CHAPTER 2
Present Value and the Opportunity Cost of Capital

Answers to Practice Questions

1. Let \( \text{INV} \) = investment required at time \( t = 0 \) (i.e., \( \text{INV} = -C_0 \)) and let \( x \) = rate of return. Then \( x \) is defined as:
\[
x = \frac{C_1 - \text{INV}}{\text{INV}}
\]
Therefore:
\[
C_1 = \text{INV}(1 + x)
\]
It follows that:
\[
\text{NPV} = C_0 + \frac{C_1}{(1 + r)}
\]
\[
\text{NPV} = -\text{INV} + \frac{([\text{INV}(1 + x)]/(1 + r))}{(1 + r)}
\]
\[
\text{NPV} = \text{INV} \left\{ \frac{(1 + x)}{(1 + r)} - 1 \right\}
\]
\[
a. \text{ When } x \text{ equals } r, \text{ then:}
\]
\[
\left\{ \frac{(1 + x)}{(1 + r)} - 1 \right\} = 0
\]
and \( \text{NPV} \) is zero.
\[
b. \text{ When } x \text{ exceeds } r, \text{ then:}
\]
\[
\left\{ \frac{(1 + x)}{(1 + r)} - 1 \right\} > 0
\]
and \( \text{NPV} \) is positive.

2. The face value of the treasury security is $1,000. If this security earns 5%, then in one year we will receive $1,050. Thus:
\[
\text{NPV} = C_0 + [C_1/(1 + r)] = -1000 + (1050/1.05) = 0
\]
This is not a surprising result, because 5 percent is the opportunity cost of capital, i.e., 5 percent is the return available in the capital market. If any investment earns a rate of return equal to the opportunity cost of capital, the NPV of that investment is zero.
3. \[ \text{NPV} = -1,300,000 + \left( \frac{1,500,000}{1.10} \right) = +$63,636 \]

Since the NPV is positive, you would construct the motel.

Alternatively, we can compute \( r \) as follows:

\[ r = \left( \frac{1,500,000}{1,300,000} \right) - 1 = 0.1538 = 15.38\% \]

Since the rate of return is greater than the cost of capital, you would construct the motel.

4.

<table>
<thead>
<tr>
<th>Investment</th>
<th>NPV</th>
<th>Return</th>
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</thead>
<tbody>
<tr>
<td>1) -10,000 + \frac{18,000}{1.20} = 5,000</td>
<td>\frac{18,000 - 10,000}{10,000} = 0.80 = 80.0%</td>
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<tr>
<td>2) -5,000 + \frac{9,000}{1.20} = 2,500</td>
<td>\frac{9,000 - 5,000}{5,000} = 0.80 = 80.0%</td>
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<tr>
<td>3) -5,000 + \frac{5,700}{1.20} = -$250</td>
<td>\frac{5,700 - 5,000}{5,000} = 0.14 = 14.0%</td>
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<tr>
<td>4) -2,000 + \frac{4,000}{1.20} = $1,333.33</td>
<td>\frac{4,000 - 2,000}{2,000} = 1.00 = 100.0%</td>
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</tbody>
</table>

a. Investment 1, because it has the highest NPV.
b. Investment 1, because it maximizes shareholders' wealth.

5. a. \[ \text{NPV} = (-50,000 + 30,000) + (30,000/1.07) = $8,037.38 \]
b. \[ \text{NPV} = (-50,000 + 30,000) + (30,000/1.10) = $7,272.73 \]

Since, in each case, the NPV is higher than the NPV of the office building ($7,143), accept E. Coli's offer. You can also think of it another way. The true opportunity cost of the land is what you could sell it for, i.e., $58,037 (or $57,273). At that price, the office building has a negative NPV.

6. The opportunity cost of capital is the return earned by investing in the best alternative investment. This return will not be realized if the investment under consideration is undertaken. Thus, the two investments must earn \textit{at least} the same return. This return rate is the discount rate used in the net present value calculation.
7. a. \[ \text{NPV} = -\$2,000,000 + \frac{[\$2,000,000 \times 1.05]}{1.05} = \$0 \]

b. \[ \text{NPV} = -\$900,000 + \frac{[\$900,000 \times 1.07]}{1.10} = -\$24,545.45 \]

The correct discount rate is 10% because this is the appropriate rate for an investment with the level of risk inherent in Norman's nephew's restaurant. The NPV is negative because Norman will not earn enough to compensate for the risk.

c. \[ \text{NPV} = -\$2,000,000 + \frac{[\$2,000,000 \times 1.12]}{1.12} = \$0 \]

d. \[ \text{NPV} = -\$1,000,000 + \frac{[\$1,100,000]}{1.12} = -\$17,857.14 \]

Norman should invest in either the risk-free government securities or the risky stock market, depending on his tolerance for risk. Correctly priced securities always have an NPV = 0.

8. a. Expected rate of return on project =

\[ \frac{\$2,100,000 - \$2,000,000}{\$2,000,000} = 0.05 = 5.0\% \]

This is equal to the return on the government securities.

b. Expected rate of return on project =

\[ \frac{\$963,000 - \$900,000}{\$900,000} = 0.07 = 7.0\% \]

This is less than the correct 10% rate of return for restaurants with similar risk.

c. Expected rate of return on project =

\[ \frac{\$2,240,000 - \$2,000,000}{\$2,000,000} = 0.12 = 12.0\% \]

This is equal to the rate of return in the stock market.

d. Expected rate of return on project =

\[ \frac{\$1,100,000 - \$1,000,000}{\$1,000,000} = 0.10 = 10.0\% \]

This is less than the return in the equally risky stock market.
9. \[ \text{NPV} = -2,600,000 + \left[ \frac{1,100,000 + (1,600,000 \times 1.12)}{1.12} \right] = -17,857.14 \]

The rate at which Norman can borrow does not reflect the opportunity cost of the investments. Norman is still investing $1,000,000 at 10% while the opportunity cost of capital is 12%.

10. a. This is incorrect. The cost of capital is an opportunity cost; it is the rate of return foregone on the next best alternative investment of equal risk.

b. Net present value is not “just theory.” An asset’s net present value is the net gain to investors who acquire the asset. The concept of “maximizing profits” is the fuzzy concept here. For example, this goal does not make it clear whether it is appropriate to try to increase profits today if it means sacrificing profits tomorrow. In contrast to the objective of maximizing profits, the net present value criterion correctly accounts for the timing of returns from an investment.

Note that “maximize profits” is an unsatisfactory objective in other respects as well. It does not take risk in to account, so that it is not possible to determine whether it is worth trying to increase (average) profits if, in the process, risk is also increased. It is also unclear which accounting figure should be maximized because the profit figure depends on the accounting methods chosen. It is cash flow that is important, not accounting profit. Cash flow can be spent or invested, while accounting profit is a number on a piece of paper which can change with changes in accounting methods.

c. The comment can be interpreted in two ways:

1. The manager may try to boost stock price temporarily by disseminating a deceptively rosy picture of the firm’s prospects. This possibility is not considered in this chapter. However, it is difficult to imagine how a manager can act in the stockholders’ best interests by deceiving them.

2. The manager may sacrifice present value in order to achieve the “gently rising trend.” This is not in the stockholders’ best interests. If they want a gently rising trend of wealth or income, they can always achieve it by shifting wealth through time (i.e., by borrowing or lending). The firm helps its stockholders most by making them as rich as possible now.
CHAPTER 3
How to Calculate Present Values

Answers to Practice Questions

1.
   a. \( PV = \$100 \times 0.905 = \$90.50 \)
   b. \( PV = \$100 \times 0.295 = \$29.50 \)
   c. \( PV = \$100 \times 0.035 = \$3.50 \)
   d. \( PV = \$100 \times 0.893 = \$89.30 \)
      \( PV = \$100 \times 0.797 = \$79.70 \)
      \( PV = \$100 \times 0.712 = \$71.20 \)
      \( PV = \$89.30 + \$79.70 + \$71.20 = \$240.20 \)

2.
   a. \( PV = \$100 \times 4.279 = \$427.90 \)
   b. \( PV = \$100 \times 4.580 = \$458.00 \)
   c. We can think of cash flows in this problem as being the difference between two separate streams of cash flows. The first stream is \$100 per year received in years 1 through 12; the second is \$100 per year paid in years 1 through 2.

      The PV of \$100 received in years 1 to 12 is:
      \[ PV = \$100 \times [\text{Annuity factor, 12 time periods, 9\%}] \]
      \[ PV = \$100 \times [7.161] = \$716.10 \]

      The PV of \$100 paid in years 1 to 2 is:
      \[ PV = \$100 \times [\text{Annuity factor, 2 time periods, 9\%}] \]
      \[ PV = \$100 \times [1.759] = \$175.90 \]

      Therefore, the present value of \$100 per year received in each of years 3 through 12 is: \((\$716.10 - \$175.90) = \$540.20 \). (Alternatively, we can think of this as a 10-year annuity starting in year 3.)
3.  a. \[ DF_1 = \frac{1}{1 + r_1} = 0.88 \Rightarrow \text{so that } r_1 = 0.136 = 13.6\% \]

b. \[ DF_2 = \frac{1}{(1 + r_2)^2} = \frac{1}{(1 + 0.105)^2} = 0.82 \]

c. \[ AF_2 = DF_1 + DF_2 = 0.88 + 0.82 = 1.70 \]

d. PV of an annuity = \( C \times [\text{Annuity factor at } r\% \text{ for } t \text{ years}] \)

Here:
\[ \$24.49 = 10 \times [AF_3] \]
\[ AF_3 = 2.45 \]

e. \[ AF_3 = DF_1 + DF_2 + DF_3 = AF_2 + DF_3 \]
\[ 2.45 = 1.70 + DF_3 \]
\[ DF_3 = 0.75 \]

4. The present value of the 10-year stream of cash inflows is (using Appendix Table 3): \( \$170,000 \times 5.216 = \$886,720 \)

