FCF}_3}{(1 + \text{WACC})^3} + \cdots + \frac{\text{FCF}_\infty}{(1 + \text{WACC})^\infty}$$

¹The cost of capital is also an important factor in the regulation of electric, gas, and telephone companies. These utilities are natural monopolies in the sense that one firm can supply service at a lower cost than could two or more firms. Because it has a monopoly, your electric or telephone company could, if it were unregulated, exploit you. Therefore, regulators (1) determine the cost of the capital investors have provided the utility and (2) then set rates designed to permit the company to earn its cost of capital, no more and no less.

Most firms set target percentages for the different financing sources. For example, National Computer Corporation (NCC) plans to raise 30% of its required capital as debt, 10% as preferred stock, and 60% as common equity. This is its **target capital structure**. We discuss how targets are established in Chapter 16, but for now simply accept NCC's 30/10/60 debt, preferred, and common percentages as given.

The following sections discuss each of the component costs in more detail, and then we show how to combine them to calculate the weighted average cost of capital.²

SELF-TEST

What are the three major capital components?

What is a component cost?

What is a target capital structure?

10.2 Cost of Debt, $r_d(1 - T)$

The first step in estimating the cost of debt is to determine the rate of return debtholders require, or r_d . Although estimating r_d is conceptually straightforward, some problems arise in practice. Companies use both fixed- and floating-rate debt, straight and convertible debt, and debt with and without sinking funds, and each form has a somewhat different cost.

It is unlikely that the financial manager will know at the start of a planning period the exact types and amounts of debt that will be used during the period. The type or types used will depend on the specific assets to be financed and on capital market conditions as they develop over time. Even so, the financial manager does know what types of debt are typical for his or her firm. For example, NCC typically issues commercial paper to raise short-term money to finance working capital, and it issues 30-year bonds to raise long-term debt used to finance its capital budgeting projects. Since the WACC is used primarily in capital budgeting, NCC's treasurer uses the cost of 30-year bonds in her WACC estimate.

Assume that it is January 2008, and NCC's treasurer is estimating the WACC for the coming year. How should she calculate the component cost of debt? Most financial managers begin by discussing current and prospective interest rates with their investment bankers. Assume that NCC's bankers believe that a new 30-year, noncallable, straight bond issue will require an 11% coupon rate with semiannual payments, and that it can be offered to the public at its \$1,000 par value. Therefore, their estimate of r_d is equal to 11%.³

Note that the 11% is the cost of **new, or marginal, debt**, and it will probably not be the same as the average rate on NCC's previously issued debt, which is called the **historical, or embedded, rate**. The embedded cost is important for some decisions but not for others. For example, the average cost of all the capital raised in the past and still outstanding is used by regulators when they determine the rate of return a public utility should be allowed to earn. However, in financial management the WACC is used primarily to make investment decisions, and these decisions hinge on projects' expected future returns versus the cost of new, or marginal, capital. *Thus, for our purposes, the relevant cost is the marginal cost of new debt to be raised during the planning period.*

²For a comprehensive treatment of the cost of capital, see Michael C. Ehrhardt, *The Search for Value: Measuring the Company's Cost of Capital* (Boston: Harvard Business School Press, 1994).

³The effective annual rate is $(1 + 0.11/2)^2 - 1 = 11.3\%$, but NCC and most other companies use nominal rates for all component costs.

Suppose NCC had issued debt in the past and the bonds are publicly traded. The financial staff could use the market price of the bonds to find their yield to maturity (or yield to call if the bonds sell at a premium and are likely to be called). The yield is the rate of return the existing bondholders expect to receive, and it is also a good estimate of r_d , the rate of return that new bondholders will require.

For example, suppose NCC has outstanding bonds with a 9% annual coupon rate, 22 years remaining until maturity, and a face value of \$1,000. The bonds make semiannual coupon payments and currently are trading in the market at a price of \$835.42. We can find the yield to maturity using a financial calculator with these inputs: $N = 44$, $PV = -835.42$, $PMT = 45$, and $FV = 1,000$. Solving for the rate, we find $I/YR = 5.500\%$. This is a semiannual periodic rate, so the nominal annual rate is 11.00%. This is consistent with the investment bankers' estimated rate, so 11% is a reasonable estimate for r_d .

If NCC had no publicly traded debt, its staff could look at yields on publicly traded debt of similar firms. This too should provide a reasonable estimate of r_d .

The required return to debtholders, r_d , is not equal to the company's cost of debt because interest payments are deductible, which means the government in effect pays part of the total cost. As a result, the cost of debt to the firm is less than the rate of return required by debtholders.

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. This is the same as r_d multiplied by $(1 - T)$, where T is the firm's marginal tax rate.⁴

$$\begin{aligned} \text{After-tax component cost of debt} &= \text{Interest rate} - \text{Tax savings} \\ &= r_d - r_d T && \text{(10-1)} \\ &= r_d(1 - T). \end{aligned}$$

Suppose NCC has a marginal federal-plus-state tax rate of 40%. NCC's after-tax cost of debt is 6.6%:⁵

$$\begin{aligned} r_d(1 - T) &= 11\%(1.0 - 0.4) \\ &= 11\%(0.6) \\ &= 6.6\%. \end{aligned}$$

Most debt offerings have very low flotation costs, especially for privately placed debt. Because the flotation costs usually are low, most analysts ignore them when estimating the after-tax cost of debt. The following example illustrates the procedure for incorporating flotation costs and their impact on the after-tax cost of debt.

Suppose NCC can issue 30-year debt with an annual coupon rate of 11%, with coupons paid semiannually. The flotation costs, F , are equal to 1% of the value of

⁴The federal tax rate for most corporations is 35%. However, most corporations are also subject to state income taxes, so the marginal tax rate on most corporate income is about 40%. For illustrative purposes, we assume that the effective federal-plus-state tax rate on marginal income is 40%. The effective tax rate is zero for a firm with such large current or past losses that it does not pay taxes. In this situation the after-tax cost of debt is equal to the pre-tax interest rate.

⁵Strictly speaking, the after-tax cost of debt should reflect the *expected* cost of debt. While NCC's bonds have a promised return of 11%, there is some chance of default, so its bondholders' expected return (and consequently NCC's cost) is a bit less than 11%. However, for a relatively strong company such as NCC, this difference is quite small.

the issue. Instead of finding the pre-tax yield based upon pre-tax cash flows and then adjusting it to reflect taxes, as we did in the example above, we can find the after-tax cost of debt based upon after-tax cash flows using this formula:

$$M(1 - F) = \sum_{t=1}^N \frac{\text{INT}(1 - T)}{[1 + r_d(1 - T)]^t} + \frac{M}{[1 + r_d(1 - T)]^N} \quad (10-2)$$

Here M is the bond's par value, F is the **percentage flotation cost** (i.e., the percentage of proceeds), N is the number of payments, T is the firm's tax rate, INT is the dollars of interest per period, and $r_d(1 - T)$ is the after-tax cost of debt adjusted for flotation costs. With a financial calculator, enter $N = 60$, $PV = -1000(1 - 0.01) = -990$, $PMT = 55(1 - 0.40) = 33$, and $FV = 1000$. Solving for I/YR , we find $I/YR = r_d(1 - T) = 3.38\%$, which is the semiannual after-tax component cost of debt. The nominal after-tax cost of debt is 6.68%. Note that this is quite close to the original 6.60% after-tax cost, so in this instance adjusting for flotation costs doesn't make much difference.⁶

However, the flotation adjustment would be higher if F were larger or if the bond's life were shorter. For example, if F were 10% rather than 1%, then the nominal annual flotation-adjusted $r_d(1 - T)$ would be 7.44%. With N at 1 year rather than 30 years, and F still equal to 1%, then the nominal annual $r_d(1 - T) = 7.66\%$. Finally, if $F = 10\%$ and $N = 1$, then the nominal annual $r_d(1 - T) = 17.97\%$. In all of these cases, the differential would be too high to ignore.

As an alternative to adjusting the cost of debt for flotation costs, in some situations it makes sense to instead adjust the project's cash flows. For example, **project financing** is a special situation in which a large project, such as an oil refinery, is financed with debt and other securities that have a specific claim on the project's cash flows. Notice that this is different from the usual debt offering, in which the debt has a claim on the corporation's cash flows. Because project financing is funded by securities with claims tied to a particular project, the flotation costs can be included with the project's other cash flows when evaluating the value of the project. However, project financing is relatively rare, so when we incorporate the impact of flotation costs, we usually do so by adjusting the component cost of new financing.

SELF-TEST

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

Is the relevant cost of debt the interest rate on already *outstanding* debt or that on *new* debt? Why?

A company has outstanding long-term bonds with a face value of \$1,000, a 10% coupon rate, 25 years remaining until maturity, and a current market value of \$1,214.82. If it pays interest semiannually, what is the nominal annual pre-tax cost of debt? If the company's tax rate is 40%, what is the after-tax cost of debt? (8%; 4.8%)

10.3 Cost of Preferred Stock, r_{ps}

A number of firms, including NCC, use preferred stock as part of their permanent financing mix. Preferred dividends are not tax deductible. Therefore, the company bears their full cost, and *no tax adjustment is used when calculating the cost of preferred stock*. Note too that while some preferred stocks are issued without a stated maturity date, today most have a sinking fund that effectively limits their life. Finally,

⁶Equation 10-2 produces the correct after-tax cost of debt only for bonds issued at par. For bonds with a price other than par, the after-tax cash flows must be adjusted to take into account the actual taxation of the discount or premium. See **Web Extension 5A** at the textbook's Web site for a discussion of the taxation of original issue discount bonds.

although it is not mandatory that preferred dividends be paid, firms generally have every intention of doing so, because otherwise (1) they cannot pay dividends on their common stock, (2) they will find it difficult to raise additional funds in the capital markets, and (3) in some cases preferred stockholders can take control of the firm.

The **component cost of preferred stock**, r_{ps} , is the cost used in weighted average cost of capital calculation. For preferred stock with a stated maturity date, we use the same approach as in the previous section for the cost of debt, keeping in mind that a firm has no tax saving with preferred stock. For preferred stock without a stated maturity date, r_{ps} is

$$\text{Component cost of preferred stock} = r_{ps} = \frac{D_{ps}}{P_{ps}(1 - F)} \quad (10-3)$$

where D_{ps} is the preferred dividend, P_{ps} is the preferred stock price, and F is flotation cost as a percentage of proceeds.

To illustrate the calculation, assume that NCC has preferred stock that pays a \$10 dividend per share and sells for \$100 per share. If NCC issued new shares of preferred, it would incur an underwriting (or flotation) cost of 2.5%, or \$2.50 per share, so it would net \$97.50 per share. Therefore, NCC's cost of preferred stock is 10.3%:

$$r_{ps} = \$10/\$97.50 = 10.3\%.$$

If we had not incorporated flotation costs, we would have incorrectly estimated $r_{ps} = \$10/\$100 = 10.0\%$, which is too big a difference to ignore. Therefore, analysts usually include flotation costs when estimating the cost of preferred stock.

SELF-TEST

Does the component cost of preferred stock include or exclude flotation costs? Explain.

Why is no tax adjustment made to the cost of preferred stock?

