
CHAPTER 16

CAPITAL STRUCTURE: LIMITS TO THE USE OF DEBT

Answers to Concepts Review and Critical Thinking Questions

1. Direct costs are potential legal and administrative costs. These are the costs associated with the litigation arising from a liquidation or bankruptcy. These costs include lawyer's fees, courtroom costs, and expert witness fees. Indirect costs include the following: 1) Impaired ability to conduct business. Firms may suffer a loss of sales due to a decrease in consumer confidence and loss of reliable supplies due to a lack of confidence by suppliers. 2) Incentive to take large risks. When faced with projects of different risk levels, managers acting in the stockholders' interest have an incentive to undertake high-risk projects. Imagine a firm with only one project, which pays \$100 in an expansion and \$60 in a recession. If debt payments are \$60, the stockholders receive \$40 ($= \$100 - 60$) in the expansion but nothing in the recession. The bondholders receive \$60 for certain. Now, alternatively imagine that the project pays \$110 in an expansion but \$50 in a recession. Here, the stockholders receive \$50 ($= \$110 - 60$) in the expansion but nothing in the recession. The bondholders receive only \$50 in the recession because there is no more money in the firm. That is, the firm simply declares bankruptcy, leaving the bondholders "holding the bag." Thus, an increase in risk can benefit the stockholders. The key here is that the bondholders are hurt by risk, since the stockholders have limited liability. If the firm declares bankruptcy, the stockholders are not responsible for the bondholders' shortfall. 3) Incentive to under-invest. If a company is near bankruptcy, stockholders may well be hurt if they contribute equity to a new project, even if the project has a positive NPV. The reason is that some (or all) of the cash flows will go to the bondholders. Suppose a real estate developer owns a building that is likely to go bankrupt, with the bondholders receiving the property and the developer receiving nothing. Should the developer take \$1 million out of his own pocket to add a new wing to a building? Perhaps not, even if the new wing will generate cash flows with a present value greater than \$1 million. Since the bondholders are likely to end up with the property anyway, the developer will pay the additional \$1 million and likely end up with nothing to show for it. 4) Milking the property. In the event of bankruptcy, bondholders have the first claim to the assets of the firm. When faced with a possible bankruptcy, the stockholders have strong incentives to vote for increased dividends or other distributions.

This will ensure them of getting some of the assets of the firm before the bondholders can lay claim to them.

2. The statement is incorrect. If a firm has debt, it might be advantageous to stockholders for the firm to undertake risky projects, even those with negative net present values. This incentive results from the fact that most of the risk of failure is borne by bondholders. Therefore, value is transferred from the bondholders to the shareholders by undertaking risky projects, even if the projects have negative NPVs. This incentive is even stronger when the probability and costs of bankruptcy are high.
3. The firm should issue equity in order to finance the project. The tax-loss carry-forwards make the firm's effective tax rate zero. Therefore, the company will not benefit from the tax shield that debt provides. Moreover, since the firm already has a moderate amount of debt in its capital structure, additional debt will likely increase the probability that the firm will face financial distress or bankruptcy. As long as there are bankruptcy costs, the firm should issue equity in order to finance the project.

4. Stockholders can undertake the following measures in order to minimize the costs of debt: 1) Use protective covenants. Firms can enter into agreements with the bondholders that are designed to decrease the cost of debt. There are two types of protective covenants. Negative covenants prohibit the company from taking actions that would expose the bondholders to potential losses. An example would be prohibiting the payment of dividends in excess of earnings. Positive covenants specify an action that the company agrees to take or a condition the company must abide by. An example would be agreeing to maintain its working capital at a minimum level. 2) Repurchase debt. A firm can eliminate the costs of bankruptcy by eliminating debt from its capital structure. 3) Consolidate debt. If a firm decreases the number of debt holders, it may be able to decrease the direct costs of bankruptcy should the firm become insolvent.
5. Modigliani and Miller's theory with corporate taxes indicates that, since there is a positive tax advantage of debt, the firm should maximize the amount of debt in its capital structure. In reality, however, no firm adopts an all-debt financing strategy. MM's theory ignores both the financial distress and agency costs of debt. The marginal costs of debt continue to increase with the amount of debt in the firm's capital structure so that, at some point, the marginal costs of additional debt will outweigh its marginal tax benefits. Therefore, there is an optimal level of debt for every firm at the point where the marginal tax benefits of the debt equal the marginal increase in financial distress and agency costs.
6. There are two major sources of the agency costs of equity: 1) Shirking. Managers with small equity holdings have a tendency to reduce their work effort, thereby hurting both the debt holders and outside equity holders. 2) Perquisites. Since management receives all the benefits of increased perquisites but only shoulder a fraction of the cost, managers have an incentive to overspend on luxury items at the expense of debt holders and outside equity holders.
7. The more capital intensive industries, such as airlines, cable television, and electric utilities, tend to use greater financial leverage. Also, industries with less predictable future earnings, such as computers or drugs, tend to use less financial leverage. Such industries also have a higher concentration of growth and startup firms. Overall, the general tendency is for firms with identifiable, tangible assets and relatively more predictable future earnings to use more debt financing. These are typically the firms with the greatest need for external financing and the greatest likelihood of benefiting from the interest tax shelter.

