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Chapter 10

Cost of Capital

10.1 COST OF CAPITAL DEFINED

Cost of capital is defined as the rate of return that is necessary to maintain the market value of the firm (or price of the firm's stock). Managers must know the cost of capital, often called the *minimum required rate of return* in: (1) making capital budgeting decisions; (2) helping to establish the optimal capital structure; and (3) making decisions such as leasing, bond refunding, and working capital management. The cost of capital is computed as a weighted average of the various capital components, which are items on the right-hand side of the balance sheet such as debt, preferred stock, common stock, and retained earnings.

10.2 COMPUTING INDIVIDUAL COSTS OF CAPITAL

Each element of capital has a component cost that is identified by the following:

k_i = before-tax cost of debt

$k_d = k_i(1 - t)$ = after-tax cost of debt, where t = tax rate

k_p = cost of preferred stock

k_s = cost of retained earnings (or internal equity)

k_e = cost of external equity, or cost of issuing new common stock

k_o = firm's overall cost of capital, or a weighted average cost of capital

Cost of Debt

The before-tax cost of debt can be found by determining the internal rate of return (or yield to maturity) on the bond cash flows, which was discussed in detail in Chapter 7. However, the following shortcut formula may be used for *approximating* the yield to maturity on a bond:

$$k_i = \frac{I + (M - V)/n}{(M + V)/2}$$

where I = annual interest payments in dollars

M = par value, usually $1,000 per bond

V = value or net proceeds from the sale of a bond

n = term of the bond in years

Since the interest payments are tax-deductible, the cost of debt must be stated on an after-tax basis. The after-tax cost of debt is:

$$k_d = k_i (1 - t)$$

where t is the tax rate.

EXAMPLE 10.1   Assume that the Carter Company issues a $1,000, 8 percent, 20-year bond whose net proceeds are $940. The tax rate is 40 percent. Then, the before-tax cost of debt, k_i, is:

$$k_i = \frac{I + (M - V)/n}{(M + V)/2}$$
$$= \frac{\$80 + (\$1,000 - \$940)/20}{(\$1,000 + \$940)/2} = \frac{\$83}{\$970} = 8.56\%$$

Therefore, the after-tax cost of debt is:

$$k_d = k_i(1 - t)$$
$$= 8.56\%(1 - 0.4) = 5.14\%$$

Cost of Preferred Stock

The cost of preferred stock, k_p, is found by dividing the annual preferred stock dividend, d_p, by the net proceeds from the sale of the preferred stock, p, as follows:

$$k_p = \frac{d_p}{p}$$

Since preferred stock dividends are not a tax-deductible expense, these dividends are paid out after taxes. Consequently, no tax adjustment is required.

EXAMPLE 10.2 Suppose that the Carter Company has preferred stock that pays a $13 dividend per share and sells for $100 per share in the market. The flotation (or underwriting) cost is 3 percent, or $3 per share. Then the cost of preferred stock is:

$$k_p = \frac{d_p}{p}$$
$$= \frac{\$13}{\$97} = 13.4\%$$

Cost of Equity Capital

The cost of common stock, k_e, is generally viewed as the rate of return investors require on a firm's common stock. Three techniques for measuring the cost of common stock equity capital are available: (1) the Gordon's growth model; (2) the capital asset pricing model (CAPM) approach; and (3) the bond plus approach.

The Gordon's Growth Model. The Gordon's model was discussed in detail in Chapter 7. The model is:

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

where P_0 = value of common stock
D_1 = dividend to be received in 1 year
r = investor's required rate of return
g = rate of growth (assumed to be constant over time)

Solving the model for r results in the formula for the cost of common stock:

$$r = \frac{D_1}{P_0} + g \qquad \text{or} \qquad k_e = \frac{D_1}{P_0} + g$$

Note that the symbol r is changed to k_e to show that it is used for the computation of cost of capital.