A company's preferred stock currently trades at \$50 per share and pays a \$3 annual dividend per share. Flotation costs are equal to 3% of the proceeds. If the company issues preferred stock, what is cost of the newly issued preferred stock? (6.19%)

10.4 Cost of Common Stock, r_s

Companies can raise common equity in two ways: (1) directly, by issuing new shares, and (2) indirectly, by reinvesting, or retaining, earnings. If new shares are issued, what rate of return must the company earn to satisfy the new stockholders? In Chapter 6, we saw that investors require a return of r_s . However, a company must earn more than r_s on new external equity to provide this rate of return to investors because there are commissions and fees, called flotation costs, when a firm issues new equity.

Few mature firms issue new shares of common stock through public offerings.⁷ In fact, less than 2% of all new corporate funds come from the external public equity market. There are three reasons for this:

1. Flotation costs can be quite high, as we show later in this chapter.
2. Investors perceive issuing equity as a negative signal about the true value of the company's stock. Investors believe that managers have superior knowledge

⁷A few companies issue new shares through new-stock dividend reinvestment plans, which we discuss in Chapter 18. Also, quite a few companies sell stock to their employees, and companies occasionally issue stock to finance huge projects or mergers.

about companies' future prospects, and that managers are most likely to issue new stock when they think the current stock price is higher than the true value. Therefore, if a mature company announces plans to issue additional shares, this typically causes its stock price to decline.

3. An increase in the supply of stock will put pressure on the stock's price, forcing the company to sell the new stock at a lower price than existed before the new issue was announced.

Therefore, we assume that the companies in the following examples do not plan to issue new shares.⁸ We will address the impact of flotation costs on the cost of equity later in the chapter.

Does new equity capital raised indirectly by retaining earnings have a cost? The answer is a resounding yes. If some earnings are retained, then stockholders will incur an **opportunity cost**—the earnings could have been paid out as dividends (or used to repurchase stock), in which case stockholders could then have reinvested the money in other investments. *Thus, the firm should earn on its reinvested earnings at least as much as its stockholders themselves could earn on alternative investments of equivalent risk.*

What rate of return can stockholders expect to earn on equivalent-risk investments? The answer is r_s , because they expect to earn that return by simply buying the stock of the firm in question or that of a similar firm. *Therefore, r_s is the cost of common equity raised internally by reinvesting earnings.* If a company cannot earn at least r_s on reinvested earnings, then it should pass those earnings on to its stockholders and let them invest the money themselves in assets that do provide r_s .

Whereas debt and preferred stock are contractual obligations that have easily determined costs, it is more difficult to estimate r_s . However, we can employ the principles described in Chapters 6, 7, and 8 to produce reasonably good cost of equity estimates. Three methods typically are used: (1) the Capital Asset Pricing Model (CAPM), (2) the discounted cash flow (DCF) method, and (3) the bond-yield-plus-risk-premium approach. These methods are not mutually exclusive. When faced with the task of estimating a company's cost of equity, we generally use all three methods and then choose among them on the basis of our confidence in the input data available for the specific case at hand.

SELF-TEST

What are the two sources of equity capital?

Why do most established firms not issue additional shares of common equity?

Explain why there is a cost to using reinvested earnings; that is, why aren't reinvested earnings a free source of capital?

10.5 The CAPM Approach

To estimate the cost of common stock using the Capital Asset Pricing Model (CAPM) as discussed in Chapter 6, we proceed as follows:

Step 1. Estimate the risk-free rate, r_{RF} .

Step 2. Estimate the current expected market risk premium, RP_M , which is the expected market return minus the risk-free rate.

Step 3. 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.

⁸There are times when companies should issue stock in spite of these problems; hence we discuss stock issues and the cost of equity later in the chapter.

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

$$r_s = r_{RF} + (RP_M)b_i \quad (10-4)$$

Equation 10-4 shows that the CAPM estimate of r_s begins with the risk-free rate, r_{RF} , to which is added a risk premium set equal to the risk premium on the market, RP_M , scaled up or down to reflect the particular stock's risk as measured by its beta coefficient. The following sections explain how to implement the four-step process.

Estimating the Risk-Free Rate

The starting point for the CAPM cost of equity estimate is r_{RF} , the risk-free rate. There is really no such thing as a truly riskless asset in the U.S. economy. Treasury securities are essentially free of default risk, but nonindexed long-term T-bonds will suffer capital losses if interest rates rise, and a portfolio of short-term T-bills will provide a volatile earnings stream because the rate earned on T-bills varies over time.

Since we cannot in practice find a truly riskless rate upon which to base the CAPM, what rate should we use? A survey of highly regarded companies shows that about two-thirds of the companies use the rate on long-term Treasury bonds.⁹ We agree with their choice, and here are our reasons:

1. Common stocks are long-term securities, and although a particular stockholder may not have a long investment horizon, most stockholders do invest on a long-term basis. Therefore, it is reasonable to think that stock returns embody long-term inflation expectations similar to those reflected in bonds rather than the short-term expectations in bills.
2. Treasury bill rates are more volatile than are Treasury bond rates and, most experts agree, more volatile than r_s .¹⁰
3. In theory, the CAPM is supposed to measure the expected return over a particular holding period. When it is used to estimate the cost of equity for a project, the theoretically correct holding period is the life of the project. Since many projects have long lives, the holding period for the CAPM also should be long. Therefore, the rate on a long-term T-bond is a logical choice for the risk-free rate.

In light of the preceding discussion, we believe that the cost of common equity is more closely related to Treasury bond rates than to T-bill rates. This leads us to favor T-bonds as the base rate, or r_{RF} , in a CAPM cost of equity analysis. T-bond rates can be found in *The Wall Street Journal* or the *Federal Reserve Bulletin*. Many analysts use the yield on a 10-year T-bond as a proxy for the risk-free rate, although the yields on a 20-year or 30-year T-bond are also reasonable proxies.



To find the rate on a T-bond, go to <http://www.federalreserve.gov>. Select "Economic Research and Data," and then select "Statistics: Releases and Historical Data." Click on "Daily" for H.15, "Interest Rates."

⁹See Robert E. Bruner, Kenneth M. Eades, Robert S. Harris, and Robert C. Higgins, "Best Practices in Estimating the Cost of Capital: Survey and Synthesis," *Financial Practice and Education*, Spring/Summer 1998, pp. 13–28.

¹⁰Economic events usually have a larger impact on short-term rates than on long-term rates. For example, see the analysis of the 1995–1996 federal debt limit disagreement between the White House and Congress provided in Srinivas Nippani, Pu Liu, and Craig T. Schulman, "Are Treasury Securities Free of Default?" *Journal of Financial and Quantitative Analysis*, June 2001, pp. 251–266.

Estimating the Market Risk Premium

The market risk premium, RP_M , is the expected market return minus the risk-free rate. This is also called the **equity risk premium**, or just the **equity premium**. It is caused by investor risk aversion: Since most investors are averse to risk, they require a higher expected return (a risk premium) to induce them to invest in risky equities versus relatively low-risk debt. The premium can be estimated on the basis of (1) historical data or (2) forward-looking data.

Historical Risk Premium Historical risk premium data for U.S. securities, updated annually, are available from Ibbotson Associates.¹¹ Their study includes historical data on stocks, T-bills, T-bonds, and corporate bonds from 1926 through the latest year (2005 currently). Ibbotson calculates the actual realized rates of return on each set of securities and defines the historical market risk premium on common stocks as the difference between the historical realized returns on stocks and T-bonds. Ibbotson's latest study reports a 6.6% arithmetic average historical risk premium and a 5.1% geometric average historical risk premium. If investor risk aversion had actually been constant during their sample period, then the arithmetic average would be the best estimate for next year's risk premium, while the geometric average would be the best estimate for the longer-term risk premium, say, for the next 20 years.

For many years, academic researchers and corporate analysts used the Ibbotson historical risk premium to estimate the current equity risk premium, under the assumption that the risk premium doesn't change over time. However, this approach has come under fire in recent years. For example, in 2000, 2001, and 2002, bonds had higher returns than stocks. This caused negative realized risk premiums during those years, which reduced the historical average risk premium. However, most knowledgeable observers believe that the true equity risk premium actually increased during the 2000–2002 period and that the increasing premium contributed to the declining stock market during those years; an increasing risk premium caused higher costs of equity, lower stock prices, and, thus, lower stock returns. As this shows, an increase in the current risk premium causes a decrease in the historical premium, and vice versa. Thus, greater risk aversion by investors will cause a lower historical risk premium as reported by Ibbotson, the exact opposite of its true effect. If risk aversion does vary over time, as many experts believe, it throws a lot of cold water on those who use the historical risk premium to estimate the current premium.



Go to <http://investor.reuters.com>, enter the ticker symbol for any company, and then click Go. Select "Ratios" from the column on the left. This page provides current values for the dividend yield of the company, industry, sector, and the S&P 500. The link "Estimates" at the bottom of the page takes you to forecasts of growth rates in sales, dividends, and earnings for the next 5 years for the company.

Forward-Looking Risk Premiums An alternative to the historical risk premium is to estimate a forward-looking, or ex ante, risk premium. The market risk premium, RP_M , can be estimated as $r_M - r_{RF}$. The risk-free rate is observable, so the key is to estimate the required return on the market. The most common approach is to use the discounted cash flow (DCF) model to estimate the expected market rate of return, \hat{r}_M . If the market is in equilibrium, then the expected return is equal to the required return: $\hat{r}_M = r_M$:

$$\text{Expected rate of return} = \hat{r}_M = \frac{D_1}{P_0} + g = r_{RF} + RP_M = r_M = \text{Required rate of return.}$$

¹¹See *Stocks, Bonds, Bills, and Inflation: Valuation Edition 2006 Yearbook* (Chicago: Ibbotson Associates, 2006).

In words, the required return on the market is the sum of the expected dividend yield plus the expected growth rate. Note that the expected dividend yield, D_1/P_0 , can be found using the current dividend yield and the expected growth rate: $D_1/P_0 = D_0(1 + g)/P_0$. Therefore, to estimate the required return on the market, all you need are estimates of the current dividend yield and the expected growth rate in dividends. Several data sources report the current dividend yield on the market, as measured by the S&P 500. For example, in mid-2006 Reuters.com reports a current dividend yield of 2.22% for the S&P 500.

It is much more difficult to obtain an estimate of the expected dividend growth rate. What we really need is the long-run dividend growth rate that a marginal investor expects to obtain if he or she buys a broad portfolio of stocks. Since we cannot identify the marginal investors, let alone get inside their heads, it is impossible to obtain a direct estimate of the relevant growth rate. Faced with these data limitations, analysts usually estimate the expected dividend growth rate in one of two ways: (1) the historical dividend growth rate or (2) analysts' forecasts for earnings growth rates as an approximation for expected dividend growth.

For example, Reuters.com reports a 9.58% annual growth rate of dividends for the S&P 500 during the past 5 years. Using the current dividend yield of 2.22%, the estimated market return is

$$\begin{aligned} r_M &= \left[\frac{D_0}{P_0} (1 + g) \right] + g \\ &= [0.0222(1 + 0.0958)] + 0.0958 \\ &= 0.1201 = 12.01\%. \end{aligned}$$

Given a current (mid-2006) long-term T-bond rate of around 5.2%, the estimated forward-looking risk premium from this approach is about $12.01\% - 5.2\% = 6.81\%$. However, the problems here are similar to those encountered with historical risk premiums—there is no compelling reason to believe that investors expect future growth to be exactly like past growth, and past growth rates are extremely sensitive to the period over which growth is measured. In addition, many companies have small dividend payments but repurchase stock as a way to return free cash flow to investors. We discuss this more in Chapter 18, but the implication here is that historical dividend growth rates don't truly reflect the cash distributions to investors.