Thus:
\[ \text{NPV} = -\$800,000 + \$886,720 = +\$86,720 \]

At the end of five years, the factory's value will be the present value of the five remaining \$170,000 cash flows. Again using Appendix Table 3:
\[ PV = 170,000 \times 3.433 = \$583,610 \]

5. a. Let \( S_t \) = salary in year \( t \)

\[ PV = \sum_{t=1}^{30} \frac{S_t}{(1.08)^t} = \sum_{t=1}^{30} \frac{20,000 (1.05)^{t-1}}{(1.08)^t} = \sum_{t=1}^{30} \frac{(20,000/1.05)^{t-1}}{(1.08/1.05)^t} = \sum_{t=1}^{30} \frac{19,048}{(1.029)^t} \]

\[ = 19,048 \times \left[ \frac{1}{0.029} - \frac{1}{(0.029) \times (1.029)^{30}} \right] = \$378,222 \]

b. \( \text{PV(salary)} \times 0.05 = \$18,911. \)

Future value = \( \$18,911 \times (1.08)^{30} = \$190,295 \)

c. Annual payment = initial value ÷ annuity factor

20-year annuity factor at 8 percent = 9.818

Annual payment = \( \$190,295/9.818 = \$19,382 \)
6.  
<table>
<thead>
<tr>
<th>Period</th>
<th>Discount Factor</th>
<th>Cash Flow</th>
<th>Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.000</td>
<td>-400,000</td>
<td>-400,000</td>
</tr>
<tr>
<td>1</td>
<td>0.893</td>
<td>+100,000</td>
<td>+ 89,300</td>
</tr>
<tr>
<td>2</td>
<td>0.797</td>
<td>+200,000</td>
<td>+159,400</td>
</tr>
<tr>
<td>3</td>
<td>0.712</td>
<td>+300,000</td>
<td>+213,600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total = NPV = $62,300</td>
</tr>
</tbody>
</table>

7.  
We can break this down into several different cash flows, such that the sum of these separate cash flows is the total cash flow. Then, the sum of the present values of the separate cash flows is the present value of the entire project. All dollar figures are in millions.

- Cost of the ship is $8 million  
  \[ PV = -$8 \text{ million} \]

- Revenue is $5 million per year, operating expenses are $4 million. Thus, operating cash flow is $1 million per year for 15 years.  
  \[ PV = 1 \text{ million} \times [\text{Annuity factor at 8\%, } t = 15] = 1 \text{ million} \times 8.559 \]
  \[ PV = 8.559 \text{ million} \]

- Major refits cost $2 million each, and will occur at times \( t = 5 \) and \( t = 10 \).  
  \[ PV = -$2 \text{ million} \times [\text{Discount factor at 8\%, } t = 5] \]
  \[ PV = -$2 \text{ million} \times [\text{Discount factor at 8\%, } t = 10] \]
  \[ PV = -$2 \text{ million} \times [0.681 + 0.463] = -$2.288 \text{ million} \]

- Sale for scrap brings in revenue of $1.5 million at \( t = 15 \).  
  \[ PV = 1.5 \text{ million} \times [\text{Discount factor at 8\%, } t = 15] \]
  \[ PV = 1.5 \text{ million} \times [0.315] = 0.473 \text{ million} \]

Adding these present values gives the present value of the entire project:  
\[ PV = -$8 \text{ million} + 8.559 \text{ million} - 2.288 \text{ million} + 0.473 \text{ million} \]
\[ PV = -$1.256 \text{ million} \]

8.  
 a. \[ PV = $100,000 \]
 b. \[ PV = $180,000/1.12^5 = $102,137 \]
 c. \[ PV = $11,400/0.12 = $95,000 \]
 d. \[ PV = $19,000 \times [\text{Annuity factor, 12\%, } t = 10] \]
\[ PV = 19,000 \times 5.650 = $107,350 \]
 e. \[ PV = $6,500/(0.12 - 0.05) = $92,857 \]

Prize (d) is the most valuable because it has the highest present value.
10. Mr. Basset is buying a security worth $20,000 now. That is its present value. The unknown is the annual payment. Using the present value of an annuity formula, we have:

\[ PV = C \times [\text{Annuity factor, } 8\%, \ t = 12] \]
\[ 20,000 = C \times 7.536 \]
\[ C = \$2,654 \]

12. The fact that Kangaroo Autos is offering “free credit” tells us what the cash payments are; it does not change the fact that money has time value. A 10 percent annual rate of interest is equivalent to a monthly rate of 0.83 percent:

\[ r_{\text{monthly}} = \frac{r_{\text{annual}}}{12} = \frac{0.10}{12} = 0.0083 = 0.83\% \]

The present value of the payments to Kangaroo Autos is:

\[ \$1000 + \$300 \times [\text{Annuity factor, } 0.83\%, \ t = 30] \]

Because this interest rate is not in our tables, we use the formula in the text to find the annuity factor:

\[ \frac{\$1,000 + \$300 \times \left(1 - \frac{1}{(1 + 0.0083)^{30}}\right)}{0.0083} = \$8,938 \]

A car from Turtle Motors costs $9,000 cash. Therefore, Kangaroo Autos offers the better deal, i.e., the lower present value of cost.

16. a. This is the usual perpetuity, and hence:

\[ PV = \frac{C}{r} = \frac{\$100}{0.07} = \$1,428.57 \]

b. This is worth the PV of stream (a) plus the immediate payment of $100:

\[ PV = \$100 + \$1,428.57 = \$1,528.57 \]
20. One way to approach this problem is to solve for the present value of:
(1) $100 per year for 10 years, and
(2) $100 per year in perpetuity, with the first cash flow at year 11
If this is a fair deal, these present values must be equal, and thus we can solve
for the interest rate, r.

The present value of $100 per year for 10 years is:

$$PV = \$100 \times \left[ \frac{1}{r} - \frac{1}{(r) \times (1+r)^{10}} \right]$$

The present value, as of year 10, of $100 per year forever, with the first payment
in year 11, is: \( PV_{10} = \frac{\$100}{r} \)

At \( t = 0 \), the present value of \( PV_{10} \) is:

$$PV = \left[ \frac{1}{(1+r)^{10}} \right] \times \left[ \frac{\$100}{r} \right]$$

Equating these two expressions for present value, we have:

$$\$100 \times \left[ \frac{1}{r} - \frac{1}{(r) \times (1+r)^{10}} \right] = \left[ \frac{1}{(1+r)^{10}} \right] \times \left[ \frac{\$100}{r} \right]$$

Using trial and error or algebraic solution, we find that \( r = 7.18\% \).
CHAPTER 4
The Value of Common Stocks

Answers to Practice Questions

1. Newspaper exercise, answers will vary

2. The value of a share is the discounted value of all expected future dividends. Even if the investor plans to hold a stock for only 5 years, for example, then, at the time that the investor plans to sell the stock, it will be worth the discounted value of all expected dividends from that point on. In fact, that is the value at which the investor expects to sell the stock. Therefore, the present value of the stock today is the present value of the expected dividend payments from years one through five plus the present value of the year five value of the stock. This latter amount is the present value today of all expected dividend payments after year five.

3. The market capitalization rate for a stock is the rate of return expected by the investor. Since all securities in an equivalent risk class must be priced to offer the same expected return, the market capitalization rate must equal the opportunity cost of capital of investing in the stock.

6. Using the growing perpetuity formula, we have:
   \[ P_0 = \frac{\text{Div}}{r-g} = \frac{10}{0.12 - 0.04} = 25 \]

7. \[ P_A = \frac{\text{DIV}_1}{r} = \frac{10}{0.10} = 100.00 \]
   \[ P_B = \frac{\text{DIV}_1}{r-g} = \frac{5}{0.10 - 0.04} = 83.33 \]
   \[ P_C = \frac{\text{DIV}_1 + \text{DIV}_2 + \text{DIV}_3 + \text{DIV}_4 + \text{DIV}_5 + \text{DIV}_6 + \left( \frac{\text{DIV}_7}{0.10} \times \frac{1}{1.10^6} \right)}{1.10^1 + 1.10^2 + 1.10^3 + 1.10^4 + 1.10^5 + 1.10^6} = \frac{5.00 + 6.00 + 7.20 + 8.64 + 10.37 + 12.44 + \left( \frac{12.44}{0.10} \times \frac{1}{1.10^6} \right)}{1.10^1 + 1.10^2 + 1.10^3 + 1.10^4 + 1.10^5 + 1.10^6} = 104.50 \]

At a capitalization rate of 10 percent, Stock C is the most valuable.

For a capitalization rate of 7 percent, the calculations are similar. The results are:
   \[ P_A = 142.86 \]
   \[ P_B = 166.67 \]
   \[ P_C = 156.48 \]

Therefore, Stock B is the most valuable.
10. Internet exercise; answers will vary depending on time period.

11. Using the concept that the price of a share of common stock is equal to the present value of the future dividends, we have:

\[
P = \frac{DIV_1}{(1+r)} + \frac{DIV_2}{(1+r)^2} + \frac{DIV_3}{(1+r)^3} + \left[ \frac{1}{(1+r)^3} \times \frac{DIV_4}{r-g} \right]
\]

50 = \frac{1}{(1+r)} + \frac{2}{(1+r)^2} + \frac{3}{(1+r)^3} + \left[ \frac{1}{(1+r)^3} \times \frac{(3 \times 1.06)}{r-0.06} \right]

Using trial and error, we find that \( r \) is approximately 11.1 percent.

12. There are two reasons why the corresponding earnings-price ratios are not accurate measures of the expected rates of return.

First, the expected rate of return is based on future expected earnings; the price-earnings ratios reported in the press are based on past actual earnings. In general, these earnings figures are different.

Second, we know that:

\[
\frac{EPS_1}{P_0} = r \left[ 1 - \frac{PVGO}{P_0} \right]
\]

Hence, the earnings-price ratio is equal to the expected rate of return only if PVGO is zero.

