

CHAPTER 9

The Cost of Capital

Fortune magazine conducts annual surveys of business leaders to identify the most-admired U.S. companies. Since the surveys began, General Electric has consistently ranked either at or close to the top of the list. Although GE's stock has fallen sharply in recent times, like that of most other companies, it was still in eighth place in the March 2009 survey.

GE is the most diversified company in the world. It originally manufactured electric generating equipment and light bulbs. Then it branched into appliances and industrial equipment such as jet engines and locomotives, then into infrastructure, various industrial services, movies, TV, and loans to individuals and businesses. People tend to think of GE as an industrial company, but by far its largest unit is GE Capital, its finance unit. This reliance on GE Capital, combined with uncertainty about potential losses on its huge loan portfolio, was primarily responsible for GE's poor stock price performance in 2008–2009.

A key factor in GE's long-run success has been its financial discipline: the company is reported to have set a uniform "hurdle rate" for potential new investments and then accepted projects if and only if their expected returns exceed that hurdle rate. Historically, the same hurdle rate was used for all projects—apparently the company did not systematically vary the rate to reflect individual projects' perceived risks. Project managers were charged with achieving the rate of return they had forecasted, and careers rose or fell depending on whether or not they "made their numbers."

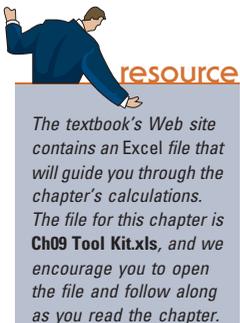
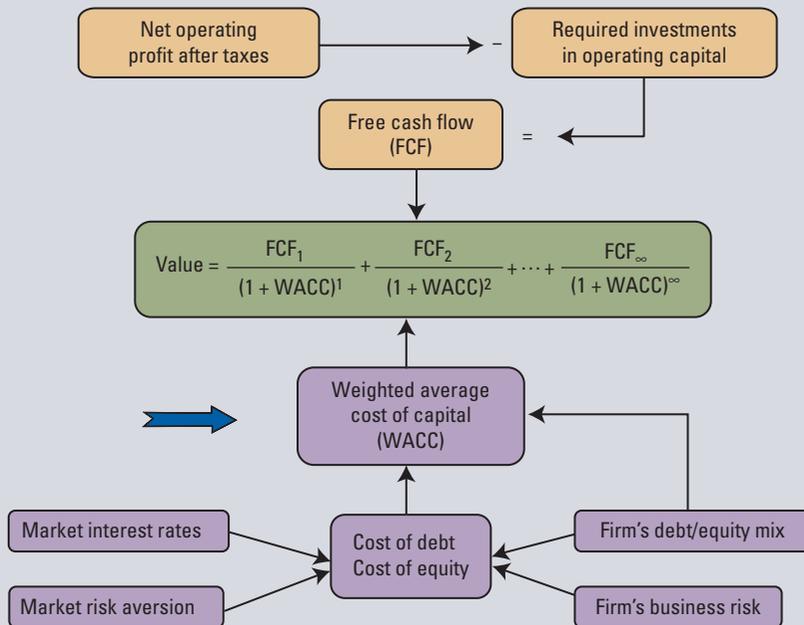
With 20-20 hindsight, we can see that there was a flaw in GE's logic. The economy enjoyed a strong upward trend from 1945 to 2007, so defaults on mortgages, corporate debt, credit cards, and other debt instruments were relatively low. Moreover, until 2009 GE was one of only six nonfinancial companies with a AAA bond rating, which enabled it to borrow at extremely low rates and then re-lend the money at much higher rates. In that environment, it was easy for GE Capital to forecast returns that exceeded the corporate hurdle rate, and that led to the unit's rapid growth. GE's other units had fewer projects that exceeded the corporate hurdle rate; hence, GE Capital's share of total corporate revenues, profits, and especially debt increased rapidly.

Recently, though, as the economy sank into a recession and the housing market collapsed, investors became worried about all lenders' loans. They started dumping financial stocks—including GE's, which led to its huge stock price decline. If GE's management had looked more closely at the potential effects of GE Capital's increased use of debt to finance the purchase of risky mortgages and other debt, and if it had used risk-adjusted hurdle rates rather than a uniform rate, then some of its pain might have been avoided.

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). Indeed, a firm's intrinsic value is found as the present value of its FCFs, discounted at the weighted average cost of capital

(WACC). In previous chapters, we examined the major sources of financing (stocks, bonds, and preferred stock) and the costs of those instruments. In this chapter, we put those pieces together and estimate the WACC that is used to determine intrinsic value.



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

¹The cost of capital is also an important factor in the regulation of electric, gas, and water 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, an unregulated electric or water company could exploit its customers. Therefore, regulators (1) determine the cost of the capital investors have provided the utility and then (2) set rates designed to permit the company to earn its cost of capital, no more and no less.

9.1 THE WEIGHTED AVERAGE COST OF CAPITAL

If a firm's only investors were common stockholders, then its cost of capital would be the required rate of return on its equity. However, most firms employ different types of capital, and because of their differences in risk, the 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 is found as a *weighted average* of the various components' costs. We call this weighted average just that, the **weighted average cost of capital**, or **WACC**.

National Computer Corporation (NCC) is a mid-sized manufacturer of main-frame computers. We will estimate NCC's cost of capital in this chapter. We begin by providing some basic information in Figure 9-1, including: (1) balance sheets; (2) percentages of total liabilities and equity comprised by each item (Column F); (3) percentages of financing in the form of "costly" capital supplied by investors, including banks, bondholders, and stockholders (Column H reports percentages based on book values from the financial statements); (4) percentages of investor-supplied capital based on current market values (Column I); and (5) target capital structure weights that management plans to use when raising new capital in the future (Column L). Following is a brief discussion of this information.

Notice that we exclude accounts payable and accruals in Columns G to L. Capital is provided by *investors*—interest-bearing debt, preferred stock, and common equity. Accounts payable and accruals arise from operating decisions, not from financing decisions. For example, payables and accruals increase automatically when sales increase, so the impact of payables and accruals is incorporated into a firm's free cash flows and a project's cash flows rather than into the cost of capital. Therefore, we consider only investor-supplied capital when we calculate the cost of capital.

Notice that Figure 9-1 (in Columns H, J, and L) reports percentages of financing based on book values, market values, and target weights. We examine the choice of target weights in more detail in Chapter 15, where we discuss the optimal capital structure: one in which the percentages of debt, preferred stock, and common equity maximize the firm's value. As shown in the last column of Figure 9-1, NCC has concluded that it should use 30% debt, 10% preferred stock, and 60% common equity in its target capital structure, and it plans to raise capital in those proportions in the future. Therefore, we use those target weights when calculating NCC's weighted average cost of capital.²

Self-Test

What is a component cost?
What is a target capital structure?

²We should also note that the weights could be based on either the book or market values of the capital components. The market value of the equity is found by multiplying the stock's price by the number of shares outstanding. Market value weights are theoretically superior. However, accountants show assets on a book value basis, bond rating agencies and security analysts generally focus on book values, and market value weights are quite unstable because stock prices fluctuate so much. If a firm's book and market values differ widely, then often it appears as though management sets *target* weights as a blend of book and market weights. We discuss this more in Chapter 15, but for now just accept the target weights provided in this chapter as determined by management.

FIGURE 9-1

National Computer Corporation: Book Values, Market Values, and Target Capital Structure (Millions of Dollars, December 31, 2010)

	Balance Sheets				Investor-Supplied Capital				Target Capital Structure
	Assets		Liabilities and Equity		Book		Market		
				Percent of Total	Book Value	Percent of Total	Market Value	Percent of Total	
Cash	\$ 65	Accounts payable	\$ 650	6.5%					
S-T investments	10	Accruals	399	4.0%					
Receivables	1,800	Spontaneous liabilities	\$1,049	10.5%					
Inventories	3,100	Notes payable	350	3.5%	\$ 350	3.9%	\$ 350	2.2%	
Total C.A.	\$4,975	Total C.L.	\$1,399	14.0%					
		Long-term debt	4,200	42.0%	4,200	46.9%	4,200	26.0%	
Net fixed assets	5,020	Total liabilities	\$5,599	56.0%	\$4,550	50.9%	\$ 4,550	28.2%	$w_d = 30.0\%$
		Preferred stock	1,200	12.0%	1,200	13.4%	1,200	7.4%	$w_{ps} = 10.0\%$
		Common stock	650	6.5%	650	7.3%			
		Retained earnings	2,546	25.5%	2,546	28.5%			
		Total common equity	\$3,196	32.0%	\$3,196	35.7%	10,400	64.4%	$w_s = 60.0\%$
Total assets	\$9,995	Total liabilities and equity	\$9,995	100.0%	\$8,946	100.0%	\$16,150	100.0%	100.0%

Notes:

1. The market value of the notes payable is equal to the book value. Some of NCC's long-term bonds sell at a discount and some sell at a premium, but their aggregate market value is approximately equal to their aggregate book value.
2. The common stock price is \$32 per share. There are 325 million shares outstanding, for a total market cap of $\$32(325) = \$10,400$ million.
3. The preferred stock price is \$100 per share. There are 12 million shares outstanding, for a total market value of $\$100(12) = \$1,200$ million.
4. When establishing the target capital structure, no distinction is made between common equity raised by issuing stock versus retaining earnings.
5. The firm assumes that it will eventually replace most notes payable with long-term bonds and that the costs of notes payable and long-term debt are approximately the same; hence it simply uses a 30% weight for all investor-supplied debt (i.e., for the combined notes payable and long-term debt).
6. Accounts payable and accruals are not sources of investor-supplied capital, so we exclude them when calculating the WACC. However, we include the effects of payables and accruals on free cash flow and on a project's cash flows, so we do not ignore payables and accruals when estimating the value of a company or project. See Chapter 16 for more discussion of payables in the context of working capital management.
7. When deciding on a target capital structure, managers consider the firm's current and recent past book and market value structures as well as those of benchmark firms. They also perform stress tests by forecasting financial statements under different assumptions regarding capital structures and different states of the economy. See Chapter 15 for more on setting the target capital structure weights.

9.2 BASIC DEFINITIONS

Now we define the key terms used in this chapter. Later we describe how to estimate the values of these variables and how to combine them to form the weighted average cost of capital, but an early overview is useful.

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

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

r_{ps} = Component cost of preferred stock, found as the yield investors expect to earn on the preferred stock. Preferred dividends are not tax deductible, so the before-tax and after-tax costs of preferred are equal.

r_s = Component cost of common equity raised by retaining earnings, or *internal equity*. It is the r_s developed in Chapter 7, where it is defined as the rate of return that investors require on a firm's common stock. Most firms, once they have become well established, obtain all of their new equity as retained earnings.

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

$w = w_d, w_{ps}, w_s, w_e$ = target weights of debt, preferred stock, internal equity (retained earnings) and external equity (new issues of common stock). The weights are the percentages of the different types of capital the firm plans to use when it raises capital in the future. Target weights may differ from actual current weights.

