

Chapter 13

Capital Structure Decisions

ANSWERS TO END-OF-CHAPTER QUESTIONS

- 13-1 a. Capital structure is the manner in which a firm's assets are financed; that is, the right-hand side of the balance sheet. Capital structure is normally expressed as the percentage of each type of capital used by the firm--debt, preferred stock, and common equity. Business risk is the risk inherent in the operations of the firm, prior to the financing decision. Thus, business risk is the uncertainty inherent in a total risk sense, future operating income, or earnings before interest and taxes (EBIT). Business risk is caused by many factors. Two of the most important are sales variability and operating leverage. Financial risk is the risk added by the use of debt financing. Debt financing increases the variability of earnings before taxes (but after interest); thus, along with business risk, it contributes to the uncertainty of net income and earnings per share. Business risk plus financial risk equals total corporate risk.
- b. Operating leverage is the extent to which fixed costs are used in a firm's operations. If a high percentage of a firm's total costs are fixed costs, then the firm is said to have a high degree of operating leverage. Operating leverage is a measure of one element of business risk, but does not include the second major element, sales variability. Financial leverage is the extent to which fixed-income securities (debt and preferred stock) are used in a firm's capital structure. If a high percentage of a firm's capital structure is in the form of debt and preferred stock, then the firm is said to have a high degree of financial leverage. The breakeven point is that level of unit sales at which costs equal revenues. Breakeven analysis may be performed with or without the inclusion of financial costs. If financial costs are not included, breakeven occurs when EBIT equals zero. If financial costs are included, breakeven occurs when EBT equals zero.
- c. Reserve borrowing capacity exists when a firm uses less debt under "normal" conditions than called for by the tradeoff theory. This allows the firm some flexibility to use debt in the future when additional capital is needed.
- 13-2 Business risk refers to the uncertainty inherent in projections of future ROE_U .
- 13-3 Firms with relatively high nonfinancial fixed costs are said to have a high degree of operating leverage.
- 13-4 Operating leverage affects EBIT and, through EBIT, EPS. Financial leverage has no effect on EBIT--it only affects EPS, given EBIT.

- 13-5 If sales tend to fluctuate widely, then cash flows and the ability to service fixed charges will also vary. Such a firm is said to have high business risk. Consequently, there is a relatively large risk that the firm will be unable to meet its fixed charges, and interest payments are fixed charges. As a result, firms in unstable industries tend to use less debt than those whose sales are subject to only moderate fluctuations.
- 13-6 Public utilities place greater emphasis on long-term debt because they have more stable sales and profits as well as more fixed assets. Also, utilities have fixed assets which can be pledged as collateral. Further, trade firms use retained earnings to a greater extent, probably because these firms are generally smaller and, hence, have less access to capital markets. Public utilities have lower retained earnings because they have high dividend payout ratios and a set of stockholders who want dividends.
- 13-7 EBIT depends on sales and operating costs. Interest is deducted from EBIT. At high debt levels, firms lose business, employees worry, and operations are not continuous because of financing difficulties. Thus, financial leverage can influence sales and costs, and hence EBIT, if excessive leverage is used.
- 13-8 The tax benefits from debt increase linearly, which causes a continuous increase in the firm's value and stock price. However, financial distress costs get higher and higher as more and more debt is employed, and these costs eventually offset and begin to outweigh the benefits of debt.

SOLUTIONS TO END-OF-CHAPTER PROBLEMS

- 13-1 a. Here are the steps involved:

- (1) Determine the variable cost per unit at present, V :

$$\begin{aligned} \text{Profit} &= P(Q) - FC - V(Q) \\ \$500,000 &= (\$100,000)(50) - \$2,000,000 - V(50) \\ 50(V) &= \$2,500,000 \\ V &= \$50,000. \end{aligned}$$

- (2) Determine the new profit level if the change is made:

$$\begin{aligned} \text{New profit} &= P_2(Q_2) - FC_2 - V_2(Q_2) \\ &= \$95,000(70) - \$2,500,000 - (\$50,000 - \$10,000)(70) \\ &= \$1,350,000. \end{aligned}$$

- (3) Determine the incremental profit:

$$\text{Profit} = \$1,350,000 - \$500,000 = \$850,000.$$

(4) Estimate the approximate rate of return on new investment:

$$\text{ROI} = \text{Profit/Investment} = \$850,000/\$4,000,000 = 21.25\%.$$

Since the ROI exceeds the 15 percent cost of capital, this analysis suggests that the firm should go ahead with the change.