8. One answer is that the right to file for bankruptcy is a valuable asset, and the financial manager acts in shareholders' best interest by managing this asset in ways that maximize its value. To the extent that a bankruptcy filing prevents "a race to the courthouse steps," it would seem to be a reasonable use of the process.

9. As in the previous question, it could be argued that using bankruptcy laws as a sword may simply be the best use of the asset. Creditors are aware at the time a loan is made of the possibility of bankruptcy, and the interest charged incorporates it.

10. One side is that Continental was going to go bankrupt because its costs made it uncompetitive. The bankruptcy filing enabled Continental to restructure and keep flying. The other side is that Continental abused the bankruptcy code. Rather than renegotiate labor agreements, Continental simply abrogated them to the detriment of its employees. In this, and the last several, questions, an important thing to keep in mind is that the bankruptcy code is a creation of law, not economics. A strong argument can always be made that making the best use of the bankruptcy code is no different from, for example, minimizing taxes by making best use of the tax code. Indeed, a strong case can be made that it is the financial manager's duty to do so. As the case of Continental illustrates, the code can be changed if socially undesirable outcomes are a problem.

Solutions to Questions and Problems

NOTE: All end-of-chapter problems were solved using a spreadsheet. Many problems require multiple steps. Due to space and readability constraints, when these intermediate steps are included in this solutions manual, rounding may appear to have occurred. However, the final answer for each problem is found without rounding during any step in the problem.

Basic

1. a. Using M&M Proposition I with taxes, the value of a levered firm is:

$$V_L = [\text{EBIT}(1 - t_C)/R_0] + t_C B$$

$$V_L = [\text{DOP}750,000(1 - .35)/.15] + .35(\text{DOP}1,500,000)$$

$$V_L = \text{DOP}3,775,000$$

- b. The CFO may be correct. The value calculated in part *a* does not include the costs of any non-marketed claims, such as bankruptcy or agency costs.

2. a. *Debt issue:*

The company needs a cash infusion of \$2 million. If the company issues debt, the annual interest payments will be:

$$\text{Interest} = \$2,000,000(.09) = \$180,000$$

The cash flow to the owner will be the EBIT minus the interest payments, or:

40 hour week cash flow = $\$500,000 - 180,000 = \$320,000$

50 hour week cash flow = $\$600,000 - 180,000 = \$420,000$

Equity issue:

If the company issues equity, the company value will increase by the amount of the issue. So, the current owner's equity interest in the company will decrease to:

Tharu's ownership percentage = $\$3,000,000 / (\$3,000,000 + 2,000,000) = .60$

So, Tharu's cash flow under an equity issue will be 60 percent of EBIT, or:

$$40 \text{ hour week cash flow} = .60(\$500,000) = \$300,000$$

$$50 \text{ hour week cash flow} = .60(\$600,000) = \$360,000$$

- b.* Tharu will work harder under the debt issue since his cash flows will be higher. Tharu will gain more under this form of financing since the payments to bondholders are fixed. Under an equity issue, new investors share proportionally in his hard work, which will reduce his propensity for this additional work.
 - c.* The direct cost of both issues is the payments made to new investors. The indirect costs to the debt issue include potential bankruptcy and financial distress costs. The indirect costs of an equity issue include shirking and perquisites.
- 3.** *a.* The interest payments each year will be:

$$\text{Interest payment} = .12(\pounds 80,000) = \pounds 9,600$$

This is exactly equal to the EBIT, so no cash is available for shareholders. Under this scenario, the value of equity will be zero since shareholders will never receive a payment. Since the market value of the company's debt is £80,000, and there is no probability of default, the total value of the company is the market value of debt. This implies the debt to value ratio is 1 (one).

