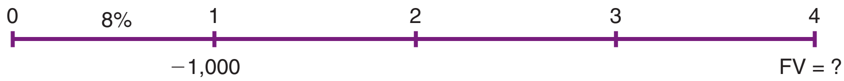
appendix a

Solutions to Self-Test Problems

Chapter 2

(ST-1) a.

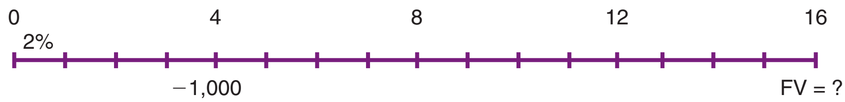


$1,000 is being compounded for 3 years, so your balance at Year 4 is $1,259.71:

$$FV_N = PV(1 + I)^N = \$1{,}000(1 + 0.08)^3 = \$1{,}259.71.$$

Alternatively, using a financial calculator, input N = 3, I/YR = 8, PV = −1000, PMT = 0, and FV = ? Solve for FV = $1,259.71.

b.

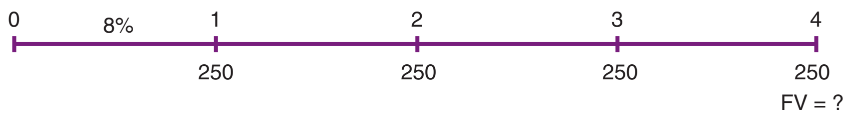


There are 12 compounding periods from Quarter 4 to Quarter 16.

$$FV_N = PV\left(1 + \frac{I_{NOM}}{M}\right)^{NM} = FV_{12} = \$1{,}000(1.02)^{12} = \$1{,}268.24.$$

Alternatively, using a financial calculator, input N = 12, I/YR = 2, PV = −1000, PMT = 0, and FV = ? Solve for FV = $1,268.24.

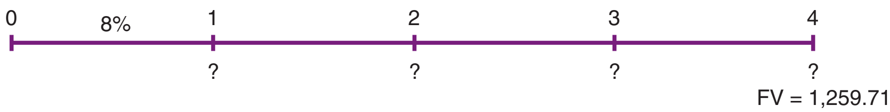
c.



$$FVA_4 = \$250\left[\frac{(1 + 0.08)^4}{0.08} - \frac{1}{0.08}\right] = \$1{,}126.53.$$

Using a financial calculator, input N = 4, I/YR = 8, PV = 0, PMT = −250, and FV = ? Solve for FV = $1,126.53.

d.



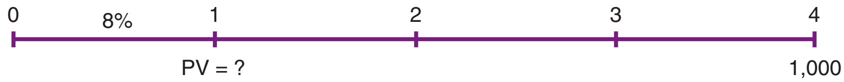
$$PMT\left[\frac{(1 + 0.08)^4}{0.08} - \frac{1}{0.08}\right] = \$1{,}259.71$$

$$PMT(4.5061) = \$1{,}259.71$$

$$PMT = \$279.56.$$

Using a financial calculator, input N = 4, I/YR = 8, PV = 0, FV = 1259.71, and PMT = ? Solve for PMT = −\$279.56.

(ST-2) a. Set up a time line like the one in the preceding problem:



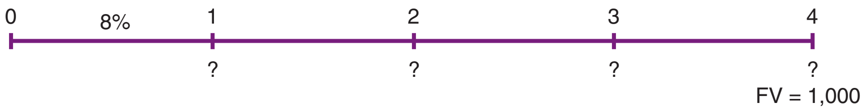
Note that your deposit will grow for 3 years at 8%. The deposit at Year 1 is the PV, and the FV is \$1,000. Here is the solution:

N = 3; I/YR = 8; PMT = 0; FV = 1000; PV = ?; PV = \$793.83.

Alternatively,

$$PV = \frac{FV_N}{(1 + I)^N} = \frac{\$1{,}000}{(1 + 0.08)^3} = \$793.83.$$

b.