The second approach for estimating the expected dividend growth rate is to obtain published forecasts from security analysts. Unfortunately, analysts generally forecast earnings growth rates, not dividend growth rates, and the longest forecast period is typically 5 years.¹² For example, Yahoo!Finance reports a 10.68% forecasted earnings 5-year growth rate for the S&P 500. If we use this earnings growth rate as an approximation of the dividend growth rate, then the estimated market return is

$$\begin{aligned} r_M &= \left[\frac{D_0}{P_0} (1 + g) \right] + g \\ &= [0.0222(1 + 0.1068)] + 0.1068 \\ &= 0.1314 = 13.14\%. \end{aligned}$$



To find an estimate of earnings growth, go to <http://finance.yahoo.com>, get a quote for any stock, and then select "Analyst Estimates" from the column on the left.

¹²In theory, the constant growth rate for sales, earnings, and dividends ought to be equal. However, this has not been true for past growth rates. For example, the S&P 500 has had past 5-year annual average growth rates of 9.59% for sales, 13.6% for earnings per share, and 9.58% for dividends.

Given a current long-term T-bond rate of 5.2%, the estimated forward-looking risk premium from this approach is $13.14\% - 5.2\% = 7.94\%$. Notice that this is quite a bit higher than our previous estimate based on the historical dividend growth rate.

Unfortunately, there are problems with this approach, too. (1) Earnings growth rates and dividend growth rates are not always identical. (2) The accuracy (and truthfulness) of analysts who work for investment banking firms has been questioned in recent years. This suggests that it might be better to use the forecasts of independent analysts, such as those who work for publications like *Value Line*, rather than those who work for the large investment banking firms. (3) Different analysts have different opinions, leading to very different growth rate estimates.

To muddy the water a bit further, some academics have recently argued for a much lower market risk premium. Eugene Fama and Kenneth French examined earnings and dividend growth rates during the period from 1951 to 2000 and found the forward-looking market risk premium to be 2.55%. Jay Ritter argues that the forward-looking market risk premium should be based on inflation-adjusted expected returns and should be even lower—closer to 1%.¹³

Our View on the Market Risk Premium After reading the previous sections, you might well be confused about the correct market risk premium, since the different approaches give different results. Here is our opinion. The risk premium is driven primarily by investors' attitudes toward risk, and there are good reasons to believe that investors are less risk averse today than 50 years ago. The advent of pension plans, Social Security, health insurance, and disability insurance means that people today can take more chances with their investments, which should make them less risk averse. Also, many households have dual incomes, which also allows investors to take more chances. Finally, the historical average return on the market as Ibbotson measures it is probably too high due to a survivorship bias. Putting it all together, we conclude that the true risk premium in 2006 is lower than the long-term historical average.

But how much lower is the current premium? In our consulting, we typically use a risk premium of about 5%, but we would have a hard time arguing with someone who used a risk premium in the range of 3.5 to 6.5%. We believe that investor risk aversion is relatively stable but not absolutely constant from year to year. When market prices are relatively high, then investors are feeling less risk averse, so we use a risk premium at the low end of our range. Conversely, we use a risk premium at the high end of our range when market prices are relatively low. The bottom line is that there is no way to prove that a particular risk premium is either right or wrong, although we would be suspicious of an estimated market premium that is less than 3.5% or greater than 6.5%.¹⁴

Estimating Beta

Recall from Chapter 6 that beta is usually estimated as the slope coefficient in a regression, with the company's stock returns on the y-axis and market returns on the x-axis. The resulting beta is called the *historical beta*, since it is based on historical data.

¹³See Eugene F. Fama and Kenneth R. French, "The Equity Premium," *Journal of Finance*, April 2002, pp. 637–659; and Jay Ritter, "The Biggest Mistakes We Teach," *Journal of Financial Research*, Summer 2002, pp. 159–168.

¹⁴For more on estimating the risk premium, see Eugene F. Brigham and Steve R. Vinson, "The Risk Premium Approach to Measuring a Utility's Cost of Equity," *Financial Management*, Spring 1985, pp. 33–45; and Robert S. Harris and Felicia C. Marston, "Estimating Shareholder Risk Premia Using Analysts' Growth Forecasts," *Financial Management*, Summer 1992, pp. 63–70.

Although this approach is conceptually straightforward, complications quickly arise in practice.

First, there is no theoretical guidance as to the correct holding period over which to measure returns. The returns for a company can be calculated using daily, weekly, or monthly time periods, and the resulting estimates of beta will differ. Beta is also sensitive to the number of observations used in the regression. With too few observations, the regression loses statistical power, but with too many, the “true” beta may have changed during the sample period. In practice, it is common to use either 4 to 5 years of monthly returns or 1 to 2 years of weekly returns.

Second, the market return should, theoretically, reflect every asset, even the human capital being built by students. In practice, however, it is common to use only an index of common stocks such as the S&P 500, the NYSE Composite, or the Wilshire 5000. Even though these indexes are highly correlated with one another, using different indexes in the regression will often result in different estimates of beta.

Third, some organizations modify the calculated historical beta in order to produce what they deem to be a more accurate estimate of the “true” beta, where the true beta is the one that reflects the risk perceptions of the marginal investor. One modification, called an *adjusted beta*, attempts to correct a possible statistical bias by adjusting the historical beta to make it closer to the average beta of 1.0. A second modification, called a *fundamental beta*, incorporates information about the company, such as changes in its product lines and capital structure.

Fourth, even the best estimates of beta for an individual company are statistically imprecise. The average company has an estimated beta of 1.0, but the 95% confidence interval ranges from about 0.6 to 1.4. For example, if your regression produces an estimated beta of 1.0, then you can be 95% sure that the true beta is in the range of 0.6 to 1.4.

The preceding discussion refers to conditions in the United States and other countries with well-developed financial markets, where relatively good data are available. Still, as we have seen, beta can only be estimated within a fairly wide range. When we move on to countries with less-developed financial markets, we are even less certain about the true size of a company’s beta.

Moreover, further complications arise when we are dealing with multinational companies, especially those that raise equity capital in different parts of the world. We might, for example, be relatively confident in the beta calculated for the parent company in its home country but less confident of the betas for subsidiaries located in other countries. When such complications arise, we are often forced to make “educated guesses” as to the appropriate beta. It would, of course, be nice to have exact, precise numbers for everything and thus be able to make decisions with a great deal of confidence. However, that’s just not the way the world is—we are often forced to use judgment, and our discussion should help improve your judgment regarding the choice of beta for use in cost of capital studies.

An Illustration of the CAPM Approach

To illustrate the CAPM approach for NCC, assume that $r_{RF} = 8\%$, $RP_M = 6\%$, and $b_i = 1.1$, indicating that NCC is somewhat riskier than average. Therefore, NCC’s cost of equity is 14.6%:

$$\begin{aligned} r_s &= 8\% + (6\%)(1.1) \\ &= 8\% + 6.6\% \\ &= 14.6\%. \end{aligned}$$



To find an estimate of beta, go to <http://investor.reuters.com> and enter the ticker symbol for a stock quote. Or go to Thomson ONE—Business School Edition. Beta is shown in the section of Key Fundamentals.

It should be noted that although the CAPM approach appears to yield an accurate, precise estimate of r_s , it is hard to know the correct estimates of the inputs required to make it operational because (1) it is hard to estimate precisely the beta that investors expect the company to have in the future, and (2) it is difficult to estimate the market risk premium. Despite these difficulties, surveys indicate that CAPM is the preferred choice for the vast majority of companies.

SELF-TEST

What is generally considered to be the most appropriate estimate of the risk-free rate, the yield on a short-term T-bill or the yield on a long-term T-bond?

Explain the two methods for estimating the market risk premium, that is, the historical data approach and the forward-looking approach.

What are some of the problems encountered when estimating beta?

A company's beta is 1.4. The yield on a long-term T-bond is 5%. If the market risk premium is 5.5%, what is r_s ? (12.7%)

10.6 Dividend-Yield-Plus-Growth-Rate, or Discounted Cash Flow (DCF), Approach

In Chapter 8, we saw that if dividends are expected to grow at a constant rate, then the price of a stock is

$$P_0 = \frac{D_1}{r_s - g}. \quad (10-5)$$

Here P_0 is the current price of the stock, D_1 is the dividend expected to be paid at the end of Year 1, and r_s is the required rate of return. 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:

$$r_s = \hat{r}_s = \frac{D_1}{P_0} + \text{Expected } g. \quad (10-6)$$

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 . 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 markets are at equilibrium (which means that $r_s = \hat{r}_s$), so we can use the terms r_s and \hat{r}_s interchangeably.

Estimating Inputs for the DCF Approach

Three inputs are required to use the DCF approach: the current stock price, the current dividend, and the expected growth in dividends. Of these inputs, the growth rate is by far the most difficult to estimate. The following sections describe the most commonly used approaches for estimating the growth rate: (1) historical growth rates, (2) the retention growth model, and (3) analysts' forecasts.

Historical Growth Rates First, if earnings and dividend growth rates have been relatively stable in the past, and if investors expect these trends to continue, then

the past realized growth rate may be used as an estimate of the expected future growth rate.

We explain several different methods for estimating historical growth rates in *Web Extension 10A*. For NCC, these different methods produce estimates of historical growth ranging from 4.6% to 11.0%, with most estimates fairly close to 7%.

As the *Tool Kit* shows, one can take a given set of historical data and, depending on the years and the calculation method used, obtain a large number of quite different growth rates. Now recall our purpose in making these calculations: We are seeking the future dividend growth rate that investors expect, and we reasoned that, if past growth rates have been stable, then investors might base future expectations on past trends. This is a reasonable proposition, but, unfortunately, we rarely find much historical stability. Therefore, the use of historical growth rates in a DCF analysis must be applied with judgment, and also be used (if at all) in conjunction with other growth estimation methods, as discussed next.

Retention Growth Model Most firms pay out some of their net income as dividends and reinvest, or retain, the rest. The payout ratio is the percent of net income that the firm pays out as a dividend, defined as total dividends divided by net income; see Chapter 4 for more details on ratios. The retention ratio is the complement of the payout ratio: Retention ratio = $(1 - \text{Payout ratio})$. ROE is the return on equity, defined as net income available for common stockholders divided by common equity. Although we don't prove it here, you should find it reasonable that the growth rate of a firm will depend on the amount of net income that it retains and the rate it earns on the retentions. Using this logic, we can write the **retention growth model**:

$$g = \text{ROE}(\text{Retention ratio}). \quad (10-7)$$

Equation 10-7 produces a constant growth rate, but when we use it we are, by implication, making four important assumptions: (1) We expect the payout rate, and thus the retention rate, to remain constant; (2) we expect the return on equity on new investment to remain constant; (3) the firm is not expected to issue new common stock, or, if it does, we expect this new stock to be sold at a price equal to its book value; and (4) future projects are expected to have the same degree of risk as the firm's existing assets.