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

The target proportions of debt (w_d), preferred stock (w_{ps}), and common equity (w_s)—along with the costs of those components—are used to calculate the firm's **weighted average cost of capital, WACC**:³

$$\begin{aligned} \text{WACC} &= \left(\begin{array}{c} \% \\ \text{of} \\ \text{debt} \end{array} \right) \left(\begin{array}{c} \text{After-tax} \\ \text{cost of} \\ \text{debt} \end{array} \right) + \left(\begin{array}{c} \% \text{ of} \\ \text{preferred} \\ \text{stock} \end{array} \right) \left(\begin{array}{c} \text{Cost of} \\ \text{preferred} \\ \text{stock} \end{array} \right) + \left(\begin{array}{c} \% \text{ of} \\ \text{common} \\ \text{equity} \end{array} \right) \left(\begin{array}{c} \text{Cost of} \\ \text{common} \\ \text{equity} \end{array} \right) \\ &= w_d r_d (1 - T) + w_{ps} r_{ps} + w_s r_s \end{aligned} \quad (9-1)$$

In the following sections we explain how to estimate the various components' costs.

Self-Test

Identify the firm's three major capital structure components and give the symbols for their respective costs and weights.

What are the two possible components of new common equity (and hence two possible costs of common equity)? Which one is normally relevant, and why is this so?

³We assume at this point that all new common equity is raised internally by retaining earnings, as is true for most companies with moderate or slow sales growth, so the cost of common equity is r_s .

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

The first step in estimating the cost of debt is to determine the rate of return debt-holders require, or r_d . Although estimating r_d is conceptually straightforward, some problems arise in practice. Companies use both fixed- and floating-rate debt, both straight and convertible debt, both long- and short-term debt, as well as debt with and without sinking funds. Each type of debt may have a somewhat different cost.

It is unlikely that the financial manager will know at the beginning 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 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 help 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 2011 and that 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 NCC's bankers believe that a new, 30-year, noncallable, straight bond issue would require a 9% coupon rate with semiannual payments. It can be offered to the public at its \$1,000 par value. Therefore, their estimate of r_d is 9%.⁴

Note that 9% 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 that 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 the new, or marginal, capital that will be used to finance those projects. *Thus, for our purposes, the relevant cost is the marginal cost of new debt to be raised during the planning period.*

Suppose NCC has issued debt in the past and the bonds are publicly traded. The financial staff can use the market price of the bonds to find the yield to maturity (or yield to call, if the bonds sell at a premium and are likely to be called). This yield is the rate of return that current 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 an 8% 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 \$904.91. We can find the yield to maturity by using a financial calculator with these inputs: $N = 44$, $PV = -904.91$, $PMT = 40$, and $FV = 1000$. Solving for the rate, we find $I/YR = 4.5\%$. This is a semiannual periodic rate, so the nominal annual rate is 9.0%. This is consistent with the investment bankers' estimated rate, so 9% is a reasonable estimate for r_d . If NCC had no publicly traded debt, then its staff could still look at the yields on publicly traded debt of similar firms for 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 weighted average cost of capital is calculated using the

⁴The effective annual rate is $(1 + 0.09/2)^2 - 1 = 9.2\%$, but NCC and most other companies use nominal rates for all component costs.

after-tax cost of debt, $r_d(1 - T)$, which is the interest rate on debt, r_d , less the tax savings that result because interest is deductible. Here T is the firm's marginal tax rate.⁵

$$\begin{aligned} \text{After-tax component cost of debt} &= \text{Interest rate} - \text{Tax savings} \\ &= r_d - r_d T \\ &= r_d(1 - T) \end{aligned} \quad (9-2)$$

If we assume that NCC's marginal federal-plus-state tax rate is 40%, then its after-tax cost of debt is 5.4%:⁶

$$\begin{aligned} r_d(1 - T) &= 9\%(1.0 - 0.4) \\ &= 9\%(0.6) \\ &= 5.4\% \end{aligned}$$

Flotation Costs and the Cost of Debt

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

Suppose NCC can issue 30-year debt with an annual coupon rate of 9%, with coupons paid semiannually. The flotation costs, F , are equal to 1% of the value of 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 before, we can find the after-tax, flotation-adjusted cost by using this formula:

$$M(1 - F) = \sum_{t=1}^N \frac{\text{INT}(1 - T)}{[1 + r_d(1 - T)]^t} + \frac{M}{[1 + r_d(1 - T)]^N} \quad (9-3)$$

Here M is the bond's maturity (or par) value, F is the **percentage flotation cost** (i.e., the percentage of proceeds paid to the investment bankers), 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 $N = 60$, $PV = -1000(1 - 0.01) = -990$, $PMT = 45(1 - 0.40) = 33$, and $FV = 1000$. Solving for I/YR , we find $I/YR = r_d(1 - T) = 2.73\%$, which is the semiannual after-tax component cost of debt. The nominal after-tax cost of debt is 5.46%. Note that this is quite close to the original 5.40% after-tax cost, so in this instance adjusting for flotation costs doesn't make much difference.⁷

⁵The 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.

⁶Strictly speaking, the after-tax cost of debt should reflect the *expected* cost of debt. Although NCC's bonds have a promised return of 9%, there is some chance of default and so its bondholders' expected return (and consequently NCC's cost) is a bit less than 9%. However, for a relatively strong company such as NCC, this difference is quite small.

⁷Equation 9-3 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* on the textbook's Web site for a discussion of the taxation of original issue discount bonds. Also, we ignored the tax shield due to amortization of flotation costs because it has very little effect on the cost of debt; see *Ch09 Tool Kit.xls* for an example that incorporates the amortization tax shield.

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 6.13%. With N at 1 year rather than 30 years and F still equal to 1%, the nominal annual $r_d(1 - T) = 6.45\%$. Finally, if $F = 10\%$ and $N = 1$, then the nominal annual $r_d(1 - T) = 16.67\%$. In all of these cases, the effect of flotation costs would be too large 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 plus other securities that have a specific claim on the project's cash flows. This is different from the usual debt offering, in which the debt has a claim on all of 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 project's value. 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 the new debt.

The Cost of Short-Term Debt

As we mentioned earlier, most U.S. companies use short-term debt primarily to finance seasonal working capital needs. Seasonal debt fluctuates during the year, often dropping close to zero, so it is not a permanent source of financing for most U.S. companies. Therefore, we usually do not include short-term debt when estimating the cost of capital.

However, some U.S. companies and many international companies, especially those in Japan, do use relatively large amounts of short-term debt on a consistent basis. For such companies, we should include short-term debt as a capital component when estimating the WACC. Most short-term debt is in the form of bank loans, often with an interest rate that is tied to the prime rate or to the London Interbank Offered Rate (LIBOR). The interest rate on short-term debt is its pre-tax cost, and it must be adjusted to determine its after-tax cost. Also, there are normally no flotation costs for short-term debt, so flotation adjustments are not required.

Self-Test

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

Is the relevant cost of debt when calculating the WACC the interest rate on already *outstanding* debt or the rate 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, then what is the nominal annual pre-tax cost of debt? **(8%)** If the company's tax rate is 40%, what is the after-tax cost of debt? **(4.8%)**

9.4 COST OF PREFERRED STOCK, r_{ps}

Many firms (including NCC) use, or plan to use, preferred stock as part of their financing mix. Preferred dividends are not tax deductible, so the company bears their full cost. Therefore, *no tax adjustment is used when calculating the cost of preferred stock*. Some preferred stocks are issued without a stated maturity date, but today most have a sinking fund that effectively limits their life. Finally, 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.

GE and Warren Buffett: The Cost of Preferred Stock

In October 2008, GE was in serious trouble. Its stock price had been crashing, its sales and earnings were declining, it was having trouble rolling over its commercial paper, and there were rumors that its bonds were about to be downgraded, which would raise its interest expense and exacerbate all its other problems. Then Warren Buffett came to the rescue. Buffett agreed to buy \$3 billion of a new GE preferred stock, and he publicly expressed his confidence by asserting that “GE will continue to be successful in the years to come.” GE needed a boost, and Buffett’s money and endorsement provided it.

However, Buffett didn’t exactly give GE something for nothing. The preferred stock carried a 10% coupon, it had a 10% call premium, and it was convertible into GE’s common stock during the next 5 years at a rate of 4.4944 shares of common per share of preferred. GE incurred no flotation costs because the deal was worked out between the two parties rather than being sold by underwriters. GE had been financing with commercial paper (until that market dried up) at an after-tax cost of about 2%, and its AAA-rated bonds were yielding about 8%, for an after-tax cost of about 4.8% because

interest is tax-deductible. So the 10% coupon cost of Buffett’s preferred stock was not cheap.

Buffett actually expected to earn more than 10% on the deal. We don’t know what he assumed the stock would do over the next 5 years, but he might have expected it to grow at a rate of 13.3% per year, which would move the stock from its then-current price of \$24.50 to \$45.74. Given that growth rate, Buffett could earn a tidy 23.3% on his investment by converting to common stock at the end of Year 5. Even if the stock appreciated at only 6% he would still earn 16.78% per year, and if the stock actually declined then he would still earn 10%—provided GE didn’t go bankrupt. (The rate of return on the convertible preferred stock is calculated in a Tab in *Ch09 Tool Kit.xls*.)

Buffett’s return is the mirror image of GE’s cost. Because GE had been doing most of its financing with commercial paper and long-term debt at much lower rates, using convertible preferred instead was a real shock to its system. Obviously, this raised GE’s weighted average cost of capital, and that presumably affected its required return on new assets and thus its capital budget.

The **component cost of preferred stock, r_{ps}** , is the cost used in the WACC 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 savings with preferred stock. For preferred stock without a stated maturity date, r_{ps} is

$$\text{Component cost of preferred stock} = r_{ps} = \frac{D_{ps}}{P_{ps}(1 - F)} \quad (9-4)$$

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

To illustrate the calculation, assume NCC has preferred stock that pays an \$8 dividend per share and sells for \$100 per share. If NCC issued new shares of preferred then 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 8.2%:

$$r_{ps} = \$8/\$97.50 = 8.2\%$$

If we had not incorporated flotation costs, we would have incorrectly estimated $r_{ps} = \$8/\$100 = 8.0\%$, which is too big a difference to ignore. Therefore, analysts usually include flotation costs when estimating the firm’s cost of preferred stock.

Although preferred stock is riskier than debt, NCC’s preferred stock has a lower return to investors than does its debt: 8% versus 9%. However, recall that most preferred stock is held by other companies, which are allowed to exclude 70% of

preferred stocks' dividends from taxation. Thus, the after-tax return to these investors is higher for preferred stock than for debt, which is consistent with preferred stock being riskier than debt.