Here we are dealing with a 4-year annuity whose first payment occurs 1 year from today and whose future value must equal \$1,000. Here is the solution:

N = 4; I/YR = 8; PV = 0; FV = 1000; PMT = ?; PMT = \$221.92.

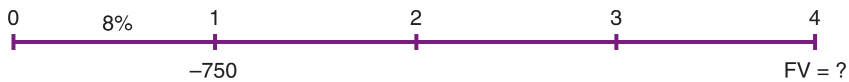
Alternatively,

$$PMT\left[\frac{(1 + 0.08)^4}{0.08} - \frac{1}{0.08}\right] = \$1{,}000$$

$$PMT(4.5061) = \$1{,}000$$

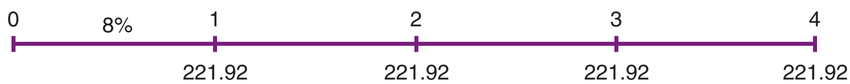
$$PMT = \$221.92.$$

c. This problem can be approached in several ways. Perhaps the simplest is to ask this question: "If I received \$750 1 year from now and deposited it to earn 8%, would I have the required \$1,000 4 years from now?" The answer is no:



$$FV_3 = \$750(1.08)(1.08)(1.08) = \$944.78.$$

This indicates that you should let your father make the payments rather than accept the lump sum of \$750.
You could also compare the \$750 with the PV of the payments:



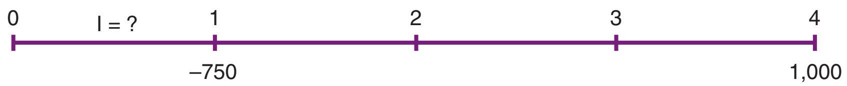
N = 4; I/YR = 8; PMT = −221.92; FV = 0; PV = ?; PV = \$735.03.

Alternatively,

$$PVA_4 = \$221.92\left[\frac{1}{0.08} - \frac{1}{(0.08)(1 + 08)^4}\right] = \$735.03.$$

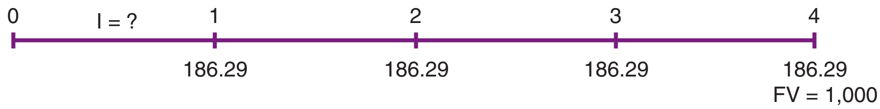
This is less than the $750 lump sum offer, so your initial reaction might be to accept the lump sum of $750. However, this would be a mistake. The problem is that when you found the $735.02 PV of the annuity, you were finding the value of the annuity *today*. You were comparing $735.02 today with the lump sum of $750 1 year from now. This is, of course, invalid. What you should have done was take the $735.02, recognize that this is the PV of an annuity as of today, multiply $735.02 by 1.08 to get $793.83, and compare $793.83 with the lump sum of $750. You would then take your father's offer to make the payments rather than take the lump sum 1 year from now.

d.



$N = 3$; $PV = -750$; $PMT = 0$; $FV = 1000$; solve for $I/YR = 10.0642\%$.

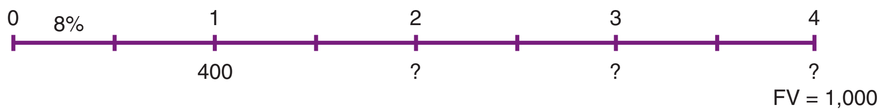
e.



$N = 4$; $PV = 0$; $PMT = -186.29$; $FV = 1000$; solve for $I/YR = 19.9997\%$.

You might be able to find a borrower willing to offer you a 20% interest rate, but there would be some risk involved—he or she might not actually pay you your $1,000!

f.