13. a. An Incorrect Application. Hotshot Semiconductor’s earnings and dividends have grown by 30 percent per year since the firm’s founding ten years ago. Current stock price is $100, and next year’s dividend is projected at $1.25. Thus:

\[
r = \frac{DIV_4}{P_0} + g = \frac{1.25}{100} + 0.30 = 0.3125 = 31.25\%
\]

This is wrong because the formula assumes perpetual growth; it is not possible for Hotshot to grow at 30 percent per year forever.
A Correct Application. The formula might be correctly applied to the Old Faithful Railroad, which has been growing at a steady 5 percent rate for decades. Its $\text{EPS}_1 = 10$, $\text{DIV}_1 = 5$, and $P_0 = 100$. Thus:

$$r = \frac{\text{DIV}_1}{P_0} + g = \frac{5}{100} + 0.05 = 0.10 = 10.0\%$$

Even here, you should be careful not to blindly project past growth into the future. If Old Faithful hauls coal, an energy crisis could turn it into a growth stock.

b. An Incorrect Application. Hotshot has current earnings of $5.00 per share. Thus:

$$r = \frac{\text{EPS}_1}{P_0} = \frac{5}{100} = 0.05 = 5.0\%$$

This is too low to be realistic. The reason $P_0$ is so high relative to earnings is not that $r$ is low, but rather that Hotshot is endowed with valuable growth opportunities. Suppose $\text{PVGO} = 60$:

$$P_0 = \frac{\text{EPS}_1}{r} + \text{PVGO}$$

$$100 = \frac{5}{r} + 60$$

Therefore, $r = 12.5\%$

A Correct Application. Unfortunately, Old Faithful has run out of valuable growth opportunities. Since $\text{PVGO} = 0$:

$$P_0 = \frac{\text{EPS}_1}{r} + \text{PVGO}$$

$$100 = \frac{10}{r} + 0$$

Therefore, $r = 10.0\%$
14. Share price = \( \frac{\text{EPS}_\alpha}{r} + \frac{\text{NPV}}{r-g} \)

Therefore:

\[ P_a = \frac{\text{EPS}_{\alpha1}}{r_a} + \frac{\text{NPV}_a}{(r_a - 0.15)} \]

\[ P_b = \frac{\text{EPS}_{\beta1}}{r_b} + \frac{\text{NPV}_b}{(r_b - 0.08)} \]

The statement in the question implies the following:

\[ \frac{\text{NPV}_b}{(r_b - 0.08)} \left( \frac{\text{EPS}_{\beta1}}{r_b} + \frac{\text{NPV}_b}{(r_b - 0.08)} \right) > \frac{\text{NPV}_a}{(r_a - 0.15)} \left( \frac{\text{EPS}_{\alpha1}}{r_a} + \frac{\text{NPV}_a}{(r_a - 0.15)} \right) \]

Rearranging, we have:

\[ \frac{\text{NPV}_a}{(r_a - 0.15)} \times \frac{r_a}{\text{EPS}_{\alpha1}} < \frac{\text{NPV}_b}{(r_b - 0.08)} \times \frac{r_b}{\text{EPS}_{\beta1}} \]

a. \( \text{NPV}_a < \text{NPV}_b \), everything else equal.

b. \( (r_a - 0.15) > (r_b - 0.08) \), everything else equal.

c. \( \frac{\text{NPV}_a}{(r_a - 0.15)} < \frac{\text{NPV}_b}{(r_b - 0.08)} \), everything else equal.

c. \( \frac{r_a}{\text{EPS}_{\alpha1}} < \frac{r_b}{\text{EPS}_{\beta1}} \), everything else equal.

15. a. Growth-Tech's stock price should be:

\[ P = \frac{0.50}{(1.12)} + \frac{0.60}{(1.12)^2} + \frac{1.15}{(1.12)^3} + \frac{1}{(1.12)^3} \times \frac{1.24}{(0.12 - 0.08)} = \$23.81 \]

b. The horizon value contributes:

\[ \text{PV}(P_H) = \frac{1}{(1.12)^3} \times \frac{1.24}{(0.12 - 0.08)} = \$22.07 \]
CHAPTER 5
Why Net Present Value Leads to Better Investment Decisions Than Other Criteria

Answers to Practice Questions

1. a. \[ NPV_A = -1000 + \frac{1000}{(1+0.10)} = -90.91 \]
   \[ NPV_B = -2000 + \frac{1000}{(1.10)^2} + \frac{1000}{(1.10)^3} + \frac{4000}{(1.10)^4} + \frac{1000}{(1.10)^5} = +$4,044.73 \]
   \[ NPV_C = -3000 + \frac{1000}{(1.10)^2} + \frac{1000}{(1.10)^3} + \frac{1000}{(1.10)^4} + \frac{1000}{(1.10)^5} = +$39.47 \]

   b. Payback\(_A\) = 1 year
      Payback\(_B\) = 2 years
      Payback\(_C\) = 4 years

c. A and B.

5. In general, the discounted payback rule is slightly better than the regular payback rule. But, in this case, it might actually be worse: with the same cut-off period, fewer long-lived investment projects will make the grade.

6. | r   | -17.44% | 0.00%  | 10.00% | 15.00% | 20.00% | 25.00% | 45.27% |
<table>
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</tr>
</thead>
<tbody>
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<td>Year 0</td>
<td>-3,000.00</td>
<td>-3,000.00</td>
<td>-3,000.00</td>
<td>-3,000.00</td>
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<tr>
<td>Year 1</td>
<td>3,500.00</td>
<td>4,239.34</td>
<td>5,000.00</td>
<td>5,868.41</td>
<td>6,797.53</td>
<td>7,726.63</td>
<td>5,000.00</td>
</tr>
<tr>
<td>Year 2</td>
<td>4,000.00</td>
<td>4,737.34</td>
<td>4,900.00</td>
<td>5,068.41</td>
<td>5,227.53</td>
<td>5,386.63</td>
<td>5,000.00</td>
</tr>
<tr>
<td>Year 3</td>
<td>-4,000.00</td>
<td>-3,000.00</td>
<td>-4,000.00</td>
<td>-3,000.00</td>
<td>-2,000.00</td>
<td>-1,000.00</td>
<td>-1,000.00</td>
</tr>
<tr>
<td>PV</td>
<td>-0.31</td>
<td>500.00</td>
<td>482.35</td>
<td>437.99</td>
<td>379.64</td>
<td>312.00</td>
<td>-0.02</td>
</tr>
</tbody>
</table>

   The two IRRs for this project are (approximately): -17.44% and 45.27%. The NPV is positive between these two discount rates.

7. a. The figure on the next page was drawn from the following points:

<table>
<thead>
<tr>
<th>Discount Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
</tr>
<tr>
<td>NPV(_A)</td>
</tr>
<tr>
<td>NPV(_B)</td>
</tr>
</tbody>
</table>

   b. From the graph, we can estimate the IRR of each project from the point where its line crosses the horizontal axis:
The company should accept Project A if its NPV is positive and higher than that of Project B; that is, the company should accept Project A if the discount rate is greater than 10.7 percent and less than 13.1 percent.

d. The cash flows for (B - A) are:

\[
\begin{align*}
C_0 & \quad C_1 & \quad C_2 & \quad C_3 \\
0 & -60 & -60 & +140
\end{align*}
\]

Therefore:

\[
\begin{align*}
\text{Discount Rate} & \quad 0\% & \quad 10\% & \quad 20\% \\
\text{NPV}_{B-A} & \quad +20.00 & \quad +1.05 & \quad -10.65
\end{align*}
\]

\[
\text{IRR}_{B-A} = 10.7\%
\]

The company should accept Project A if the discount rate is greater than 10.7% and less than 13.1%. As shown in the graph, for these discount rates, the IRR for the incremental investment is less than the opportunity of cost of capital.
8. a. Because Project A requires a larger capital outlay, it is possible that
Project A has both a lower IRR and a higher NPV than Project B. (In fact,
NPV_A is greater than NPV_B for all discount rates less than 10 percent.)
Because the goal is to maximize shareholder wealth, NPV is the correct
criterion.

b. To use the IRR criterion for mutually exclusive projects, calculate the IRR
for the incremental cash flows:

\[
\begin{array}{cccc}
C_0 & C_1 & C_2 & \text{IRR} \\
A - B & -200 & +110 & +121 & 10% \\
\end{array}
\]

Because the IRR for the incremental cash flows exceeds the cost of
capital, the additional investment in A is worthwhile.

c. \[NPV_A = -400 + \frac{250}{(1.09)} + \frac{300}{(1.09)^2} = $81.86\]

\[NPV_B = -200 + \frac{140}{(1.09)} + \frac{179}{(1.09)^2} = $79.10\]

9. Use incremental analysis:

\[
\begin{array}{ccc}
\text{Current arrangement} & C_1 & C_2 & C_3 \\
\text{Extra shift} & -250,000 & -250,000 & +650,000 \\
\text{Incremental flows} & -550,000 & +650,000 & 0 \\
\text{Current arrangement} & -300,000 & +900,000 & -650,000 \\
\end{array}
\]

The IRRs for the incremental flows are approximately 21.13 \text{ and } 78.87 \%.
If the cost of capital is between these rates, Titanic should work the extra shift.
CHAPTER 6
Making Investment Decisions with the Net Present Value Rule

2. No, this is not the correct procedure. The opportunity cost of the land is its value in its best use, so Mr. North should consider the $45,000 value of the land as an outlay in his NPV analysis of the funeral home.

3. Unfortunately, there is no simple adjustment to the discount rate that will resolve the issue of taxes. Mathematically:

\[
\frac{C_1}{1.10} = \frac{C_1/(1 - 0.35)}{1.15}
\]

and

\[
\frac{C_2}{1.10^2} = \frac{C_2/(1 - 0.35)}{1.15^2}
\]

9. a. Capital Expenditure
   1. If the spare warehouse space will be used now or in the future, then the project should be credited with these benefits.
   2. Charge opportunity cost of the land and building.
   3. The salvage value at the end of the project should be included.