- b. If we measure operating leverage by the ratio of fixed costs to total costs at the expected output, then the change would increase operating leverage:

$$\text{Old: } \frac{\text{FC}}{\text{FC} + \text{V}(Q)} = \frac{\$2,000,000}{\$2,000,000 + \$2,500,000} = 44.44\%.$$

$$\text{New: } \frac{\text{FC}_2}{\text{FC}_2 + \text{V}_2(Q_2)} = \frac{\$2,500,000}{\$2,500,000 + \$2,800,000} = 47.17\%.$$

The change would also increase the breakeven point:

$$\text{Old: } Q_{\text{BE}} = \frac{F}{P - V} = \frac{\$2,000,000}{\$100,000 - \$50,000} = 40 \text{ units.}$$

$$\text{New: } Q_{\text{BE}} = \frac{\$2,500,000}{\$95,000 - \$40,000} = 45.45 \text{ units.}$$

However, one could measure operating leverage in other ways, say by degree of operating leverage:

$$\text{Old: } \text{DOL} = \frac{QP - V}{Q(P - V) - F} = \frac{5Q(\$50,000)}{5Q(\$50,000) - \$2,000,000} = 5.0.$$

New: The new DOL, at the expected sales level of 70, is

$$\frac{7Q(\$95,000 - \$40,000)}{7Q(\$55,000) - \$2,500,000} = 2.85.$$

The problem here is that we have changed both output and sales price, so the DOLs are not really comparable.

- c. It is impossible to state unequivocally whether the new situation would have more or less business risk than the old one. We would need information on both the sales probability distribution and the uncertainty about variable input cost in order to make this determination. However, since a higher breakeven point, other things held constant, is more risky, the change in breakeven points--and also the higher percentage of fixed costs--suggests that the new situation is more risky.

13-2 a. Expected ROE for Firm C:

$$\begin{aligned} \text{ROE}_C &= (0.1)(-5.0\%) + (0.2)(5.0\%) + (0.4)(15.0\%) \\ &\quad + (0.2)(25.0\%) + (0.1)(35.0\%) = 15.0\%. \end{aligned}$$

Note: The distribution of ROE_C is symmetrical. Thus, the answer to this problem could have been obtained by simple inspection.

Standard deviation of ROE for Firm C:

$$\begin{aligned} \sigma_c &= \sqrt{0.1(-5.0 - 15.0)^2 + 0.2(5.0 - 15.0)^2 + 0.4(15.0 - 15.0)^2 + 0.2(25.0 - 15.0)^2 + 0.1(35.0 - 15.0)^2} \\ &= \sqrt{0.1(-20)^2 + 0.2(-10)^2 + 0.4(0)^2 + 0.2(10)^2 + 0.1(20)^2} = \sqrt{40 + 20 + 0 + 20 + 40} = \sqrt{120} = 11.0\%. \end{aligned}$$

- b. According to the standard deviations of ROE, Firm A is the least risky, while C is the most risky. However, this analysis does not take into account portfolio effects--if C's ROE goes up when most other companies' ROEs decline (that is, its beta is negative), its apparent riskiness would be reduced.
- c. Firm A's $\sigma_{\text{ROE}} = \sigma_{\text{BEP}} = 5.5\%$. Therefore, Firm A uses no financial leverage and has no financial risk. Firm B and Firm C have $\sigma_{\text{ROE}} > \sigma_{\text{BEP}}$, and hence both use leverage. Firm C uses the most leverage because it has the highest $\sigma_{\text{ROE}} - \sigma_{\text{BEP}}$ = measure of financial risk. However, Firm C's stockholders also have the highest expected ROE.

13-3 a. Original value of the firm ($D = \$0$):

$$V = D + S = 0 + (\$15)(200,000) = \$3,000,000.$$

Original cost of capital:

$$\begin{aligned} \text{WACC} &= w_d r_d(1-T) + w_e r_s \\ &= 0 + (1.0)(10\%) = 10\%. \end{aligned}$$

With financial leverage ($w_d=30\%$):

$$\begin{aligned} \text{WACC} &= w_d r_d(1-T) + w_e r_s \\ &= (0.3)(7\%)(1-0.40) + (0.7)(11\%) = 8.96\%. \end{aligned}$$

Because growth is zero, the value of the company is:

$$V = \frac{\text{FCF}}{\text{WACC}} = \frac{(\text{EBIT})(1-T)}{\text{WACC}} = \frac{(\$500,000)(1-0.40)}{0.0896} = \$3,348,214.286..$$

Increasing the financial leverage by adding \$900,000 of debt results in an increase in the firm's value from \$3,000,000 to \$3,348,214.286.

