CHAPTER 16
FINANCIAL LEVERAGE AND CAPITAL STRUCTURE POLICY

Answers to Concepts Review and Critical Thinking Questions

1. Business risk is the equity risk arising from the nature of the firm’s operating activity and is directly related to the systematic risk of the firm’s assets. Financial risk is the equity risk that is due entirely to the firm’s chosen capital structure. As financial leverage, or the use of debt financing, increases, so does financial risk and, hence, the overall risk of the equity. Thus, Firm B could have a higher cost of equity if it uses greater leverage.

2. No, it doesn’t follow. While it is true that the equity and debt costs are rising, the key thing to remember is that the cost of debt is still less than the cost of equity. Since we are using more and more debt, the WACC does not necessarily rise.

3. Because many relevant factors such as bankruptcy costs, tax asymmetries, and agency costs cannot easily be identified or quantified, it’s practically impossible to determine the precise debt-equity ratio that maximizes the value of the firm. However, if the firm’s cost of new debt suddenly becomes much more expensive, it’s probably true that the firm is too highly leveraged.

4. 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.

5. It’s called leverage (or “gearing” in the UK) because it magnifies gains or losses.

6. Homemade leverage refers to the use of borrowing on the personal level as opposed to the corporate level.

7. 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.

8. 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.
9. 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 question, as well as the last several, 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 the 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.

10. The basic goal is to minimize the value of nonmarketed claims.

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. A table outlining the income statement for the three possible states of the economy is shown below. The EPS is the net income divided by the 6,000 shares outstanding. The last row shows the percentage change in EPS the company will experience in a recession or an expansion economy.

<table>
<thead>
<tr>
<th></th>
<th>Recession</th>
<th>Normal</th>
<th>Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT</td>
<td>$16,100</td>
<td>$23,000</td>
<td>$27,600</td>
</tr>
<tr>
<td>Interest</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NI</td>
<td>$16,100</td>
<td>$23,000</td>
<td>$27,600</td>
</tr>
<tr>
<td>EPS</td>
<td>$ 2.68</td>
<td>$ 3.83</td>
<td>$ 4.60</td>
</tr>
<tr>
<td>%ΔEPS</td>
<td>–30</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

b. If the company undergoes the proposed recapitalization, it will repurchase:

\[
\text{Share price} = \frac{\text{Equity}}{\text{Shares outstanding}} \\
\text{Share price} = \frac{\$180,000}{6,000} = \$30 \\
\text{Shares repurchased} = \frac{\text{Debt issued}}{\text{Share price}} \\
\text{Shares repurchased} = \frac{\$75,000}{\$30} = 2,500
\]
The interest payment each year under all three scenarios will be:

Interest payment = $75,000(0.07) = $5,250

The last row shows the percentage change in EPS the company will experience in a recession or an expansion economy under the proposed recapitalization.

<table>
<thead>
<tr>
<th></th>
<th>Recession</th>
<th>Normal</th>
<th>Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT</td>
<td>$16,100</td>
<td>$23,000</td>
<td>$27,600</td>
</tr>
<tr>
<td>Interest</td>
<td>$5,250</td>
<td>$5,250</td>
<td>$5,250</td>
</tr>
<tr>
<td>NI</td>
<td>$10,850</td>
<td>$17,750</td>
<td>$30,100</td>
</tr>
<tr>
<td>EPS</td>
<td>$3.10</td>
<td>$5.07</td>
<td>$6.39</td>
</tr>
<tr>
<td>%ΔEPS</td>
<td>–38.87</td>
<td></td>
<td>+25.92</td>
</tr>
</tbody>
</table>

2.  

a. A table outlining the income statement with taxes for the three possible states of the economy is shown below. The share price is still $30, and there are still 6,000 shares outstanding. The last row shows the percentage change in EPS the company will experience in a recession or an expansion economy.