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 for \$50 per share and pays a \$3 annual dividend. Flotation costs are equal to 3% of the gross proceeds. If the company issues preferred stock, what is the cost of that stock? (6.19%)

9.5 COST OF COMMON STOCK, r_s

Companies can raise common equity in two ways: (1) by selling newly issued shares to the public, and (2) by retaining and reinvesting earnings. If new shares are issued, what rate of return must the company earn to satisfy the new stockholders? In previous chapters we have seen 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 flotation costs when a firm issues new equity.

Few firms with moderate or slow growth issue new shares of common stock through public offerings.⁸ In fact, less than 2% of all new corporate funds come from the external public equity market. There are three reasons for this.

1. As we noted earlier, flotation costs can be quite high.
2. Investors perceive the issuance of common stock as a negative signal about the true value of the company's stock. Investors believe that managers have superior knowledge about companies' future prospects and that managers are most likely to issue new stock when they think the current stock price is above its intrinsic value. Suppose a company has an extremely profitable new project but will have to finance it with external capital. If the firm finances the project with common stock, the new stockholders will share in the windfall when the new project's profits start rolling in. Therefore, it is logical to think that managers will want to finance really good new projects with debt, temporarily increasing the debt ratio but planning to sell stock when profits rise and pull up the stock price. On the other hand, if things look bad, management might want to finance with stock to let new shareholders share in the pain. The net result is that if a mature company announces plans to issue additional shares, investors typically take this as a signal of bad news; as a result, the stock declines.
3. Even without the signaling effect, 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.

In the remainder of this section, we assume that the company does not plan to issue new shares.⁹ We will address the impact of flotation costs on the cost of equity in Section 9.10.

Does new equity capital raised by reinvesting earnings have a cost? The answer is a resounding "yes!" If earnings are reinvested, then stockholders will incur an

⁸A few companies issue new shares through new-stock dividend reinvestment plans, which we discuss in Chapter 14. Many companies sell stock to their employees, and companies occasionally issue stock to finance huge projects or mergers. Also, some utilities regularly issue common stock.

⁹There 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.

opportunity cost—the earnings could have been paid out as dividends or used to repurchase stock, and in either case stockholders would have received funds that they could reinvest in other securities. *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 could stockholders expect to earn on equivalent-risk investments? The answer is r_s , because they could presumably 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 as reinvested earnings.* If a company can't 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 yield 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 and 7 to produce reasonably good estimates for the cost of equity. Three methods are typically used: (1) the Capital Asset Pricing Model (CAPM), (2) the discounted cash flow (DCF) method, and (3) the over-own-bond-yield-plus-judgmental-risk-premium approach. These methods are not mutually exclusive: When estimating a company's cost of equity, we generally use all three methods and then use an average, weighted on the basis of our confidence in the data used for each method.

Self-Test

What are the two primary 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?

9.6 THE CAPM APPROACH

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

1. Estimate the risk-free rate, r_{RF} .
2. Estimate the current market risk premium, RP_M , which is the required market return minus the risk-free rate.
3. Estimate the stock's beta coefficient, b_i , which measures the stock's relative risk. The subscript i signifies Stock i 's beta.
4. Use these three values in Equation 9-5 to estimate the stock's required rate of return:

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

(9-5)

Equation 9-5 shows that the CAPM estimate of r_s begins with the risk-free rate, r_{RF} . We then add a risk premium that is 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 this 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 no such thing as a truly riskless asset in the U.S. economy. Treasury securities are essentially free of default risk; however, nonindexed long-term T-bonds will suffer capital losses if interest rates rise, indexed long-term bonds will decline if the



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

real rate rises, 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 them use the rate on 10-year Treasury bonds.¹⁰ 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 relatively long-term basis. Therefore, it is reasonable to think that stock returns embody relatively long-term inflation expectations similar to those reflected in bonds rather than the short-term expectations in bills.
2. Short-term Treasury bill rates are more volatile than are long-term Treasury bond rates and, most experts agree, are more volatile than r_f .¹¹
3. In theory, the CAPM is supposed to measure the required 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 a time period of 10 years is a reasonable average for projects' lives, the return on a 10-year T-bond is a logical choice for the risk-free rate.

T-bond rates can be found in *The Wall Street Journal*, the *Federal Reserve Bulletin*, or on the Internet. Although most analysts use the yield on a 10-year T-bond as a proxy for the risk-free rate, yields on 20- or 30-year T-bonds are also reasonable proxies.

Estimating the Market Risk Premium

Recall from Chapter 6 that the market risk premium, RP_M , is the required return on the stock market minus the risk-free rate, where the risk-free rate usually is defined as the yield on a 10-year Treasury bond. This is also called the **equity risk premium**, or just the **equity premium**. Since most investors are risk averse, they require a higher anticipated return (a risk premium) to induce them to invest in risky equities versus a Treasury bond. Unfortunately, the required return on the market, and hence the equity premium, is not directly observable. Three approaches may be used to estimate the market risk premium: (1) calculate historical premiums and use them to estimate the current premium; (2) use the current value of the market to estimate forward-looking premiums; and (3) survey experts. We proceed with an explanation of each approach.

Historical Risk Premium. Historical risk premium data for U.S. securities, updated annually, are available from many sources, including Ibbotson Associates.¹² Using data from 1926 through the most recent year, Ibbotson calculates the actual realized rate of return each year for the stock market and for long-term government bonds. Ibbotson defines the annual equity risk premium as the difference between

¹⁰See 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.

¹¹Economic 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.

¹²See *Ibbotson Stocks, Bonds, Bills, and Inflation: 2009 Valuation Yearbook* (Chicago: Morningstar, Inc., 2009) for the most recent estimates.

the historical realized returns on stocks and the historical returns on long-term T-bonds.¹³ Ibbotson's 2009 book reported a 6.5% arithmetic average historical risk premium and a 4.4% geometric average. If investor risk aversion had actually been constant during the sample period, then the arithmetic average would be the best estimate for next year's risk premium, whereas the geometric average would be the best estimate for the longer-term risk premium, say, for the next 20 years.

There are several problems with using historical averages to estimate the current risk premium. First, stock returns are quite volatile, which leads to low confidence in estimated averages. For example, the estimated historical average premium is 6.5%, but the 95% confidence interval ranges from about 1.6% to 11.4%. In other words, there is a very good chance that the true risk premium is much different from the calculated 6.5% average.

Second, the historical average is extremely sensitive to the period over which it is calculated. Just 9 years ago the historical average premium was 8.1%, which is substantially different from the current 6.5% average. In fact, over the past 12 years the average T-bond return has been higher than the average stock return, resulting in a negative historical premium. However, the expected premium can't be negative—no one would invest in the stock market expecting to get a return that is less than the risk-free rate.

Third, changes in the risk premium can occur if investors' tolerance for risk changes. This causes problems in interpreting historical returns because a change in the required risk premium causes an *opposite change in the observed* premium. For example, an increase in the required premium means that investors have become more risk averse and require a higher return on stocks. But applying a higher discount rate to a stock's future cash flows causes a decline in stock price. Thus, an *increase* in the required premium causes a simultaneous *decrease* in the observed premium. Part of the market's precipitous decline in 2008 surely was due to investors' increased risk aversion.

Forward-Looking Risk Premiums. An alternative to the historical risk premium is the forward-looking, or *ex ante*, risk premium. Again, the market risk premium is $RP_M = r_M - r_{RF}$, but r_M and r_{RF} are measured using forward-looking rather than historical data. As explained previously, we can use the yield to maturity on a 10-year T-bond as an estimate of the risk-free rate, which was 2.94% when we wrote this in May 2009. The challenge is to estimate the required return on the market, r_M . The most common approach is to assume that the market is in equilibrium, in which case the required return is equal to the expected return: $r_M = \hat{r}_M$. We can use the discounted cash flow (DCF) model from Chapter 7 to estimate the expected market rate of return, \hat{r}_M . If we assume that the market dividend will grow at a constant rate and that the firms that make up the market pay out as dividends all the funds available for distribution (i.e., the firms make no stock repurchases or purchases of short-term investments), then the required return is:

$$\text{Required rate of return} = r_M = \frac{\text{Expected rate of return}}{\hat{r}_M} = \frac{D_1}{P_0} + g \quad (9-6)$$

Thus, the required return on the market can be estimated as the sum of the market's expected dividend yield plus the expected constant growth rate in dividends.

¹³The risk premium should be defined using the yield on T-bonds, so Ibbotson actually uses the return on T-bonds due to coupons rather than the total bond return (which includes capital gains and appreciation) as a proxy for the yield.



For current estimates from Standard & Poor's, go to <http://www2.standardandpoors.com/spf/xls/index/SP500EPSEST.XLS>.



Go to the Federal Reserve Web site at <http://www.federalreserve.gov/releases/h15/update/> for current yields on T-bonds and TIPS.

It is easy to obtain the market's actual dividend yield; in May 2009, Reuters.com reported a dividend yield of 2.93% for the S&P 500. It is a little more difficult, but not impossible, to find an estimate of the expected dividend yield. In April 2009, Standard & Poor's reported a projected dividend yield of 2.8% for the S&P 500.

We have an estimate of the expected dividend yield to use in Equation 9-6, but where can we get an estimate of the constant dividend growth rate, g ? There is no definitive answer to that question, but neither are we totally in the dark. In the long run, constant dividend growth is driven by constant earnings growth, which in turn is driven by constant sales growth; hence it is reasonable to use an estimate of the market's long-term growth rate of sales as a proxy for the dividend growth rate.

Sales revenue growth is determined by growth in prices and units sold. In the long run, price growth will follow inflation. Historically, the average inflation rate has been about 3%. We can get a forward estimate of inflation by subtracting the real interest rate from the yield on a 10-year T-bond. The yield of an inflation-protected Treasury bond (called a TIPS) is a good estimate of the real interest rate. In May 2009, the yield on a 10-year TIPS was 1.69%, so a forward estimate of inflation is $2.94\% - 1.69\% = 1.25\%$.¹⁴ This suggests that a reasonable estimate of expected inflation is somewhere between 1.25% and the historical average of 3%. In the long run, quantity growth will be driven by population growth. What is a reasonable estimate of sustainable population growth? There is no definitive answer, but somewhere around 1% to 2.5% is reasonable. Combining long-term population growth with expected inflation suggests that the long-term constant growth rate in sales is around 2.25% to 5.5%.¹⁵

Using a mid-point of our inflation and population growth estimates, a reasonable estimate of g is about 3.88%. When we combine this with the market's projected dividend yield, our estimate of the expected market risk return is

$$\begin{aligned} r_M = \hat{r}_M &= \frac{D_1}{P_0} + g \\ &= 2.82\% + 3.88\% \\ &= 6.70\% \end{aligned}$$

Given the 10-year T-bond yield of 2.94%, the estimated forward-looking market risk premium is therefore

$$\begin{aligned} RP_M &= r_M - r_{RF} \\ &= 6.70\% - 2.94\% \\ &= 3.76\% \end{aligned}$$

This probably underestimates the market risk premium because it relies on two unrealistic assumptions: (1) firms will not repurchase any stock and (2) growth in dividends will be constant. Let's examine each of these assumptions and see how to incorporate them into the forward-looking approach.