Research and Development
   1. Research and development is a sunk cost.

Working Capital
   1. Will additional inventories be required as volume increases?
   2. Recovery of inventories at the end of the project should be included.
   3. Is additional working capital required due to changes in receivables, payables, etc.?

Revenues
   1. Revenue forecasts assume prices (and quantities) will be unaffected by competition, a common and critical mistake.

Operating Costs
   1. Are percentage labor costs unaffected by increase in volume in the early years?
   2. Wages generally increase faster than inflation. Does Reliable expect continuing productivity gains to offset this?

Overhead
   1. Is "overhead" truly incremental?

Depreciation
   1. Depreciation is not a cash flow, but the ACRS depreciation does affect tax payments.
   2. ACRS depreciation is fixed in nominal terms. The real value of the depreciation tax shield is reduced by inflation.
Interest
1. It is bad practice to deduct interest charges (or other payments to security holders). Value the project as if it is all equity-financed.

Taxes
1. See comments on ACRS depreciation and interest.
2. If Reliable has profits on its remaining business, the tax loss should not be carried forward.

Net Cash Flow
1. See comments on ACRS depreciation and interest.
2. Discount rate should reflect project characteristics; in general, it is not equivalent to the company’s borrowing rate.

b. 1. Potential use of warehouse.
   2. Opportunity cost of building.
   3. Other working capital items.
   4. More realistic forecasts of revenues and costs.
   5. Company’s ability to use tax shields.

The table on the next page shows a sample NPV analysis for the project. The analysis is based on the following assumptions:
1. Inflation: 10 percent per year.
2. Capital Expenditure: $8 million for machinery; $5 million for market value of factory; $2.4 million for warehouse extension (we assume that it is eventually needed or that electric motor project and surplus capacity cannot be used in the interim). We assume salvage value of $3 million in real terms less tax at 35 percent.
3. Working Capital: We assume inventory in year t is 9.1 percent of expected revenues in year (t + 1). We also assume that receivables less payables, in year t, is equal to 5 percent of revenues in year t.
4. Depreciation Tax Shield: Based on 35 percent tax rate and 5-year ACRS class. This is a simplifying and probably inaccurate assumption; i.e., not all the investment would fall in the 5-year class. Also, the factory is currently owned by the company and may already be partially depreciated. We assume the company can use tax shields as they arise.
5. Revenues: Sales of 2,000 motors in 2000, 4,000 motors in 2001, and 10,000 motors thereafter. The unit price is assumed to decline from $4,000 (real) to $2,850 when competition enters in 2002. The latter is the figure at which new entrants’ investment in the project would have NPV = 0.
6. Operating Costs: We assume direct labor costs decline progressively from $2,500 per unit in 2000, to $2,250 in 2001 and to $2,000 in real terms in 2002 and after.
7. Other Costs: We assume true incremental costs are 10 percent of revenue.
8. Tax: 35 percent of revenue less costs.
11. 

<table>
<thead>
<tr>
<th></th>
<th>( t = 0 )</th>
<th>( t = 1 )</th>
<th>( t = 2 )</th>
<th>( t = 3 )</th>
<th>( t = 4 )</th>
<th>( t = 5 )</th>
<th>( t = 6 )</th>
<th>( t = 7 )</th>
<th>( t = 8 )</th>
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<tr>
<td>Sales</td>
<td>4,200.0</td>
<td>4,410.0</td>
<td>4,630.5</td>
<td>4,862.0</td>
<td>5,105.1</td>
<td>5,360.4</td>
<td>5,628.4</td>
<td>5,909.8</td>
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<tr>
<td>Manufacturing Costs</td>
<td>3,780.0</td>
<td>3,969.0</td>
<td>4,167.5</td>
<td>4,375.8</td>
<td>4,594.6</td>
<td>4,824.3</td>
<td>5,065.6</td>
<td>5,318.8</td>
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<tr>
<td>Depreciation</td>
<td>120.0</td>
<td>120.0</td>
<td>120.0</td>
<td>120.0</td>
<td>120.0</td>
<td>120.0</td>
<td>120.0</td>
<td>120.0</td>
<td></td>
</tr>
<tr>
<td>Rent</td>
<td>100.0</td>
<td>104.0</td>
<td>108.2</td>
<td>112.5</td>
<td>117.0</td>
<td>121.7</td>
<td>126.5</td>
<td>131.6</td>
<td></td>
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<tr>
<td>Earnings Before Taxes</td>
<td>200.0</td>
<td>217.0</td>
<td>234.9</td>
<td>253.7</td>
<td>273.5</td>
<td>294.4</td>
<td>316.3</td>
<td>339.4</td>
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<tr>
<td>Taxes</td>
<td>70.0</td>
<td>76.0</td>
<td>82.2</td>
<td>88.8</td>
<td>95.7</td>
<td>103.0</td>
<td>110.7</td>
<td>118.8</td>
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<tr>
<td>Cash Flow</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td>180.0</td>
<td>240.1</td>
<td>250.6</td>
<td>261.8</td>
<td>273.5</td>
<td>285.8</td>
<td>298.8</td>
<td>1,247.4</td>
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<tr>
<td>Working Capital</td>
<td>350.0</td>
<td>420.0</td>
<td>441.0</td>
<td>463.1</td>
<td>486.2</td>
<td>510.5</td>
<td>536.0</td>
<td>562.8</td>
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</tr>
<tr>
<td>Increase in W.C.</td>
<td>350.0</td>
<td>420.0</td>
<td>441.0</td>
<td>463.1</td>
<td>486.2</td>
<td>510.5</td>
<td>536.0</td>
<td>562.8</td>
<td></td>
</tr>
<tr>
<td>Rent (after tax)</td>
<td>70.0</td>
<td>21.0</td>
<td>22.1</td>
<td>23.2</td>
<td>24.3</td>
<td>25.5</td>
<td>26.8</td>
<td>-562.8</td>
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<td>Initial Investment</td>
<td>1,200.0</td>
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<td></td>
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<tr>
<td>Sale of Plant</td>
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<tr>
<td>Tax on Sale</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Cash Flow</td>
<td>-1,550.0</td>
<td>180.0</td>
<td>240.1</td>
<td>250.6</td>
<td>261.8</td>
<td>273.5</td>
<td>285.8</td>
<td>298.8</td>
<td></td>
</tr>
<tr>
<td>NPV(at 12%)</td>
<td>85.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. Note: There are several different calculations of pre-tax profit and taxes given in Section 6.2, based on different assumptions; the solution below is based on Table 6.6 in the text.

See the table on the next page. With full usage of the tax losses, the NPV of the tax payments is $4,779. With tax losses carried forward, the NPV of the tax payments is $5,741. Thus, with tax losses carried forward, the project's NPV decreases by $962, so that the value to the company of using the deductions immediately is $962.

### Tax Cash Flows

<table>
<thead>
<tr>
<th></th>
<th>( t = 0 )</th>
<th>( t = 1 )</th>
<th>( t = 2 )</th>
<th>( t = 3 )</th>
<th>( t = 4 )</th>
<th>( t = 5 )</th>
<th>( t = 6 )</th>
<th>( t = 7 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretax Profit</td>
<td>-4,000</td>
<td>-4,514</td>
<td>748</td>
<td>9,807</td>
<td>16,940</td>
<td>11,579</td>
<td>5,539</td>
<td>1,949</td>
</tr>
<tr>
<td>Full usage of tax losses (Table 6.6)</td>
<td>-1,400</td>
<td>-1,580</td>
<td>262</td>
<td>3,432</td>
<td>5,929</td>
<td>4,053</td>
<td>1,939</td>
<td>682</td>
</tr>
<tr>
<td>NPV at 20%</td>
<td>$4,779</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax loss carry-forward</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>714</td>
<td>5,929</td>
<td>4,053</td>
<td>1,939</td>
<td>682</td>
</tr>
<tr>
<td>NPV (at 20%)</td>
<td>$5,741</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 7
Introduction to Risk, Return, and the Opportunity Cost of Capital

Answers to Practice Questions

6. In the context of a well-diversified portfolio, the only risk characteristic of a single security that matters is the security's contribution to the overall portfolio risk. This contribution is measured by beta. Lonesome Gulch is the safer investment for a diversified investor because its beta (+0.10) is lower than the beta of Amalgamated Copper (+0.66). For a diversified investor, the standard deviations are irrelevant.

15. a. In general, we expect a stock's price to change by an amount equal to (beta x change in the market). Beta equal to -0.25 implies that, if the market rises by an extra 5 percent, the expected change is -1.25 percent. If the market declines an extra 5 percent, then the expected change is +1.25 percent.

b. "Safest" implies lowest risk. Assuming the well-diversified portfolio is invested in typical securities, the portfolio beta is approximately one. The largest reduction in beta is achieved by investing the $20,000 in a stock with a negative beta. Answer (iii) is correct.
6. Internet exercise; answers will vary depending on time period.

7. a. 