- b.* At a 5 percent growth rate, the earnings next year will be:

$$\text{Earnings next year} = \pounds 9,600(1.05) = \pounds 10,080$$

So, the cash available for shareholders is:

$$\text{Payment to shareholders} = \pounds 10,080 - 9,600 = \pounds 480$$

Since there is no risk, the required return for shareholders is the same as the required return on the company's debt. The payments to stockholders will increase at the growth rate of five percent (a growing perpetuity), so the value of these payments today is:

$$\text{Value of equity} = £480 / (.12 - .05) = £6,857.14$$

And the debt to value ratio now is:

$$\text{Debt/Value ratio} = £80,000 / (£80,000 + 6,857.14) = 0.921$$

- c. At a 8 percent growth rate, the earnings next year will be:

$$\text{Earnings next year} = \text{£}9,600(1.08) = \text{£}10,368$$

So, the cash available for shareholders is:

$$\text{Payment to shareholders} = \text{£}10,368 - 9,600 = \text{£}768$$

Since there is no risk, the required return for shareholders is the same as the required return on the company's debt. The payments to stockholders will increase at the growth rate of eight percent (a growing perpetuity), so the value of these payments today is:

$$\text{Value of equity} = \text{£}768 / (.12 - .08) = \text{£}19,200.00$$

And the debt to value ratio now is:

$$\text{Debt/Value ratio} = \text{£}80,000 / (\text{£}80,000 + 19,200) = .806452$$

4. According to M&M Proposition I with taxes, the value of the levered firm is:

$$V_L = V_U + t_c B$$

$$V_L = \$12,000,000 + .35(\$4,000,000)$$

$$V_L = \$13,400,000$$

We can also calculate the market value of the firm by adding the market value of the debt and equity. Using this procedure, the total market value of the firm is:

$$V = B + S$$

$$V = \$4,000,000 + 250,000(\$35)$$

$$V = \$12,750,000$$

With no nonmarketed claims, such as bankruptcy costs, we would expect the two values to be the same. The difference is the value of the nonmarketed claims, which are:

$$V_T = V_M + V_N$$

$$\$12,750,000 = \$13,400,000 - V_N$$

$$V_N = \$650,000$$

5. The president may be correct, but he may also be incorrect. It is true the interest tax shield is valuable, and adding debt can possibly increase the value of the company. However, if the company's debt is increased beyond some level, the value of the interest tax shield becomes less than the additional costs from financial distress.

Intermediate

6. a. The total value of a firm's equity is the discounted expected cash flow to the firm's stockholders. If the expansion continues, each firm will generate earnings before interest and taxes of \$2 million. If there is a recession, each firm will generate earnings before interest and taxes of only \$800,000. Since Steinberg owes its bondholders \$750,000 at the end of the year, its stockholders will receive \$1.25 million (= \$2,000,000 – 750,000) if the expansion continues. If there is a recession, its stockholders will only receive \$50,000 (= \$800,000 – 750,000). So, assuming a discount rate of 13 percent, the market value of Steinberg's equity is:

$$S_{\text{Steinberg}} = [.80(\$1,250,000) + .20(\$50,000)] / 1.13 = \$893,805$$

Steinberg's bondholders will receive \$750,000 whether there is a recession or a continuation of the expansion. So, the market value of Steinberg's debt is:

$$B_{\text{Steinberg}} = [.80(\$750,000) + .20(\$750,000)] / 1.13 = \$663,717$$

Since Dietrich owes its bondholders \$1 million at the end of the year, its stockholders will receive \$1 million (= \$2 million – 1 million) if the expansion continues. If there is a recession, its stockholders will receive nothing since the firm's bondholders have a more senior claim on all \$800,000 of the firm's earnings. So, the market value of Dietrich's equity is:

$$S_{\text{Dietrich}} = [.80(\$1,000,000) + .20(\$0)] / 1.13 = \$707,965$$

Dietrich's bondholders will receive \$1 million if the expansion continues and \$800,000 if there is a recession. So, the market value of Dietrich's debt is:

$$B_{\text{Dietrich}} = [.80(\$1,000,000) + .20(\$800,000)] / 1.13 = \$849,558$$

- b. The value of company is the sum of the value of the firm's debt and equity. So, the value of Steinberg is:

$$V_{\text{Steinberg}} = B + S$$

$$V_{\text{Steinberg}} = \$663,717 + \$893,805$$

$$V_{\text{Steinberg}} = \$1,557,522$$

And value of Dietrich is:

$$V_{\text{Dietrich}} = B + S$$

$$V_{\text{Dietrich}} = \$707,965 + 849,558$$

$$V_{\text{Dietrich}} = \$1,557,522$$

You should disagree with the CEO's statement. The risk of bankruptcy *per se* does not affect a firm's value. It is the actual costs of bankruptcy that decrease the value of a firm. Note that this problem assumes that there are no bankruptcy costs.

7. a. The expected value of each project is the sum of the probability of each state of the economy times the value in that state of the economy. Since this is the only project for the company, the company value will be the same as the project value, so:

$$\text{Low-volatility project value} = .50(\pounds 500) + .50(\pounds 700)$$

$$\text{Low-volatility project value} = \pounds 600$$

$$\text{High-volatility project value} = .50(\pounds 100) + .50(\pounds 800)$$

$$\text{High-volatility project value} = \pounds 450$$

The low-volatility project maximizes the expected value of the firm.

- b. The value of the equity is the residual value of the company after the bondholders are paid off. If the low-volatility project is undertaken, the firm's equity will be worth £0 if the economy is bad and £200 if the economy is good. Since each of these two scenarios is equally probable, the expected value of the firm's equity is:

$$\text{Expected value of equity with low-volatility project} = .50(\pounds 0) + .50(\pounds 200)$$

$$\text{Expected value of equity with low-volatility project} = \pounds 100$$

And the value of the company if the high-volatility project is undertaken will be:

$$\text{Expected value of equity with high-volatility project} = .50(\pounds 0) + .50(\pounds 300)$$

$$\text{Expected value of equity with high-volatility project} = \pounds 150$$

- c. Risk-neutral investors prefer the strategy with the highest expected value. Thus, the company's stockholders prefer the high-volatility project since it maximizes the expected value of the company's equity.
- d. In order to make stockholders indifferent between the low-volatility project and the high-volatility project, the bondholders will need to raise their required debt payment so that the expected value of equity if the high-volatility project is undertaken is equal to the expected value of equity if the low-volatility project is undertaken. As shown in part a, the expected value of equity if the low-volatility project is undertaken is £100. If the high-volatility project is undertaken, the value of the firm will be £100 if the economy is bad and £800 if the economy is good. If the economy is bad, the entire £100 will go to the bondholders and stockholders will receive nothing. If the economy is good, stockholders will receive the

difference between £800, the total value of the firm, and the required debt payment. Let X be the debt payment that bondholders will require if the high-volatility project is undertaken. In order for stockholders to be indifferent between the two projects, the expected value of equity if the high-volatility project is undertaken must be equal to £100, so:

$$\text{Expected value of equity} = £100 = .50(£0) + .50(£800 - X)$$

$$X = £600$$

8. a. The expected payoff to bondholders is the face value of debt or the value of the company, whichever is less. Since the value of the company in a recession is ¥100 million and the required debt payment in one year is ¥150 million, bondholders will receive the lesser amount, or ¥100 million.