EXAMPLE 10.3 Assume that the market price of the Carter Company's stock is $40. The dividend to be paid at the end of the coming year is $4 per share and is expected to grow at a constant annual rate of 6 percent. Then the cost of this common stock is:

$$k_e = \frac{D_1}{P_0} + g = \frac{\$4}{\$40} + 6\% = 16\%$$

The cost of *new* common stock, or external equity capital, is higher than the cost of existing common stock because of the flotation costs involved in selling the new common stock.

If f is flotation cost in percent, the formula for the cost of new common stock is:

$$k_e = \frac{D_1}{P_0(1-f)} + g$$

EXAMPLE 10.4   Assume the same data as in Example 10.3, except the firm is trying to sell new issues of stock A and its flotation cost is 10 percent. Then:

$$
\begin{aligned}
k_e &= \frac{D_1}{P_0(1-f)} + g \\
&= \frac{\$4}{\$40(1-0.1)} + 6\% = \frac{\$4}{\$36} + 6\% = 11.11\% + 6\% = 17.11\%
\end{aligned}
$$

The CAPM Approach. An alternative approach to measuring the cost of common stock is to use the CAPM, which involves the following steps:

1. Estimate the risk-free rate, r_f, generally taken to be the United States Treasury bill rate.
2. Estimate the stock's beta coefficient, b, which is an index of systematic (or nondiversifiable market) risk.
3. Estimate the rate of return on the market portfolio such as the Standard & Poor's 500 Stock Composite Index or Dow Jones 30 Industrials.
4. Estimate the required rate of return on the firm's stock, using the CAPM (or SML) equation:

$$k_e = r_f + b(r_m - r_f)$$

Again, note that the symbol r_j is changed to k_e.

EXAMPLE 10.5   Assuming that r_f is 7 percent, b is 1.5, and r_m is 13 percent, then:

$$k_e = r_f + b(r_m - r_f) = 7\% + 1.5(13\% - 7\%) = 16\%$$

This 16 percent cost of common stock can be viewed as consisting of a 7 percent risk-free rate plus a 9 percent risk premium, which reflects that the firm's stock price is 1.5 times more volatile than the market portfolio to the factors affecting nondiversifiable, or systematic, risk.

The Bond Plus Approach. Still another simple but useful approach to determining the cost of common stock is to add a *risk premium* to the firm's own cost of long-term debt, as follows:

$$k_e = \text{long-term bond rate} + \text{risk premium}$$
$$= k_i(1-t) + \text{risk premium}$$

A risk premium of about 4 percent is commonly used with this approach.

EXAMPLE 10.6   Using the data found in Example 10.1, the cost of common stock using the bond plus approach is:

$$
\begin{aligned}
k_e &= \text{long-term bond rate} + \text{risk premium} \\
&= k_i(1-t) + \text{risk premium} \\
&= 5.14\% + 4\% = 9.14\%
\end{aligned}
$$

Cost of Retained Earnings

The cost of retained earnings, k_s, is closely related to the cost of existing common stock, since the cost of equity obtained by retained earnings is the same as the rate of return investors require on the firm's common stock. Therefore,

$$k_e = k_s$$

10.3   MEASURING THE OVERALL COST OF CAPITAL

The firm's overall cost of capital is the weighted average of the individual capital costs, with the weights being the proportions of each type of capital used. Let k_o be the overall cost of capital.

$$k_o = \sum \begin{pmatrix} \text{\% of total capital} & \text{cost of capital} \\ \text{structure supplied by} & \times \text{ for each source} \\ \text{each type of capital} & \text{of capital} \end{pmatrix}$$

$$= w_d \cdot k_d + w_p \cdot k_p + w_e \cdot k_e + w_s \cdot k_s$$

where w_d = % of total capital supplied by debt
$\quad w_p$ = % of total capital supplied by preferred stock
$\quad w_e$ = % of total capital supplied by external equity
$\quad w_s$ = % of total capital supplied by retained earnings (or internal equity)

The weights can be historical, target, or marginal.