![Graph showing the relationship between Beta and Expected Return]

b. Market risk premium = \( r_m - r_f = 0.12 - 0.04 = 0.08 = 8.0\% \)

c. Use the security market line:
\[
r = r_f + \beta(r_m - r_f)
\]
\[
r = 0.04 + [1.5 \times (0.12 - 0.04)] = 0.16 = 16.0\%
\]
d. For any investment, we can find the opportunity cost of capital using the security market line. With \( \beta = 0.8 \), the opportunity cost of capital is:
\[
r = r_f + \beta(r_m - r_f)
\]
\[
r = 0.04 + [0.8 \times (0.12 - 0.04)] = 0.104 = 10.4\%
\]
The opportunity cost of capital is 10.4 percent and the investment is expected to earn 9.8 percent. Therefore, the investment has a negative NPV.

e. Again, we use the security market line:
\[
r = r_f + \beta(r_m - r_f)
\]
\[
0.112 = 0.04 + \beta(0.12 - 0.04) \quad \Rightarrow \quad \beta = 0.9
\]

8. Internet exercise; answers will vary depending on time period.
10. a. Percival's current portfolio provides an expected return of 9 percent with an annual standard deviation of 10 percent. First we find the portfolio weights for a combination of Treasury bills (security 1: standard deviation = 0 percent) and the index fund (security 2: standard deviation = 16 percent) such that portfolio standard deviation is 10 percent. In general, for a two security portfolio:

\[ \sigma_p^2 = x_1^2 \sigma_1^2 + 2x_1x_2 \sigma_1 \sigma_2 \rho_{12} + x_2^2 \sigma_2^2 \]

\[ (0.10)^2 = 0 + 0 + x_2^2(0.16)^2 \]

\[ x_2 = 0.625 \Rightarrow x_1 = 0.375 \]

Further:

\[ r_p = x_1r_1 + x_2r_2 \]

\[ r_p = (0.375 \times 0.06) + (0.625 \times 0.14) = 0.11 = 11.0\% \]

Therefore, he can improve his expected rate of return without changing the risk of his portfolio.

b. With equal amounts in the corporate bond portfolio (security 1) and the index fund (security 2), the expected return is:

\[ r_p = x_1r_1 + x_2r_2 \]

\[ r_p = (0.5 \times 0.09) + (0.5 \times 0.14) = 0.115 = 11.5\% \]

\[ \sigma_p^2 = x_1^2 \sigma_1^2 + 2x_1x_2 \sigma_1 \sigma_2 \rho_{12} + x_2^2 \sigma_2^2 \]

\[ \sigma_p^2 = (0.5)^2(0.10)^2 + 2(0.5)(0.5)(0.10)(0.16)(0.10) + (0.5)^2(0.16)^2 \]

\[ \sigma_p^2 = 0.0097 \]

\[ \sigma_p = 0.985 = 9.85\% \]

Therefore, he can do even better by investing equal amounts in the corporate bond portfolio and the index fund. His expected return increases to 11.5% and the standard deviation of his portfolio decreases to 9.85%.

11. No. Every stock has unique risk in addition to market risk. The unique risk reflects uncertain events that are unrelated to the return on the market portfolio. The Capital Asset Pricing Model does not predict these events. If the events are favorable, the stock will do better than the model predicts. If the events are unfavorable, the stock will do worse.

12. a. True  
b. True  
c. True
Answers to Practice Questions

1. It is true that the cost of capital depends on the risk of the project being evaluated. However, if the risk of the project is similar to the risk of the other assets of the company, then the appropriate rate of return is the company cost of capital.

2. Internet exercise; answers will vary.

3. Internet exercise; answers will vary.

4. a. Both British Petroleum and British Airways had $R^2$ values of 0.25, which means that, for both stocks 25% of total risk comes from movements in the market (i.e., market risk). Therefore, 75% of total risk is unique risk.

b. The variance of British Petroleum is: $(25)^2 = 625$
Unique variance for British Petroleum is: $(0.75 \times 625) = 468.75$

c. The t-statistic for $\beta_{BA}$ is: $(0.90/0.17) = 5.29$
This is significant at the 1% level, so that the confidence level is 99%.

d. $r_{BP} = r_f + \beta_{BP} \times (r_m - r_f) = 0.05 + (1.37) \times (0.12 - 0.05) = 0.1459 = 14.59\%$

e. $r_{BP} = r_f + \beta_{BP} \times (r_m - r_f) = 0.05 + (1.37) \times (0 - 0.05) = -0.0185 = -1.85\%$

7. a. The total market value of outstanding debt is 300,000 euros. The cost of debt capital is 8 percent. For the common stock, the outstanding market value is: $(50 \text{ euros} \times 10,000) = 500,000$ euros. The cost of equity capital is 15 percent. Thus, Lorelei’s weighted-average cost of capital is:

$$r_{\text{assets}} = \left( \frac{300,000}{300,000 + 500,000} \right) \times (0.08) + \left( \frac{500,000}{300,000 + 500,000} \right) \times (0.15)$$

$$r_{\text{assets}} = 0.124 = 12.4\%$$

b. Because business risk is unchanged, the company’s weighted-average cost of capital will not change. The financial structure, however, has changed. Common stock is now worth 250,000 euros. Assuming that the market value of debt and the cost of debt capital are unchanged, we can use the same equation as in Part (a) to calculate the new equity cost of capital, $r_{\text{equity}}$:

$$0.124 = \left( \frac{300,000}{300,000 + 250,000} \right) \times (0.08) + \left( \frac{250,000}{300,000 + 250,000} \right) \times (r_{\text{equity}})$$

$$r_{\text{equity}} = 0.177 = 17.7\%$$

23
9. a. With risk-free debt: $\beta_{assets} = E/V \times \beta_{equity}$
   Therefore:
   
   \[ \beta_{food} = 0.7 \times 0.8 = 0.56 \]
   \[ \beta_{elec} = 0.8 \times 1.6 = 1.28 \]
   \[ \beta_{chem} = 0.6 \times 1.2 = 0.72 \]

   b. $\beta_{assets} = (0.5 \times 0.56) + (0.3 \times 1.28) + (0.2 \times 0.72) = 0.81$

   Still assuming risk-free debt:
   
   \[ \beta_{assets} = (E/V) \times (\beta_{equity}) \]
   \[ 0.81 = (0.6) \times (\beta_{equity}) \]
   \[ \beta_{equity} = 1.35 \]

   c. Use the Security Market Line:
   
   \[ r_{assets} = r_f + \beta_{assets} \times (r_m - r_f) \]

   We have:
   
   \[ r_{food} = 0.07 + (0.56) \times (0.15 - 0.07) = 0.115 = 11.5\% \]
   \[ r_{elec} = 0.07 + (1.28) \times (0.15 - 0.07) = 0.172 = 17.2\% \]
   \[ r_{chem} = 0.07 + (0.72) \times (0.15 - 0.07) = 0.128 = 12.8\% \]

   d. With risky debt:
   
   \[ \beta_{food} = (0.3 \times 0.2) + (0.7 \times 0.8) = 0.62 \Rightarrow r_{food} = 12.0\% \]
   \[ \beta_{elec} = (0.2 \times 0.2) + (0.8 \times 1.6) = 1.32 \Rightarrow r_{elec} = 17.6\% \]
   \[ \beta_{chem} = (0.4 \times 0.2) + (0.6 \times 1.2) = 0.80 \Rightarrow r_{chem} = 13.4\% \]

13. a. The threat of a coup d'état means that the expected cash flow is less than $250,000. The threat could also increase the discount rate, but only if it increases market risk.

   b. The expected cash flow is: $[(0.25 \times 0) + (0.75 \times 250,000)] = $187,500

   Assuming that the cash flow is about as risky as the rest of the company's business:

   \[ PV = \frac{187,500}{1.12} = \$167,411 \]

14. a. Expected daily production =

   \[ (0.2 \times 0) + (0.8) \times [(0.4 \times 1,000) + (0.6 \times 5,000)] = 2,720 \text{ barrels} \]

   Expected annual cash revenues = $2,720 \times 365 \times \$15 = \$14,892,000

   b. The possibility of a dry hole is a diversifiable risk and should not affect the discount rate. This possibility should affect forecasted cash flows, however. See Part (a).

   24
16. a. Using the Security Market Line, we find the cost of capital:

\[ r = 0.07 + 1.5 \times (0.16 - 0.07) = 0.205 = 20.5\% \]

Therefore:

\[ PV = \frac{40}{1.205} + \frac{60}{1.205^2} + \frac{50}{1.205^3} = 103.09 \]

17. At \( t = 2 \), there are two possible values for the project's NPV:

\[ NPV_2 \text{(if test is not successful)} = 0 \]

\[ NPV_2 \text{(if test is successful)} = -5,000,000 + \frac{700,000}{0.12} = \$833,333 \]

Therefore, at \( t = 0 \):

\[ NPV_0 = -500,000 + \frac{(0.40 \times 0) + (0.60 \times 833,333)}{1.40^2} = -\$244,898 \]
12. (See Figure 10.9, which is a revision of Figure 10.8 in the text.)

Which plane should we buy?

We analyze the decision tree by working backwards. So, for example, if we
purchase the piston plane and demand is high:

- The NPV at \( t = 1 \) of the 'Expanded' branch is:
  \[
  -150 + \frac{(0.8 \times 800) + (0.2 \times 100)}{1.08} = $461
  \]

- The NPV at \( t = 1 \) of the 'Continue' branch is:
  \[
  \frac{(0.8 \times 410) + (0.2 \times 180)}{1.08} = $337
  \]

Thus, if we purchase the piston plane and demand is high, we should expand
further at \( t = 1 \). This branch has the highest NPV.

Similarly, if we purchase the piston plane and demand is low:

- The NPV of the 'Continue' branch is:
  \[
  \frac{(0.4 \times 220) + (0.6 \times 100)}{1.08} = $137
  \]

- We can now use these results to calculate the NPV of the 'Piston' branch at
  \( t = 0 \):
  \[
  -180 + \frac{(0.6 \times (100 + 461) + (0.4 \times (50 + 137))}{1.08} = $201
  \]

- Similarly for the 'Turbo' branch, if demand is high, the expected cash flow at
  \( t = 1 \) is:
  \[
  (0.8 \times 960) + (0.2 \times 220) = $812
  \]

- If demand is low, the expected cash flow is:
  \[
  (0.4 \times 930) + (0.6 \times 140) = $456
  \]

- So, for the 'Turbo' branch, the combined NPV is:
  \[
  \text{NPV} = -350 + \frac{(0.6 \times 150) + (0.4 \times 30) + (0.6 \times 812) + (0.4 \times 456)}{(1.08)^2} = $319
  \]

Therefore, the company should buy the turbo plane.