¹⁴The difference in the yield on a T-bond and a TIPS of the same maturity actually includes a risk premium for bearing inflation risk as well as the anticipated inflation, but we assume that anticipated inflation makes up most of the difference.

¹⁵Our estimates might be a little low because they ignore potential innovation and sustainable productivity growth. Will innovation create net increases in the quantity sold as new products hit the market, or will new products simply replace old products, resulting in no net increase in quantity sold? Real productivity (measured as per capita GDP) in the United States has grown at an average annual rate of about 1.5% to 2.5%. Will this continue, or will the law of diminishing returns cause productivity eventually to level off? If you are optimistic about the positive prospects of innovation and productivity, then you might want to add about 1% to our estimates of long-term sales growth. Keep in mind, though, that there's a reason economics is called "the dismal science"!

In recent years, companies in the S&P 500 have distributed roughly as much cash to shareholders in the form of stock repurchases as in dividends.¹⁶ We define Rep/Div as the dollars used to repurchase stock divided by the dollars paid out in dividends and define Rep₁ as the expected repurchases at Year 1. In this notation, the total dollars paid out in dividends and repurchases will be (1 + Rep/Div)(Div). When stocks are repurchased each year, the number of outstanding shares declines each year, so the long-term growth rate in dividends per share (DPS) no longer is equal to the growth rate in sales. Let *g* be the long-term growth rate in total payouts (which should be the same as the long-term growth rate in sales and earnings) and let *g*_{DPS} be the long-term growth in DPS. The expected market return is given by

$$\begin{aligned} r_M = \hat{r}_M &= (1 + \text{Rep/Div}) \frac{D_1}{P_0} + g \\ &= \frac{D_1}{P_0} + \frac{\text{Rep}_1}{P_0} + g \\ &= \frac{D_1}{P_0} + g_{\text{DPS}} \end{aligned} \tag{9-7}$$

where the actual growth rate in dividends per share, *g*_{DPS}, is the sum of the repurchase yield (Rep₁/P₀) and the long-term growth rate in sales. All three versions of Equation 9-7 are equivalent, but we usually work with the first line because it's easier to obtain the necessary inputs.

If we assume that companies will, in aggregate, distribute about as many dollars via repurchases as via cash dividends in the future as they have in the recent past, then Rep/Div ≈ 1. Using our previous estimates of the dividend yield and the long-term growth rate, the expected market return and risk premium are

$$\begin{aligned} r_M = \hat{r}_M &= (1 + \text{Rep/Div}) \frac{D_1}{P_0} + g \\ &= (1 + 1)(2.82\%) + 3.88\% = 9.52\%; \\ \text{RP}_M &= r_M - r_{\text{RF}} = 9.52\% - 2.94\% = 6.98\% \end{aligned}$$

As these equations show, it is fairly easy to incorporate the impact of stock repurchases into our estimated market risk premium. We can also incorporate nonconstant payouts. We do this in *Web Extension 9A* and in the tab *Web 9A* in *Ch09 Tool Kit.xls*. Allowing for nonconstant growth and stock repurchases, we estimate that the required market return is about 8.97%. This would imply a market risk premium of

$$\text{RP}_M = r_M - r_{\text{RF}} = 8.97\% - 2.94\% = 6.03\%$$

Although this is our best estimate of the market risk premium as of April 2009, the forward-looking approach has some potential problems. First, analysts (and professors!) have a hard time accurately predicting sales, earnings, and payouts for more than a few quarters into the future. Second, the accuracy (and truthfulness) of analysts who work for investment banking firms has been questioned in recent years. This suggests 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 who sell stocks for a living. Third, different analysts

¹⁶For example, see the analysis by Douglas J. Skinner, "The Evolving Relation between Earnings, Dividends, and Stock Repurchases," *Journal of Financial Economics*, Vol. 87, 2008, pp. 582–609. We discuss payout strategies in more detail in Chapter 14.

have different estimates for growth, and we don't know which estimate, if any, truly represents the views of the marginal investor.

Surveys of Experts. What do the experts think about the market risk premium? Two professors at Duke University, John Graham and Campbell Harvey (now working in conjunction with *CFO* magazine), have surveyed CFOs quarterly beginning in 2000.¹⁷ One survey question asks CFOs what they expect the S&P 500 return to be over the next year. Their answers over the past 8 years have implied an average expected risk premium of 3.46%. It is interesting that, in the most recent survey (March 2009), CFOs expect the S&P 500 to have a 2.18% return—this is less than the 10-year T-bond rate, which implies a negative market risk premium.

According to recent surveys of professors, the expected market risk premium is around 5.0% to 6.5%, with most professors in 2007 and 2008 indicating that they believe the risk premium has fallen somewhat since 2000.¹⁸

To muddy the water a bit further, some academics have recently argued for a much lower market risk premium. Professors Eugene Fama and Kenneth French examined earnings and dividend growth rates during the period from 1951 to 2000 and estimated the forward-looking market risk premium to be 2.55%. Similarly, Professor Jay Ritter from the University of Florida argues that the forward-looking market risk premium should be based on inflation-adjusted expected returns, which would make it even lower—closer to 1%.¹⁹

Our View on the Market Risk Premium. After reading the previous sections, you might well be confused about the best way to estimate the market risk premium. Here's our opinion: The risk premium is driven primarily by investors' attitudes toward risk, and there are good reasons to believe that investors' risk aversion changes over time. Some factors suggest that the premium has declined. The introduction of pension plans, Social Security, health insurance, and disability insurance over the last 50 years means that people today can take more chances with their investments, which should make them less risk averse. Moreover, 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 for two reasons. The first is survivorship bias: the companies that fail had low returns, so excluding them raises the average historical return on stocks, which in turn raises the historical risk premium. The second reason is that increases in required returns cause decreases in observed returns, and vice versa.

On the other hand, we have recently seen a huge plunge in stock and home prices, most of us know people who have recently lost their jobs, and the pundits speak of investors exiting the stock market as a result of recent losses and fears of more losses. And some analysts who were recently extolling the virtues of "stocks for the long run" are now recommending T-bonds and other low-risk assets rather than stock.

Putting it all together, we conclude that the true risk premium in 2009 is lower than Ibbotson's long-term historical average, but it is certainly not negative as suggested by

¹⁷See John Graham and Campbell Harvey, "The Equity Risk Premium in 2008," Working Paper, Duke University, 2008. For updates on the survey, see <http://www.cfosurvey.org>.

¹⁸See Ivo Welch, "Views of Financial Economists on The Equity Premium and Other Issues," *The Journal of Business*, October 2000, 501–537, with 2009 updates at <http://welch.econ.brown.edu/academics/equupdate-results2009.html>. Also see Pablo Fernaández, "Market Risk Premium Used in 2008 by Professors: A Survey with 1,400 Answers" (April 16, 2009), at SSRN: <http://ssrn.com/abstract=1344209>.

¹⁹See 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.

some recent data. But just how low is it? In our consulting, we currently (during the bear market of 2008–2009) use a risk premium of about 6%, but we would have a hard time arguing with someone who used a risk premium anywhere in the range of 3.5% to 6.5%. We believe that investors' aversion to risk is relatively stable much of the time, but it is not absolutely constant from year to year and is certainly not constant during periods of great stress, such as during the 2008–2009 financial crisis. When stock prices are relatively high, investors feel less risk averse, so we would use a risk premium at the low end of our range. Conversely, when prices are depressed, we would use a premium at the high end of the range. The bottom line is that there is no way to prove that a particular risk premium is either right or wrong, though we'd be suspicious of an estimated market premium that is less than 3.0% or greater than 6.5%.²⁰

Estimating Beta

Recall from Chapter 6 that beta can be 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 result is called the *historical beta* because it is based on historical data. Although this approach is conceptually straightforward, complications quickly arise in practice.

First, there is no theoretical guidance as to the correct holding period for measuring returns. The returns for a company can be calculated using daily, weekly, or monthly periods, and the resulting betas will differ. Beta is also sensitive to the number of years of data that are used. With too few years, there will be few observations and the regression will not be statistically significant. On the other hand, with too many years the statistical significance may be improved but the "true" beta may have changed over the sample period. In practice, it is common to use either 3 to 5 years of monthly returns, or perhaps 1 to 2 years of weekly returns. Unfortunately, betas calculated in different ways can be different, and it is impossible to know for certain which is correct.

A second problem is that the market return should, in theory, reflect returns on every single asset—even human capital as reflected in people's earning power. 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 correlated with one another, using different indexes in the regression will result in a different beta, and we would surely obtain a different beta if we broadened the index to include real estate and other assets.

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 known average beta of 1.0. A second modification is to estimate a *fundamental beta*, which incorporates known information such as any changes in the company's product lines or capital structure.

Fourth, the estimate of beta for any individual company is 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 most companies, if your regression produces an estimated beta of 1.0, then in general you can only be 95% sure that the true beta lies within the range from 0.6 to 1.4. This isn't a big problem with well-diversified portfolios, but it does add another element of uncertainty when calculating the cost of equity for a single company.

²⁰For more on estimating the risk premium, see Robert S. Harris and Felicia C. Marston, "Estimating Shareholder Risk Premia Using Analysts' Growth Forecasts," *Financial Management*, Summer 1992, pp. 63–70.



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

The preceding discussion refers to conditions in the United States and other countries with well-developed financial markets where relatively good data are available. When we consider countries with less-developed financial markets, we are much 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 be nice to have exact, precise numbers for everything and thus be able to make decisions with a great deal of confidence, but that's not the way the world is—we are often forced to use judgment and to make educated guesses. Still, our discussion should help improve your judgment regarding the choice of beta for use in cost-of-capital studies, and it should also keep you from being too dogmatic about the accuracy of your beta and therefore your estimated cost of capital.

One More Caveat Regarding the CAPM Approach

We should point out one more potential problem with the CAPM: It has never been proven that investors base their required rates of return on the equation $r_M = r_{RF} + (RP_M)b_i$. Hundreds, perhaps thousands of studies have been conducted to test the validity of the CAPM, but there have been no definitive answers. The principal problem is that the CAPM itself deals only with *expectations*, yet the tests of the theory (such as the Fama-French work described in Chapter 6) have necessarily relied on historical data.

Still, we do know that security analysts and portfolio managers rely on the CAPM for much of their work, and betas are widely publicized. In addition, the CAPM's focus on diversification and systematic risk is quite logical, so it makes sense for people to use it when they make investment decisions. Therefore, it is reasonable to use the CAPM when you estimate the cost of equity, as most academics recommend and most corporate practitioners do. Just recognize that there may be other factors at work and so—even if you could estimate r_{RF} , b_i , and RP_M exactly—your estimate of r_s might still not be exact.