NCC has had an average return on equity of about 14.5% over the past 15 years. The ROE has been relatively steady, but even so it has ranged from a low of 11.0% to a high of 17.6%. In addition, NCC's dividend payout rate has averaged 0.52 over the past 15 years, so its retention rate has averaged $1.0 - 0.52 = 0.48$. Using Equation 10-7, we estimate g to be 7%:¹⁵

$$g = 14.5\%(0.48) = 7\%.$$

Analysts' Forecasts A third technique calls for using security analysts' forecasts. Analysts publish earnings' growth rate estimates for most of the larger publicly owned companies. For example, *Value Line* provides such forecasts on 1,700



e-resource

See **Web Extension 10A** at the textbook's Web site. The **Web 10A** worksheet in the file **FM12 Ch 10 Tool Kit.xls** shows all calculations.

¹⁵The retention growth model can also be applied to find the market's growth rate by using the market's payout ratio and ROE. For example, in mid-2006, Reuters reports a dividend payout ratio of 28.63% and current ROE of 19.8% for the S&P 500. This implies $g = 0.198(1 - 0.2863) = 0.1413 = 14.13\%$ for the market.



For example, see <http://www.zacks.com>.



e-resource

See **Web Extension 10B** at the textbook's Web site for an explanation of this approach; all calculations are in the worksheet **Web 10B** in the file **FM12 Ch 10 Tool Kit.xls**.

companies, and all of the larger brokerage houses provide similar forecasts. Further, several companies compile analysts' forecasts on a regular basis and provide summary information such as the median and range of forecasts on widely followed companies. These growth rate summaries, such as those compiled by Zack's or by Thomson ONE, can be found on the Internet. These earnings' growth rates are often used as estimates of dividend growth rates.

However, these forecasts often involve nonconstant growth. For example, some analysts were forecasting that NCC would have a 10.4% annual growth rate in earnings and dividends over the next 5 years, but a growth rate after 5 years of 6.5%.

This nonconstant growth forecast can be used to develop a proxy constant growth rate. Computer simulations indicate that dividends beyond Year 50 contribute very little to the value of any stock—the present value of dividends beyond Year 50 is virtually zero, so for practical purposes, we can ignore anything beyond 50 years. If we consider only a 50-year horizon, we can develop a weighted average growth rate and use it as a constant growth rate for cost of capital purposes. In the NCC case, we assumed a growth rate of 10.4% for 5 years followed by a growth rate of 6.5% for 45 years. We weight the short-term growth by $5/50 = 10\%$ and the long-term growth by $45/50 = 90\%$. This produces an average growth rate of $0.10(10.4\%) + 0.90(6.5\%) = 6.9\%$.

Rather than convert nonconstant growth estimates into an approximate average growth rate, it is possible to use the nonconstant growth estimates to directly estimate the required return on common stock.

Illustration of the Discounted Cash Flow Approach

To illustrate the DCF approach, suppose NCC's stock sells for \$32; its next expected dividend is \$2.40; and its expected growth rate is 7%. NCC's expected and required rate of return, hence its cost of common stock, would then be 14.5%:

$$\begin{aligned}\hat{r}_s = r_s &= \frac{\$2.40}{\$32.00} + 7.0\% \\ &= 7.5\% + 7.0\% \\ &= 14.5\%.\end{aligned}$$

Evaluating the Methods for Estimating Growth

Note that the DCF approach expresses the cost of common equity as the dividend yield (the expected dividend divided by the current price) plus the growth rate. The dividend yield can be estimated with a high degree of certainty, but uncertainty in the growth estimate induces uncertainty in the DCF cost estimate. We discussed three methods for estimating future growth: (1) historical growth rates, (2) retention growth model, and (3) analysts' forecasts. Of these three methods, studies have shown that analysts' forecasts usually represent the best source of growth rate data for DCF cost of capital estimates.¹⁶

¹⁶See Robert Harris, "Using Analysts' Growth Rate Forecasts to Estimate Shareholder Required Rates of Return," *Financial Management*, Spring 1986, pp. 58–67. Analysts' forecasts are the best predictors of actual future growth, and also the growth rate investors say they use in valuing stocks. Also see Stephen G. Timme and Peter C. Eisemann, "On the Use of Consensus Forecasts of Growth in the Constant Growth Model: The Case of Electric Utilities," *Financial Management*, Winter 1989, pp. 23–35.

SELF-TEST

What inputs are required for the DCF method?

What are the ways to estimate the dividend growth rate?

Which of these methods provides the best estimate?

A company's estimated growth rate in dividends is 6%. Its current stock price is \$40 and its expected annual dividend is \$2. Using the DCF approach, what is r_s ? (11%)

10.7 Bond-Yield-Plus-Risk-Premium Approach

Some analysts use a subjective, ad hoc procedure to estimate a firm's cost of common equity: They simply add a judgmental risk premium of 3 to 5 percentage points to the interest rate on the firm's own long-term debt. It is logical to think that firms with risky, low-rated, and consequently high-interest-rate debt will also have risky, high-cost equity, and the procedure of basing the cost of equity on a readily observable debt cost utilizes this logic. In this approach,

$$r_s = \text{Bond yield} + \text{Bond risk premium.} \quad (10-8)$$

The bonds of NCC have a yield of 11.0%. If its bond risk premium is estimated as 3.7%, its estimated cost of equity is 14.7%:

$$r_s = 11.0\% + 3.7\% = 14.7\%.$$

Because the 3.7% risk premium is a judgmental estimate, the estimated value of r_s is also judgmental. Empirical work suggests that the risk premium over a firm's own bond yield has generally ranged from 3 to 5 percentage points, with recent values close to 3%. With such a large range, this method is not likely to produce a precise cost of equity. However, it can get us "into the right ballpark."

SELF-TEST

What is the reasoning behind the bond-yield-plus-risk-premium approach?

A company's bond yield is 7%. If the appropriate bond risk premium is 3.5%, what is r_s , based on the bond-yield-plus-risk-premium approach? (10.5%)

10.8 Comparison of the CAPM, DCF, and Bond-Yield-Plus-Risk-Premium Methods

We have discussed three methods for estimating the required return on common stock. For NCC, the CAPM estimate is 14.6%, the DCF constant growth estimate is 14.5%, and the bond-yield-plus-risk-premium is 14.7%. The overall average of these three methods is $(14.6\% + 14.5\% + 14.7\%)/3 = 14.6\%$. These results are unusually consistent, so it would make little difference which one we used. However, if the methods produced widely varied estimates, then a financial analyst would have to use his or her judgment as to the relative merits of each estimate and then choose the estimate that seemed most reasonable under the circumstances.

Recent surveys found that the CAPM approach is by far the most widely used method. Although most firms use more than one method, almost 74% of respondents

in one survey, and 85% in the other, used the CAPM.¹⁷ This is in sharp contrast to a 1982 survey, which found that only 30% of respondents used the CAPM.¹⁸ Approximately 16% now use the DCF approach, down from 31% in 1982. The bond-yield-plus-risk-premium is used primarily by companies that are not publicly traded.

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 exact cost of equity capital. Unfortunately, this is not possible—finance is in large part a matter of judgment, and we simply must face that fact.

SELF-TEST

Which approach for estimating the required return on common stock is used most often by businesses today?

10.9 Adjusting the Cost of Stock for Flotation Costs

As explained earlier, most mature companies rarely issue new public equity. However, for those that do, the **cost of new common equity**, r_e , or external equity, is higher than the cost of equity raised internally by reinvesting earnings, r_s , because of **flotation costs** involved in issuing new common stock. What rate of return must be earned on funds raised by selling new stock to make issuing stock worthwhile? To put it another way, what is the cost of new common stock?

The answer for a constant growth stock is found by applying this formula:

$$r_e = \hat{r}_e = \frac{D_1}{P_0(1 - F)} + g \quad (10-9)$$

In Equation 10-9, F is the percentage flotation cost incurred in selling the new stock, so $P_0(1 - F)$ is the net price per share received by the company.

Using the same inputs as before when we estimated NCC's cost of stock using the DCF approach, but assuming that NCC has a flotation cost of 10%, its cost of new outside equity is computed as follows:

$$\begin{aligned} r_e &= \frac{\$2.40}{\$32(1 - 0.10)} + 7.0\% \\ &= \frac{\$2.40}{\$28.00} + 7.0\% \\ &= 8.6\% + 7.0\% = 15.6\% \end{aligned}$$

As we calculated earlier using the DCF model but ignoring flotation costs, NCC's stockholders require a return of $r_s = 14.5\%$. However, because of flotation costs the company must earn *more* than 14.5% on the net funds obtained by selling stock if

¹⁷See John R. Graham and Campbell Harvey, "The Theory and Practice of Corporate Finance: Evidence from the Field," *Journal of Financial Economics*, 2001, pp. 187–243, and the paper cited in Footnote 9. Interestingly, a growing number of firms (about 34%) also are using CAPM-type models with more than one factor. Of these firms, over 40% include factors for interest-rate risk, foreign exchange risk, and business cycle risk (proxied by gross domestic product). More than 20% of these firms include a factor for inflation, size, and exposure to particular commodity prices. Less than 20% of these firms make adjustments due to distress factors, book-to-market ratios, or momentum factors.

¹⁸See Lawrence J. Gitman and Vincent Mercurio, "Cost of Capital Techniques Used by Major U.S. Firms: Survey Analysis of Fortune's 1000," *Financial Management*, 1982, pp. 21–29.

Table 10-1

Average Flotation Costs for Debt and Equity

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	2.32
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*, Spring 1996, pp. 59–74. Reprinted with permission.

investors are to receive a 14.5% return on the money they put up. Specifically, if the firm earns 15.6% 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, as a result, the price per share will not decline. If the firm earns less than 15.6%, then earnings, dividends, and growth will fall below expectations, causing the stock price to decline. If the firm earns more than 15.6%, the stock price will rise.

As we noted earlier, most analysts use the CAPM to estimate the cost of equity. In an earlier section, we estimated NCC's CAPM cost of equity as 14.6%. How could the analyst incorporate flotation costs? In the example above, application of the DCF methodology gives a cost of equity of 14.5% if flotation costs are ignored and a cost of equity of 15.6% if flotation costs are included. Therefore, flotation costs add 1.1 percentage points to the cost of equity ($15.6 - 14.5 = 1.1$). To incorporate flotation costs into the CAPM estimate, you would add the 1.1 percentage points to the 14.6% CAPM estimate, resulting in a 15.7% estimated cost of external equity. As an alternative, you could find the average of the CAPM, DCF, and bond-yield-plus-risk-premium costs of equity ignoring flotation costs, and then add to it the 1.1 percentage points due to flotation costs.

Table 10-1 shows the average flotation cost for debt and equity issued by U.S. corporations in the 1990s. The common stock flotation costs are for non-IPOs. Costs associated with IPOs are even higher—about 17% of gross proceeds for common equity if the amount raised is less than \$10 million and about 6% if more than \$500 million is raised. The data include both utility and nonutility companies. If utilities were excluded, flotation costs would be even higher. Notice that flotation costs are higher for equity than for debt, and that flotation costs (as a percent of capital raised) fall as the amount of capital raised increases.

SELF-TEST

What are flotation costs?

Are flotation costs higher for debt or equity?