Historical Weights

Historical weights are based on a firm's existing capital structure. The use of these weights is based on the assumption that the firm's existing capital structure is optimal and therefore should be maintained in the future. Two types of historical weights can be used—book value weights and market value weights.

Book Value Weights. The use of book value weights in calculating the firm's weighted cost of capital assumes that new financings will be raised using the same method the firm used for its present capital structure. The weights are determined by dividing the book value of each capital component by the sum of the book values of all the long-term capital sources. The computation of overall cost of capital is illustrated in the following example.

EXAMPLE 10.7   Assume the following capital structure for the Carter Company:

Mortgage bonds ($1,000 par)	$20,000,000
Preferred stock ($100 par)	5,000,000
Common stock ($40 par)	20,000,000
Retained earnings	5,000,000
Total	$50,000,000

The book value weights and the overall cost of capital are computed as follows:

Source	Book Value	Weights	Cost	Weighted Cost
Debt	$20,000,000	40%	5.14%	2.06%
Preferred stock	5,000,000	10	13.40%	1.34
Common stock	20,000,000	40	17.11%	6.84
Retained earnings	5,000,000	10	16.00%	1.60
Totals	$50,000,000	100%		11.84%

Overall cost of capital = k_o = 11.84%

Market Value Weights. Market value weights are determined by dividing the market value of each source by the sum of the market values of all sources. The use of market value weights for computing a firm's weighted average cost of capital is theoretically more appealing than the use of book value weights because the market values of the securities closely approximate the actual dollars to be received from their sale.

EXAMPLE 10.8   In addition to the data from Example 10.7, assume that the security market prices are as follows:

$$\text{Mortgage bonds} = \$1,100 \text{ per bond}$$
$$\text{Preferred stock} = \$90 \text{ per share}$$
$$\text{Common stock} = \$80 \text{ per share}$$

The firm's number of securities in each category is:

$$\text{Mortgage bonds} = \frac{\$20,000,000}{\$1,000} = 20,000$$

$$\text{Preferred stock} = \frac{\$5,000,000}{\$100} = 50,000$$

$$\text{Common stock} = \frac{\$20,000,000}{\$40} = 500,000$$

Therefore, the market value weights are:

Source	Number of Securities	Price	Market Value
Debt	20,000	$1,100	$22,000,000
Preferred stock	50,000	$90	4,500,000
Common stock	500,000	$80	40,000,000
			$66,500,000

The $40 million common stock value must be split in the ratio of 4 to 1 (the $20 million common stock versus the $5 million retained earnings in the original capital structure), since the market value of the retained earnings has been impounded into the common stock.

The firm's cost of capital is as follows:

Source	Market Value	Weights	Cost	Weighted Average
Debt	$22,000,000	33.08%	5.14%	1.70%
Preferred stock	4,500,000	6.77	13.40%	0.91
Common stock	32,000,000	48.12	17.11%	8.23
Retained earnings	8,000,000	12.03	16.00%	1.92
	$66,500,000	100.00%		12.76%

Overall cost of capital = $k_o = 12.76\%$

Target Weights

If the firm has determined the capital structure it believes most consistent with its goal, the use of that capital structure and associated weights is appropriate.

Marginal Weights

The use of marginal weights involves weighting the specific costs of various types of financing by the percentage of the total financing expected to be raised using each method. In using target weights, the firm is concerned with what it believes to be the optimal capital structure or target percentage. In using marginal weights, the firm is concerned with the *actual* dollar amounts of each type of financing to be needed for a given investment project.