<table>
<thead>
<tr>
<th></th>
<th>Recession</th>
<th>Normal</th>
<th>Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT</td>
<td>$16,100</td>
<td>$23,000</td>
<td>$27,600</td>
</tr>
<tr>
<td>Interest</td>
<td>$5,250</td>
<td>$5,250</td>
<td>$5,250</td>
</tr>
<tr>
<td>Taxes</td>
<td>$5,635</td>
<td>$8,500</td>
<td>$9,660</td>
</tr>
<tr>
<td>NI</td>
<td>$10,465</td>
<td>$14,950</td>
<td>$17,940</td>
</tr>
<tr>
<td>EPS</td>
<td>$1.74</td>
<td>$2.49</td>
<td>$2.99</td>
</tr>
<tr>
<td>%ΔEPS</td>
<td>–30</td>
<td></td>
<td>+20</td>
</tr>
</tbody>
</table>

b. A table outlining the income statement with taxes for the three possible states of the economy and assuming the company undertakes the proposed capitalization is shown below. The interest payment and shares repurchased are the same as in part b of Problem 1.

<table>
<thead>
<tr>
<th></th>
<th>Recession</th>
<th>Normal</th>
<th>Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT</td>
<td>$16,100</td>
<td>$23,000</td>
<td>$27,600</td>
</tr>
<tr>
<td>Interest</td>
<td>$5,250</td>
<td>$5,250</td>
<td>$5,250</td>
</tr>
<tr>
<td>Taxes</td>
<td>$3,798</td>
<td>$6,213</td>
<td>$7,823</td>
</tr>
<tr>
<td>NI</td>
<td>$7,053</td>
<td>$11,538</td>
<td>$14,528</td>
</tr>
<tr>
<td>EPS</td>
<td>$2.02</td>
<td>$3.30</td>
<td>$4.15</td>
</tr>
<tr>
<td>%ΔEPS</td>
<td>–38.87</td>
<td></td>
<td>+25.92</td>
</tr>
</tbody>
</table>

Notice that the percentage change in EPS is the same both with and without taxes.
3.  

   a.  Since the company has a market-to-book ratio of 1.0, the total equity of the firm is equal to the market value of equity. Using the equation for ROE:

   \[ \text{ROE} = \frac{\text{NI}}{\$180,000} \]

   The ROE for each state of the economy under the current capital structure and no taxes is:

<table>
<thead>
<tr>
<th>State</th>
<th>ROE</th>
<th>%(\Delta)ROE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recession</td>
<td>.0894</td>
<td>–30</td>
</tr>
<tr>
<td>Normal</td>
<td>.1278</td>
<td>–</td>
</tr>
<tr>
<td>Expansion</td>
<td>.1533</td>
<td>+20</td>
</tr>
</tbody>
</table>

   The second row shows the percentage change in ROE from the normal economy.

   b.  If the company undertakes the proposed recapitalization, the new equity value will be:

   \[ \text{Equity} = \$180,000 - 75,000 \]
   \[ \text{Equity} = \$105,000 \]

   So, the ROE for each state of the economy is:

   \[ \text{ROE} = \frac{\text{NI}}{\$105,000} \]

<table>
<thead>
<tr>
<th>State</th>
<th>ROE</th>
<th>%(\Delta)ROE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recession</td>
<td>.1033</td>
<td>–38.87</td>
</tr>
<tr>
<td>Normal</td>
<td>.1690</td>
<td>–</td>
</tr>
<tr>
<td>Expansion</td>
<td>.2129</td>
<td>+25.92</td>
</tr>
</tbody>
</table>

   c.  If there are corporate taxes and the company maintains its current capital structure, the ROE is:

   \[ \text{ROE} = \frac{\text{NI}}{\$180,000} \]
   \[ \text{ROE} = \frac{\text{NI}}{\$105,000} \]

   If the company undertakes the proposed recapitalization, and there are corporate taxes, the ROE for each state of the economy is:

<table>
<thead>
<tr>
<th>State</th>
<th>ROE</th>
<th>%(\Delta)ROE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recession</td>
<td>.0672</td>
<td>–38.87</td>
</tr>
<tr>
<td>Normal</td>
<td>.1099</td>
<td>–</td>
</tr>
<tr>
<td>Expansion</td>
<td>.1384</td>
<td>+25.92</td>
</tr>
</tbody>
</table>

   Notice that the percentage change in ROE is the same as the percentage change in EPS. The percentage change in ROE is also the same with or without taxes.