An Illustration of the CAPM Approach

To illustrate the CAPM approach, assume that $r_{RF} = 5\%$, $RP_M = 5.5\%$, and NCC's $b_i = 1.2$. Therefore, NCC is riskier than an average company, and its cost of equity is about 11.6%:

$$\begin{aligned} r_s &= 5\% + (5.5\%)(1.2) \\ &= 5\% + 6.6\% \\ &= 11.6\% \end{aligned}$$

It should be obvious by now that, although the CAPM approach appears to yield precise estimates of r_s , it is impossible to know with certainty the correct values of the required inputs to make it operational; this is because (1) it is impossible to estimate the required inputs precisely and (2) even if we knew the correct inputs, it might still turn out that the CAPM does not perfectly reflect the views of the marginal investor. Still, in our judgment it is possible to develop “reasonable” estimates of the required variables, and we believe that investors do use the CAPM concept when making decisions; thus that it can be used to obtain reasonable estimates of the cost of equity capital. Indeed, despite the difficulties we have pointed out, surveys indicate that the CAPM is the dominant choice for the vast majority of companies in the United States and around the world.

Self-Test

What is generally considered to be the more appropriate estimate of the risk-free rate: the yield on a short-term T-bill or the yield on a 10-year T-bond?

Explain both the historical and the forward-looking approach to estimating the market risk premium.

Describe some problems one encounters when estimating beta.

A company's beta is 1.4, the yield on a 10-year T-bond is 4%, and the market risk premium is 4.5%. What is r_s ? (10.3%)

9.7 DIVIDEND-YIELD-PLUS-GROWTH-RATE, OR DISCOUNTED CASH FLOW (DCF), APPROACH

In Chapter 7, we saw that if the marginal investor expects dividends to grow at a constant rate and if the company makes all payouts in the form of dividends (the company does not repurchase stock), then the price of a stock can be found as follows:

$$P_0 = \frac{D_1}{r_s - g} \quad (9-8)$$

Here P_0 is the price of the stock, D_1 is the dividend expected to be paid at the end of Year 1, g is the expected growth rate in dividends, and r_s is the required rate of return. Assuming the stock is in equilibrium, 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:

$$\hat{r}_s = r_s = \frac{D_1}{P_0} + \text{Expected } g \quad (9-9)$$

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 $r_s = \hat{r}_s$), and this permits us to 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 marginal investor's expected dividend growth rate. The stock price and the dividend are easy to obtain, but the expected growth rate is difficult to estimate, as we will see in the following sections.

Historical Growth Rates. 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. This is a reasonable proposition, but such situations occur only at a handful of very mature, slow-growing companies. Unfortunately, this limits the usefulness of historical growth rates as predictors of future growth rates for most companies.

Retention Growth Model. Most firms pay out some of their net income as dividends and reinvest, or retain, the rest. The more they retain, and the higher the earned rate of return on those retained earnings, the larger their growth rate. This is the idea behind the retention growth model.

The **payout ratio** is the percent of net income that the firm pays out in dividends, and the **retention ratio** is the complement of the payout ratio: Retention ratio = $(1 - \text{Payout ratio})$. NCC's payout ratio has averaged 63% over the past 15 years, so its retention rate has averaged $1.0 - 0.63 = 0.37 = 37\%$. Also, NCC's return on equity (ROE) has averaged 14.5% over the past 15 years. We know that, other things held constant, the earnings growth rate depends on the amount of income the firm retains and the rate of return it earns on those retained earnings, and the **retention growth equation** can be expressed as follows:

$$g = \text{ROE}(\text{Retention ratio}) \quad (9-10)$$

When we use this equation to estimate the DCF growth rate, we are implicitly making four important assumptions: (1) we expect the payout rate, and thus the retention rate, to remain constant; (2) we expect the ROE on new investments to remain constant and equal to the ROE on existing assets; (3) the firm is not expected to repurchase or issue new common stock, or, if it does, this new stock will 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. Under these assumptions, the earnings growth rate will be constant, and it will also be the dividend growth rate.

Using NCC's 14.5% average ROE and its 37% retention rate, we can use Equation 9-10 to find the estimated g :

$$g = 14.5\%(0.37) = 5.365 \approx 5.4\%$$

Analysts' Forecasts. A third technique calls for using security analysts' forecasts. As we discussed earlier, analysts publish earnings' growth rate estimates for most of the larger publicly owned companies. For example, *Value Line* provides such forecasts on about 1,700 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 Zacks or by Thomson ONE—BSE, can be found on the Internet. These earnings growth rates are often used as proxies for dividend growth rates.

Note, however, that analysts' forecasts often involve nonconstant growth. For example, one widely followed analyst forecasted that NCC would have a 10.4% annual growth rate in earnings and dividends over the next 5 years, after which the growth rate would decline to 5%. Such nonconstant growth forecasts can be converted to an approximate constant growth rate. Computer simulations indicate that dividends beyond Year 50 contribute very little to the value of any stock—the present value of all 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, then 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 assume a growth rate of 10.4% for 5 years followed by a growth rate of 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 $0.10(10.4\%) + 0.90(5\%) = 5.54\% \approx 5.5\%$.²¹

²¹Instead of converting nonconstant growth estimates into an approximate average growth rate, it is possible to use the nonconstant growth estimates to estimate directly the required return on common stock. See *Web Extension 9A* on the textbook's Web site for an explanation of this approach; all calculations are in the worksheet *Web 9A* in the file *Ch09 Tool Kit.xls*.

WWW

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

Applying the DCF Approach. To illustrate the DCF approach, suppose NCC's stock sells for \$32, its next expected dividend is \$1.82, and its expected growth rate is 5.5%. NCC is not expected to repurchase any stock. NCC's stock is thought to be in equilibrium, so its expected and required rates of return are equal. Based on these assumptions, its estimated DCF cost of common equity is 11.2%:

$$\begin{aligned}\hat{r}_s = r_s &= \frac{\$1.82}{\$32.00} + 5.5\% \\ &= 5.7\% + 5.5\% \\ &= 11.2\%\end{aligned}$$

Evaluating the Methods for Estimating Growth

Observe that the DCF approach finds 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 without much error, but there is uncertainty in the growth estimate. We would like to know the expected average growth rate as forecasted by the marginal investor, but that rate simply cannot be observed. However, we have considered three methods that can be used to estimate expected future growth: (1) historical growth rates, which implicitly assume that investors expect past results to be repeated in the future; (2) the retention growth model, which implicitly assumes that investors expect historical payout ratios and ROEs to be repeated; and (3) analysts' forecasts. Of these three methods, the third is the most logical. Moreover, studies have also shown that analysts' forecasts usually predict actual future growth better than the other methods. We recommend a primary reliance on analysts' forecasts for the growth rate in DCF cost of capital estimates.²²

Self-Test

What inputs are required for the DCF method?

What are three ways to estimate the expected dividend growth rate, and which of these methods is likely to provide 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 the firm's r_s ? **(11%)**

9.8 OVER-OWN-BOND-YIELD-PLUS-JUDGMENTAL-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% to the interest rate on the firm's own long-term debt. It is logical to think that firms with risky, low-rated, and hence high-interest rate debt will also have risky, high-cost equity, and the procedure for basing the cost of equity on a readily observable debt cost utilizes this logic. In this approach,

$$r_s = \text{Company's own bond yield} + \text{Judgmental risk premium}$$

(9-11)

²²See Robert Harris, "Using Analysts' Growth Rate Forecasts to Estimate Shareholder Required Rates of Return," *Financial Management*, Spring 1986, pp. 58–67.

NCC's bonds yield 9.0%, so if its over-own-bond-yield judgmental risk premium is estimated as 3% then its estimated cost of equity is 12%:

$$r_s = 9\% + 3\% = 12\%$$

Because the risk premium is a judgmental estimate, the estimated value of r_s is also judgmental. Similarly, though, a lot of judgment goes into the CAPM and DCF estimates of r_s . Empirical work suggests that the risk premium over a firm's own bond yield generally has ranged from 3 to 5 percentage points.²³ Therefore, this method is not likely to produce a precise cost of equity, but it can help "get us into the ballpark."

Self-Test

Explain the reasoning behind the bond-yield-plus-judgmental-risk-premium approach.

A company's bond yield is 7%. If the appropriate over-own-bond-yield risk premium is 3.5%, then what is r_s ? (10.5%)

9.9 COMPARISON OF THE CAPM, DCF, AND OVER-OWN-BOND-YIELD-PLUS-JUDGMENTAL-RISK-PREMIUM METHODS

We have discussed three methods for estimating the cost of common stock. For NCC, the CAPM estimate is 11.6%, the DCF constant growth estimate is 11.2%, and the over-own-bond-yield-plus-judgmental-risk-premium estimate is 12%. The overall average of these three methods is $(11.6\% + 11.2\% + 12\%)/3 = 11.6\%$. These results are unusually close, 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 own best judgment regarding the relative merits of each estimate and then choose one that seemed reasonable under the circumstances.

Recent surveys indicate that the CAPM 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 another) used the CAPM.²⁴ This is in sharp contrast to a 1982 survey, which found that only 30% of respondents used the CAPM.²⁵ Only 16% now use the DCF approach, down from 31% in 1982. The bond-yield-plus-judgmental-risk-premium is relied upon 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

²³Analysts have surveyed portfolio managers, asking how much more they would have to expect to earn on a firm's stock versus its bonds to induce them to buy the stock. The range we have seen is 3% to 5%, which is what we use. Discussions with financial executives indicate that most are comfortable with this range. All this is purely judgmental, but that's the case for much of finance.

²⁴See 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 10. It is interesting that 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.

²⁵See 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.

equity capital. Unfortunately, this is not possible—finance is in large part a matter of judgment, and we simply must face that fact.²⁶

Self-Test

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

9.10 ADJUSTING THE COST OF EQUITY FOR FLOTATION COSTS

As explained earlier, most mature companies rely primarily on reinvesting a large portion of their earnings and hence rarely issue new common stock. 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 the **flotation costs** involved in issuing new common stock. What rate of return must be earned on new investments to make issuing stock worthwhile? Put another way, what is the cost of new common stock?

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

$$r_e = \hat{r}_e = \frac{D_1}{P_0(1-F)} + g \quad (9-12)$$

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

Using the same inputs as when we estimated NCC's cost of common equity using the DCF approach—but assuming that NCC incurs a flotation cost of 12.5% to sell new common stock—its cost of new outside equity is calculated as follows:

$$\begin{aligned} r_e &= \frac{\$1.82}{\$32(1-0.125)} + 5.5\% \\ &= 6.5\% + 5.5\% = 12.0\% \end{aligned}$$

As we calculated earlier using the DCF model (but ignoring flotation costs), NCC's stockholders require a return of $r_s = 11.2\%$. However, because of flotation costs the company must earn *more* than 11.2% on the net funds it has to invest if investors are to receive an 11.2% return on the money they actually contributed. Specifically, if the firm earns 12.0% on net 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 so the price per share will not decline. If it earns less than 12.0% then earnings, dividends, and growth will fall below expectations, which will cause a decline in the stock price. If it earns more than 12.0%, the stock price will rise.