b. The promised return on debt is:

$$\text{Promised return} = (\text{Face value of debt} / \text{Market value of debt}) - 1$$

$$\text{Promised return} = (\text{¥150,000,000} / \text{¥108,930,000}) - 1$$

$$\text{Promised return} = .3770 \text{ or } 37.70\%$$

c. In part a, we determined bondholders will receive ¥100 million in a recession. In a boom, the bondholders will receive the entire ¥150 million promised payment since the market value of the company is greater than the payment. So, the expected value of debt is:

$$\text{Expected payment to bondholders} = .60(\text{¥150,000,000}) + .40(\text{¥100,000,000})$$

$$\text{Expected payment to bondholders} = \text{¥130,000,000}$$

So, the expected return on debt is:

$$\text{Expected return} = (\text{Expected value of debt} / \text{Market value of debt}) - 1$$

$$\text{Expected return} = (\text{¥130,000,000} / \text{¥108,930,000}) - 1$$

$$\text{Expected return} = .1934 \text{ or } 19.34\%$$

Challenge

9. a. In their no tax model, MM assume that t_C , t_B , and $C(B)$ are all zero. Under these assumptions, $V_L = V_U$, signifying that the capital structure of a firm has no effect on its value. There is no optimal debt-equity ratio.

b. In their model with corporate taxes, MM assume that $t_C > 0$ and both t_B and $C(B)$ are equal to zero. Under these assumptions, $V_L = V_U + t_C B$, implying that raising the amount of debt in a firm's capital structure will increase the overall value of the firm. This model implies that the debt-equity ratio of every firm should be infinite.

c. If the costs of financial distress are zero, the value of a levered firm equals:

$$V_L = V_U + \{1 - [(1 - t_C) / (1 - t_B)]\} \times B$$

Therefore, the change in the value of this all-equity firm that issues debt and uses the proceeds to repurchase equity is:

$$\text{Change in value} = \{1 - [(1 - t_C) / (1 - t_B)]\} \times B$$

$$\text{Change in value} = \{1 - [(1 - .34) / (1 - .20)]\} \times \text{¥} 1,000,000$$

$$\text{Change in value} = \text{¥} 175,000$$

d. If the costs of financial distress are zero, the value of a levered firm equals:

$$V_L = V_U + \{1 - [(1 - t_C) / (1 - t_B)]\} \times B$$

Therefore, the change in the value of an all-equity firm that issues $\bar{\text{€}} 1$ of perpetual debt instead of $\bar{\text{€}} 1$ of perpetual equity is:

$$\text{Change in value} = \{1 - [(1 - t_C) / (1 - t_B)]\} \times \bar{\text{€}} 1$$

If the firm is not able to benefit from interest deductions, the firm's taxable income will remain the same regardless of the amount of debt in its capital structure, and no tax shield will be created by issuing debt. Therefore, the firm will receive no tax benefit as a result of issuing debt in place of equity. In other words, the *effective* corporate tax rate when we consider the *change* in the value of the firm is zero. Debt will have no effect on the value of the firm since interest payments will not be tax deductible. So, for this firm, the change in value is:

$$\text{Change in value} = \{1 - [(1 - 0) / (1 - .20)]\} \times \bar{\text{€}} 1$$

$$\text{Change in value} = -\bar{\text{€}} 0.25$$

The value of the firm will decrease by $\bar{\text{€}} 0.25$ if it adds $\bar{\text{€}} 1$ of perpetual debt rather than $\bar{\text{€}} 1$ of equity.

10. a. If the company decides to retire all of its debt, it will become an unlevered firm. The value of an all-equity firm is the present value of the aftertax cash flow to equity holders, which will be:

$$V_U = (\text{EBIT})(1 - t_C) / R_0$$

$$V_U = (\text{UYU}1,100,000)(1 - .35) / .20$$

$$V_U = \text{UYU}3,575,000$$

b. Since there are no bankruptcy costs, the value of the company as a levered firm is:

$$V_L = V_U + \{1 - [(1 - t_C) / (1 - t_B)]\} \times B$$

$$V_L = \text{UYU}3,575,000 + \{1 - [(1 - .35) / (1 - .25)]\} \times \text{UYU}2,000,000$$

$$V_L = \text{UYU}3,841,666.67$$

c. The bankruptcy costs would not affect the value of the unlevered firm since it could never be forced into bankruptcy. So, the value of the levered firm with bankruptcy would be:

$$V_L = V_U + \{1 - [(1 - t_C) / (1 - t_B)]\} \times B - C(B)$$

$$V_L = (\text{UYU}3,575,000 + \{1 - [(1 - .35) / (1 - .25)]\} \times \text{UYU}2,000,000) - \text{UYU}300,000$$

$$V_L = \text{UYU}3,541,666.67$$

The company should choose the all-equity plan with this bankruptcy cost.