CHAPTER 14
COST OF CAPITAL

Answers to Concepts Review and Critical Thinking Questions

1. It is the minimum rate of return the firm must earn overall on its existing assets. If it earns more than this, value is created.

4. Interest expense is tax-deductible. There is no difference between pretax and aftertax equity costs.

5. The primary advantage of the DCF model is its simplicity. The method is disadvantaged in that (a) the model is applicable only to firms that actually pay dividends; many do not; (b) even if a firm does pay dividends, the DCF model requires a constant dividend growth rate forever; (c) the estimated cost of equity from this method is very sensitive to changes in g, which is a very uncertain parameter; and (d) the model does not explicitly consider risk, although risk is implicitly considered to the extent that the market has impounded the relevant risk of the stock into its market price. While the share price and most recent dividend can be observed in the market, the dividend growth rate must be estimated. Two common methods of estimating g are to use analysts’ earnings and payout forecasts or to determine some appropriate average historical g from the firm’s available data.

7. The appropriate aftertax cost of debt to the company is the interest rate it would have to pay if it were to issue new debt today. Hence, if the YTM on outstanding bonds of the company is observed, the company has an accurate estimate of its cost of debt. If the debt is privately placed, the firm could still estimate its cost of debt by (a) looking at the cost of debt for similar firms in similar risk classes, (b) looking at the average debt cost for firms with the same credit rating (assuming the firm’s private debt is rated), or (c) consulting analysts and investment bankers. Even if the debt is publicly traded, an additional complication occurs when the firm has more than one issue outstanding; these issues rarely have the same yield because no two issues are ever completely homogeneous.

8. a. This only considers the dividend yield component of the required return on equity.
   b. This is the current yield only, not the promised yield to maturity. In addition, it is based on the book value of the liability, and it ignores taxes.
   c. Equity is inherently more risky than debt (except, perhaps, in the unusual case where a firm’s assets have a negative beta). For this reason, the cost of equity exceeds the cost of debt. If taxes are considered in this case, it can be seen that at reasonable tax rates, the cost of equity does exceed the cost of debt.
Solutions to Questions and Problems

1. With the information given, we can find the cost of equity using the dividend growth model. Using this model, the cost of equity is:

   \[ R_E = \frac{\$3.40(1.045)}{\$53} + .045 \]
   \[ R_E = .1120, \text{ or } 11.20\% \]

2. Here we have information to calculate the cost of equity using the CAPM. The cost of equity is:

   \[ R_E = .035 + 1.15(.11 - .035) \]
   \[ R_E = .1213, \text{ or } 12.13\% \]

5. The cost of preferred stock is the dividend payment divided by the price, so:

   \[ R_P = \frac{\$3.75}{\$87} \]
   \[ R_P = .0431, \text{ or } 4.31\% \]

7. a. The pretax cost of debt is the YTM of the company’s bonds, so:

   \[ P_0 = \$930 = \$35(PVIFA_{R\%,54}) + \$1,000(PVIF_{R\%,54}) \]
   \[ R = 3.807\% \]
   \[ YTM = 2 \times 3.807\% = 7.61\% \]

   b. The aftertax cost of debt is:

   \[ R_D = .0761(1 - .35) \]
   \[ R_D = .0495, \text{ or } 4.95\% \]

   c. The aftertax rate is more relevant because that is the actual cost to the company.