A firm has common stock with $D_1 = \$3.00$; $P_0 = \$30$; $g = 5\%$; and $F = 4\%$. If the firm must issue new stock, what is its cost of external equity, r_e ? (15.42%)

10.10 Composite, or Weighted Average, Cost of Capital, WACC

As we will see in Chapter 15, each firm has an optimal capital structure, defined as that mix of debt, preferred, and common equity that causes its stock price to be maximized. Therefore, a value-maximizing firm will establish a *target (optimal) capital structure* and then raise new capital in a manner that will 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 constantly on target. How the target is established is examined in Chapter 15.

The target proportions of debt, preferred stock, and common equity, along with the component costs of capital, are used to calculate the firm's WACC. To illustrate, suppose NCC has a target capital structure calling for 30% debt, 10% preferred stock, and 60% common equity. Its before-tax cost of debt, r_d , is 11%; its after-tax cost of debt is $r_d(1 - T) = 11\%(0.6) = 6.6\%$; its cost of preferred stock, r_{ps} , is 10.3%; its cost of common equity, r_s , is 14.6%; its marginal tax rate is 40%; and all of its new equity will come from retained earnings. We can calculate NCC's weighted average cost of capital, WACC, as follows:

$$\begin{aligned} \text{WACC} &= w_d r_d(1 - T) + w_{ps} r_{ps} + w_{ce} r_s \\ &= 0.3(11.0\%)(0.6) + 0.1(10.3\%) + 0.6(14.6\%) \quad (10-10) \\ &= 11.76\% \approx 11.8\%. \end{aligned}$$

Here w_d , w_{ps} , and w_{ce} are the weights used for debt, preferred, and common equity, respectively.

Every dollar of new capital that NCC obtains will on average consist of 30 cents of debt with an after-tax cost of 6.6%, 10 cents of preferred stock with a cost of 10.3%, and 60 cents of common equity with a cost of 14.6%. The average cost of each whole dollar, the WACC, is 11.8%.

Two points should be noted. First, the WACC is the current weighted average cost the company would face for a new, or *marginal*, dollar of capital—it is not the average cost of dollars raised in the past. Second, the percentages of each capital component, called weights, should be based on management's target capital structure, which is presumably an estimate of the firm's optimal capital structure. Here are the rationales for those points.

The required rates of return for a company's investors, whether they are new or old, are always marginal rates. For example, a stockholder might have invested in a company last year when the risk-free interest rate was 6% and might have had a required return on equity of 12%. If the risk-free rate subsequently falls and is now 4%, then the investor's required return on equity is now 10% (holding all else constant). This is the same required rate of return that a new equity holder would have, whether the new investor bought stock in the secondary market or through a new equity offering. In other words, whether the shareholders are already equity holders or are brand new equity holders, all have the same required rate of return, which is the current required rate of return on equity. The same reasoning applies for the firm's bondholders. All bondholders, whether old or new, have a required

Global Variations in the Cost of Capital

For U.S. firms to be competitive with foreign companies, they must have a cost of capital no greater than 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 a very low cost of capital, which lowered their total costs and thus made it hard for U.S. firms to compete. Recent events, however, have considerably narrowed cost of capital differences between U.S. and Japanese firms. In particular, the U.S. stock market has outperformed the Japanese market in the last decade, which has made it easier and cheaper for U.S. firms to raise equity capital.

As capital markets become increasingly integrated, cross-country differences in the cost 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 cost 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.

rate of return equal to the yield on the firm's debt, which is based on current market conditions.

Because all investors have required rates of return based on current market conditions rather than the past market conditions at the investments' purchase dates, the cost of capital depends on current conditions, not on historic or past market conditions. It is in this sense that the cost of capital is a marginal cost, since it depends on current market rates, which are the rates the company would pay on any new capital (ignoring flotation costs, which we discuss later in the chapter).

We have heard managers (and students!) say, "We are only raising debt this year, and it has a 5% after-tax cost, so we should use this, and not our 10% WACC, to evaluate this year's projects." Here is the flaw in that line of reasoning: Although some investors, such as debtholders, have higher-priority claims relative to other investors, *all* investors have claims on *all* future cash flows. For example, if a company raises debt and also invests in a new project that same year, the new debtholders don't have a specific claim on that specific project's cash flows (assuming it is not nonrecourse project financing). In fact, new debtholders receive a claim on the cash flows being generated by existing as well as new projects, while old debtholders (and equity holders) have claims on both new and existing projects. Thus, the decision to take on a new project should depend on the project's ability to satisfy all of the company's investors, not just the new debtholders, even if only debt is being raised that year.

An investor expects to receive a rate of return on the full amount that is at stake, which is the current market value of the investment. Therefore, the weights used in estimating the WACC should be based on market values, not book values. Recall from Chapter 4 that a firm's risk, as measured by its bond rating, affects its cost of debt. Recall also that the bond rating depends in part on the percentage of the firm that is financed with debt. As we show in Chapter 16, this also affects the cost of equity. In other words, the costs of debt and equity depend on the capital structure weights. However, these costs depend more on the future weights that investors expect than the current weights, which fluctuate due to market conditions and the most recent form of external financing (debt or equity). Thus, the

weights used in calculating the WACC should also be based on the expected future weights, which are the firm's target weights.

SELF-TEST

How is the weighted average cost of capital calculated? Write out the equation.

On what should the weights be based?

A firm has the following data: Target capital structure of 25% debt, 10% preferred stock, and 65% common equity; Tax rate = 40%; $r_d = 7\%$; $r_{ps} = 7.5\%$; and $r_s = 11.5\%$. Assume the firm will not issue new stock. What is this firm's WACC? (9.28%)

10.11 Factors That Affect the Weighted Average Cost of Capital

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

Factors the Firm Cannot Control

The three most important factors that are beyond a firm's direct control are (1) the level of interest rates, (2) the market risk premium, and (3) tax rates.

The Level of Interest Rates If interest rates in the economy rise, the cost of debt increases because firms will have to pay bondholders a higher interest rate to obtain debt capital. Also, recall from our discussion of the CAPM that higher interest rates increase the costs of common and preferred equity. During the 1990s, interest rates in the United States declined significantly and are still relatively low in mid-2006. This reduced the cost of both debt and equity capital for all firms, which encouraged additional investment. Lower interest rates also enabled U.S. firms to compete more effectively with German and Japanese firms, which in the past had enjoyed relatively low costs of capital.

Market Risk Premium The perceived risk inherent in stocks and investors' aversion to risk determine the market risk premium. Individual firms have no control over this factor, but it affects the cost of equity and, through a substitution effect, the cost of debt, and thus the WACC.

Tax Rates Tax rates, which are largely beyond the control of an individual firm (although firms do lobby for more favorable tax treatment), have an important effect on the cost of capital. Tax rates are used in the calculation of the cost of debt as used in the WACC, and there are other, less obvious ways in which tax policy affects the cost of capital. For example, lowering the capital gains tax rate relative to the rate on ordinary income would make stocks more attractive, which would reduce the cost of equity relative to that of debt. That would, as we see in Chapter 16, lead to a change in a firm's optimal capital structure toward less debt and more equity.

Factors the Firm Can Control

A firm can affect its cost of capital through (1) its capital structure policy, (2) its dividend policy, and (3) its investment (capital budgeting) policy.

Capital Structure Policy In this chapter, we assume that a firm has a given target capital structure, and we use weights based on that target structure to calculate the WACC. It is clear, though, that a firm can change its capital structure, and such a change can affect its cost of capital. First, beta is a function of financial leverage, so capital structure affects the cost of equity. Second, the after-tax cost of debt is lower than the cost of equity. Therefore, if the firm decides to use more debt and less common equity, this change in the weights in the WACC equation will tend to lower the WACC. However, an increase in the use of debt will increase the risk of both the debt and the equity, and increases in component costs will tend to offset the effects of the change in the weights. In Chapter 16 we discuss this in more depth, and we demonstrate that a firm's optimal capital structure is the one that minimizes its cost of capital.

Dividend Policy As we see in Chapter 18, the percentage of earnings paid out in dividends may affect a stock's required rate of return, r_s . Also, if a firm's payout ratio is so high that it must issue new stock to fund its capital budget, this will force it to incur flotation costs, and this too will affect its cost of capital. This second point is discussed in detail earlier in this chapter and also in Chapter 17.

Investment Policy 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 rates reflect the risk of the firm's existing assets. Therefore, we have implicitly been assuming that new capital will be invested in assets with the same degree of risk as existing assets. This assumption is generally correct, as most firms do invest in assets similar to those they currently use. However, it would be incorrect if a firm dramatically changed its investment policy. For example, if a firm invests in an entirely new line of business, its marginal cost of capital should reflect the risk of that new business. To illustrate, Time Warner's merger with AOL undoubtedly increased its risk and cost of capital.

SELF-TEST

What three factors that affect the cost of capital are generally beyond the firm's control?

What three policies under the firm's control are likely to affect its cost of capital?

Explain how a change in interest rates in the economy would affect each component of the weighted average cost of capital.

10.12 Adjusting the Cost of Capital for Risk

As we have calculated it, the cost of capital reflects the average risk and overall capital structure of the entire firm. But what if a firm has divisions in several business lines that differ in risk? Or what if a company is considering a project that is much riskier than its typical project? It doesn't make sense for a company to use its overall cost of capital to discount divisional or project-specific cash flows that don't have the same risk as the company's average cash flows. The following sections explain how to adjust the cost of capital for divisions and for specific projects.

The Divisional Cost of Capital

Consider Starlight Sandwich Shops, a company with two divisions—a bakery operation and a chain of cafes. The bakery division is low risk and has a 10% cost of capital. The cafe division is riskier and has a 14% cost of capital. Each division is approximately the same size, so Starlight's overall cost of capital is 12%. The bakery

manager has a project with an 11% expected rate of return, and the cafe division manager has a project with a 13% expected return. Should these projects be accepted or rejected? Starlight can create value if it accepts the bakery's project, since its rate of return is greater than its cost of capital ($11\% > 10\%$), but the cafe project's rate of return is less than its cost of capital ($13\% < 14\%$), so it should be rejected. However, if one simply compared the two projects' returns with Starlight's 12% overall cost of capital, then the bakery's value-adding project would be rejected while the cafe's value-destroying project would be accepted.

Many firms use the CAPM to estimate the cost of capital for specific divisions. To begin, recall that the Security Market Line equation expresses the risk/return relationship as follows:

$$r_s = r_{RF} + (RP_M)b_i.$$

As an example, consider the case of Huron Steel Company, an integrated steel producer operating in the Great Lakes region. For simplicity, assume that Huron has only one division and uses only equity capital, so its cost of equity is also its corporate cost of capital, or WACC. Huron's beta = $b = 1.1$; $r_{RF} = 7\%$; and $RP_M = 6\%$. Thus, Huron's cost of equity is 13.6%:

$$r_s = 7\% + (6\%)1.1 = 13.6\%.$$

This suggests that investors should be willing to give Huron money to invest in average-risk projects if the company expects to earn 13.6% or more on this money. By average risk we mean projects having risk similar to the firm's existing division.

