Chapter 11
The Cost of Capital
ANSWERS TO SELECTED END-OF-CHAPTER QUESTIONS

11-1 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.

b. The after-tax cost of debt, $k_d(1 - T)$, 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, $k_d(1 - T)$ is the appropriate component cost of debt (in the weighted average cost of capital).

c. The cost of preferred stock, k_{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.

d. The cost of new common equity, k_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 funds 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.

e. 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.

f. 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.

g. The cost of new common equity is higher than that of common equity raised internally by reinvesting earnings. Project's financed with external equity must earn a higher rate of return, since they project must cover the flotation costs.

11-2 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.

11-3

	Probable Effect on $k_d(1 - T)$	k_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 dividend payout ratio is increased.	0	0	0
e. The firm doubles the amount of capital it raises during the year.	0 or +	0 or +	0 or +
f. The firm expands into a risky new area.	+	+	+
g. The firm merges with another firm whose earnings are countercyclical both to those of the first firm and to the stock market.	-	-	-
h. The stock market falls drastically, and the firm's stock falls along with the rest.	0	+	+
i. Investors become more risk averse.	+	+	+
j. The firm is an electric utility with a large investment in nuclear plants. Several states propose a ban on nuclear power generation.	+	+	+

11-4 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.

11-5 If a company’s composite WACC estimate were 10 percent, its managers might use 10 percent to evaluate average-risk projects, 12 percent for those with high-risk, and 8 percent 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 SELECTED END-OF-CHAPTER PROBLEMS

11-1 40% Debt; 60% Equity; k_d = 9%; T = 40%; WACC = 9.96%; k_s = ?

$$WACC = (w_d)(k_d)(1 - T) + (w_{ce})(k_s)$$
$$9.96\% = (0.4)(9\%)(1 - 0.4) + (0.6)k_s$$
$$9.96\% = 2.16\% + 0.6k_s$$
$$7.8\% = 0.6k_s$$
$$k_s = 13\%.$$

11-2 V_{ps} = \$50; D_{ps} = \$3.80; F = 5%; k_{ps} = ?

$$k_{ps} = \frac{D_{ps}}{V_{ps}(1 - F)}$$
$$= \frac{\$3.80}{\$50(1 - 0.05)}$$
$$= \frac{\$3.80}{\$47.50} = 8\%.$$

11-3 P_0 = \$30; D_1 = \$3.00; g = 5%; k_s = ?

$$k_s = \frac{D_1}{P_0} + g = \quad + 0.05 = 15\%.$$

11-4 a. $k_d(1 - T) = 13\%(1 - 0) = 13.00\%.$

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

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

11-5 $k_d(1 - T) = 0.12(0.65) = 7.80\%.$

11-6 $$k_{ps} = \frac{\$100(0.11)}{\$97.00(1 - 0.05)} = \frac{\$11}{\$97.00(0.95)} = \frac{\$11}{\$92.15} = 11.94\%.$$

11-7 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%.

11-8 a. $k_s = \frac{D_1}{P_0} + g = \frac{\$2.14}{\$23} + 7\% = 9.3\% + 7\% = 16.3\%.$

b. $k_s = k_{RF} + (k_M - k_{RF})b$
$= 9\% + (13\% - 9\%)1.6 = 9\% + (4\%)1.6 = 9\% + 6.4\% = 15.4\%.$

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

d. The bond-yield-plus-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 percent, which is the average of the three methods.

11-9 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 = 8.02% ≈ 8%.

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

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

11-11 a. Common equity needed:

0.5($30,000,000) = $15,000,000.

b. Cost using k_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. k_s and the WACC will increase due to the flotation costs of new equity.

11-12 a. After-tax cost of new debt = $k_d(1 - T)$:

$k_d(1 - T) = 0.08(1 - 0.4) = 0.048 = 4.8\%.$

Cost of common equity = k_s:

$k_s = D_1/P_0 + g.$

Using the point-to-point technique, g = 8.01%. Thus,

$$k_s = \$2.00(1.08)/\$50.00 + 8\% = 4.3\% + 8\% = 12.3\%.$$

b. WACC calculation:

Component	% Capital Structure	×	After-Tax Cost	=	Component Cost
Debt	0.30		4.8%		1.44%
Common equity	0.70		12.3		8.61
	1.00			WACC =	10.05%

11-13 The book and market value of the current liabilities are both $10,000,000.

