# Chapter 9
# The Cost of Capital
## ANSWERS TO END-OF-CHAPTER QUESTIONS

9-1 a. The weighted average cost of capital, WACC, is the weighted average of the after-tax component costs of capital—-debt, preferred stock, and common equity. Each weighting factor is the proportion of that type of capital in the optimal, or target, capital structure. The after-tax cost of debt, $r_d(1 - T)$, is the relevant cost to the firm of *new* debt financing. Since interest is deductible from taxable income, the after-tax cost of debt to the firm is less than the before-tax cost. Thus, $r_d(1 - T)$ is the appropriate component cost of debt (in the weighted average cost of capital).

b. The cost of preferred stock, $r_{ps}$, is the cost to the firm of issuing new preferred stock. For perpetual preferred, it is the preferred dividend, $D_{ps}$, divided by the net issuing price, $P_n$. Note that no tax adjustments are made when calculating the component cost of preferred stock because, unlike interest payments on debt, dividend payments on preferred stock are not tax deductible. The cost of new common equity, $r_e$, is the cost to the firm of equity obtained by selling new common stock. It is, essentially, the cost of retained earnings adjusted for flotation costs. Flotation costs are the costs that the firm incurs when it issues new securities. The amount actually available to the firm for capital investment from the sale of new securities is the sales price of the securities less flotation costs. Note that flotation costs consist of (1) direct expenses such as printing costs and brokerage commissions, (2) any price reduction due to increasing the supply of stock, and (3) any drop in price due to informational asymmetries.

c. The target capital structure is the relative amount of debt, preferred stock, and common equity that the firm desires. The WACC should be based on these target weights.

d. There are considerable costs when a company issues a new security, including fees to an investment banker and legal fees. These costs are called flotation costs. The cost of new common equity is higher than that of common equity raised internally by reinvesting earnings. Projects financed with external equity must earn a higher rate of return, since the project must cover the flotation costs.

9-2 The WACC is an average cost because it is a weighted average of the firm's component costs of capital. However, each component cost is a marginal cost; that is, the cost of new capital. Thus, the WACC is the weighted average *marginal* cost of capital.

9-3

| | Probable Effect on | | |
|---|---|---|---|
| | $r_d(1 - T)$ | $r_s$ | WACC |
| a. The corporate tax rate is lowered. | + | 0 | + |
| b. The Federal Reserve tightens credit. | + | + | + |
| c. The firm uses more debt; that is, it increases its debt/assets ratio. | + | + | 0 |
| d. The firm doubles the amount of capital it raises during the year. | 0 or + | 0 or + | 0 or + |
| e. The firm expands into a risky new area. | + | + | + |
| f. Investors become more risk averse. | + | + | + |

9-4 Stand-alone risk views a project's risk in isolation, hence without regard to portfolio effects; within-firm risk, also called corporate risk, views project risk within the context of the firm's portfolio of assets; and market risk (beta) recognizes that the firm's stockholders hold diversified portfolios of stocks. In theory, market risk should be most relevant because of its direct effect on stock prices.

9-5 If a company's composite WACC estimate were 10%, its managers might use 10% to evaluate average-risk projects, 12% for high-risk projects, and 8% for low-risk projects. 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.

# SOLUTIONS TO END-OF-CHAPTER PROBLEMS

9-1 a. $r_d(1 - T) = 13\%(1 - 0) = 13.00\%$.

b. $r_d(1 - T) = 13\%(0.80) = 10.40\%$.

c. $r_d(1 - T) = 13\%(0.65) = 8.45\%$.

9-2 $r_d(1 - T) = 0.08(0.65) = 5.2\%$.

9-3 $V_{ps} = \$50$; $D_{ps} = \$4.50$; $F = 0\%$; $r_{ps} = ?$

$$r_{ps} = \frac{D_{ps}}{V_{ps}(1-F)}$$

$$= \frac{\$4.50}{\$50(1-0.0)}$$

$$= 9\%.$$

9-4 $$r_{ps} = \frac{\$60(0.06)}{\$70.00(1-0.05)} = \frac{\$3.60}{\$66.50} = 5.41\%.$$

9-5 $P_0 = \$36$; $D_1 = \$3.00$; $g = 5\%$; $r_s = ?$

$$r_s = \frac{D_1}{P_0} + g = (\$3.00/\$36.00) + 0.05 = 13.33\%.$$

9-6 $r_s = r_{RF} + b_i(RP_M) = 0.06 + 0.8(0.055) = 10.4\%$.

9-7 30% Debt; 5% Preferred Stock; 65% Equity; $r_d = 6\%$; $T = 40\%$; $r_{ps} = 5.8\%$; $r_s = 12\%$.

$WACC = (w_d)(r_d)(1 - T) + (w_{ps})(r_{ps}) + (w_s)(r_s)$
$WACC = 0.30(0.06)(1-0.40) + 0.05(0.058) + 0.65(0.12) = 9.17\%$.