4.  

   a.  Under Plan I, the unlevered company, net income is the same as EBIT with no corporate tax. The EPS under this capitalization will be:

   \[ \text{EPS} = \frac{\$500,000}{210,000} \text{ shares} \]
   \[ \text{EPS} = \$2.38 \]
Under Plan II, the levered company, EBIT will be reduced by the interest payment. The interest payment is the amount of debt times the interest rate, so:

\[
NI = 750,000 - 0.08(2,280,000) \\
NI = 317,600
\]

And the EPS will be:

\[
EPS = \frac{317,600}{150,000 \text{ shares}} \\
EPS = 2.12
\]

Plan I has the higher EPS when EBIT is $500,000.

\[b.\] Under Plan I, the net income is $750,000 and the EPS is:

\[
EPS = \frac{750,000}{210,000 \text{ shares}} \\
EPS = 3.57
\]

Under Plan II, the net income is:

\[
NI = 750,000 - 0.08(2,280,000) \\
NI = 567,600
\]

And the EPS is:

\[
EPS = \frac{567,600}{150,000 \text{ shares}} \\
EPS = 3.78
\]

Plan II has the higher EPS when EBIT is $750,000.

\[c.\] To find the breakeven EBIT for two different capital structures, we simply set the equations for EPS equal to each other and solve for EBIT. The breakeven EBIT is:

\[
\frac{\text{EBIT}}{210,000} = \frac{\text{EBIT} - 0.08(2,280,000)}{150,000} \\
\text{EBIT} = 638,400
\]

5. We can find the price per share by dividing the amount of debt used to repurchase shares by the number of shares repurchased. Doing so, we find the share price is:

\[
\text{Share price} = \frac{2,280,000}{210,000 - 150,000} \\
\text{Share price} = 38.00 \text{ per share}
\]

The value of the company under the all-equity plan is:

\[
V = 38.00(210,000 \text{ shares}) = 7,980,000
\]

And the value of the company under the levered plan is:

\[
V = 38.00(80,000 \text{ shares}) + 2,280,000 \text{ debt} = 7,980,000
\]
6.  

   a. The income statement for each capitalization plan is:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>All-equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT</td>
<td>$48,000</td>
<td>$48,000</td>
<td>$48,000</td>
</tr>
<tr>
<td>Interest</td>
<td>$9,000</td>
<td>$19,800</td>
<td>0</td>
</tr>
<tr>
<td>NI</td>
<td>$39,000</td>
<td>$28,200</td>
<td>$48,000</td>
</tr>
<tr>
<td>EPS</td>
<td>$3.90</td>
<td>$3.71</td>
<td>$4.00</td>
</tr>
</tbody>
</table>

The all-equity plan has the highest EPS; Plan II has the lowest EPS.

   b. The breakeven level of EBIT occurs when the capitalization plans result in the same EPS. The EPS is calculated as:

   $$\text{EPS} = \frac{\text{EBIT} - R_dD}{\text{Shares outstanding}}$$

   This equation calculates the interest payment ($R_dD$) and subtracts it from the EBIT, which results in the net income. Dividing by the shares outstanding gives us the EPS. For the all-equity capital structure, the interest term is zero. To find the breakeven EBIT for two different capital structures, we simply set the equations equal to each other and solve for EBIT. The breakeven EBIT between the all-equity capital structure and Plan I is:

   $$\frac{\text{EBIT}}{12,000} = \frac{\text{EBIT} - .10(90,000)}{10,000}$$
   $$\text{EBIT} = $54,000$$

   And the breakeven EBIT between the all-equity capital structure and Plan II is:

   $$\frac{\text{EBIT}}{12,000} = \frac{\text{EBIT} - .10(198,000)}{7,600}$$
   $$\text{EBIT} = $54,000$$

   The break-even levels of EBIT are the same because of M&M Proposition I.

   c. Setting the equations for EPS from Plan I and Plan II equal to each other and solving for EBIT, we get:

   $$\frac{\text{EBIT} - .10(90,000)}{10,000} = \frac{\text{EBIT} - .10(198,000)}{7,600}$$
   $$\text{EBIT} = $54,000$$