Now suppose Huron creates a new transportation division consisting of a fleet of barges to haul iron ore, and barge operations have betas of 1.5 rather than 1.1. The barge division, with $b = 1.5$, has a 16.0% cost of capital:

$$r_{\text{Barge}} = 7\% + (6\%)1.5 = 16.0\%.$$

On the other hand, if Huron adds a low-risk division, such as a new distribution center with a beta of only 0.5, its divisional cost of capital would be 10%:

$$r_{\text{Center}} = 7\% + (6\%)0.5 = 10.0\%.$$

A firm itself may be regarded as a "portfolio of assets," and since the beta of a portfolio is a weighted average of the betas of its individual assets, adding the barge and distribution center divisions will change Huron's overall beta. The exact value of the new beta would depend on the relative size of the investment in the new divisions versus Huron's original steel operations. If 70% of Huron's total value ends up in the steel division, 20% in the barge division, and 10% in the distribution center, then its new corporate beta would be

$$\text{New beta} = 0.7(1.1) + 0.2(1.5) + 0.1(0.5) = 1.12.$$

Thus, investors in Huron's stock would have a required return of

$$r_{\text{Huron}} = 7\% + (6\%)1.12 = 13.72\%.$$

Even though the investors require an overall return of 13.72%, they expect a rate of return in each division at least as good as the division's required return based on the SML. In particular, they expect a return of at least 13.6% from the steel division, 16.0% from the barge division, and 10.0% from the distribution center.

Techniques for Measuring Divisional Betas

In Chapter 6 we discussed the estimation of betas for stocks and indicated the difficulties in estimating beta. The estimation of divisional betas is much more difficult because divisions do not have their own publicly traded stock.¹⁹ Therefore, we must estimate the beta that the division would have if it were a separate publicly traded company. Two approaches can be used to estimate individual assets' betas—the pure play method and the accounting beta method.

The Pure Play Method In the **pure play method**, the company tries to find several single-product companies in the same line of business as the division being evaluated, and it then averages those companies' betas to determine the cost of capital for its own division. For example, suppose Huron could find three existing single-product firms that operate barges, and suppose also that Huron's management believes its barge division would be subject to the same risks as those firms. Huron could then determine the betas of those firms, average them, and use this average beta as a proxy for the barge division's beta.²⁰

The Accounting Beta Method As noted above, it may be impossible to find single-product, publicly traded firms suitable for the pure play approach. If that is the case, we may be able to use the **accounting beta method**. Betas normally are found by regressing the returns of a particular company's *stock* against returns on a *stock market index*. However, we could run a regression of the division's *accounting return on assets* against the *average return on assets* for a large sample of companies, such as those included in the S&P 500. Betas determined in this way (that is, by using accounting data rather than stock market data) are called **accounting betas**.

Estimating the Cost of Capital for Individual Projects

Although it is intuitively clear that riskier projects have a higher cost of capital, it is difficult to estimate project risk. First, note that three separate and distinct types of risk can be identified:

1. **Stand-alone risk** is the variability of the project's expected returns.
2. **Corporate, or within-firm, risk** is the variability the project contributes to the corporation's returns, giving consideration to the fact that the project represents only one asset of the firm's portfolio of assets, hence that some of its risk effects will be diversified away.
3. **Market, or beta, risk** is the risk of the project as seen by a well-diversified stockholder. Market risk is measured by the project's effect on the firm's beta coefficient.

Taking on a project with a high degree of either stand-alone or corporate risk will not necessarily affect the firm's beta. However, if the project has highly uncertain returns, and if those returns are highly correlated with returns on the firm's other assets and with most other assets in the economy, then the project will have a high degree of all types of risk. For example, suppose General Motors decides to undertake a major expansion to build electric autos. GM is not sure how its

¹⁹This same problem applies to privately held companies, which we discuss in a later section.

²⁰If the pure play firms employ different capital structures than that of Huron, this fact must be dealt with by adjusting the beta coefficients. See Chapter 16 for a discussion of this aspect of the pure play method. For a technique that can be used when pure play firms are not available, see Yatin Bhagwat and Michael Ehrhardt, "A Full Information Approach for Estimating Divisional Betas," *Financial Management*, Summer 1991, pp. 60–69.

technology will work on a mass production basis, so there is much risk in the venture—its stand-alone risk is high. Management also estimates that the project will do best if the economy is strong, for then people will have more money to spend on the new autos. This means that the project will tend to do well if GM's other divisions are doing well and will tend to do badly if other divisions are doing badly. This being the case, the project will also have high corporate risk. Finally, since GM's profits are highly correlated with those of most other firms, the project's beta will also be high. Thus, this project will be risky under all three definitions of risk.

Of the three measures, market risk is theoretically the most relevant because of its direct effect on stock prices. Unfortunately, the market risk for a project is also the most difficult to estimate. In practice, most decision makers consider all three risk measures in a judgmental manner.

The first step is to determine the divisional cost of capital, and then to group divisional projects into subjective risk categories. Then, using the divisional WACC as a starting point, **risk-adjusted costs of capital** are developed for each category. For example, a firm might establish three risk classes—high, average, and low—then assign average-risk projects the divisional cost of capital, higher-risk projects an above-average cost, and lower-risk projects a below-average cost. Thus, if a division's WACC were 10%, its managers might use 10% to evaluate average-risk projects in the division, 12% for high-risk projects, and 8% for low-risk projects. While this approach is better than not risk adjusting at all, these risk adjustments are necessarily subjective and somewhat arbitrary. Unfortunately, given the data, there is no completely satisfactory way to specify exactly how much higher or lower we should go in setting risk-adjusted costs of capital.

SELF-TEST

Based on the CAPM, how would one find the required return for a low-risk division and for a high-risk division?

Describe the pure play and the accounting beta methods for estimating divisional betas.

What are the three types of project risk?

Which type of risk is theoretically the most relevant? Why?

Describe a procedure firms can use to develop costs of capital for projects with differing degrees of risk.

10.13 Privately Owned Firms and Small Businesses

Up until now, our discussion of the cost of stock has been focused on publicly owned corporations. When we estimated the rate of return required by public stockholders, we used stock prices as input data for the DCF method and stock returns to estimate beta as an input for the CAPM approach. But how should one measure the cost of stock for a firm whose stock is not traded? Most analysts begin by identifying one or more publicly traded firms that are in the same industry and that are approximately the same size as the privately owned firm.²¹ The analyst then estimates the betas for these publicly traded firms and uses their average beta as an estimate of the beta of the privately owned firm. Note that this is similar to the pure play method for estimating divisional betas that we discussed earlier. With an estimate of beta, the cost of stock can be estimated with the CAPM approach.

²¹In Chapter 16 we show how to adjust for differences in capital structures.

The liquidity of an ownership stake in a privately held firm is less than the liquidity of publicly held stock. Just as the yield on a thinly traded bond has a liquidity premium, the required return on stock in a privately held firm should reflect a liquidity premium.²² Many analysts make an ad hoc adjustment to reflect this lack of liquidity by adding 1 to 3 percentage points to the firm's cost of equity. This "rule of thumb" is not very satisfying theoretically because we don't know exactly how large a liquidity premium to add, but it is very common in practice. In fact, some analysts make a similar liquidity adjustment for any small firm's cost of stock, even if the firm is publicly traded.

In addition to difficulty in estimating the cost of equity for small firms and privately held firms, there are also problems in estimating the capital structure weights. These weights should be based on the target market-value weights. However, a privately held firm can't observe its market value. If a firm doesn't know its current market weights, that makes it difficult for the firm to estimate its target weights. To resolve this problem, many analysts begin by making a trial guess as to the value of the firm's equity. The analysts then use this estimated value of equity to estimate the cost of capital, then use the cost of capital to estimate the value of the firm, and complete the circle by using the estimated value of the firm to estimate the value of its equity.²³ If this newly estimated equity value is different than their trial guess, analysts repeat the process but start the iteration with the newly estimated equity value as the trial value of equity. After several iterations, the trial value of equity and the resulting estimated equity value usually converge. Although somewhat tedious, this process provides a good estimate of the weights and the cost of capital.

SELF-TEST

Identify some problems that occur when estimating the cost of capital for a privately held firm. What are some solutions to these problems?

10.14 Four Mistakes to Avoid

We often see managers and students make the following mistakes when estimating the cost of capital. Although we have discussed these errors previously at separate places in the chapter, they are worth repeating here:

1. *Never use the coupon rate on a firm's existing debt as the pre-tax cost of debt.* The relevant pre-tax cost of debt is the interest rate the firm would pay if it issued debt today.
2. *When estimating the market risk premium for the CAPM method, never use the historical average return on stocks in conjunction with the current risk-free rate.* The historical average return on common stocks has been about 12.4%, the historical return on long-term Treasury bonds about 5.8%, and the difference between them, which is the **historical risk premium**, is 6.6%. The **current risk premium** is found as the difference between an estimate of the current expected rate of return on common stocks and the current expected yield on T-bonds. To illustrate, suppose an estimate of the future return on common stock is 10%, and the current rate on long-term T-bonds is 4%. This implies that you expect to earn 10% if you buy stock today and 4% if you buy bonds. Therefore, this implies a current market risk premium of $10\% - 4\% = 6\%$. A case could be made for

²²See Yakov Amihud and Haim Mendelson, "Liquidity and Cost of Capital: Implications for Corporate Management," *Journal of Applied Corporate Finance*, Fall 1989, pp. 65–73.

²³See Chapter 15 for more discussion on estimating the value of a firm.



To find the current S&P 500 market-to-book ratio, go to <http://investor.reuters.com>, get the stock quote for any company, and select "Ratios." Then look for the Price to Book ratio.

using either the historical or the current risk premium, but it would be wrong to take the *historical* rate of return on the market, 12.4%, subtract from it the *current* 4% rate on T-bonds, and then use $12.4\% - 4\% = 8.4\%$ as the risk premium.

3. *Never use the book value of equity when estimating the capital structure weights for the WACC.* Your first choice should be to use the target capital structure to determine the weights. If you are an outside analyst and do not know the target weights, it is better to estimate weights based on the current market values of the capital components than on their book values. This is especially true for equity. For example, the stock of an average S&P 500 firm in mid-2006 had a market value that was about 3.74 times its book value, and in general, stocks' market values are rarely close to their book values. If the company's debt is not publicly traded, then it is reasonable to use the book value of debt to estimate the weights, since book and market values of debt, especially short-term debt, are usually close to one another. To summarize, if you don't know the target weights, then use market values of equity rather than book values to obtain the weights used to calculate WACC.
4. *Always remember that capital components are funds that come from investors.* If it's not from an investor, then it's not a capital component. Sometimes the argument is made that accounts payable and accruals are sources of funding and should be included in the calculation of the WACC. However, these accounts are due to operating relationships with suppliers and employees, and they are deducted when determining the investment requirement for a project. Therefore, they should not be included in the WACC. Of course, they are not ignored in either corporate valuation or capital budgeting. As we saw in Chapter 3, current liabilities do affect cash flow, hence have an effect on corporate valuation. Moreover, in Chapter 12 we show that the same is true for capital budgeting, namely, that current liabilities affect the cash flows of a project, but not its WACC.

SELF-TEST

What are four common mistakes people make when estimating the WACC?

Summary

This chapter showed how the cost of capital is developed for use in capital budgeting. The key concepts covered are listed below.