In order to determine the value of the option to expand, we first compute the NPV
without the option to expand:

\[
\text{NPV} = -250 + \frac{(0.6 \times 100) + (0.4 \times 50)}{(1.08)} + \frac{(0.6)[(0.8 \times 410) + (0.2 \times 180)] + (0.4)[(0.4 \times 220) + (0.6 \times 100)]}{(1.08)^2} = $62.07
\]

Therefore, the value of the option to expand is: $201 - $62 = $139
FIGURE 10.9

Hi demand (.6)
$150

Hi demand (.8)
$960
Lo demand (.2)
$220

Hi demand (.4)
$930
Lo demand (.6)
$140

Expand
-$150
Hi demand (.8)
$800
Lo demand (.2)
$100
Hi demand (.8)
$410
Lo demand (.2)
$180

Hi demand (.4)
$220
Lo demand (.6)
$100

Lo demand (.4)
$50

Turbo
-$350

Piston
-$180

Hi demand (.6)
$100

Hi demand (.6)
$100

Continue

Lo demand (.4)
$30

Continue

Lo demand (.4)
$30
Ms. Magna should be prepared to sell either plane at $t = 1$ if the present value of the expected cash flows is less than the present value of selling the plane.

b. See Figure 10.10, which is a revision of Figure 10.8 in the text.

c. We analyze the decision tree by working backwards. So, for example, if we purchase the piston plane and demand is high:

- The NPV at $t = 1$ of the 'Expand' branch is:
  $$-150 + \frac{(0.8 \times 800) + (0.2 \times 100)}{1.08} = $461$$

- The NPV at $t = 1$ of the 'Continue' branch is:
  $$\frac{(0.8 \times 410) + (0.2 \times 180)}{1.08} = $337$$

- The NPV at $t = 1$ of the 'Quit' branch is $150$.

Thus, if we purchase the piston plane and demand is high, we should expand further at $t = 1$ because this branch has the highest NPV.

Similarly, if we purchase the piston plane and demand is low:

- The NPV of the 'Continue' branch is:
  $$\frac{(0.4 \times 220) + (0.6 \times 100)}{1.08} = $137$$

- The NPV of the 'Quit' branch is $150$

Thus, if we purchase the piston plane and demand is low, we should sell the plane at $t = 1$ because this alternative has a higher NPV.

Putting these results together, we calculate the NPV of the 'Piston' branch at $t = 0$:

$$-180 + \frac{(0.6 \times (100 + 461) + (0.4 \times (50 + 150))}{1.08} = $206$$

- Similarly for the 'Turbo' branch, if demand is high, the NPV at $t = 1$ is:
  $$\frac{(0.8 \times 960) + (0.2 \times 220)}{1.08} = $752$$

- The NPV at $t = 1$ of 'Quit' is $500$.

- If demand is low, the NPV at $t = 1$ of 'Quit' is $500$. 

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The NPV of 'Continue' is:

\[
\frac{(0.4 \times 930) + (0.6 \times 140)}{1.08} = \$422
\]

In this case, 'Quit' is better than 'Continue.' Therefore, for the 'Turbo' branch at \( t = 0 \), the NPV is:

\[
-350 + \frac{0.6 \times (150 + 752) + 0.4 \times (30 + 500)}{1.08} = \$347
\]

With the abandonment option, the turbo has the greater NPV, $347 compared to $206 for the piston.

d. The value of the abandonment option is different for the two different planes. For the piston plane, without the abandonment option, NPV at \( t = 0 \) is:

\[
-180 + \frac{0.6 \times (100 + 461) + 0.4 \times (50 + 137)}{1.08} = \$201
\]

Thus, for the piston plane, the abandonment option has a value of:

\$206 - \$201 = \$5

For the turbo plane, without the abandonment option, NPV at \( t = 0 \) is:

\[
-350 + \frac{0.6 \times (150 + 752) + 0.4 \times (30 + 422)}{1.08} = \$319
\]

For the turbo plane, the abandonment option has a value of:

\$347 - \$319 = \$28

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Challenge Questions

1. a. Assume we open the mine at \( t = 0 \). Taking into account the distribution of possible future prices of gold over the next 3 years, we have:

\[
NPV = -100,000 + \frac{(1,000) \times ([0.5 \times 550] + [0.5 \times 450] - 460)}{1.10} + \frac{(1,000) \times [(0.5^3) \times (650 + 500 + 500 + 400) - 460]}{1.10^2} + \frac{(1,000) \times [(0.5^3) \times (650 + 550 + 550 + 450 + 450 + 450 + 350) - 460]}{1.10^3} = -\$526
\]

Notice that the answer is the same if we simply assume that the price of gold remains at \$500. This is because, at \( t = 0 \), the expected price for all future periods is \$500.

Because this NPV is negative, we should not open the mine at \( t = 0 \). Further, we know that it does not make sense to plan to open the mine at any price less than or equal to \$500 per ounce.

2. Assume we wait until \( t = 1 \) and then open the mine if the price is \$550. At that point:

\[
NPV = -100,000 + \sum_{i=1}^{3} \frac{(1,000) \times (550 - 460)}{1.10^i} = \$123,817
\]

Since it is equally likely that the price will rise or fall by \$50 from its level at the start of the year, then, at \( t = 1 \), if the price reaches \$550, the expected price for all future periods is then \$550. The NPV, at \( t = 0 \), of this NPV at \( t = 1 \) is:

\[
\$123,817/1.10 = \$112,561
\]

If the price rises to \$550 at \( t = 1 \), we should open the mine at that time. The expected NPV of this strategy is:

\[
(0.50 \times 112,561) + (0.50 \times 0) = 56,280.5
\]

b. Suppose you open at \( t = 0 \), when the price is \$500. At \( t = 2 \), there is a 0.25 probability that the price will be \$400. Then, since the price at \( t = 3 \) cannot rise above the extraction cost, the mine should be closed. At \( t = 1 \), there is a 0.5 probability that the price will be \$450. In that case, you face the following, where each branch has a probability of 0.5:

\[
\begin{align*}
t = 1 & \quad t = 2 & \quad t = 3 \\
\Rightarrow & \quad 500 & \Rightarrow 550 \\
450 & \quad \Rightarrow 400 & \Rightarrow 450 \\
& \quad \Rightarrow \text{Close mine}
\end{align*}
\]

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To check whether you should close the mine at $t = 1$, calculate the PV with the mine open:

$$ PV = (0.5) \sum_{t=1}^{2} \frac{1,000 \times (500 - 460)}{1.10^t} + (0.5) \times \frac{1,000 \times (400 - 460)}{1.10} = \$7,438 $$

Thus, if you open the mine when the price is $500, you should not close if the price is $450 at $t = 1$, but you should close if the price is $400 at $t = 2$. There is a 0.25 probability that the price will be $400 at $t = 1$, and then you will save an expected loss of $60,000 at $t = 3$. Thus, the value of the option to close is:

$$ (0.25) \times \frac{1,000 \times 60}{1.10^3} = \$11,270 $$

Now calculate the PV, at $t = 1$, for the branch with price equal to $550:

$$ PV = \sum_{t=0}^{2} \frac{90,000}{1.10^t} = \$246,198 $$

The expected PV at $t = 1$, with the option to close, is:

$$ (0.5) \times [7,438 + (450 - 460) \times (1,000)] + (0.5 \times 246,198) = \$121,818 $$

The NPV at $t = 0$, with the option to close, is:

$$ NPV = 121,818/1.10 - 100,000 = \$10,744 $$

Therefore, opening the mine at $t = 0$ now has a positive NPV.

We can verify this result by noting that the NPV from part (a) (without the option to abandon) is -$526, and the value of the option to abandon is $11,270 so that the NPV with the option to abandon is:

$$ NPV = -526 + 11,270 = 10,744 $$

2. Now assume that we wait until $t = 1$ and then open the mine if the price is $550 at that time. For this strategy, the mine will be abandoned if price reaches $450 at $t = 3$ because the expected profit at $t = 4$ is: $[(450 - 460) \times 1,000] = -$10,000

Thus, with this strategy, the value of the option to close is:

$$ (0.125) \times (10,000/1.10^4) = \$854 $$

Therefore, the NPV for this strategy is: $56,280.5$ [the NPV for this strategy from part (a)] plus the value of the option to close:

$$ NPV = 56,280.5 + 854 = 57,134.5 $$

The option to close the mine increases the net present value for each strategy, but the optimal choice remains the same; that is, strategy 2 is still the preferable alternative because its NPV ($57,134.5$) is still greater than the NPV for strategy 1 ($10,744$).
See Figure 10.11. The choice is between buying the computer or renting.

If we buy:

The cost is $2,000 at t = 0. If demand is high at t = 1, we will have, at that time:

\[(900 - 500) = 400\]

If demand is high at t = 1, there is an 80 percent chance that demand will continue high for the remaining time (until t = 10). The present value (at t = 1) of $400 per year for 9 years is $2,304. Because there is an 80 percent chance demand will be high for the remaining time, there is a 20 percent chance it will be low, in which case we will get \((700 - 500) = 200\) per year. This has a present value of $1,152. Similar calculations are made for the case of low initial demand.

If we rent:

The cost is 40 percent of revenue per year, so if demand is high at t = 1, then we will get:

\[
[(900 - 500) - (0.4 \times 900)] = 40
\]

If demand continues high, we get $40 per year for the remaining time. This has a present value of $230. If demand is low at t = 2, we will get:

\[(70 - 500) - (0.4 \times 700)] = -80
\]

In this case, it pays to stop renting after low demand in year 2 because we know this low demand will continue. Similar calculations are made for the case of low initial demand.