As we noted previously, most analysts use the CAPM to estimate the cost of equity. In an earlier section, we estimated NCC's CAPM cost of equity as 11.6%. How would the analyst incorporate flotation costs into a CAPM cost estimate? If application of the DCF methodology gives a cost of internally generated equity of

²⁶One senior executive told us that, in his judgment, the CAPM's popularity was partly the result of lower-level staffers wanting to use methods that can be defended by reference to the finance literature and to "hard" numbers based on published data, like historical betas and risk premiums. His conclusion was that the CAPM's use with historical data is widely discussed in the finance literature and taught in MBA programs, so the result is sort of a self-fulfilling prophecy. He went on to say that in his opinion a great deal of judgment is required; in his company, lower-level staffers derived relatively precise results and then experienced, senior managers applied judgment when making decisions based on those results. He thought this procedure worked out well for his company.

TABLE 9-1 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.

11.2% but a cost of 12.0% when flotation costs are involved, then the flotation costs add 0.8 percentage points to the cost of equity. To incorporate flotation costs into the CAPM estimate, we would simply add 0.8% to the 11.6% CAPM estimate, resulting in a 12.4% estimated cost of external equity. As an alternative, you could find the average of the CAPM, DCF, and over-own-bond-yield-plus-judgmental-risk-premium costs of equity (ignoring flotation costs) and then add to it the 0.8 percentage points to adjust for flotation costs.

Table 9-1 shows the average flotation costs for debt and equity issued by U.S. corporations in the 1990s. The common stock flotation costs are for non-IPO issues. For IPOs, flotation costs are higher: about 17% higher if less than \$10 million is raised and higher still as issue size increases. The data in Table 9-1 include both utility and nonutility companies; if utilities had been excluded, the reported flotation costs would have been higher. Table 9-1 shows that flotation costs are significantly higher for equity than for debt. Notice that all flotation costs, as a *percentage* of capital raised, fall as the *amount* of capital raised increases.

The lower cost for issuing debt results from two factors. First, debt is a contractual obligation; hence returns are more predictable, which makes selling debt easier. Second, corporate debt is sold mainly in large blocks to institutional investors, whereas common stock is sold in smaller amounts to many different investors; this imposes higher costs on the investment banks, who pass these costs on to the issuing company.

Self-Test

What are flotation costs?

Why are flotation costs higher for stock than for debt?

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%**)

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

As we saw earlier in this chapter (and as we discuss in more detail in Chapter 15), each firm has an optimal capital structure, which is defined as the mix of debt, preferred, and common equity that maximizes its stock price. Therefore, a value-maximizing firm must attempt to find its *target (or 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 WACC, as shown previously in Equation 9-1:

$$\text{WACC} = w_d r_d (1 - T) + w_{ps} r_{ps} + w_s r_s \quad (9-1)$$

Here w_d , w_{ps} , and w_s are the target weights for debt, preferred, and common equity, respectively.²⁷

To illustrate, we first note that 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 9%; its cost of preferred stock, r_{ps} , is 8.2%; its cost of common equity, r_s , is 11.6%; its marginal tax rate is 40%; and all of its new equity will come from reinvested earnings. We can now calculate NCC's weighted average cost of capital as follows:

$$\begin{aligned} \text{WACC} &= 0.3(9.0\%)(1 - 0.4) + 0.1(8.2\%) + 0.6(11.6\%) \\ &= 9.4\% \end{aligned}$$

Three points should be noted. First, the WACC is the cost the company would incur to raise each 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, not on the particular sources of financing in any single year. Third, the target weights should be based on market values and not on book values. We discuss these points in what follows.

Marginal Rates versus Historical Rates

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

Because investors' required rates of return are based on *current* market conditions, not on market conditions when they purchased their securities, it follows that the cost of capital depends on current conditions and not on past market conditions.

²⁷If a company also used short-term debt as a permanent source of financing, then its cost of capital would be:

$$\text{WACC} = w_d r_d (1 - T) + w_{STD} r_{STD} (1 - T) + w_{ps} r_{ps} + w_s r_s \quad (9-1a)$$

where w_{STD} is the percentage of the firm that is financed with short-term debt and r_{STD} is the cost of short-term debt.

Target Weights versus Annual Financing Choices

We have heard managers (and students!) say, “Our debt has a 5% after-tax cost versus a 10% WACC and a 14% cost of equity. Therefore, since we will finance only with debt this year, we should evaluate this year’s projects at a 5% cost.” There are two flaws in that line of reasoning.

First, suppose the firm exhausts its capacity to issue low-cost debt this year to take on projects with after-tax returns as low as 5.1% (which is slightly higher than the after-tax cost of debt). Then next year, when the firm must finance with common equity, it will have to turn down projects with returns as high as 13.9% (which is slightly lower than the cost of equity). To avoid this problem, a firm that plans to remain in business indefinitely should evaluate all projects using the 10% WACC.

Second, both existing and new 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 non-recourse 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.

Weights for Component Costs: Book Values versus Market Values versus Targets

Our primary reason for calculating the WACC is to use it in capital budgeting or corporate valuation, since we need to compare the expected returns on projects and companies with the cost of the funds used to finance them. As Figure 9-1 showed, accountants report financial statements in book value terms, but financial analysts can convert those numbers into market values.

At one time academics—and, to a lesser extent, financial executives—debated whether we should use book value versus market value weights when estimating the cost of capital. The main arguments in favor of book weights were (1) these are the numbers shown on financial statements, (2) the bond rating agencies seem to focus on book weights, and (3) book values are more stable than market values, so book value weights produce more stable inputs for use in capital budgeting. The main arguments in favor of market value weights were (1) firms raise funds by selling securities at their market values, not at book values, and (2) market values are more consistent with the idea of value maximization.

Market value supporters won the argument, as they should have, but in a dynamic world it is simply not feasible to blindly and mechanically focus on current market value weights (i.e., on the market value weights given in Column J of Figure 9-1). As a result of the stock market crash of 2008–2009, many firms saw their equity ratios drop from about 75% to near 10%, and managers concluded that neither the book value nor market value numbers represented how they wanted to finance in the future. Thus, they didn’t want to use either book value or market value weights.

What they did, as we discuss in Chapter 15, was focus on a less mechanical, more judgmental capital structure—the **Target Capital Structure**. At the target structure, the firm uses enough debt to gain the benefits of interest tax shields and also leverages up earnings per share. However, the amount of debt is not so great that it subjects the firm to a high probability of financial distress during a period of economic recession. Managements have some flexibility in setting their target capital

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 with them. 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 recent years, 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 declining. Today, most large corporations raise capital throughout the world; hence, we are moving toward one global capital market instead of distinct capital markets in each country. Government policies and market conditions can affect the cost of capital within a given country, but this primarily affects smaller firms that do not have access to global capital markets, and even these differences are becoming less important as time passes. What matters most is the risk of the individual firm, not the market in which it raises capital.

structures, but they are also subject to constraints and market forces. Firms compare their data with those of benchmark firms in their industry; this allows firms to see how they are doing relative to other firms in their industry. If a company uses too little debt then its earnings will be lower than they could have been without subjecting the firm to undue risk, and individual stockholders, private equity firms, or hedge funds will probably challenge management and force it toward the optimal structure. If a company uses too much debt, then lenders will raise interest rates or perhaps refuse to lend at all, rating agencies and analysts will report on its risky situation, the intrinsic value of the firm's stock will decline, and its market value will suffer. Thus, forces exist to compel firms to set their target capital structures at levels that will maximize their intrinsic values and thus their stock prices.

Finally, note that an optimal capital structure in one economic environment may not be optimal under different market conditions. In a dynamic economy it is important to constantly monitor the situation and make adjustments to the target capital structure as circumstances change.

Self-Test

How is the weighted average cost of capital calculated? Write out the equation. Should the weights used to calculate the WACC be based on book values, market values, or something else? Explain.
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%)**

9.12 FACTORS THAT AFFECT THE WACC

The cost of capital is affected by some factors that are under a firm's control and some that are not.

Three Factors the Firm Cannot Control

Three key determinants of WACC are beyond a firm's control: (1) the state of the financial markets, including stock prices in general and the level of interest rates; (2) investors' aversion to risk and thus the market risk premium; and (3) tax rates as set by Congress.

Stock and Bond Markets. The stock and bond markets, and the market for short-term debt, are normally in equilibrium and thus fairly stable. However, at times the markets are disrupted, making it virtually impossible for a firm to raise capital at reasonable rates. This happened in 2008 and 2009, before the U.S. Treasury and the Federal Reserve intervened to open up the capital markets. During such times, firms tend to cut back on growth plans; if they must raise capital, its cost can be extraordinarily high. For example, see the box “GE and Warren Buffett: The Cost of Preferred Stock” presented earlier in the chapter.

Note also that if interest rates in the economy rise, the costs of both debt and equity will increase. The firm will have to pay bondholders a higher interest rate to obtain debt capital; and, as indicated in our discussion of the CAPM, higher interest rates also increase the cost of equity. Interest rates are heavily influenced by inflation. When inflation hit historic highs in the early 1980s, interest rates followed, but they trended down until the financial crisis in 2008 led to an upward spike. However, strong actions by the federal government in the spring of 2009 brought rates back down. These actions should encourage investment, and there is little doubt that they will eventually lead the economy out of its recession. However, many observers fear that the government’s actions will also reignite long-run inflation, which would lead to higher interest rates.²⁸

Market Risk Premium. Investors’ aversion to risk determines the market risk premium. Individual firms have no control over the RP_M , which affects the cost of equity and thus the WACC.

Tax Rates. Tax rates, which are influenced by the president and set by Congress, have an important effect on the cost of capital. They are used when we calculate the after-tax cost of debt for use in the WACC. In addition, the lower tax rate on dividends and capital gains than on interest income favors financing with stock rather than bonds, as we discuss in detail in Chapter 15.

Three 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 the current chapter we assume that the firm has a given target capital structure, and we use weights based on that target to calculate its WACC. However, a firm can change its capital structure, and such a change can affect its cost of capital. For example, the after-tax cost of debt is lower than the cost of equity, so if the firm decides to use more debt and less common equity, then this increase in debt will tend to lower the WACC. However, an increased use of debt will increase the risk of debt and the equity, offsetting to some extent the effect due to a greater weighting of debt. In Chapter 15 we discuss this in more depth, and we demonstrate that the optimal capital structure is the one that minimizes the WACC and simultaneously maximizes the intrinsic value of the stock.

Dividend Policy. As we will see in Chapter 14, the percentage of earnings paid out in dividends may affect a stock’s required rate of return, r_s . Also, if the payout ratio is so high that the firm must issue new stock to fund its capital budget, then the resulting flotation costs will also affect the WACC.

²⁸Other things held constant, if the government doubles the money supply then there would be twice as many dollars chasing the same amount of goods, and this would eventually lead to inflation. So one cost of the stimulus program may be higher inflation.