9. a. Using the equation to calculate the WACC, we find:

   \[ WACC = .70(.11) + .05(.05) + .25(.07)(1 - .35) \]
   \[ WACC = .0909, \text{ or } 9.09\% \]

   b. Since interest is tax deductible and dividends are not, we must look at the aftertax cost of debt, which is:

   \[ R_D = .07(1 - .35) \]
   \[ R_D = .0455, \text{ or } 4.55\% \]

   Hence, on an aftertax basis, debt is cheaper than the preferred stock.
14. a. Using the equation to calculate WACC, we find:

\[ \text{WACC} = 0.099 = \frac{1}{1.85}(0.14) + \frac{0.85}{1.85}(1 - 0.35)R_D \]
\[ R_D = 0.0781, \text{ or } 7.81\% \]

b. Using the equation to calculate WACC, we find:

\[ \text{WACC} = 0.099 = \frac{1}{1.85}R_E + \frac{0.85}{1.85}(0.068) \]
\[ R_E = 0.1254, \text{ or } 12.54\% \]

15. We will begin by finding the market value of each type of financing. We find:

\[ \text{MV}_D = 10,000(\$1,000)(1.08) = \$10,800,000 \]
\[ \text{MV}_E = 495,000(\$63) = \$31,185,000 \]
\[ \text{MV}_P = 35,000(\$72) = \$2,520,000 \]

And the total market value of the firm is:

\[ V = \$10,800,000 + 31,185,000 + 2,520,000 \]
\[ V = \$44,505,000 \]

Now, we can find the cost of equity using the CAPM. The cost of equity is:

\[ R_E = 0.032 + 1.15(0.07) \]
\[ R_E = 0.1125, \text{ or } 11.25\% \]

The cost of debt is the YTM of the bonds, so:

\[ P_0 = 1,080 = 32(PVIFA_{R\%,50}) + 1,000(PVIF_{R\%,50}) \]
\[ R = 2.895\% \]
\[ \text{YTM} = 2.895\% \times 2 = 5.79\% \]

And the aftertax cost of debt is:

\[ R_D = (1 - 0.35)(0.0579) \]
\[ R_D = 0.0376, \text{ or } 3.76\% \]

The cost of preferred stock is:

\[ R_P = 3.50 / \$72 \]
\[ R_P = 0.0486, \text{ or } 4.86\% \]

Now we have all of the components to calculate the WACC. The WACC is:

\[ \text{WACC} = 0.0376(\$10,800,000 / \$44,505,000) + 0.1125(\$31,185,000 / \$44,505,000) + 0.0486(\$2,520,000 / \$44,505,000) \]
\[ \text{WACC} = 0.0907, \text{ or } 9.07\% \]

Notice that we didn’t include the \((1 - T_c)\) term in the WACC equation. We used the aftertax cost of debt in the equation, so the term is not needed here.
16.  

a. We will begin by finding the market value of each type of financing. We find:

\[
\begin{align*}
MV_D &= 120,000(1,000)(1.07) = 128,400,000 \\
MV_E &= 7,300,000(46) = 335,800,000 \\
MV_P &= 220,000(91) = 20,020,000 \\
\end{align*}
\]

And the total market value of the firm is:

\[
V = 128,400,000 + 335,800,000 + 20,020,000 = 484,220,000
\]

So, the market value weights of the company’s financing are:

\[
\begin{align*}
D/V &= 128,400,000 / 484,220,000 = .2652 \\
P/V &= 20,020,000 / 484,220,000 = .0413 \\
E/V &= 335,800,000 / 484,220,000 = .6935 \\
\end{align*}
\]

b. For projects equally as risky as the firm itself, the WACC should be used as the discount rate.

First we can find the cost of equity using the CAPM. The cost of equity is:

\[
R_E = .036 + .95(.07) = .1025, \text{ or } 10.25\%
\]

The cost of debt is the YTM of the bonds, so:

\[
\begin{align*}
P_0 &= $1,070 = $32.50(PVIFA_{R\%,30}) + $1,000(PVIF_{R\%,30}) \\
R &= 2.8976\% \\
YTM &= 2.8976\% \times 2 = 5.80\%
\end{align*}
\]

And the aftertax cost of debt is:

\[
R_D = (1 – .35)(.0580) = .0358, \text{ or } 3.77\%
\]

The cost of preferred stock is:

\[
R_P = $4.50 / $91 = .0495, \text{ or } 4.95\%
\]