From the tree (Figure 10.11):

\[
PV_{Buy} = -2000 + \frac{(0.6 \times 400) + (0.4 \times 200)}{1.10}
\]

\[
+ \frac{(0.6)[(0.8 \times 2,304) + (0.2 \times 1,152)] + (0.4)[(0.4 \times 2,304) + (0.6 \times 1,152)]}{1.10}
\]

\[
PV_{Buy} = 8.44 \text{ or } 8,440
\]

\[
PV_{Rent} = \frac{(0.6 \times 40) + [0.4 \times (-80)]}{1.10}
\]

\[
+ \frac{(0.6)[(0.8 \times 230) + (0.2 \times (-80))] + (0.4)[(0.4 \times 230) + (0.6 \times (-80))]}{1.10}
\]

\[
PV_{Rent} = 100.36 \text{ or } 100,360
\]

The computer should be rented, not purchased.

3. In the extreme case, if future cash flows are known with certainty, options have no value because optimal choices can be determined with certainty. Therefore, the option to choose other alternative courses of action has no value to the decision-maker. On the other hand, the option to abandon a project has value if there is a chance that demand for a product will not meet expectations, so that cash flows are below expectations. Or, the option to expand a project has value if there is a chance that demand will exceed expectations.
Answers to Practice Questions

3. The company cost of capital is:

\[ r_A = (0.8 \times 0.12) + (0.2 \times 0.06) = 0.108 = 10.8\% \]

Under Proposition I, this is unaffected by capital structure changes. With the bonds remaining at the 6 percent default-risk free rate, we have:

<table>
<thead>
<tr>
<th>Debt-Equity Ratio</th>
<th>( r_E )</th>
<th>( r_A )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.108</td>
<td>0.108</td>
</tr>
<tr>
<td>0.10</td>
<td>0.113</td>
<td>0.108</td>
</tr>
<tr>
<td>0.50</td>
<td>0.132</td>
<td>0.108</td>
</tr>
<tr>
<td>1.00</td>
<td>0.156</td>
<td>0.108</td>
</tr>
<tr>
<td>2.00</td>
<td>0.204</td>
<td>0.108</td>
</tr>
<tr>
<td>3.00</td>
<td>0.252</td>
<td>0.108</td>
</tr>
</tbody>
</table>

See figure on next page.

4. This is not a valid objection. MM's Proposition II explicitly allows for the rates of return for both debt and equity to increase as the proportion of debt in the capital structure increases. The rate for debt increases because the debt-holders are taking on more of the risk of the firm; the rate for common stock increases because of increasing financial leverage. See Figure 17.2 and the accompanying discussion.
5. a. Under Proposition I, the firm’s cost of capital \( (r_A) \) is not affected by the choice of capital structure. The reason the quoted statement seems to be true is that it does not account for the changing proportions of the firm financed by debt and equity. As the debt-equity ratio increases, it is true that both the cost of equity and the cost of debt increase, but a smaller proportion of the firm is financed by equity. The overall effect is to leave the firm’s cost of capital unchanged.

b. Moderate borrowing does not significantly affect the probability of financial distress, but it does increase the variability (and market risk) borne by stockholders. This additional risk must be offset by a higher average return to stockholders.

6. a. If the opportunity were the firm’s only asset, this would be a good deal. Stockholders would put up no money and, therefore, would have nothing to lose. However, rational lenders will not advance 100 percent of the asset’s value for an 8 percent promised return unless other assets are put up as collateral.

Sometimes firms find it convenient to borrow all the cash required for a particular investment. Such investments do not support all of the additional debt; lenders are protected by the firm’s other assets too.

In any case, if firm value is independent of leverage, then any asset’s contribution to firm value must be independent of how it is financed. Note also that the statement ignores the effect on the stockholders of an increase in financial leverage.

b. This is not an important reason for conservative debt levels. So long as MM’s Proposition I holds, the company’s overall cost of capital is unchanged despite increasing interest rates paid as the firm borrows more. (However, the increasing interest rates may signal an increasing probability of financial distress—and that can be important.

8. Why does share price drop during a recession? Because forecasted cash flows to stockholders decline. (Stockholders may also perceive higher risks and demand a higher expected rate of return.) The stock price will decline to the point where the expected return to the stock, given the amount of debt, is a ‘fair’ return.

Suppose that a recession hits and stock price declines. Would the cost of capital for new investment be less if the firm had used more debt in the past? No, the firm’s past financing decisions are bygones. Moreover, MM’s Proposition I holds in recessions as well as booms. The firm’s overall cost of capital is independent of its debt ratio.

Incidentally, the more debt a firm has, the greater the percentage decline in the value of its shares as a result of a recession or any other unfortunate event.
11. We begin with $r_E$ and the capital asset pricing model:
\[
    r_E = r_f + \beta_E (r_m - r_f)
\]

\[
    r_E = 0.10 + 1.5 (0.18 - 0.10) = 0.22 = 22.0\%
\]

Similarly for debt:
\[
    r_D = r_f + \beta_D (r_m - r_f)
\]

\[
    0.12 = 0.10 + \beta_D (0.18 - 0.10)
\]

\[
    \beta_D = 0.25
\]

Also, we know that:
\[
    r_A = \left( \frac{D}{D+E} \times r_D \right) + \left( \frac{E}{D+E} \times r_E \right) = (0.5 \times 0.12) + (0.5 \times 0.22) = 0.17 = 17.0\%
\]

To solve for $\beta_A$, use the following:
\[
    \beta_A = \left( \frac{D}{D+E} \times \beta_D \right) + \left( \frac{E}{D+E} \times \beta_E \right) = (0.5 \times 0.25) + (0.5 \times 1.5) = 0.875
\]

12. We know from Proposition I that the value of the firm will not change. Also, because the expected operating income is unaffected by changes in leverage, the firm’s overall cost of capital will not change. In other words, $r_A$ remains equal to 17% and $\beta_A$ remains equal to 0.875. However, risk and, hence, the expected return for equity and for debt, will change. We know that $r_D$ is 11%, so that, for debt:
\[
    r_D = r_f + \beta_D (r_m - r_f)
\]

\[
    0.11 = 0.10 + \beta_D (0.18 - 0.10)
\]

\[
    \beta_D = 0.125
\]

For equity:
\[
    r_A = \left( \frac{D}{D+E} \times r_D \right) + \left( \frac{E}{D+E} \times r_E \right)
\]

\[
    0.17 = (0.3 \times 0.11) + (0.7 \times r_E)
\]

\[
    r_E = 0.196 = 19.6\%
\]

Also:
\[
    r_E = r_f + \beta_E (r_m - r_f)
\]

\[
    0.196 = 0.10 + \beta_E (0.18 - 0.10)
\]

\[
    \beta_E = 1.20
\]
13. Before the refinancing, Schuldenfrei is all equity financed. The equity beta is 0.8 and the expected return on equity is 8%. Thus, the firm's asset beta is 0.8 and the firm's cost of capital is 8%. We know that these overall firm values will not change after the refinancing and that the debt is risk-free.

a. 
\[
\beta_A = \left( \frac{D}{D+E} \times \beta_D \right) + \left( \frac{E}{D+E} \times \beta_E \right)
\]

\[
0.8 = (0.5 \times 0) + (0.5 \times \beta_E)
\]

\[
\beta_E = 1.60
\]

b. Before the refinancing, the stock's required return is 8% and the risk-free rate is 5%; thus, the risk premium for the stock is 3%.

c. After the refinancing:

\[
r_A = \left( \frac{D}{D+E} \times r_D \right) + \left( \frac{E}{D+E} \times r_E \right)
\]

\[
0.08 = (0.5 \times 0.05) + (0.5 \times r_E)
\]

\[
r_E = 0.11 = 11.0\%
\]

After the refinancing, the risk premium for the stock is 6%.

d. The required return for the debt is 5%, the risk-free rate.

e. The required return for the company remains at 8%.

f. Let E be the operating profit of the company and N the number of shares outstanding before the refinancing. Also, we know that E is (0.08V).

Thus, the earnings per share before the refinancing is:

\[
EPS_b = 0.08V/N
\]

After the refinancing the operating profit is still E and the number of shares is (0.5 \times N). Interest on the debt is 5% of the value of the debt, which is (0.5 \times V). Thus, the earnings per share after the refinancing is:

\[
EPS_A = \frac{(0.08V - (0.05 \times 0.5 \times V))}{(0.5 \times N)} = 0.11V/N
\]

It follows that earnings per share has increased by 37.5%.

g. Before the refinancing, the P/E ratio is 12.5. The price of the common stock is the same before and after the refinancing, but the earnings per share has increased from (0.08V/N) to (0.11V/N). (See Part (f) above.) Thus, the new P/E ratio is 9.09.
CHAPTER 18
How Much Should a Firm Borrow?