   This break-even level of EBIT is the same as in part b again because of M&M Proposition I.
d. The income statement for each capitalization plan with corporate income taxes is:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>All-equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT</td>
<td>$48,000</td>
<td>$48,000</td>
<td>$48,000</td>
</tr>
<tr>
<td>Interest</td>
<td>9,000</td>
<td>19,800</td>
<td>0</td>
</tr>
<tr>
<td>Taxes</td>
<td>15,600</td>
<td>11,280</td>
<td>19,200</td>
</tr>
<tr>
<td>NI</td>
<td>$23,400</td>
<td>$16,920</td>
<td>$28,800</td>
</tr>
<tr>
<td>EPS</td>
<td>$2.34</td>
<td>$2.23</td>
<td>$2.40</td>
</tr>
</tbody>
</table>

The all-equity plan still has the highest EPS; Plan II still has the lowest EPS.

We can calculate the EPS as:

\[ \text{EPS} = \left( \frac{\text{EBIT} - \text{RD}}{1 - T} \right) / \text{Shares outstanding} \]

This is similar to the equation we used before, except now we need to account for taxes. Again, the interest expense term is zero in the all-equity capital structure. So, the breakeven EBIT between the all-equity plan and Plan I is:

\[ \text{EBIT}(1 - .40)/11,000 = \left( \frac{\text{EBIT} - .10(90,000)}{1 - .40} \right)/10,000 \]
\[ \text{EBIT} = 54,000 \]

The break-even EBIT between the all-equity plan and Plan II is:

\[ \text{EBIT}(1 - .40)/11,000 = \left( \frac{\text{EBIT} - .10(198,000)}{1 - .40} \right)/7,600 \]
\[ \text{EBIT} = 54,000 \]

And the breakeven between Plan I and Plan II is:

\[ \left( \frac{\text{EBIT} - .10(90,000)}{1 - .40} \right)/10,000 = \left( \frac{\text{EBIT} - .10(198,000)}{1 - .40} \right)/7,600 \]
\[ \text{EBIT} = 54,000 \]

The break-even levels of EBIT do not change because the addition of taxes reduces the income of all three plans by the same percentage; therefore, they do not change relative to one another.

7. To find the value per share of the stock under each capitalization plan, we can calculate the price as the value of shares repurchased divided by the number of shares repurchased. So, under Plan I, the value per share is:

\[ P = 90,000/(12,000 - 10,000 \text{ shares}) \]
\[ P = 45 \text{ per share} \]

And under Plan II, the value per share is:

\[ P = 198,000/(12,000 - 7,600 \text{ shares}) \]
\[ P = 45 \text{ per share} \]

This shows that when there are no corporate taxes, the stockholder does not care about the capital structure decision of the firm. This is M&M Proposition I without taxes.
8.  

a. The earnings per share are:

\[
\text{EPS} = \frac{27,000}{7,000} \text{ shares} \\
\text{EPS} = 3.86
\]

So, the cash flow for the investor is:

\[
\text{Cash flow} = 3.86(100 \text{ shares}) \\
\text{Cash flow} = 385.71
\]

b. To determine the cash flow to the shareholder, we need to determine the EPS of the firm under the proposed capital structure. The market value of the firm is:

\[
V = 55(7,000) \\
V = 385,000
\]

Under the proposed capital structure, the firm will raise new debt in the amount of:

\[
D = 0.30(385,000) \\
D = 115,500
\]

in debt. This means the number of shares repurchased will be:

\[
\text{Shares repurchased} = \frac{115,500}{55} \\
\text{Shares repurchased} = 2,100
\]

Under the new capital structure, the company will have to make an interest payment on the new debt. The net income with the interest payment will be:

\[
\text{NI} = 27,000 - 0.08(115,500) \\
\text{NI} = 17,760
\]

This means the EPS under the new capital structure will be:

\[
\text{EPS} = \frac{17,760}{7,000 - 2,100} \text{ shares} \\
\text{EPS} = 3.62
\]

Since all earnings are paid as dividends, the shareholder will receive:

\[
\text{Shareholder cash flow} = 3.62(100 \text{ shares}) \\
\text{Shareholder cash flow} = 362.45
\]

c. To replicate the proposed capital structure, the shareholder should sell 30 percent of their shares, or 30 shares, and lend the proceeds at 8 percent. The shareholder will have an interest cash flow of:

\[
\text{Interest cash flow} = 30(55)(.08) \\
\text{Interest cash flow} = 132
\]
The shareholder will receive dividend payments on the remaining 70 shares, so the dividends received will be:

Dividends received = $3.62(70 shares)  
Dividends received = $253.71

The total cash flow for the shareholder under these assumptions will be:

Total cash flow = $132 + 253.71  
Total cash flow = $385.71

This is the same cash flow we calculated in part a.

d. The capital structure is irrelevant because shareholders can create their own leverage or unlever the stock to create the payoff they desire, regardless of the capital structure the firm actually chooses.