9-8 40% Debt; 60% Equity; $r_d$ = 9%; T = 40%; WACC = 9.96%; $r_s$ = ?

$$\text{WACC} = (w_d)(r_d)(1 - T) + (w_s)(r_s)$$
$$9.96\% = (0.4)(9\%)(1 - 0.4) + (0.6)r_s$$
$$9.96\% = 2.16\% + 0.6r_s$$
$$7.8\% = 0.6r_s$$
$$r_s = 13\%.$$

9-9 Enter these values: N = 60, PV = -515.16, PMT = 30, and FV = 1000, to get I = 6% = periodic rate. The nominal rate is 6%(2) = 12%, and the after-tax component cost of debt is 12%(0.6) = 7.2%.

9-10 a. $r_s = \frac{D_1}{P_0} + g = \frac{\$2.14}{\$23} + 7\% = 9.3\% + 7\% = 16.3\%.$

b. $r_s = r_{RF} + (r_M - r_{RF})b$
$= 9\% + (13\% - 9\%)1.6 = 9\% + (4\%)1.6 = 9\% + 6.4\% = 15.4\%.$

c. $r_s$ = Bond rate + Risk premium = 12% + 4% = 16%.

d. The bond-yield-plus-judgmental-risk-premium approach and the CAPM method both resulted in lower cost of equity values than the DCF method. The firm's cost of equity should be estimated to be about 15.9%, which is the average of the three methods.

9-11 a. $\$6.50 = \$4.42(1+g)^5$
$(1+g)^5 = \$6.50/\$4.42 = 1.471$
$(1+g) = 1.471^{(1/5)} = 1.080$
$g = 8\%.$

Alternatively, with a financial calculator, input N = 5, PV = -4.42, PMT = 0, FV = 6.50, and then solve for I/YR = 8.02% ≈ 8%.

b. $D_1 = D_0(1 + g) = \$2.60(1.08) = \$2.81.$

c. $r_s = D_1/P_0 + g = \$2.81/\$36.00 + 8\% = 15.81\%.$

9-12 a. $r_s = \dfrac{D_1}{P_0} + g$

$$0.09 = \frac{\$3.60}{\$60.00} + g$$

$0.09 = 0.06 + g$

$g = 3\%$.

b.

| | |
|---|---|
| Current EPS | \$5.400 |
| Less: Dividends per share | 3.600 |
| Retained earnings per share | \$1.800 |
| Rate of return | × 0.090 |
| Increase in EPS | \$0.162 |
| Current EPS | 5.400 |
| Next year's EPS | \$5.562 |

Alternatively, $EPS_1 = EPS_0(1 + g) = \$5.40(1.03) = \$5.562$.

9-13 $P_0 = \$30$; $D_1 = \$3.00$; $g = 5\%$; $F = 10\%$; $r_s = ?$

$r_s = [D_1/(1 - F) P_0] + g = [\$3/(1 - 0.10)(\$30)] + 0.05 = 16.1\%$.

9-14 Enter these values: N = 20, PV =1,000(1 - 0.02) = 980, PMT = -90(1 - 0.4) = -54, and FV = -1000, to get I/YR = 5.57%, which is the after-tax component cost of debt.

9-15 a. Common equity needed:

$$0.5(\$30{,}000{,}000) = \$15{,}000{,}000.$$

b. Cost using $r_s$:

| | Percent | × | After-Tax Cost | = | Product |
|---|---|---|---|---|---|
| Debt | 0.50 | | 4.8%* | | 2.4% |
| Common equity | 0.50 | | 12.0 | | 6.0 |
| | | | | WACC = | 8.4% |

*8%(1 - T) = 8%(0.6) = 4.8%.

c. $r_s$ and the WACC will increase due to the flotation costs of new equity.

9-16 The book and market value of the current liabilities are both $10,000,000.

The bonds have a value of

$$V = \$60(PVIFA_{10\%,20}) + \$1{,}000(PVIF_{10\%,20})$$
$$= \$60([1/0.10]-[1/(0.1*(1+0.10)^{20})]) + \$1{,}000((1+0.10)^{-20})$$
$$= \$60(8.5136) + \$1{,}000(0.1486)$$
$$= \$510.82 + \$148.60 = \$659.42.$$

Alternatively, using a financial calculator, input N = 20, I/YR = 10, PMT = 60, and FV = 1000 to arrive at a PV = $659.46.

The total market value of the long-term debt is 30,000($659.46) = $19,783,800.

There are 1 million shares of stock outstanding, and the stock sells for $60 per share. Therefore, the market value of the equity is $60,000,000.

The market value capital structure is thus:

| | | |
|---|---|---|
| Short-term debt | $10,000,000 | 11.14% |
| Long-term debt | 19,783,800 | 22.03 |
| Common equity | 60,000,000 | 66.83 |
| | $89,783,800 | 100.00% |

9-17 Several steps are involved in the solution of this problem. Our solution follows:

<u>Step 1</u>.

Establish a set of market value capital structure weights. In this case, A/P and accruals should be disregarded because they are not sources of financing from investors. Instead of being incorporated into the WACC, they are accounted for when calculating cash flows. For this firm, short-term debt is used to finance seasonal goods, and the balance is reduced to zero in off-seasons. Therefore, this is not a source of permanent financing. and should be disregarded when calculating the WACC.