Now we can calculate the WACC as:

\[
WACC = .2652(.0377) + .0413(.0495) + .6935(.1025) = .0831, \text{ or } 8.31\%
\]
20. Using the debt-equity ratio to calculate the WACC, we find:

\[ WACC = \frac{.80}{1.80}(0.046) + \frac{1}{1.80}(0.11) \]

\[ WACC = 0.0816, \text{ or } 8.16\% \]

Since the project is riskier than the company, we need to adjust the project discount rate for the additional risk. Using the subjective risk factor given, we find:

Project discount rate = 8.16\% + 3.00\%
Project discount rate = 11.16\%

We would accept the project if the NPV is positive. The NPV is the PV of the cash outflows plus the PV of the cash inflows. The cash inflows are a growing perpetuity. If you remember, the equation for the PV of a growing perpetuity is the same as the dividend growth equation, so:

PV of future cash flows = \( \frac{2,100,000}{.1116 - .02} \)
PV of future cash flows = $25,936,893

The project should only be undertaken if its cost is less than $25,936,893 since costs less than this amount will result in a positive NPV.

30. The $3.9 million cost of the land three years ago is a sunk cost and irrelevant; the $4.4 million appraised value of the land is an opportunity cost and is relevant. The $4.8 million land value in five years is a relevant cash flow as well. The fact that the company is keeping the land rather than selling it is unimportant. The land is an opportunity cost in five years and is a relevant cash flow for this project. The market value capitalization weights are:

MV_D = 210,000($1,000)(1.08) = $226,800,000
MV_E = 8,300,000($68) = $564,400,000
MV_P = 450,000($81) = $36,450,000

The total market value of the company is:

\[ V = 226,800,000 + 564,400,000 + 36,450,000 \]

\[ V = 827,650,000 \]

Next we need to find the cost of funds. We have the information available to calculate the cost of equity using the CAPM, so:

\[ R_E = .035 + 1.10(.07) \]

\[ R_E = .1120, \text{ or } 11.20\% \]

The cost of debt is the YTM of the company’s outstanding bonds, so:

\[ P_0 = $1,080 = 32(PVIFA_{R\%,50}) + 1,000(PVIF_{R\%,50}) \]

\[ R = 2.895\% \]

\[ YTM = 2.895\% \times 2 = 5.79\% \]

And the aftertax cost of debt is:
\[ R_D = (1 - .35)(.0579) \]
\[ R_D = .0376, \text{ or } 3.76\% \]

The cost of preferred stock is:

\[ R_P = \frac{$4.50}{81} \]
\[ R_P = .0556, \text{ or } 5.56\% \]

\[ a. \text{ The weighted average flotation cost is the sum of the weight of each source of funds in the} \]
\[ \text{capital structure of the company times the flotation costs, so:} \]
\[ f_T = \left(\frac{$564.4}{827.65}\right)(.08) + \left(\frac{$36.45}{827.65}\right)(.06) + \left(\frac{$226.8}{827.65}\right)(.04) \]
\[ f_T = .0682, \text{ or } 6.82\% \]

The initial cash outflow for the project needs to be adjusted for the flotation costs. To account for the flotation costs:

Amount raised \( (1 - .0682) = $37,000,000 \)
Amount raised \( = \frac{$37,000,000}{1 - .0682} \)
Amount raised \( = $39,706,304 \)

So the cash flow at time zero will be:

\[ CF_0 = -$4,400,000 - 39,706,304 - 1,300,000 \]
\[ CF_0 = -$45,501,390 \]

There is an important caveat to this solution. This solution assumes that the increase in net working capital does not require the company to raise outside funds; therefore the flotation costs are not included. However, this is an assumption and the company could need to raise outside funds for the NWC. If this is true, the initial cash outlay includes these flotation costs, so:

Total cost of NWC including flotation costs:

\( \frac{$1,300,000}{1 - .0682} = $1,395,086 \)