9. a. The rate of return earned will be the dividend yield. The company has debt, so it must make an interest payment. The net income for the company is:

\[
\text{NI} = 68,000 - .08(325,000)  
\text{NI} = 42,000
\]

The investor will receive dividends in proportion to the percentage of the company’s share they own. The total dividends received by the shareholder will be:

Dividends received = $42,000(48,750/325,000)  
Dividends received = $6,300

So the return the shareholder expects is:

\[
R = 6,300/48,750  
R = .1292, or 12.92\
\]

b. To generate exactly the same cash flows in the other company, the shareholder needs to match the capital structure of ABC. The shareholder should sell all shares in XYZ. This will net $48,750. The shareholder should then borrow $48,750. This will create an interest cash flow of:

Interest cash flow = .08(–$48,750)  
Interest cash flow = –$3,900

The investor should then use the proceeds of the stock sale and the loan to buy shares in ABC. The investor will receive dividends in proportion to the percentage of the company’s share they own. The total dividends received by the shareholder will be:

Dividends received = $68,000[(48,750 + 48,750)/650,000]  
Dividends received = $10,200
The total cash flow for the shareholder will be:

Total cash flow = $10,200 – 3,900
Total cash flow = $6,300

The shareholders return in this case will be:

\[ R = \frac{6,300}{48,750} \]
\[ R = .1292, \text{ or } 12.92\% \]

c. ABC is an all equity company, so:

\[ R_E = R_A = \frac{68,000}{650,000} \]
\[ R_E = .1046, \text{ or } 10.46\% \]

To find the cost of equity for XYZ we need to use M&M Proposition II, so:

\[ R_E = R_A + (R_A - R_D)(D/E)(1 - T) \]
\[ R_E = .1046 + (.1046 - .08)(1)(1) \]
\[ R_E = .1292, \text{ or } 12.92\% \]

d. To find the WACC for each company we need to use the WACC equation:

\[ \text{WACC} = \left( \frac{E}{V} \right) R_E + \left( \frac{D}{V} \right) R_D(1 - T) \]

So, for ABC, the WACC is:

\[ \text{WACC} = (1)(.1046) + (0)(.08) \]
\[ \text{WACC} = .1046, \text{ or } 10.46\% \]

And for XYZ, the WACC is:

\[ \text{WACC} = \frac{1}{2}(.1292) + \frac{1}{2}(.08) \]
\[ \text{WACC} = .1046, \text{ or } 10.46\% \]

When there are no corporate taxes, the cost of capital for the firm is unaffected by the capital structure; this is M&M Proposition II without taxes.

10. With no taxes, the value of an unlevered firm is the EBIT divided by the unlevered cost of equity, so:

\[ V = \frac{\text{EBIT}}{\text{WACC}} \]
\[ $18,000,000 = \frac{\text{EBIT}}{.08} \]
\[ \text{EBIT} = .08($18,000,000) \]
\[ \text{EBIT} = $1,440,000 \]
11. If there are corporate taxes, the value of an unlevered firm is:

\[ V_U = \frac{\text{EBIT}(1 - T)}{R_U} \]

Using this relationship, we can find EBIT as:

\[
\begin{align*}
$18,000,000 &= \text{EBIT}(1 - .35)/.08 \\
\text{EBIT} &= \$2,215,384.62
\end{align*}
\]

The WACC remains at 8 percent. Due to taxes, EBIT for an all-equity firm would have to be higher for the firm to still be worth $18 million.