EXAMPLE 10.9   The Carter Company is considering raising $8 million for plant expansion. Management estimates using the following mix for financing this project:

Debt	$4,000,000	50%
Common stock	2,000,000	25
Retained earnings	2,000,000	25
	$8,000,000	100%

The company's cost of capital is computed as follows:

Source	Marginal Weights	Cost	Weighted Cost
Debt	50%	5.14%	2.57%
Common stock	25	17.11%	4.28
Retained earnings	25	16.00%	4.00
	100%		10.85%

Overall cost of capital = k_o = 10.85%

10.4 LEVEL OF FINANCING AND THE MARGINAL COST OF CAPITAL (MCC)

Because external equity capital has a higher cost than retained earnings due to flotation costs, the weighted cost of capital increases for each dollar of new financing. Therefore, lower-cost capital sources are used first. In fact, the firm's cost of capital is a function of the size of its total investment. A schedule or graph relating the firm's cost of capital to the level of new financing is called the *weighted marginal cost of capital (MCC)*. Such a schedule is used to determine the discount rate to be used in the firm's capital budgeting process. The steps to be followed in calculating the firm's marginal cost of capital are summarized below.

1. Determine the cost and the percentage of financing to be used for each source of capital (debt, preferred stock, common stock equity).

2. Compute the break points on the MCC curve where the weighted cost will increase. The formula for computing the break points is:

$$\text{Break point} = \frac{\text{maximum amount of the lower-cost source of capital}}{\text{percentage financing provided by the source}}$$

3. Calculate the weighted cost of capital over the range of total financing between break points.

4. Construct an MCC schedule or graph that shows the weighted cost of capital for each level of total new financing. This schedule will be used in conjunction with the firm's available investment opportunities schedule (IOS) in order to select the investments. As long as a project's IRR is greater than the marginal cost of new financing, the project should be accepted. Also, the point at which the IRR intersects the MCC gives the optimal capital budget.

Example 10.10 illustrates the procedure for determining a firm's weighted cost of capital for each level of new financing and how a firm's investment opportunity schedule (IOS) is related to its discount rate.

EXAMPLE 10.10 A firm is contemplating three investment projects, A, B, and C, whose initial cash outlays and expected IRR are shown below. IOS for these projects is:

Project	Cash Outlay	IRR
A	$2,000,000	13%
B	$2,000,000	15%
C	$1,000,000	10%

If these projects are accepted, the financing will consist of 50 percent debt and 50 percent common stock. The firm should have $1.8 million in earnings available for reinvestment (internal common). The firm will consider only the effects of increases in the cost of common stock on its marginal cost of capital.

1. The costs of capital for each source of financing have been computed and are given below:

Source	Cost
Debt	5%
Common stock ($1.8 million)	15%
New common stock	19%

If the firm uses only internally generated common stock, the weighted cost of capital is:

$$k_o = \Sigma \text{ percentage of the total capital structure supplied by each source of capital}$$
$$\times \text{ cost of capital for each source}$$

In this case the capital structure is composed of 50 percent debt and 50 percent internally generated common stock. Thus,

$$k_o = (0.5)5\% + (0.5)15\% = 10\%$$

If the firm uses only new common stock, the weighted cost of capital is:

$$k_o = (0.5)5\% + (0.5)19\% = 12\%$$

Range of Total New Financing (In Millions of Dollars)	Type of Capital	Proportion	Cost	Weighted Cost
$0–$3.6	Debt	0.5	5%	2.5%
	Internal common	0.5	15%	7.5
				10.0%
$3.6 and up	Debt	0.5	5%	2.5%
	New common	0.5	19%	9.5
				12.0%

2. Next compute the break point, which is the level of financing at which the weighted cost of capital increases.

$$\text{Break point} = \frac{\text{maximum amount of source of the lower-cost source of capital}}{\text{percentage financing provided by the source}}$$

$$= \frac{\$1,800,000}{0.5} = \$3,600,000$$

3. That is, the firm may be able to finance $3.6 million in new investments with internal common stock and debt without having to change the current mix of 50 percent debt and 50 percent common stock. Therefore, if the total financing is $3.6 million or less, the firm's cost of capital is 10 percent.