This would make the total initial cash flow:

\[ CF_0 = -$4,400,000 - 39,706,304 - 1,395,086 \]
\[ CF_0 = -$45,501,390 \]

\[ b. \text{ To find the required return on this project, we first need to calculate the WACC for the} \]
\[ \text{company. The company’s WACC is:} \]
\[ \text{WACC} = [(\frac{$564.4}{827.65})(.1120) + (\frac{$36.45}{827.65})(.0556) + (\frac{$226.8}{827.65})(.0376)] \]
\[ \text{WACC} = .0891, \text{ or } 8.91\% \]

The company wants to use the subjective approach to this project because it is located overseas. The adjustment factor is 2 percent, so the required return on this project is:

Project required return \( = .0891 + .02 \)
Project required return = .1091, or 10.91%

c. The annual depreciation for the equipment will be:

\[
\frac{37,000,000}{8} = 4,625,000
\]

So, the book value of the equipment at the end of five years will be:

\[
BV_5 = 37,000,000 - 5(4,625,000) \\
BV_5 = 13,875,000
\]

So, the aftertax salvage value will be:

\[
\text{Aftertax salvage value} = 5,100,000 + .35(13,875,000 - 5,100,000) \\
\text{Aftertax salvage value} = 8,171,250
\]

d. Using the tax shield approach, the OCF for this project is:

\[
OCF = \left[ (P - v)Q - FC \right](1 - T_c) + T_c D
\]

\[
OCF = \left[ (11,450 - 9,500)(15,300) - 6,700,000 \right](1 - .35) + .35(37,000,000 / 8)
\]

\[
OCF = 16,656,500
\]

e. The accounting breakeven sales figure for this project is:

\[
Q_A = \frac{(FC + D)}{(P - v)}
\]

\[
Q_A = \frac{(6,700,000 + 4,652,000)}{(11,450 - 9,500)}
\]

\[
Q_A = 5,808 	ext{ units}
\]

f. We have calculated all cash flows of the project. We just need to make sure that in Year 5 we add back the aftertax salvage value and the recovery of the initial NWC. The cash flows for the project are:

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>–45,406,304</td>
</tr>
<tr>
<td>1</td>
<td>16,656,500</td>
</tr>
<tr>
<td>2</td>
<td>16,656,500</td>
</tr>
<tr>
<td>3</td>
<td>16,656,500</td>
</tr>
<tr>
<td>4</td>
<td>16,656,500</td>
</tr>
<tr>
<td>5</td>
<td>30,927,750</td>
</tr>
</tbody>
</table>

Using the required return of 10.91 percent, the NPV of the project is:

\[
\text{NPV} = -45,406,304 + 16,656,500(PVIFA_{10.91\%,4}) + 30,927,750 / 1.1091^5
\]

\[
\text{NPV} = 24,790,606.10
\]

And the IRR is:

\[
\text{NPV} = 0 = -45,406,304 + 16,656,500(PVIFA_{\text{IRR}\%,5}) + 30,927,750 / (1 + IRR)^5
\]

\[
\text{IRR} = 28.94\%
\]

If the initial NWC is assumed to be financed from outside sources, the cash flows are:
<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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</tr>
<tr>
<td>5</td>
<td>30,927,750</td>
</tr>
</tbody>
</table>

With this assumption, and the required return of 10.91 percent, the NPV of the project is:

\[
\text{NPV} = –$45,501,390 + 16,656,500(PVIFA_{10.91\%,4}) + \frac{30,927,750}{1.1091^5}
\]

\[
\text{NPV} = $24,695,519.75
\]

And the IRR is:

\[
\text{NPV} = 0 = –$45,501,390 + 16,656,500(PVIFA_{\text{IRR}\%,4}) + \frac{30,927,750}{(1 + \text{IRR})^5}
\]

\[
\text{IRR} = 28.85\%
\]