12. a. With the information provided, we can use the equation for calculating WACC to find the cost of equity. The equation for WACC is:

\[ \text{WACC} = \left( \frac{E}{V} \right) R_E + \left( \frac{D}{V} \right) R_D (1 - T) \]

The company has a debt-equity ratio of 1.5, which implies the weight of debt is 1.5/2.5, and the weight of equity is 1/2.5, so

\[ \text{WACC} = .09 = (1/2.5) R_E + (1.5/2.5)(.055)(1 - .35) \]

\[ R_E = .1714, \text{ or } 17.14\% \]

b. To find the unlevered cost of equity we need to use M&M Proposition II with taxes, so:

\[ R_E = R_U + (R_U - R_D)(D/E)(1 - T) \]

\[ .1714 = R_U + (R_U - .055)(1.5)(1 - .35) \]

\[ R_U = .1139, \text{ or } 11.39\% \]

c. To find the cost of equity under different capital structures, we can again use M&M Proposition II with taxes. With a debt-equity ratio of 2, the cost of equity is:

\[ R_E = R_U + (R_U - R_D)(D/E)(1 - T) \]

\[ R_E = .1139 + (.1139 - .055)(2)(1 - .35) \]

\[ R_E = .1905, \text{ or } 19.05\% \]

With a debt-equity ratio of 1.0, the cost of equity is:

\[ R_E = .1139 + (.1139 - .055)(1)(1 - .35) \]

\[ R_E = .1522, \text{ or } 15.22\% \]

And with a debt-equity ratio of 0, the cost of equity is:

\[ R_E = .1139 + (.1139 - .055)(0)(1 - .35) \]

\[ R_E = R_U = .1139, \text{ or } 11.39\% \]
13. a. For an all-equity financed company:

\[
WACC = R_U = R_E = 0.095 \text{ or 9.5%}
\]

b. To find the cost of equity for the company with leverage we need to use M&M Proposition II with taxes, so:

\[
R_E = R_U + (R_U - R_D)(D/E)(1 - T)
\]

\[
R_E = 0.095 + (0.095 - 0.061)(0.25/0.75)(0.65)
\]

\[
R_E = 0.1024, \text{ or 10.24%}
\]

c. Using M&M Proposition II with taxes again, we get:

\[
R_E = R_U + (R_U - R_D)(D/E)(1 - T)
\]

\[
R_E = 0.095 + (0.095 - 0.061)(0.50/0.50)(1 - 0.35)
\]

\[
R_E = 0.1171, \text{ or 11.71%}
\]

d. The WACC with 25 percent debt is:

\[
WACC = (E/V)R_E + (D/V)R_D(1 - T)
\]

\[
WACC = 0.75(0.1024) + 0.25(0.061)(1 - 0.35)
\]

\[
WACC = 0.0867, \text{ or 8.67%}
\]

And the WACC with 50 percent debt is:

\[
WACC = (E/V)R_E + (D/V)R_D(1 - T)
\]

\[
WACC = 0.50(0.1171) + 0.50(0.061)(1 - 0.35)
\]

\[
WACC = 0.0784, \text{ or 7.84%}
\]

14. a. The value of the unlevered firm is:

\[
V_U = \text{EBIT}(1 - T)/R_U
\]

\[
V_U = $74,000(1 - 0.35)/0.12
\]

\[
V_U = $400,833.33
\]

b. The value of the levered firm is:

\[
V_U = V_U + TD
\]

\[
V_U = $400,833.33 + 0.35($125,000)
\]

\[
V_U = $444,583.33
\]
15. We can find the cost of equity using M&M Proposition II with taxes. Doing so, we find:

\[ R_E = R_U + (R_U - R_D)(D/E)(1 - T) \]
\[ R_E = .12 + (.12 - .07)(\$125,000/\$444,583)(1 - .35) \]
\[ R_E = .1327, \text{ or } 13.27\% \]

Using this cost of equity, the WACC for the firm after recapitalization is:

\[ \text{WACC} = \left( \frac{E}{V} \right) R_E + \left( \frac{D}{V} \right) R_D (1 - T) \]
\[ \text{WACC} = .1327\left(\frac{\$444,583 - \$125,000}{\$444,583}\right) + .07(1 - .35)(\$125,000/\$444,583) \]
\[ \text{WACC} = .1082, \text{ or } 10.82\% \]

When there are corporate taxes, the overall cost of capital for the firm declines the more highly leveraged is the firm’s capital structure. This is M&M Proposition I with taxes.