<u>Debt</u>:

The long-term debt has a market value found as follows:

$$V_0 = \sum_{t=1}^{40} \frac{\$40}{(1.06)^t} + \frac{\$1{,}000}{(1.06)^{40}} = \$699,$$

or 0.699($30,000,000) = $20,970,000 in total. Notice that short-term debt is not included in the capital structure for this company. We usually include short-term debt in the total debt figure for calculating weights because in the absence of any other information, we assume the short-term debt will be rolled over from year to year. In this case, however, the company does not use short-term debt as a permanent source of financing. Indeed, as stated in the problem, the short-term debt balance is zero off-season. In such a situation neither the lender nor the company believes that the debt balance will be rolled over from year to year as the loan is closed out each off-season and so it is not considered a component of the capital structure.

<u>Preferred Stock</u>:

The preferred has a value of

$$P_{ps} = \frac{\$2}{0.11/4} = \$72.73.$$

There are $5,000,000/$100 = 50,000 shares of preferred outstanding, so the total market value of the preferred is

$$50{,}000(\$72.73) = \$3{,}636{,}500.$$

Common Stock:

The market value of the common stock is

$$4,000,000(\$20) = \$80,000,000.$$

Therefore, here is the firm's market value capital structure, which we assume to be optimal:

| | | |
|---|---|---|
| Long-term debt | $ 20,970,000 | 20.05% |
| Preferred stock | 3,636,500 | 3.48 |
| Common equity | 80,000,000 | 76.47 |
| | $104,606,500 | 100.00% |

We would round these weights to 20% debt, 4% preferred, and 76% common equity.

Step 2.

Establish cost rates for the various capital structure components.

Debt cost:

$$r_d(1 - T) = 12\%(0.6) = 7.2\%.$$

Preferred cost:

Annual dividend on new preferred = 11%($100) = $11. Therefore,

$$r_{ps} = \$11/\$100(1 - 0.05) = \$11/\$95 = 11.6\%.$$

Common equity cost:

There are three basic ways of estimating $r_s$: CAPM, DCF, and judgmental risk premium over own bonds. None of the methods is very exact.

CAPM:

We would use $r_{RF}$ = T-bond rate = 10%. For $RP_M$, we would use 4.5% to 5.5%. For beta, we would use a beta in the 1.3 to 1.7 range. Combining these values, we obtain this range of values for $r_s$:

Highest: $r_s = 10\% + (5.5)(1.7) = 19.35\%.$
Lowest: $r_s = 10\% + (4.5)(1.3) = 15.85\%.$

Midpoint: $r_s$ = 10% + (5.0)(1.5) = 17.50%.

DCF:

The company seems to be in a rapid, non-constant growth situation, but we do not have the inputs necessary to develop a non-constant $r_s$. Therefore, we will use the constant growth model but temper our growth rate; that is, think of it as a long-term average g that may well be higher in the immediate future than in the more distant future.

We could use as a growth estimator this method:

$$g = b(ROE) = 0.5(24\%) = 12\%.$$

It would not be appropriate to base g on the 30% ROE, because investors do not expect that rate.

Finally, we could use the analysts' forecasted g range, 10% to 15%. The dividend yield is $D_1/P_0$. Assuming g = 12%,

$$\frac{D_1}{P_0} = \frac{\$1(1.12)}{\$20} = 5.6\%.$$

One could look at a range of yields, based on P in the range of \$17 to \$23, but because we believe in efficient markets, we would use $P_0$ = \$20. Thus, the DCF model suggests a $r_s$ in the range of 15.6% to 20.6%:

Highest: $r_s$ = 5.6% + 15% = 20.6%.
Lowest: $r_s$ = 5.6% + 10% = 15.6%.
Midpoint: $r_s$ = 5.6% + 12.5% = 18.1%.

Generalized risk premium:

Highest: $r_s$ = 12% + 6% = 18%.
Lowest: $r_s$ = 12% + 4% = 16%.
Midpoint: $r_s$ = 12% + 5% = 17%.

Based on the three midpoint estimates, we have $r_s$ in this range:

| | |
|---|---|
| CAPM | 17.5% |
| DCF | 18.1% |
| Risk Premium | 17.0% |

Step 3.

Calculate the WACC:

$$\text{WACC} = (D/V)(r_{dAT}) + (P/V)(r_{ps}) + (S/V)(r_s \text{ or } r_e)$$
$$= 0.20(r_{dAT}) + 0.04(r_{ps}) + 0.76(r_s \text{ or } r_e).$$

It would be appropriate to calculate a range of WACCs based on the ranges of component costs, but to save time, we shall assume $r_{dAT}$ = 7.2%, $r_{ps}$ = 11.6%, and $r_s$ = 17.5%. With these cost rates, here is the WACC calculation:

$$\text{WACC} = 0.2(7.2\%) + 0.04(11.6\%) + 0.76(17.5\%) = 15.2\%.$$