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, which reflect the risks inherent in the existing assets. Therefore, we are implicitly assuming that new capital will be invested in assets with the same degree of risk as existing assets. This assumption is generally correct, because most firms do invest in assets similar to those they currently use. However, the equal risk assumption is incorrect if a firm dramatically changes its investment policy. For example, if a company invests in an entirely new line of business, then its marginal cost of capital should reflect the risk of that new business. With hindsight we can therefore see that GE's huge investments in the TV and movie businesses, as well as its investment in mortgages, increased its risk and thus its cost of capital.

Self-Test

Name some factors that are generally beyond the firm's control but still affect its cost of capital.

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

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

9.13 ADJUSTING THE COST OF CAPITAL FOR RISK

As we have calculated it, the weighted average cost of capital reflects the average risk and overall capital structure of the entire firm. No adjustments are needed when using the WACC as the discount rate when estimating the value of a company by discounting its cash flows. However, adjustments for risk are often needed when evaluating a division or project. For example, 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 is not logical to use the 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.

Divisional Costs 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% WACC. The cafe division is riskier and has a 14% WACC. 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 will 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 reject that project. However, if management 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 (SML) 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 = $b = 1.1$, $r_{RF} = 5\%$, and $RP_M = 6\%$. Thus, Huron's cost of equity (and WACC) is 11.6%:

$$r_s = 5\% + (6\%)1.1 = 11.6\%$$

This suggests that investors should be willing to give Huron money to invest in new, average-risk projects if the company expects to earn 11.6% 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 suppose barge operations typically have betas of 1.5 rather than 1.1. The barge division, with $b = 1.5$, has a 14.0% cost of capital:

$$r_{\text{Barge}} = 5\% + (6\%)1.5 = 14.0\%$$

On the other hand, if Huron adds a low-risk division, such as a new distribution center with a beta of only 0.5, then that division's cost of capital would be 8%:

$$r_{\text{Center}} = 5\% + (6\%)0.5 = 8.0\%$$

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 corporate beta would depend on the size of the investments in the new divisions relative to 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 calculated as follows:

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

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

$$r_{\text{Huron}} = 5\% + (6\%)1.12 = 11.72\%$$

Even though investors require an overall return of 11.72%, they should expect a rate of return on projects in each division at least as high as the division's required return based on the SML. In particular, they should expect a return of at least 11.6% from the steel division, 14.0% from the barge division, and 8.0% from the distribution center.

Obviously, our example suggests a level of precision that is much higher than firms can obtain in the real world. Still, managers should be aware of the logic of our example, and they should strive to measure the required inputs as well as possible.

Techniques for Measuring Divisional Betas

In Chapter 6 we discussed the estimation of betas for stocks and indicated how difficult it is to measure beta precisely. Estimating divisional betas is much more difficult, primarily because divisions do not have their own publicly traded stock.²⁹ Therefore, we must estimate the beta that the division would have if it were an independent, publicly traded company. Two approaches can be used to estimate divisional betas: the pure play method and the accounting beta method.

The Pure Play Method. In the **pure play method**, the company tries to find the betas of several publicly held specialized companies in the same line of business as the

²⁹This same problem applies to privately held companies, which we discuss in Section 9.14.

division being evaluated, and it then averages those betas to determine the cost of capital for its own division. For example, suppose Huron found three companies devoted exclusively to operating barges, and suppose that Huron's management believes its barge division would be subject to the same risks as those firms. Then Huron could use the average beta of those firms as a proxy for its barge division's beta.³⁰

The Accounting Beta Method. As noted above, it may be impossible to find specialized 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 are normally 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

In Chapter 11 we examine ways to estimate the risk inherent in individual projects, but at this point it is useful to consider how project risk is reflected in measures of the firm's cost of capital. First, although it is intuitively clear that riskier projects have a higher cost of capital, it is difficult to measure projects' relative risks. Also, note that three separate and distinct types of risk can be identified as follows.

1. **Stand-alone risk**, which is the variability of the project's expected returns.
2. **Corporate**, or **within-firm, risk**, which 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 and so some of its risk will be diversified away.
3. **Market**, or **beta, risk**, which is the risk of the project as seen by a well-diversified stockholder who owns many different stocks. A project's market risk is measured by its effect on the firm's overall beta coefficient.

Taking on a project with a high degree of either stand-alone or corporate risk will not necessarily increase the corporate 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 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 automobiles. This means that the project will tend to do well if GM's other divisions are doing well but will do poorly if other divisions are doing poorly. This being the case, the project will also have a high degree of 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

³⁰If the pure play firms employ different capital structures than that of Huron, then this must be addressed by adjusting the beta coefficients. See Chapter 15 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.

most difficult to estimate. In practice, most decision makers consider all three risk measures in a subjective manner.

The first step is to determine the divisional cost of capital before grouping 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—and 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. Although this approach is better than ignoring project risk, these 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 adjust the corporation’s overall cost of capital to establish the required return for most projects in a low-risk division and in a high-risk division?

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

What are the three types of risk to which projects are exposed? Which type of risk is theoretically the most relevant? Why?

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

9.14 PRIVATELY OWNED FIRMS AND SMALL BUSINESSES

Up until now, our discussion of the cost of common equity 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 used stock returns to estimate beta as an input for the CAPM approach. But how can one measure the cost of equity 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.³¹ 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. This is similar to the pure play method discussed earlier for estimating divisional betas. With an estimate of beta, the cost of equity can be estimated using the CAPM approach.

The stock of a privately held firm is less liquid than that of a publicly held firm. Just as investors demand a liquidity premium on thinly traded bonds, they also add a liquidity premium to obtain the required return on a privately held firm’s stock.³² 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 theoretically satisfying because we don’t know exactly how large the liquidity premium should be, but it is logical and is also a common practice.³³

³¹In Chapter 15 we show how to adjust for differences in capital structures.

³²See Yakov Amihud and Haim Mendelson, “Liquidity and Cost of Capital: Implications for Corporate Management,” *Journal of Applied Corporate Finance*, Fall 1989, pp. 65–73.

³³In fact, some analysts make a similar liquidity adjustment for any small firm’s cost of common equity even if the firm is publicly traded. Ibbotson Association’s data, discussed earlier in the chapter in connection with historical risk premiums, support this position: the smaller the firm, the larger the historical risk premiums.

In addition to the difficulty of estimating the cost of equity for small and privately held firms, there are also problems in estimating their proper capital structure weights. These weights should take account of the firm's market value weights. However, a privately held firm can't directly observe its market value, so it can't directly observe its market value 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, next use the cost of capital to estimate the value of the firm, and finally complete the circle by using the estimated value of the firm to estimate the value of its equity.³⁴ If this newly estimated equity value is different from 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 consistent estimates 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?

9.15 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 base the cost of debt on the coupon rate on a firm's existing debt.* The cost of debt must be based on the interest rate the firm would pay if it issued new 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 return on T-bonds.* The historical average return on bonds should be subtracted from the past average return on stocks to calculate the *historical market risk premium*. On the other hand, it is appropriate to subtract today's yield on T-bonds from an estimate of the expected future return on stocks to obtain the *forward-looking market risk premium*. A case can be made for using either the historical or the current risk premium, but it would be wrong to take the *historical* rate of return on stocks, subtract from it the *current* rate on T-bonds, and then use the difference as the market risk premium.
3. *Never use the current book value capital structure to obtain the weights when estimating the WACC.* Your first choice should be to use the firm's target capital structure for the weights. However, if you are an outside analyst and do not know the target weights, it would probably be best to estimate weights based on the current market values of the capital components. If the company's debt is not publicly traded, then it is reasonable to use the book value of debt to estimate the weights because book and market values of debt, especially short-term debt, are usually close to one another. However, stocks' market values in recent years have generally been at least 2–3 times their book values, so using book values for equity could lead to serious errors. The bottom line: If you don't know the target weights then use the market value, not the book value, of equity when calculating the 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



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

³⁴See Chapter 13 for more discussion on estimating the value of a firm.

made that accounts payable and accruals should be included in the calculation of the WACC. However, these funds are not provided by investors. Instead, they arise from operating relationships with suppliers and employees. Such funds are not included when calculating free cash flows, and they are not included when we calculate the amount of capital needed in a capital budgeting analysis. Therefore, they should not be included when we calculate the WACC.

Self-Test

What four mistakes are commonly made when estimating the WACC?

Summary

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

- Much of the chapter was devoted to pointing out the problems encountered when estimating the cost of capital. Although these problems are not trivial, the state of the art in cost-of-capital estimation is really not in bad shape. The procedures outlined in this chapter can be used to obtain cost-of-capital estimates that are sufficiently accurate for practical purposes.
- 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 interest rate paid on new debt by $1 - T$, where T is the firm's marginal tax rate: $r_d(1 - T)$.
- Most debt is raised directly from lenders without the use of investment bankers, hence no flotation costs are incurred. However, a **debt flotation cost adjustment** should be made if large flotation costs are incurred. We 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 price the firm receives after deducting flotation costs: $r_{ps} = D_{ps}/[P_{ps}(1 - F)]$. Flotation costs on preferred stock are usually fairly high, so we typically include the impact of flotation costs when estimating r_{ps} . Also note that if the preferred stock is convertible into common stock, then the true cost of the preferred stock will exceed the flotation-adjusted yield of the preferred dividend.
- The **cost of common equity**, r_s , also called the **cost of common stock**, is the rate of return required by the firm's stockholders, and it can be estimated in three ways: (1) the **CAPM**; (2) the **dividend-yield-plus-growth-rate**, or **DCF approach**; and (3) the **over-own-bond-yield-plus-judgmental-risk-premium approach**.
- To use the **CAPM approach**, we (1) estimate the firm's beta, (2) multiply this beta by the market risk premium to obtain the firm's risk premium, and then (3) add the firm's risk premium to the risk-free rate to obtain its 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, with 10 years the maturity used most frequently.
- To use the **dividend-yield-plus-growth-rate approach**, which is also called the **discounted cash flow (DCF) approach**, add the firm's expected dividend growth rate to its expected dividend yield: $r_s = \hat{r}_s = D_1/P_0 + g$. **Web Extension 9A** shows how to estimate the DCF cost of equity if dividends are not growing at a constant rate.

- The growth rate for use in the DCF model can be based on security analysts' **published forecasts**, on **historical growth rates** of earnings and dividends, or on the **retention growth model**, $g = (1 - \text{Payout})(\text{Return on equity})$.
- The **over-own-bond-yield-plus-judgmental-risk-premium approach** calls for adding a subjective risk premium of 3 to 5 percentage points to the interest rate on the firm's own long-term debt: $r_s = \text{Bond yield} + \text{Judgmental risk premium}$.
- When calculating the **cost of new common stock, r_e** , the DCF approach can be used to estimate the flotation cost. For a constant growth stock, the flotation-adjusted 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 . We can find the difference between r_e and r_s and then add this differential to the CAPM estimate of r_s to find the CAPM estimate of r_e .
- Each firm has a **target capital structure**, which is defined as the mix of debt, preferred stock, and common equity that minimizes its **weighted average cost of capital (WACC)**:

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

We discuss in Chapter 15 how the target weights are determined, but keep in mind that if you don't know the target weights, it's better to calculate WACC using market value than book value weights.