- b. Using its target capital structure of 30% debt, the company must have debt of:

$$D = w_d V = 0.30(\$3,348,214.286) = \$1,004,464.286.$$

Therefore, its debt value of equity is:

$$S = V - D = \$2,343,750.$$

$$\text{Alternatively, } S = (1-w_d)V = 0.7(\$3,348,214.286) = \$2,343,750.$$

The new price per share, P, is:

$$P = [S + (D - D_0)]/n_0 = [\$2,343,750 + (\$1,004,464.286 - 0)]/200,000 = \$16.741.$$

- c. The number of shares repurchased, X, is:

$$X = (D - D_0)/P = \$1,004,464.286 / \$16.741 = 60,000.256 \approx 60,000.$$

The number of remaining shares, n, is:

$$n = 200,000 - 60,000 = 140,000.$$

Initial position:

$$\text{EPS} = [(\$500,000 - 0)(1-0.40)] / 200,000 = \$1.50.$$

With financial leverage:

$$\begin{aligned} \text{EPS} &= [(\$500,000 - 0.07(\$1,004,464.286))(1-0.40)] / 140,000 \\ &= [(\$500,000 - \$70,312.5)(1-0.40)] / 140,000 \\ &= \$257,812.5 / 140,000 = \$1.842. \end{aligned}$$

Thus, by adding debt, the firm increased its EPS by \$0.342.

d. 30% debt:
$$\text{TIE} = \frac{\text{EBIT}}{I} = \frac{\text{EBIT}}{\$70,312.5}.$$

<u>Probability</u>	<u>TIE</u>
0.10	(1.42)
0.20	2.84
0.40	7.11
0.20	11.38
0.10	15.64

The interest payment is not covered when TIE < 1.0. The probability of this occurring is 0.10, or 10 percent.

13-4 a. Present situation (50% debt):

$$\begin{aligned} \text{WACC} &= w_d r_d(1-T) + w_e r_s \\ &= (0.5)(10\%)(1-0.15) + (0.5)(14\%) = 11.25\%. \end{aligned}$$

$$V = \frac{\text{FCF}}{\text{WACC}} = \frac{(\text{EBIT})(1-T)}{\text{WACC}} = \frac{(\$13.24)(1-0.15)}{0.1125} = \$100 \text{ million.}$$

70 percent debt:

$$\begin{aligned} \text{WACC} &= w_d r_d(1-T) + w_e r_s \\ &= (0.7)(12\%)(1-0.15) + (0.3)(16\%) = 11.94\%. \end{aligned}$$

$$V = \frac{\text{FCF}}{\text{WACC}} = \frac{(\text{EBIT})(1-T)}{\text{WACC}} = \frac{(\$13.24)(1-0.15)}{0.1194} = \$94.255 \text{ million.}$$

30 percent debt:

$$\begin{aligned} \text{WACC} &= w_d r_d(1-T) + w_e r_s \\ &= (0.3)(8\%)(1-0.15) + (0.7)(13\%) = 11.14\%. \end{aligned}$$

$$V = \frac{\text{FCF}}{\text{WACC}} = \frac{(\text{EBIT})(1-T)}{\text{WACC}} = \frac{(\$13.24)(1-0.15)}{0.1114} = \$101.023 \text{ million.}$$

13-5 a. BEA's unlevered beta is $b_U = b_L / (1 + (1-T)(D/S)) = 1.0 / (1 + (1-0.40)(20/80)) = 0.870$.

b. $b_L = b_U (1 + (1-T)(D/S))$.

$$\begin{aligned} \text{At 40 percent debt: } b_L &= 0.87 (1 + 0.6(40\%/60\%)) = 1.218. \\ r_s &= 6 + 1.218(4) = 10.872\% \end{aligned}$$

c. $\text{WACC} = w_d r_d(1-T) + w_e r_s = (0.4)(9\%)(1-0.4) + (0.6)(10.872\%) = 8.683\%$.

$$V = \frac{\text{FCF}}{\text{WACC}} = \frac{(\text{EBIT})(1-T)}{\text{WACC}} = \frac{(\$14.933)(1-0.4)}{0.08683} = \$103.188 \text{ million.}$$

13-6 Tax rate = 40% $r_{RF} = 5.0\%$
 $b_U = 1.2$ $r_M - r_{RF} = 6.0\%$

From data given in the problem and table we can develop the following table:

	D/A	E/A	D/E	r_d	$r_d(1 - T)$	Leveraged beta ^a	r_s ^b	WACC ^c
0.00	1.00	0.0000	7.00%	4.20%	1.20	12.20%	12.20%	
0.20	0.80	0.2500	8.00	4.80	1.38	13.28	11.58	
0.40	0.60	0.6667	10.00	6.00	1.68	15.08	11.45	
0.60	0.40	1.5000	12.00	7.20	2.28	18.68	11.79	
0.80	0.20	4.0000	15.00	9.00	4.08	29.48	13.10	

Notes:

^a These beta estimates were calculated using the Hamada equation, $b = b_U[1 + (1 - T)(D/E)]$.

^b These r_s estimates were calculated using the CAPM, $r_s = r_{RF} + (r_M - r_{RF})b$.

^c These WACC estimates were calculated with the following equation:
 $WACC = w_d(r_d)(1 - T) + (w_c)(r_s)$.

The firm's optimal capital structure is that capital structure which minimizes the firm's WACC. Elliott's WACC is minimized at a capital structure consisting of 40% debt and 60% equity. At that capital structure, the firm's WACC is 11.45%.