Find the future value of the original $400 deposit:

$$FV_6 = PV(1 + I)^6 = 400(1 + 0.04)^6 = \$400(1.2653) = \$506.12.$$

This means that at Year 4, you need an additional sum of $493.88:

$$\$1{,}000.00 - \$506.12 = \$493.88.$$

This will be accumulated by making 6 equal payments which earn 8% compounded semiannually, or 4% each 6 months:

$$N = 6;\ I/YR = 4;\ PV = 0;\ FV = 493.88;\ PMT = ?;\ PMT = \$74.46.$$

Alternatively,

$$PMT\left[\frac{(1 + 0.04)^6}{0.04} - \frac{1}{0.04}\right] = \$493.88$$

$$PMT(6.6330) = \$493.88$$

$$PMT = \$74.46.$$

g.

$$EFF\% = \left(1 + \frac{I_{NOM}}{M}\right)^M - 1.0$$

$$= \left(1 + \frac{0.08}{2}\right)^2 - 1.0$$

$$= 1.0816 - 1 = 0.0816 = 8.16\%.$$

(ST-3) Bank A's effective annual rate is 8.24%:

$$\text{EFF\%} = \left(1 + \frac{0.08}{4}\right)^4 - 1.0$$
$$= 1.0824 - 1 = 0.0824 = 8.24\%.$$

Now Bank B must have the same effective annual rate:

$$\left(1 + \frac{I}{12}\right)^{12} - 1.0 = 0.0824$$
$$\left(1 + \frac{I}{12}\right)^{12} = 1.0824$$
$$\left(1 + \frac{I}{12}\right) = (1.0824)^{1/12}$$
$$\left(1 + \frac{I}{12}\right) = 1.00662$$
$$\frac{I}{12} = 0.00662$$
$$I = 0.07944 = 7.94\%.$$

Thus, the two banks have different quoted rates—Bank A's quoted rate is 8%, while Bank B's quoted rate is 7.94%; however, both banks have the same effective annual rate of 8.24%. The difference in their quoted rates is due to the difference in compounding frequency.

Chapter 3

(ST-1) a.

EBIT	$5,000,000
Interest	1,000,000
EBT	$4,000,000
Taxes (40%)	1,600,000
Net income	$2,400,000

b.
$$\begin{aligned} \text{NCF} &= \text{NI} + \text{DEP and AMORT} \\ &= \$2{,}400{,}000 + \$1{,}000{,}000 = \$3{,}400{,}000. \end{aligned}$$

c.
$$\begin{aligned} \text{NOPAT} &= \text{EBIT}(1 - \text{T}) \\ &= \$5{,}000{,}000(0.6) \\ &= \$3{,}000{,}000. \end{aligned}$$

d.
$$\begin{aligned} \text{NOWC} &= \text{Operating current assets} \\ &\quad - \text{Operating current liabilities} \\ &= \$14{,}000{,}000 - \$4{,}000{,}000 \\ &= \$10{,}000{,}000. \end{aligned}$$

$$\begin{aligned} \text{Total net operating capital} &= \text{NOWC} + \text{operating long-term assets} \\ &= \$10{,}000{,}000 + \$15{,}000{,}000 \\ &= \$25{,}000{,}000. \end{aligned}$$

e.
$$\begin{aligned} \text{FCF} &= \text{NOPAT} - \text{Net investment in operating capital} \\ &= \$3{,}000{,}000 - (\$25{,}000{,}000 - \$24{,}000{,}000) \\ &= \$2{,}000{,}000. \end{aligned}$$

f.
$$\begin{aligned} \text{EVA} &= \text{EBIT}(1 - \text{T}) - (\text{Total capital})(\text{After-tax cost of capital}) \\ &= \$5{,}000{,}000(0.6) - (\$25{,}000{,}000)(0.10) \\ &= \$3{,}000{,}000 - \$2{,}500{,}000 = \$500{,}000. \end{aligned}$$