The bonds have a value of

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

Alternatively, using a financial calculator, input N = 20, I = 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%

11-14 This is not an easy question. Basically, we must fall back on our confidence in the parameter estimates that go into each model. The CAPM requires estimates of beta, k_M, and k_{RF}. If the capital markets have been unusually volatile recently, the estimates for k_{RF} and k_M may be suspect. Further, if the riskiness of the firm is changing, it is unlikely that a beta estimate based on historical data would reflect the expected future market risk of the firm. Thus, highly volatile capital markets and changing risk would lower our confidence in the CAPM estimate.

The key variable in the DCF model is the dividend growth rate. If the stock has experienced relatively constant historical dividend growth and if this trend is expected to continue, then (1) the constant growth model can be used, and (2) we can have some confidence in our estimate of g. If dividend growth has been erratic, the constant growth model is unsuitable and we have considerably less confidence in our g estimates. Institutional Brokers Estimate System (IBES) compiles the 5-year dividend growth estimates of numerous analysts and publishes the median and standard deviation of g estimates. A large standard deviation would indicate a lack of consensus among analysts, and would lessen our confidence in the DCF model. Thus, the DCF model would be most useful when there is consensus of forecasts and constant growth.

The critical element in the bond yield plus risk premium model is the risk premium. Volatile markets would lessen our confidence in the risk premium. Further, since our risk premium estimates are based on "average" stocks, the more the firm deviates from average, especially in riskiness, the less confidence we have in this estimate.

11-15 Several steps are involved in the solution of this problem. Our solution follows:

Step 1.

Establish a set of market value capital structure weights. In this case, A/P and accruals, and also short-term debt, may be disregarded because the firm does not use these as a source of permanent financing.

Debt:

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.

Preferred Stock:

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 percent debt, 4 percent preferred, and 76 percent common equity.

Step 2.

Establish cost rates for the various capital structure components.

Debt cost:

k_d(1 - T) = 12%(0.6) = 7.2%.

Preferred cost:

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

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

Common equity cost:

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

CAPM:

We would use k_{RF} = T-bond rate = 10%. For RP_M, we would use 14.5 to 15.5 - 10.0 = 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 k_s:

Highest: $k_s = 10\% + (5.5)(1.7) = 19.35\%$.
Lowest: $k_s = 10\% + (4.5)(1.3) = 15.85\%$.
Midpoint: $k_s = 10\% + (5.0)(1.5) = 17.50\%$.

DCE:

The company seems to be in a rapid, nonconstant growth situation, but we do not have the inputs necessary to develop a nonconstant k_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 than in the more distant future.

Data exist that would permit us to calculate historic growth rates, but problems would clearly arise, because the growth rate has been variable and also because $g_{EPS} \neq g_{DPS}$. For the problem at hand, we would simply disregard historic growth rates, except for a discussion about calculating them as an exercise.

We could use as a growth estimator this method:

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

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 percent. 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 k_s in the range of 15.6 to 20.6 percent:

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

Generalized risk premium.

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

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

CAPM	17.5%
DCF	18.1%
Risk Premium	17.0%

Step 3.

Calculate the WACC:

$$WACC = (D/V)(k_{dAT}) + (P/V)(k_{ps}) + (S/V)(k_s \text{ or } k_e)$$
$$= 0.20(k_{dAT}) + 0.04(k_{ps}) + 0.76(k_s \text{ or } k_e).$$

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

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

11-16 P_0 = \$30; D_1 = \$3.00; g = 5%; F = 10%; k_s = ?

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

11-17 Enter these values: N = 20, PV = 1000(1-0.02) = 980, PMT = -90(1-.4)=-54, and FV = -1000, to get I = 5.57%, which is the after-tax component cost of debt.