- **Various factors affect a firm's cost of capital.** Some are determined by the financial environment, but the firm can influence others through its financing, investment, and dividend policies.
- Many firms estimate **divisional costs of capital** that reflect each division's risk and capital structure.
- The **pure play** and **accounting beta methods** can 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 effect 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 stockholders' risk, 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 subjective manner and then classify projects into risk categories. Using the firm's 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 its risk. The greater a project's risk, the higher its 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 and subjective; hence, project risk adjustments tend to be more subjective than precisely measured.

The cost of capital as developed in this chapter is used in the next two chapters to evaluate potential capital budgeting projects, and it is used later in the text to determine the value of a corporation.

Questions

- (9-1) 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
- (9-2) How can the WACC be both an average cost and a marginal cost?
- (9-3) How would each of the factors in the following table 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 that all other factors 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.	_____	_____	_____

- (9-4) 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?
- (9-5) Suppose a firm estimates its overall 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) 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. Ten-year Treasury bonds yield 6%, the market risk premium is 5%, and LCI's beta is 1.3. The following 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%.

Common: New common equity will be raised only by retaining earnings.

- Find the component costs of debt, preferred stock, and common stock.
- What is the WACC?

Problems

Answers Appear in Appendix B

EASY PROBLEMS 1–8

- (9–1)** Calculate the after-tax cost of debt under each of the following conditions:
After-Tax Cost of Debt
- Interest rate of 13%, tax rate of 0%
 - Interest rate of 13%, tax rate of 20%
 - Interest rate of 13%, tax rate of 35%
- (9–2)** LL Incorporated's currently outstanding 11% coupon bonds have a yield to maturity of 8%. LL believes it could issue new bonds at par that would provide a similar yield to maturity. If its marginal tax rate is 35%, what is LL's after-tax cost of debt?
After-Tax Cost of Debt
- (9–3)** Duggins Veterinary Supplies can issue perpetual preferred stock at a price of \$50 a share with an annual dividend of \$4.50 a share. Ignoring flotation costs, what is the company's cost of preferred stock, r_{ps} ?
Cost of Preferred Stock
- (9–4)** Burnwood Tech plans to issue some \$60 par preferred stock with a 6% dividend. A similar stock is selling on the market for \$70. Burnwood must pay flotation costs of 5% of the issue price. What is the cost of the preferred stock?
Cost of Preferred Stock with Flotation Costs
- (9–5)** Summerdahl Resort's 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 its cost of common equity?
Cost of Equity: DCF
- (9–6)** Booher 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%, and the return on an average stock in the market last year was 15%. What is the estimated cost of common equity using the CAPM?
Cost of Equity: CAPM
- (9–7)** Shi Importer's balance sheet shows \$300 million in debt, \$50 million in preferred stock, and \$250 million in total common equity. Shi's tax rate is 40%, $r_d = 6%$, $r_{ps} = 5.8%$, and $r_s = 12%$. If Shi has a target capital structure of 30% debt, 5% preferred stock, and 65% common stock, what is its WACC?
WACC
- (9–8)** 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

- (9–9)** 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 after-tax 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
- (9–10)** 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%, then what would be the firm's cost of equity based on the CAPM approach?
- If the firm's bonds earn a return of 12%, then what would be your estimate of r_s using the over-own-bond-yield-plus-judgmental-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 be your estimate of Shelby's cost of equity?

(9-11)
Cost of Equity

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

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

(9-12)
Calculation of g and
EPS

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.

- If investors require a 9% return, what rate of growth must be expected for Spencer?
- If Spencer reinvests earnings in projects with average returns equal to the stock's expected rate of return, then what will be next year's EPS? (*Hint: $g = \text{ROE} \times \text{Retention ratio}$.*)

(9-13)
The Cost of Equity and
Flotation Costs

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

(9-14)
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, then what is the after-tax cost of debt? Disregard the tax shield from the amortization of flotation costs.

CHALLENGING
PROBLEMS 15-17

(9-15)
WACC Estimation

On January 1, the total market value of the Tyseland 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. There is no short-term debt.

Debt	\$30,000,000
Common equity	<u>30,000,000</u>
Total capital	<u><u>\$60,000,000</u></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. The 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 the dividend yield is $\$1.20/\$30 = 4\%$.) The marginal tax rate is 40%.

- In order to maintain the present capital structure, how much of the new investment must be financed by common equity?
- Assuming there is sufficient cash flow for Tysseland to maintain its target capital structure without issuing additional shares of equity, what is its WACC?
- 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? No numbers are required to answer this question.

(9-16)

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

Market Value Capital
Structure

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. These bank loans are not used for seasonal financing but instead are part of the company's permanent capital structure. The long-term debt consists of 30,000 bonds, each with a par value of \$1,000, an annual coupon interest rate of 6%, and a 20-year maturity. 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.

(9-17)

WACC Estimation

The table below gives the balance sheet for Travellers Inn Inc. (TII), a company that was formed by merging a number of regional motel chains.

Travellers Inn: December 31, 2009 (Millions of Dollars)

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

The following facts also apply to TII.

- 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 bank loans are zero in the off-season.

- (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 have a 12% yield to maturity.
- (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 price range from \$17 to \$23. $D_0 = \$1$ and $EPS_0 = \$2$. ROE based on average equity was 24% in 2008, but management expects to increase this return on equity to 30%; however, security analysts and investors generally 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 from 4.5% to 5.5%. Some brokerage house analysts report forecasted growth dividend growth rates in the range of 10% to 15% over the foreseeable future.
- (6) TII's financial vice president recently polled some pension fund investment managers who hold TII's securities regarding what minimum rate of return on TII's common would make them willing to buy the common rather than TII bonds, given that 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 predicts a decline in interest rates, with r_d falling to 10% and the T-bond rate to 8%, although the bank acknowledges that an increase in the expected inflation rate could lead to an increase rather than a decrease in interest rates.

Assume that you were recently hired by TII as a financial analyst and that your boss, the treasurer, has asked you to estimate the company's WACC under the assumption that no new equity will be issued. Your cost of capital should be appropriate for use in evaluating projects that are in the same risk class as the assets TII now operates.

SPREADSHEET PROBLEM

(9-18)

Build a Model: WACC



Start with the partial model in the file *Cb09 P18 Build a Model.xls* on 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 issue additional long-term debt at an interest rate (or a 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—in other words, the after-tax cost of debt, the cost of preferred stock (including flotation costs), and the cost of equity (ignoring flotation costs). Use both the DCF method and the CAPM method to find the cost of equity.
- 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 then add that difference 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 reinvested 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.

THOMSON ONE | Business School Edition Problem

Use the Thomson ONE—Business School Edition online database to work this chapter's questions.

CALCULATING 3M'S COST OF CAPITAL

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

Thomson ONE—BSE Discussion Questions

1. As a first step we need to estimate what percentage of MMM's capital comes from long-term debt, preferred stock, and common equity. If we click on FINANCIALS, we can see immediately from the balance sheet the amount of MMM's long-term debt and common equity (as of mid-2008, MMM had no preferred stock). Alternatively, you can click on FUNDAMENTAL RATIOS in the next row of tabs below and then select WORLDSCOPE'S BALANCE SHEET RATIOS. Here, you will also find a recent measure of long-term debt as a percentage of total capital.

Recall that the weights used in the WACC are based on the company's target capital structure. If we assume the company wants to maintain the same mix of capital that it currently has on its balance sheet, then what weights should you use to estimate the WACC for MMM? (In Chapter 15, we will see that we might arrive at different estimates for these weights if we assume that MMM bases its target capital structure on the market values, rather than the book values, of debt and equity.)

2. Once again, we can use the CAPM to estimate MMM's cost of equity. Thomson ONE provides various estimates of beta; select the measure that you believe is best and combine this with your estimates of the risk-free rate and the market risk premium to obtain an estimate of its cost of equity. (See the Thomson ONE exercise in Chapter 6 for more details.) What is your estimate for the cost of equity? Why might it not make much sense to use the DCF approach to estimate MMM's cost of equity?
3. Next, we need to calculate MMM's cost of debt. Unfortunately, Thomson ONE doesn't provide a direct measure of the cost of debt. However, we can use different approaches to estimate it. One approach is to take the company's long-term interest expense and divide it by the amount of long-term debt. This approach works only if the historical cost of debt equals the yield to maturity in today's market (that is, only if MMM's outstanding bonds are trading at close to par). This approach may produce misleading estimates in the years during which MMM issues a significant amount of new debt.

For example, if a company issues a lot of debt at the end of the year, then the full amount of debt will appear on the year-end balance sheet, yet we still may not see a sharp increase in interest expense on the annual income statement because the debt was outstanding for only a small portion of the entire year. When this situation occurs, the estimated cost of debt will likely understate the true cost of debt.

Another approach is to try to find this number in the notes to the company's annual report by accessing the company's home page and its Investor Relations section. Remember that you need the after-tax cost of debt to calculate a firm's WACC, so you will need MMM's average tax rate (which has been about 37% in recent years). What is your estimate of MMM's after-tax cost of debt?

4. Putting all this information together, what is your estimate of MMM's WACC? How confident are you in this estimate? Explain your answer.

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 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, noncallable 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 \$3.12, and dividends are expected to grow at a constant rate of 5.8% in the foreseeable future. Harry Davis's beta is 1.2, the yield on T-bonds is 5.6%, and the market risk premium is estimated to be 6%. For the over-own-bond-yield-plus-judgmental-risk-premium approach, the firm uses a 3.2% risk premium.

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

To help you structure the task, Leigh 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?
 - (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 what is the component cost of this debt for WACC purposes?
- 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 has paid out 62% of earnings, and suppose investors expect similar values to obtain 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 5.8% growth rate given earlier?
 - (3) Could the DCF method be applied if the growth rate were not constant? How?
- f. What is the cost of equity based on the over-own-bond- yield-plus-judgmental-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 overall, or composite, WACC as the hurdle rate for each of its divisions?
- k. What procedures can be used to estimate 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 that will focus primarily on developing new Internet-based projects. In trying to determine the cost of capital for this new division, you discover that specialized firms involved in similar projects have, on average, the following characteristics: (1) their capital structure is 10% debt and 90% common equity; (2) their cost of debt is typically 12%; and (3) they have a beta of 1.7. Given this information, what would your estimate be for the new division's cost of capital?
- m. What are three types of project risk? How can each type of risk be considered when thinking about the new division's cost of capital?
- n. Explain in words why new common stock that is raised externally has a higher percentage cost than equity that is raised internally by retaining 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?

SELECTED ADDITIONAL CASES

The following cases from Textchoice, Cengage 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)."