- The cost of capital used in capital budgeting is a **weighted average** of the types of capital the firm uses, typically debt, preferred stock, and common equity.
- The **component cost of debt** is the **after-tax cost of new debt**. It is found by multiplying the cost of new debt by $(1 - T)$, where T is the firm's marginal tax rate: $r_d(1 - T)$.
- **Flotation cost adjustments** should be made for debt if the flotation costs are relatively large. Reduce the bond's issue price by the flotation expenses, reduce the bond's cash flows to reflect taxes, and then solve for the after-tax yield to maturity.
- The **component cost of preferred stock** is calculated as the preferred dividend divided by the net issuing price, where the net issuing price is the price the firm receives after deducting flotation costs: $r_{ps} = D_{ps}/[P_{ps}(1 - F)]$. Flotation costs are usually relatively large for preferred stock issues, so we typically include the impact of flotation costs when estimating r_{ps} .

- The **cost of common equity**, r_s , is also called the **cost of common stock**. It is the rate of return required by the firm's stockholders, and it can be estimated by three methods: (1) the **CAPM approach**, (2) the **dividend-yield-plus-growth-rate**, or **DCF approach**, and (3) the **bond-yield-plus-risk-premium approach**.
- To use the **CAPM approach**, (1) estimate the firm's beta, (2) multiply this beta by the market risk premium to determine the firm's risk premium, and (3) add the firm's risk premium to the risk-free rate to obtain the cost of common stock: $r_s = r_{RF} + (RP_M)b_i$.
- The best proxy for the **risk-free rate** is the yield on long-term T-bonds.
- To use the **dividend-yield-plus-growth-rate approach**, which is also called the **discounted cash flow (DCF) approach**, add the firm's expected growth rate to its expected dividend yield: $r_s = \hat{r}_s = D_1/P_0 + g$.
- The growth rate can be estimated from **historical earnings and dividends** or by use of the **retention growth model**, $g = (1 - \text{Payout})(\text{Return on equity})$, or it can be based on **analysts' forecasts**.
- The **bond-yield-plus-risk-premium approach** calls for adding a risk premium of from 3 to 5 percentage points to the firm's interest rate on long-term debt: $r_s = \text{Bond yield} + \text{Bond RP}$.
- When calculating the **cost of new common stock**, r_e , the DCF approach can be adapted to account for flotation costs. For a constant growth stock, this cost can be expressed as $r_e = \hat{r}_e = D_1/[P_0(1 - F)] + g$. Note that flotation costs cause r_e to be greater than r_s .
- Each firm has a **target capital structure**, defined as that mix of debt, preferred stock, and common equity that minimizes its **weighted average cost of capital (WACC)**:

$$\text{WACC} = w_d r_d (1 - T) + w_{ps} r_{ps} + w_{ce} r_s$$

- **Various factors affect a firm's cost of capital**. Some of these factors are determined by the financial environment, but the firm influences others through its financing, investment, and dividend policies.
- Many firms estimate a **divisional cost of capital** for each division that reflects that division's risk and capital structure.
- The **pure play** and **accounting beta methods** can sometimes be used to estimate betas for large projects or for divisions.
- A project's **stand-alone risk** is the risk the project would have if it were the firm's only asset and if stockholders held only that one stock. Stand-alone risk is measured by the variability of the asset's expected returns.
- **Corporate**, or **within-firm**, **risk** reflects the effects of a project on the firm's risk, and it is measured by the project's effect on the firm's earnings variability.
- **Market**, or **beta**, **risk** reflects the effects of a project on the risk of stockholders, assuming they hold diversified portfolios. Market risk is measured by the project's effect on the firm's beta coefficient.
- Most decision makers consider all three risk measures in a judgmental manner and then classify projects into subjective risk categories. Using the divisional WACC as a starting point, risk-adjusted costs of capital are developed for each category. The **risk-adjusted cost of capital** is the cost of capital appropriate for a given project, given the risk of that project. The greater the risk, the higher the cost of capital.
- Firms may be able to use the **CAPM** to estimate the cost of capital for specific projects or divisions. However, estimating betas for projects is difficult.

The cost of capital as developed in this chapter is used in the following chapters to determine the value of a corporation and to evaluate capital budgeting projects. In addition, we extend the concepts developed here in Chapter 16, where we consider the effect of the capital structure on the cost of capital.

Questions

- (10-1)** Define each of the following terms:
- Weighted average cost of capital, WACC; after-tax cost of debt, $r_d(1 - T)$
 - Cost of preferred stock, r_{ps} ; cost of common equity or cost of common stock, r_s
 - Target capital structure
 - Flotation cost, F ; cost of new external common equity, r_e
- (10-2)** In what sense is the WACC an average cost? A marginal cost?
- (10-3)** 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 weighted average cost of capital, 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 other things are held constant. Be prepared to justify your answer, but recognize that several of the parts probably 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.	_____	_____	_____
d. The firm doubles the amount of capital it raises during the year.	_____	_____	_____
e. The firm expands into a risky new area.	_____	_____	_____
f. Investors become more risk averse.	_____	_____	_____

- (10-4)** Distinguish between beta (or market) risk, within-firm (or corporate) risk, and stand-alone risk for a potential project. Of the three measures, which is theoretically the most relevant, and why?
- (10-5)** Suppose a firm estimates its cost of capital for the coming year to be 10%. What might be reasonable costs of capital for average-risk, high-risk, and low-risk projects?

Self-Test Problem Solution Appears in Appendix A

(ST-1)
WACC

Longstreet Communications Inc. (LCI) has the following capital structure, which it considers to be optimal: debt = 25%, preferred stock = 15%, and common stock = 60%. LCI's tax rate is 40% and investors expect earnings and dividends to grow at a constant rate of 6% in the future. LCI paid a dividend of \$3.70 per share last year (D_0), and its stock currently sells at a price of \$60 per share. Treasury bonds yield 6%, the market risk premium is 5%, and LCI's beta is 1.3. These terms would apply to new security offerings:

Preferred: New preferred could be sold to the public at a price of \$100 per share, with a dividend of \$9. Flotation costs of \$5 per share would be incurred.

Debt: Debt could be sold at an interest rate of 9%.

- a. Find the component costs of debt, preferred stock, and common stock. Assume LCI does not have to issue any additional shares of common stock.
- b. What is the WACC?

Problems Answers Appear in Appendix B

Easy
Problems 1–8

Calculate the after-tax cost of debt under each of the following conditions:

(10-1)
After-Tax Cost of Debt

- a. Interest rate, 13%; tax rate, 0%.
- b. Interest rate, 13%; tax rate, 20%.
- c. Interest rate, 13%; tax rate, 35%.

(10-2)
After-Tax Cost of Debt

LL Incorporated's currently outstanding 11% coupon bonds have a yield to maturity of 8%. LL believes it could issue at par new bonds that would provide a similar yield to maturity. If its marginal tax rate is 35%, what is LL's after-tax cost of debt?

(10-3)
Cost of Preferred Stock

Duggins Veterinary Supplies can issue perpetual preferred stock at a price of \$50 a share. The issue is expected to pay a constant annual dividend of \$4.50 a share. Ignoring flotation costs, what is the company's cost of preferred stock, r_{ps} ?

(10-4)
Cost of Preferred Stock
with Flotation Costs

Burnwood Tech plans to issue some \$60 par preferred stock with a 6% dividend. The stock is selling on the market for \$70.00, and Burnwood must pay flotation costs of 5% of the market price. What is the cost of the preferred stock?

(10-5)
Cost of Equity: DCF

Summerdahl Resorts' common stock is currently trading at \$36 a share. The stock is expected to pay a dividend of \$3.00 a share at the end of the year ($D_1 = \$3.00$), and the dividend is expected to grow at a constant rate of 5% a year. What is the cost of common equity?

(10-6) Booyer Book Stores has a beta of 0.8. The yield on a 3-month T-bill is 4% and the yield on a 10-year T-bond is 6%. The market risk premium is 5.5%, but the stock market return in the previous years was 15%. What is the estimated cost of common equity using the CAPM?

Cost of Equity: CAPM

(10-7) Shi Importers' balance sheet shows \$300 million in debt, \$50 million in preferred stock, and \$250 million in total common equity. Shi faces a 40% tax rate and the following data: $r_d = 6%$, $r_{ps} = 5.8%$, and $r_s = 12%$. If Shi has a target capital structure of 30% debt, 5% preferred stock, and 65% common stock, what is Shi's WACC?

WACC

(10-8) David Ortiz Motors has a target capital structure of 40% debt and 60% equity. The yield to maturity on the company's outstanding bonds is 9%, and the company's tax rate is 40%. Ortiz's CFO has calculated the company's WACC as 9.96%. What is the company's cost of equity capital?

WACC

Intermediate Problems 9–14

(10-9) A company's 6% coupon rate, semiannual payment, \$1,000 par value bond that matures in 30 years sells at a price of \$515.16. The company's federal-plus-state tax rate is 40%. What is the firm's component cost of debt for purposes of calculating the WACC? (Hint: Base your answer on the *nominal* rate.)

Bond Yield and After-Tax Cost of Debt

(10-10) The earnings, dividends, and stock price of Shelby Inc. are expected to grow at 7% per year in the future. Shelby's common stock sells for \$23 per share, its last dividend was \$2.00, and the company will pay a dividend of \$2.14 at the end of the current year.

Cost of Equity

- Using the discounted cash flow approach, what is its cost of equity?
- If the firm's beta is 1.6, the risk-free rate is 9%, and the expected return on the market is 13%, what will be the firm's cost of equity using the CAPM approach?
- If the firm's bonds earn a return of 12%, what will r_s be using the bond-yield-plus-risk-premium approach? (Hint: Use the midpoint of the risk premium range.)
- On the basis of the results of parts a through c, what would you estimate Shelby's cost of equity to be?

(10-11) Radon Homes' current EPS is \$6.50. It was \$4.42 5 years ago. The company pays out 40% of its earnings as dividends, and the stock sells for \$36.

Cost of Equity

- Calculate the past growth rate in earnings. (Hint: This is a 5-year growth period.)
- Calculate the *next* expected dividend per share, D_1 [$D_0 = 0.4(\$6.50) = \2.60]. Assume that the past growth rate will continue.
- What is the cost of equity, r_s , for Radon Homes?

(10-12) Spencer Supplies' stock is currently selling 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.

Calculation of g and EPS

- If investors require a 9% return, what rate of growth must be expected for Spencer?

- b. If Spencer reinvests earnings in projects with average returns equal to the stock's expected rate of return, what will be next year's EPS? [Hint: $g = \text{ROE}(\text{Retention ratio})$.]

(10-13)
The Cost of Equity
and Flotation Costs

Messman Manufacturing will issue common stock to the public for \$30. The expected dividend and growth in dividends are \$3.00 per share and 5%, respectively. If the flotation cost is 10% of the issue proceeds, what is the cost of external equity, r_e ?

(10-14)
The Cost of Debt
and Flotation Costs

Suppose a company will issue new 20-year debt with a par value of \$1,000 and a coupon rate of 9%, paid annually. The tax rate is 40%. If the flotation cost is 2% of the issue proceeds, what is the after-tax cost of debt?

**Challenging
Problems 15–17**

(10-15)
WACC Estimation

On January 1, the total market value of the Tysseland Company was \$60 million. During the year, the company plans to raise and invest \$30 million in new projects. The firm's present market value capital structure, shown below, is considered to be optimal. Assume that there is no short-term debt.