**Intermediate**

16. To find the value of the levered firm we first need to find the value of an unlevered firm. So, the value of the unlevered firm is:

\[ V_U = \frac{\text{EBIT}(1 - T)}{R_U} \]
\[ V_U = (\$73,000)(1 - .35)/.11 \]
\[ V_U = \$431,363.64 \]

Now we can find the value of the levered firm as:

\[ V_L = V_U + TD \]
\[ V_L = \$431,363.64 + .35(\$145,000) \]
\[ V_L = \$482,113.64 \]

Applying M&M Proposition I with taxes, the firm has increased its value by issuing debt. As long as M&M Proposition I holds, that is, there are no bankruptcy costs and so forth, then the company should continue to increase its debt/equity ratio to maximize the value of the firm.

17. a. With no debt, we are finding the value of an unlevered firm, so:

\[ V = \frac{\text{EBIT}(1 - T)}{R_0} \]
\[ V = \$19,750(1 - .35)/.15 \]
\[ V = \$85,583.33 \]

b. The general expression for the value of a leveraged firm is:

\[ V_L = V_U + TD \]

If debt is 50 percent of \(V_U\), then \(D = (.50) V_U\), and we have:

\[ V_L = V_U + T[(.50)V_U] \]
\[ V_L = \$85,583.33 + .35(.50)(\$85,583.33) \]
\[ V_L = \$100,560.42 \]
And if debt is 100 percent of \( V_U \), then \( D = (1.0) V_U \), and we have:

\[
V_L = V_U + TD
\]

\[
V_L = \$85,583.33 + .35(1.0)(\$85,583.33)
\]

\[
V_L = \$115,537.50
\]

c. According to M&M Proposition I with taxes:

\[
V_L = V_U + TD
\]

With debt being 50 percent of the value of the levered firm, \( V_U \) must equal \( T(.50)D \), so:

\[
\$85,583.33 = .35(.50)D
\]

\[
D = \$489,047.62
\]

This means the value of the levered firm is:

\[
V_L = \$85,583.33 + .35(\$489,047.62)
\]

\[
V_L = \$256,750.00
\]

If the debt is 100 percent of the levered value, \( V_U \) must equal \( T(1) V_U \), so:

\[
\$85,583.33 = .35D
\]

\[
D = \$244,523.81
\]

This means the value of the levered firm is:

\[
V_L = \$85,583.33 + .35(\$244,523.81)
\]

\[
V_L = \$171,166.67
\]

18. a. To purchase 5 percent of Knight’s equity, the investor would need:

Knight investment = \(.05(\$2,050,000)\) = \$102,500

And to purchase 5 percent of Veblen without borrowing would require:

Veblen investment = \(.05(\$3,100,000)\) = \$155,000

In order to compare dollar returns, the initial net cost of both positions should be the same. Therefore, the investor will need to borrow the difference between the two amounts, or:

\[
\text{Amount to borrow} = \$155,000 - 102,500 = \$52,500
\]

An investor who owns 5 percent of Knight’s equity will be entitled to 5 percent of the firm’s earnings available to common stock holders at the end of each year. While Knight’s expected operating income is \$500,000, it must pay \$78,000 to debt holders before distributing any of its earnings to stockholders. So, the amount available to this shareholder will be:

\[
\text{Cash flow from Knight to shareholder} = .05(\$500,000 - 78,000) = \$21,100
\]
Veblen will distribute all of its earnings to shareholders, so the shareholder will receive:

Cash flow from Veblen to shareholder = .05($500,000) = $25,000

However, to have the same initial cost, the investor has borrowed $52,500 to invest in Veblen, so interest must be paid on the borrowings. The net cash flow from the investment in Veblen will be:

Net cash flow from Veblen investment = $25,000 – .06($52,500) = $21,850

For the same initial cost, the investment in Veblen produces a higher dollar return.

b. Both of the two strategies have the same initial cost. Since the dollar return to the investment in Veblen is higher, all investors will choose to invest in Veblen over Knight. The process of investors purchasing Veblen’s equity rather than Knight’s will cause the market value of Veblen’s equity to rise and the market value of Knight’s equity to fall. Any differences in the dollar returns to the two strategies will be eliminated, and the process will cease when the total market values of the two firms are equal.