Chapter 4

(ST-1) Argent paid \$2 in dividends and retained \$2 per share. Since total retained earnings rose by \$12 million, there must be 6 million shares outstanding. With a book value of \$40 per share, total common equity must be \$40(6 million) = \$240 million. Since Argent has \$120 million of debt, its debt ratio must be 33.3%:

$$\frac{\text{Debt}}{\text{Assets}} = \frac{\text{Debt}}{\text{Debt} + \text{Equity}} = \frac{\$120 \text{ million}}{\$120 \text{ million} + \$240 \text{ million}}$$
$$= 0.333 = 33.3\%.$$

a. In answering questions such as this, always begin by writing down the relevant definitional equations, then start filling in numbers. Note that the extra zeros indicating millions have been deleted in the calculations below.

(1)
$$\text{DSO} = \frac{\text{Accounts receivable}}{\text{Sales}/365}$$
$$40.55 = \frac{\text{A/R}}{\text{Sales}/365}$$
$$\text{A/R} = 40.55(\$2.7397) = \$111.1 \text{ million.}$$

(2)
$$\text{Quick ratio} = \frac{\text{Current assets} - \text{Inventories}}{\text{Current liabilities}} = 2.0$$
$$= \frac{\text{Cash and marketable securities} + \text{A/R}}{\text{Current liabilities}} = 2.0$$
$$2.0 = \frac{\$100.0 + \$111.1}{\text{Current liabilities}}$$
$$\text{Current liabilities} = (\$100.0 + \$111.1)/2 = \$105.5 \text{ million.}$$

(3)
$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} = 3.0$$
$$= \frac{\text{Current assets}}{\$105.5} = 3.0$$
$$\text{Current assets} = 3.0(\$105.5) = \$316.50 \text{ million.}$$

(4)
$$\begin{aligned} \text{Total assets} &= \text{Current assets} + \text{Fixed assets} \\ &= \$316.5 + \$283.5 = \$600 \text{ million.} \end{aligned}$$

(5)
$$\begin{aligned}\text{ROA} &= \text{Profit margin} \times \text{Total assets turnover}\\ &= \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}}\\ &= \frac{\$50}{\$1{,}000} \times \frac{\$1{,}000}{\$600}\\ &= 0.05 \times 1.667 = 0.083333 = 8.3333\%.\end{aligned}$$

(6)
$$\begin{aligned}\text{ROE} &= \text{ROA} \times \frac{\text{Assets}}{\text{Equity}}\\ 12.0\% &= 8.3333\% \times \frac{\$600}{\text{Equity}}\\ \text{Equity} &= \frac{(8.3333\%)(\$600)}{12.0\%}\\ &= \$416.67 \text{ million.}\end{aligned}$$

(7)
$$\begin{aligned}\text{Total assets} = \text{Total claims} &= \$600 \text{ million.}\\ \text{Current liabilities} + \text{Long-term debt} + \text{Equity} &= \$600 \text{ million}\\ \$105.5 + \text{Long-term debt} + \$416.67 &= \$600 \text{ million}\\ \text{Long-term debt} = \$600 - \$105.5 - \$416.67 &= \$77.83 \text{ million.}\end{aligned}$$

Note: We could have found equity as follows:

$$\begin{aligned}\text{ROE} &= \frac{\text{Net income}}{\text{Equity}}\\ 12.0\% &= \frac{\$50}{\text{Equity}}\\ \text{Equity} &= \$50/0.12\\ &= \$416.67 \text{ million.}\end{aligned}$$

Then we could have gone on to find long-term debt.

b. Jacobus's average sales per day were $1,000/365 = $2.7397 million. Its DSO was 40.55, so A/R = 40.55($2.7397) = $111.1 million. Its new DSO of 30.4 would cause A/R = 30.4($2.7397) = $83.3 million. The reduction in receivables would be $111.1 − $83.3 = $27.8 million, which would equal the amount of cash generated.