Debt	\$30,000,000
Common equity	<u>30,000,000</u>
Total capital	<u>\$60,000,000</u>

New bonds will have an 8% coupon rate, and they will be sold at par. Common stock is currently selling at \$30 a share. Stockholders' required rate of return is estimated to be 12%, consisting of a dividend yield of 4% and an expected constant growth rate of 8%. (The next expected dividend is \$1.20, so $\$1.20/\$30 = 4\%$.) The marginal corporate tax rate is 40%.

- a. To maintain the present capital structure, how much of the new investment must be financed by common equity?
- b. Assume that there is sufficient cash flow such that Tysseland can maintain its target capital structure without issuing additional shares of equity. What is the WACC?
- c. Suppose now that there is not enough internal cash flow and the firm must issue new shares of stock. Qualitatively speaking, what will happen to the WACC?

(10-16)
Market Value Capital
Structure

Suppose the Schoof Company has this *book value* balance sheet:

Current assets	\$30,000,000	Current liabilities	\$10,000,000
Fixed assets	50,000,000	Long-term debt	30,000,000
		Common equity	
		Common stock	
		(1 million shares)	1,000,000
		Retained earnings	<u>39,000,000</u>
Total assets	<u>\$80,000,000</u>	Total claims	<u>\$80,000,000</u>

The current liabilities consist entirely of notes payable to banks, and the interest rate on this debt is 10%, the same as the rate on new bank loans. The long-term debt consists of 30,000 bonds, each of which has a par value of \$1,000, carries an annual coupon interest rate of 6%, and matures in 20 years. The going rate of interest on new long-term debt, r_d , is 10%, and this is the present yield to maturity on the bonds. The common stock sells at a price of \$60 per share. Calculate the firm's market value capital structure.

(10-17)
WACC Estimation

A summary of the balance sheet of Travellers Inn Inc. (TII), a company that was formed by merging a number of regional motel chains and that hopes to rival Holiday Inn on the national scene, is shown in the table:

Travellers Inn: December 31, 2006 (Millions of Dollars)

Cash	\$ 10	Accounts payable	\$ 10
Accounts receivable	20	Accruals	10
Inventories	20	Short-term debt	5
Current assets	\$ 50	Current liabilities	\$ 25
Net fixed assets	50	Long-term debt	30
		Preferred stock	5
		Common equity	
		Common stock	\$ 10
		Retained earnings	30
		Total common equity	\$ 40
Total assets	\$100	Total liabilities and equity	\$100

These facts are also given for TII:

- (1) Short-term debt consists of bank loans that currently cost 10%, with interest payable quarterly. These loans are used to finance receivables and inventories on a seasonal basis, so in the off-season, bank loans are zero.
- (2) The long-term debt consists of 20-year, semiannual payment mortgage bonds with a coupon rate of 8%. Currently, these bonds provide a yield to investors of $r_d = 12\%$. If new bonds were sold, they would yield investors 12%.
- (3) TII's perpetual preferred stock has a \$100 par value, pays a quarterly dividend of \$2, and has a yield to investors of 11%. New perpetual preferred would have to provide the same yield to investors, and the company would incur a 5% flotation cost to sell it.
- (4) The company has 4 million shares of common stock outstanding. $P_0 = \$20$, but the stock has recently traded in the range of \$17 to \$23. $D_0 = \$1$ and $EPS_0 = \$2$. ROE based on average equity was 24% in 2006, but management expects to increase this return on equity to 30%; however, security analysts are not aware of management's optimism in this regard.
- (5) Betas, as reported by security analysts, range from 1.3 to 1.7; the T-bond rate is 10%; and RP_M is estimated by various brokerage houses to be in the range of 4.5% to 5.5%. Brokerage house reports forecast growth rates in the range of 10% to 15% over the foreseeable future. However, some analysts do not explicitly forecast growth rates, but they indicate to their clients that they expect TII's historical trends, as shown in the table in fact (9), to continue.

- (6) At a recent conference, TII's financial vice president polled some pension fund investment managers on the minimum rate of return they would have to expect on TII's common to make them willing to buy the common rather than TII bonds, when the bonds yielded 12%. The responses suggested a risk premium over TII bonds of 4 to 6 percentage points.
- (7) TII is in the 40% federal-plus-state tax bracket.
- (8) TII's principal investment banker, Henry, Kaufman & Company, predicts a decline in interest rates, with r_d falling to 10% and the T-bond rate to 8%, although Henry, Kaufman & Company acknowledges that an increase in the expected inflation rate could lead to an increase rather than a decrease in rates.
- (9) Here is the historical record of EPS and DPS:

Year	EPS	DPS	Year	EPS	DPS
1992	\$0.09	\$0.00	2000	\$0.78	\$0.00
1993	-0.20	0.00	2001	0.80	0.00
1994	0.40	0.00	2002	1.20	0.20
1995	0.52	0.00	2003	0.95	0.40
1996	0.10	0.00	2004	1.30	0.60
1997	0.57	0.00	2005	1.60	0.80
1998	0.61	0.00	2006	2.00	1.00
1999	0.70	0.00			

Assume that you are a recently hired financial analyst, and your boss, the treasurer, has asked you to estimate the company's WACC; assume no new equity will be issued. Your cost of capital should be appropriate for use in evaluating projects which are in the same risk class as the firm's average assets now on the books.



Spreadsheet Problem

(10-18)
Build a Model: WACC

Start with the partial model in the file *FM12 Ch 10 P18 Build a Model.xls* from the textbook's Web site. The stock of Gao Computing sells for \$50, and last year's dividend was \$2.10. A flotation cost of 10% would be required to issue new common stock. Gao'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. Security analysts are projecting that the common dividend will grow at a rate of 7% a year. The firm can also issue additional long-term debt at an interest rate (or before-tax cost) of 10%, and its marginal tax rate is 35%. The market risk premium is 6%, the risk-free rate is 6.5%, and Gao's beta is 0.83. In its cost-of-capital calculations, Gao uses a target capital structure with 45% debt, 5% preferred stock, and 50% common equity.

- a. Calculate the cost of each capital component (that is, the after-tax cost of debt), the cost of preferred stock (including flotation costs), and the cost of equity (ignoring flotation costs) with the DCF method and the CAPM method.

- b. Calculate the cost of new stock using the DCF model.
- 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. Assuming that Gao will not issue new equity and will continue to use the same target capital structure, what is the company's WACC?
- e. Suppose Gao is evaluating three projects with the following characteristics:
 - (1) Each project has a cost of \$1 million. They will all be financed using the target mix of long-term debt, preferred stock, and common equity. The cost of the common equity for each project should be based on the beta estimated for the project. All equity will come from retained earnings.
 - (2) Equity invested in Project A would have a beta of 0.5 and an expected return of 9.0%.
 - (3) Equity invested in Project B would have a beta of 1.0 and an expected return of 10.0%.
 - (4) Equity invested in Project C would have a beta of 2.0 and an expected return of 11.0%.
- f. Analyze the company's situation and explain why each project should be accepted or rejected.



Cyberproblem

Please go to the textbook's Web site to access any Cyberproblems.

Mini Case



During the last few years, Harry Davis Industries has been too constrained by the high cost of capital to make many capital investments. Recently, though, capital costs have been declining, and the company has decided to look seriously at a major expansion program that has been proposed by the marketing department. Assume that you are an assistant to Leigh Jones, the financial vice president. Your first task is to estimate Harry Davis's cost of capital. Jones has provided you with the following data, which she believes may be relevant to your task:

- (1) The firm's tax rate is 40%.
- (2) The current price of Harry Davis's 12% coupon, semiannual payment, non-callable bonds with 15 years remaining to maturity is \$1,153.72. Harry Davis does not use short-term interest-bearing debt on a permanent basis. New bonds would be privately placed with no flotation cost.
- (3) The current price of the firm's 10%, \$100 par value, quarterly dividend, perpetual preferred stock is \$116.95. Harry Davis would incur flotation costs equal to 5% of the proceeds on a new issue.
- (4) Harry Davis's common stock is currently selling at \$50 per share. Its last dividend (D_0) was \$4.19, and dividends are expected to grow at a constant rate of 5% in the foreseeable future. Harry Davis's beta is 1.2, the yield on T-bonds is

7%, and the market risk premium is estimated to be 6%. For the bond-yield-plus-risk-premium approach, the firm uses a 4 percentage point risk premium.

- (5) Harry Davis's target capital structure is 30% long-term debt, 10% preferred stock, and 60% common equity.

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

- a. (1) What sources of capital should be included when you estimate Harry Davis's weighted average cost of capital (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 Harry Davis's debt and its component cost of debt?
- c. (1) What is the firm's cost of preferred stock?
 - (2) Harry Davis'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) What are the two primary ways companies raise common equity?
 - (2) Why is there a cost associated with reinvested earnings?
 - (3) Harry Davis doesn't plan to issue new shares of common stock. Using the CAPM approach, what is Harry Davis's estimated cost of equity?
- e. (1) What is the estimated cost of equity using the discounted cash flow (DCF) approach?
 - (2) Suppose the firm has historically earned 15% on equity (ROE) and retained 35% of earnings, and investors expect this situation to continue in the future. How could you use this information to estimate the future dividend growth rate, and what growth rate would you get? Is this consistent with the 5% growth rate given earlier?
 - (3) Could the DCF method be applied if the growth rate was not constant? How?
- f. What is the cost of equity based on the bond-yield-plus-risk-premium method?
- g. What is your final estimate for the cost of equity, r_s ?
- h. What is Harry Davis's weighted average cost of capital (WACC)?
- i. What factors influence a company's WACC?
- j. Should the company use the composite WACC as the hurdle rate for each of its divisions?
- k. What procedures are used to determine the risk-adjusted cost of capital for a particular division? What approaches are used to measure a division's beta?
- l. Harry Davis is interested in establishing a new division, which will focus primarily on developing new Internet-based projects. In trying to determine the cost of capital for this new division, you discover that stand-alone firms involved in similar projects have on average the following characteristics:
 - Their capital structure is 10% debt and 90% common equity.
 - Their cost of debt is typically 12%.
 - The beta is 1.7.

Given this information, what would your estimate be for the division's cost of capital?

- m. What are three types of project risk? How is each type of risk used?
 - n. Explain in words why new common stock that is raised externally has a higher percentage cost than equity that is raised internally by reinvesting earnings.
 - o. (1) Harry Davis estimates that if it issues new common stock, the flotation cost will be 15%. Harry Davis incorporates the flotation costs into the DCF approach. What is the estimated cost of newly issued common stock, taking into account the flotation cost?
(2) Suppose Harry Davis issues 30-year debt with a par value of \$1,000 and a coupon rate of 10%, paid annually. If flotation costs are 2%, what is the after-tax cost of debt for the new bond issue?
 - p. What four common mistakes in estimating the WACC should Harry Davis avoid?
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Selected Additional Cases

The following cases from Textchoice, Thomson Learning's online library, cover many of the concepts discussed in this chapter and are available at <http://www.textchoice2.com>.

Klein-Brigham Series:

Case 42, "West Coast Semiconductor"; Case 54, "Ace Repair"; Case 55, "Premier Paint & Body";

Case 6, "Randolph Corporation"; Case 75, "The Western Company"; and Case 81, "Pressed Paper Products."

Brigham-Buzzard Series:

Case 5, "Powerline Network Corporation (Determining the Cost of Capital)."