Answers to Practice Questions

1. For $1 of debt income:
   - Corporate tax = 0
   - Personal tax = 0.44 x $1 = $0.440
   - Total = $0.440

For $1 of equity income, with all capital gains realized immediately:
   - Corporate tax = 0.35 x $1 = $0.350
   - Personal tax = 0.44 x 0.5 x ($1 - (0.35 x $1)) + 0.20 x 0.5 x ($1 - (0.35 x $1)) = $0.208
   - Total = $0.558

For $1 of equity income, with all capital gains deferred forever:
   - Corporate tax = 0.35 x $1 = $0.350
   - Personal tax = 0.44 x 0.5 x ($1 - (0.35 x $1)) = $0.143
   - Total = $0.493

2. Consider a firm that is levered, has perpetual expected cash flow X, and has an interest rate for debt of r_D. The personal and corporate tax rates are T_p and T_c, respectively. The cash flow to stockholders each year is:

\[(X - r_D D)(1 - T_c)(1 - T_p)\]

Therefore, the value of the stockholders' position is:

\[V_L = \frac{(X)(1 - T_c)(1 - T_p)}{(r)(1 - T_p)} - \frac{(r_D)(D)(1 - T_c)(1 - T_p)}{(r_D)(1 - T_p)}\]

\[V_L = \frac{(X)(1 - T_c)(1 - T_p)}{(r)(1 - T_p)} - [(D)(1 - T_c)]\]

where r is the opportunity cost of capital for an all-equity-financed firm. If the stockholders borrow D at the same rate r_D, and invest in the unlevered firm, their cash flow each year is:

\[[(X)(1 - T_c)(1 - T_p)] - [(r_D)(D)(1 - T_p)]\]
The value of the stockholders' position is then:

\[ V_u = \frac{(X)(1 - T_c)(1 - T_p)}{(r)(1 - T_p)} - \frac{(r_D)(D)}{(r_D)(1 - T_p)} \]

\[ V_u = \frac{(X)(1 - T_c)(1 - T_p)}{(r)(1 - T_p)} - D \]

The difference in stockholder wealth, for investment in the same assets, is:

\[ V_L - V_U = DT_c \]

This is the change in stockholder wealth predicted by MM. If individuals could not deduct interest for personal tax purposes, then:

\[ V_u = \frac{(X)(1 - T_c)(1 - T_p)}{(r)(1 - T_p)} - \frac{(r_D)(D)}{(r_D)(1 - T_p)} \]

Then:

\[ V_L - V_U = \frac{(r_D)(D) - [(r_D)(D)(1 - T_c)(1 - T_p)]}{(r_D)(1 - T_p)} \]

\[ V_L - V_U = (D T_c) + \left( D \frac{T_p}{(1 - T_p)} \right) \]

So the value of the shareholders' position in the levered firm is relatively greater when no personal interest deduction is allowed.

3. The book value of Pfizer's assets is $21,529 million. With a 40 percent book debt ratio:

Long-term debt + Other long-term liabilities = 0.40 \times $21,529 = $8,612

This is [$8,612 - ($2,123 + $4,330)] = $2,159 more than shown in Table 18.3(a).
The corporate tax rate is 35 percent, so firm value increases by:

0.35 \times $2,159 = $756 million

The market value of the firm is now: ($296,247 + $756) = $297,003 million.

The market value balance sheet is:

<table>
<thead>
<tr>
<th>Net working capital</th>
<th>$5,206</th>
<th>$4,282</th>
<th>Long-term debt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market value of long-term assets</td>
<td>291,797</td>
<td>4,330</td>
<td>Other long-term liabilities</td>
</tr>
<tr>
<td>Total Assets</td>
<td>$297,003</td>
<td>$297,003</td>
<td>Firm market value</td>
</tr>
</tbody>
</table>

4. Answers here will vary depending on the company chosen.
8. Static trade-off theory reduces the debt-equity decision to a trade-off between interest tax shields and the costs of financial distress. In the real world, matters are not so simple because there are costs to adjusting the firm's capital structure, and individual managers have different attitudes toward debt. High-tech growth firms with risky assets tend to be equity financed while low risk mature businesses tend to have more debt. Similarly, firms often issue equity to pay off excess debt. However, many profitable firms have very little debt and changes in tax rates have little effect on debt-equity ratios.

9. Answers here will vary according to the companies chosen; however, the important considerations are given in the text, Section 18.3.

10. a. SOS stockholders could lose if they invest in the positive NPV project and then SOS becomes bankrupt. Under these conditions, the benefits of the project accrue to the bondholders.

b. If the new project is sufficiently risky, then, even though it has a negative NPV, it might increase stockholder wealth by more than the money invested. This is a result of the fact that, for a very risky investment, undertaken by a firm with a significant risk of default, stockholders benefit if a more favorable outcome is actually realized, while the cost of unfavorable outcomes is borne by bondholders.

c. Again, think of the extreme case: Suppose SOS pays out all of its assets as one lump-sum dividend. Stockholders get all of the assets, and the bondholders are left with nothing.

These conflicts of interest are severe only when the company is in financial distress. Adherence to a moderate target debt ratio limits the conflicts.
11. a. The bondholders benefit. The fine print limits actions that transfer wealth from the bondholders to the stockholders.

b. The stockholders benefit. In the absence of fine print, bondholders charge a higher rate of interest to ensure that they receive a fair deal. The firm would probably issue the bond with standard restrictions. It is likely that the restrictions would be less costly than the higher interest rate.

12. Certainly part of this drop must be attributed to bankruptcy costs, which come out of the shareholders' pockets. It is likely, however, that the actual bankruptcy filing conveyed some negative information to the market about Caldor's future prospects and that part of the drop must, therefore, be attributed to this negative information.

13. Other things equal, the announcement of a new stock issue to fund an investment project with an NPV of $40 million should increase equity value by $40 million (less issue costs). But, based on past evidence, management expects equity value to fall by $30 million. There may be several reasons for the discrepancy:

(i) Investors may have already discounted the proposed investment. (However, this alone would not explain a fall in equity value.)

(ii) Investors may not be aware of the project at all, but they may believe instead that cash is required because of, say, low levels of operating cash flow.

(iii) Investors may believe that the firm's decision to issue equity rather than debt signals management's belief that the stock is overvalued.

If the stock is indeed overvalued, the stock issue merely brings forward a stock price decline that will occur eventually anyway. Therefore, the fall in value is not an issue cost in the same sense as the underwriter's spread. If the stock is not overvalued, management needs to consider whether it could release some information to convince investors that its stock is correctly valued, or whether it could finance the project by an issue of debt.
14. a. Masulis' results are consistent with the view that debt is always preferable because of its tax advantage, but are not consistent with the 'tradeoff' theory, which holds that management strikes a balance between the tax advantage of debt and the costs of possible financial distress. In the tradeoff theory, exchange offers would be undertaken to move the firm's debt level toward the optimum. That ought to be good news, if anything, regardless of whether leverage is increased or decreased.

b. The results are consistent with the evidence regarding the announcement effects on security issues and repurchases.

c. One explanation is that the exchange offers signal management's assessment of the firm's prospects. Management would only be willing to take on more debt if they were quite confident about future cash flow, for example, and would want to decrease debt if they were concerned about the firm's ability to meet debt payments in the future.

15. Let us assume that, as companies are started, grow, and mature, they stick to the same line of business and are consistently profitable. Then, if the tradeoff theory is correct, because the types of assets the company has do not change over time, the firm's debt ratio will likewise not be expected to change over time. If the pecking-order theory is correct, the company's debt ratio will tend to decrease over time because the company will fund projects from retained earnings, i.e., internally generated cash.

16. In general, the pecking order theory explains intra-industry debt levels since less profitable firms end up borrowing more because they have lower internal cash flow. However, the argument seems to fail on an inter-industry basis. High-tech, high growth firms have low debt levels even though they need cash, and stable, mature industries (e.g., utilities) often do not pay down debt but pay the cash out as dividends.
CHAPTER 34
Control, Governance, and Financial Architecture

Answers to Practice Questions

1. a. In the U.S., the largest shareholders of corporations are financial institutions. However, since ownership is usually widely dispersed, effective control often rests with management. In many countries outside the U.S., families and governments often have large equity stakes.

b. False. Top managers in Germany are more likely to balance the interests of all stakeholders (rather than just those of shareholders), but poor performance can still result in management turnover.

c. True. Carve-out or spin-off of a division improves incentives for the division’s managers. If the businesses are independent, it is easier to measure the performance of the division’s managers.

d. False. The limited life of a private-equity partnership reassures the limited partners that the cash flow will not be reinvested in a wasteful manner. It also tends to ensure that partnerships focus on opportunities to reorganize poorly performing businesses and to provide them with new management before selling them off.

e. True. The remuneration package for the general partners typically includes a 20% carried interest. This is equivalent to a call option on the partnership’s value and, as is the case for all options, this option is more valuable when the value of the assets is highly variable.

2. In general, firms with narrow margins in highly competitive environments are not good candidates for LBO’s or MBO’s. These firms are often highly efficient and do not have excess assets or unnecessary capital expenditures. Further, the thinness of the margins limits the amount of debt capacity.

3. The common theme is that investors do not want companies to waste resources. Investors would much prefer that companies pay out their free cash flow, instead of wasting it on poor capital investments or using it to subsidize an inefficient operation. Financial leverage was a necessary part of both deals because it increased the companies’ cash obligations and, thus, reduced managers’ flexibility.
4. RJR issued a lot of debt and repurchased shares to reduce the equity base. Sealed Air issued a lot of debt and paid a special dividend to all shareholders to reduce the equity base. RJR was seen as a company that needed to streamline operations and reexamine its capital expenditures and asset holdings. The firm was in a highly competitive environment, but had the advantage of brand name recognition for its products. Sealed Air needed to streamline its operations because it had grown inefficient due to the patent protection it had for its products. Sealed Air remained public in order to increase the pressure to perform by remaining exposed to buying and selling pressure in the market.

5. Answers will vary depending upon the examples chosen.

6. The story told in *Barbarians at the Gate* is a very complicated one. Those who favor mergers can find much evidence in this story to support their position, as can those who oppose mergers. In a similar fashion, those who espouse one particular theory or another as to why companies merge can find evidence here to support their position (and evidence to refute the positions of others). Thus, the answer will vary, depending on one’s views.

7. Private equity partnerships are usually run by professional equity managers representing larger institutional investors. The institutional investors act as the limited partners while the professional managers act as general partners in the limited partnership. The general partners are companies that focus on funding and managing equity investments in closely-held firms. The incentive for general partners is a management fee plus a share in the company profits that they can increase if they successfully “fix” the firm. The limited partners get paid first but are not entitled to all the profits. Further, the limited life of the partnership precludes wasteful reinvestment. These partnerships are designed to make investments in various types of firms from venture capital start-ups to mature firms that need to re-invigorate management.

8. There are, in general, four reasons for conglomerates to exist outside of the United States. First, you can be limited by the size of the local economy. To be a larger firm is to be a diversified firm. Second, increased size often means increased political power when dealing with centrally managed economies or operating in countries with unstable economic policies. Third, companies may need to be of a certain size to attract professional management. Finally, size is important if the external capital market is poorly developed and internal capital is an important source of funds.