4. Construct the MCC schedule on the IOS graph to determine the discount rate to be used in order to decide in which project to invest and to show the firm's optimal capital budget. See Fig. 10-1.

The firm should continue to invest up to the point where the IRR equals the MCC. From the graph in Fig. 10-1, note that the firm should invest in projects B and A, since each IRR exceeds the marginal cost of capital. The firm should reject project C since its cost of capital is greater than the IRR. The optimal capital budget is $4 million, since this is the sum of the cash outlay required for projects A and B.
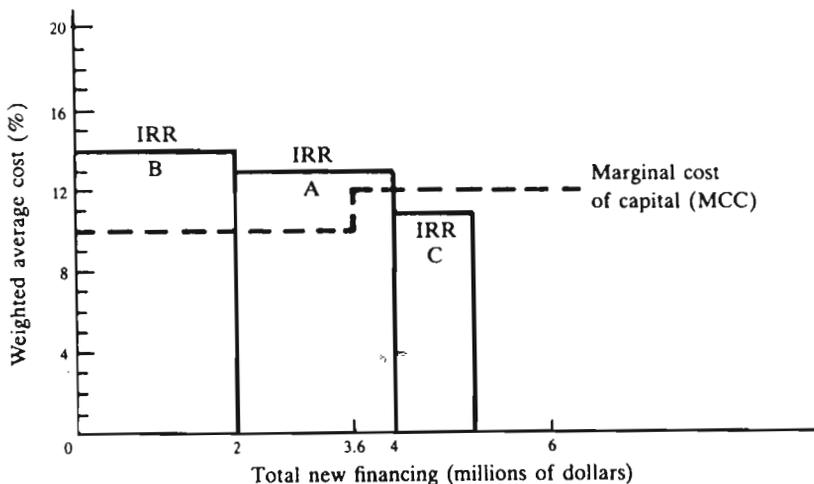
Fig. 10-1 MCC schedule and IOS graph

Review Questions

1. The firm's cost of capital is calculated as a(n) _____ of the costs of the various types of financing.

2. Capital components on the right-hand side of the firm's balance sheet are _____, _____, _____, and _____.

3. There are three techniques for measuring the cost of common stock. They are _____, _____, and _____.

4. The cost of capital, often called the _____, is used in: (1) making _____ decisions; (2) helping to establish the _____; and (3) making such decisions as _____, bond financing, and working capital management.

5. The after-tax cost of debt is k_i times _____.

6. The _____ is found by dividing the annual _____ dividend by the net proceeds from sale.

7. No tax adjustments are necessary for the computation of the costs of _____ and preferred stock.

8. The cost of _____ is higher than the cost of common stock because of _____ involved in its sale.

9. The _____ approach to determining the cost of common stock is to add a _____ to the firm's own cost of long-term debt.

10. Two types of historical weights are used: _____ and _____.

11. In computing the firm's overall cost of capital, the weights that can be used are _____,
    _____, and _____.

12. The _____ schedule shows the weighted cost of capital for each level of total new
    financing.

13. The comparison of the _____ and the _____ helps determine the firm's
    _____ to be used in the capital budgeting process.

14. Using the _____, the cost of common equity is a function of the risk-free rate,
    _____, and the market return.

15. Using the _____, the cost of common equity is dividend yield plus _____.

Answers: (1) weighted average; (2) long-term debt, preferred stock, common stock, retained earnings; (3) the Gordon's growth model approach, the CAPM approach, the bond plus approach; (4) required rate of return, capital budgeting, optimal capital structure, leasing; (5) $(1 - \text{tax rate})$; (6) cost of preferred stock, preferred stock; (7) common stock (equity); (8) new common stock, flotation costs; (9) bond plus, risk premium; (10) book value, market value; (11) historical, target, marginal; (12) marginal cost of capital (MCC); (13) MCC, investment opportunity schedule (IOS), optimal capital budget; (14) CAPM, beta; (15) Gordon's growth model, growth rate in earnings and dividends.