**Challenge**

19. M&M Proposition II states:

\[ R_E = R_U + (R_U - R_D)(D/E)(1 - T) \]

And the equation for WACC is:

\[ WACC = \left(\frac{E}{V}\right)R_E + \left(\frac{D}{V}\right)R_D(1 - T) \]

Substituting the M&M Proposition II equation into the equation for WACC, we get:

\[ WACC = \left(\frac{E}{V}\right)[R_U + (R_U - R_D)(D/E)(1 - T)] + \left(\frac{D}{V}\right)R_D(1 - T) \]

Rearranging and reducing the equation, we get:

\[ WACC = R_U\left(\frac{E}{V} + \left(\frac{D}{E}\right)(1 - T)\right) + R_D\left(1 - T\right)\left(\frac{D}{V}\right) - \left(\frac{E}{V}\right)\left(\frac{D}{E}\right) \]

\[ WACC = R_U\left[\frac{(E+D)}{V} - T\left(\frac{D}{V}\right)\right] \]

20. The return on equity is net income divided by equity. Net income can be expressed as:

\[ NI = (EBIT - RD)(1 - T) \]

So, ROE is:

\[ R_E = (EBIT - RD)(1 - T)/E \]
Now we can rearrange and substitute as follows to arrive at M&M Proposition II with taxes:

\[ R_E = \left[ \frac{\text{EBIT}(1 - T)}{E} \right] - \left[ \frac{R_D(D/E)(1 - T)}{E} \right] \]
\[ R_E = \frac{R_V}{E} - \frac{R_D(D/E)(1 - T)}{E} \]
\[ R_E = \frac{R_V(V_L - TD)}{E} - \frac{R_D(D/E)(1 - T)}{E} \]
\[ R_E = \frac{R_V(E + D - TD)}{E} - \frac{R_D(D/E)(1 - T)}{E} \]
\[ R_E = R_U + (R_U - R_D)(D/E)(1 - T) \]

21. M&M Proposition II, with no taxes is:

\[ R_E = R_U + (R_U - R_f)(D/E) \]

Note that we use the risk-free rate as the return on debt. This is an important assumption of M&M Proposition II. The CAPM to calculate the cost of equity is expressed as:

\[ R_E = \beta_E(R_M - R_f) + R_f \]

We can rewrite the CAPM to express the return on an unlevered company as:

\[ R_A = \beta_A(R_M - R_f) + R_f \]

We can now substitute the CAPM for an unlevered company into M&M Proposition II. Doing so and rearranging the terms we get:

\[ R_E = \beta_A(R_M - R_f) + R_f + \left[ \beta_A(R_M - R_f) + R_f - R_f \right](D/E) \]
\[ R_E = \beta_A(R_M - R_f) + R_f + \left[ \beta_A(R_M - R_f) \right](D/E) \]
\[ R_E = (1 + D/E)\beta_A(R_M - R_f) + R_f \]

Now we set this equation equal to the CAPM equation to calculate the cost of equity and reduce:

\[ \beta_A(R_M - R_f) + R_f = (1 + D/E)\beta_A(R_M - R_f) + R_f \]
\[ \beta_A(R_M - R_f) = (1 + D/E)\beta_A(R_M - R_f) \]
\[ \beta_E = \beta_A(1 + D/E) \]
22. Using the equation we derived in Problem 21:

\[ \beta_E = \beta_A (1 + D/E) \]

The equity beta for the respective asset betas is:

<table>
<thead>
<tr>
<th>Debt-Equity Ratio</th>
<th>Equity Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1(1 + 0) = 1</td>
</tr>
<tr>
<td>1</td>
<td>1(1 + 1) = 2</td>
</tr>
<tr>
<td>5</td>
<td>1(1 + 5) = 6</td>
</tr>
<tr>
<td>20</td>
<td>1(1 + 20) = 21</td>
</tr>
</tbody>
</table>

The equity risk to the shareholder is composed of both business and financial risk. Even if the assets of the firm are not very risky, the risk to the shareholder can still be large if the financial leverage is high. These higher levels of risk will be reflected in the shareholder’s required rate of return \( R_E \), which will increase with higher debt/equity ratios.