(1)
$$\begin{aligned}\text{New equity} &= \text{Old equity} - \text{Stock bought back}\\ &= \$416.7 - \$27.8\\ &= \$388.9 \text{ million.}\end{aligned}$$

Thus,

$$\text{New ROE} = \frac{\text{Net income}}{\text{New equity}}$$

$$= \frac{\$50}{\$388.9}$$

$$= 12.86\% \text{ (versus old ROE of } 12.0\%\text{).}$$

(2) $$\text{New ROA} = \frac{\text{Net income}}{\text{Total assets} - \text{Reduction in A/R}}$$

$$= \frac{\$50}{\$600 - \$27.8}$$

$$= 8.74\% \text{(versus old ROA of } 8.33\%\text{).}$$

(3) The old debt is the same as the new debt:

$$\text{Debt} = \text{Total claims} - \text{Equity}$$
$$= \$600 - \$416.7 = \$183.3 \text{ million.}$$
$$\text{New total assets} = \text{Old total assets} - \text{Reduction in A/R}$$
$$= \$600 - \$27.8$$
$$= \$572.2 \text{ million.}$$

Therefore,

$$\frac{\text{Debt}}{\text{Old total assets}} = \frac{\$183.3}{\$600} = 30.6\%$$

while

$$\frac{\text{New debt}}{\text{New total assets}} = \frac{\$183.3}{\$572.2} = 32.0\%.$$

Chapter 5

(ST-1) a. Pennington's bonds were sold at par; therefore, the original YTM equaled the coupon rate of 12%.

b. $$V_B = \sum_{t=1}^{50} \frac{\$120/2}{\left(1 + \frac{0.10}{2}\right)^t} + \frac{\$1,000}{\left(1 + \frac{1.10}{2}\right)^{50}}$$

$$= \$60\left[\frac{1}{0.05} - \frac{1}{0.05(1 + 0.05)^{50}}\right] + \frac{\$1,000}{(1 + 0.05)^{50}}$$

$$= \$1,182.56.$$

Alternatively, with a financial calculator, input the following: N = 50, I/YR = 5, PMT = 60, FV = 1000, and PV = ? Solve for PV = −$1,182.56.

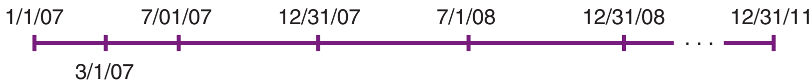
c. $$\text{Current yield} = \text{Annual coupon payment/Price}$$
$$= \$120/\$1,182.56$$
$$= 0.1015 = 10.15\%.$$
$$\text{Capital gains yield} = \text{Total yield} - \text{Current yield}$$
$$= 10\% - 10.15\% = -0.15\%.$$

d. $$\$916.42 = \sum_{t=1}^{13} \frac{\$60}{(1 + r_d/2)^t} + \frac{\$1000}{(1 + r_d/2)^{13}}.$$

With a financial calculator, input the following: N = 13, PV = −916.42, PMT = 60, FV = 1000, and $r_d/2$ = I/YR = ? Calculator solution = $r_d/2 = 7.00\%$; therefore, $r_d = 14.00\%$.

e.
$$\text{Current yield} = \$120/\$916.42 = 13.09\%;$$
$$\text{Capital gains yield} = 14\% - 13.09\% = 0.91\%.$$

f. The following time line illustrates the years to maturity of the bond:



Thus, on March 1, 2007, there were 13⅔ periods left before the bond matured. Bond traders actually use the following procedure to determine the price of the bond:

(1) Find the price of the bond on the next coupon date, July 1, 2007.

$$V_B = \$60\left[\frac{1}{0.0775} - \frac{1}{0.0775(1 + 0.0775)^{13}}\right] + \frac{\$1{,}000}{(1 + 0.0775)^{13}}$$
$$= \$859.76.$$

Using a financial calculator, input N = 13, I/YR = 7.75, PMT = 60, FV = 1000, and PV = ? Solve for PV = −$859.76.

(2) Add the coupon, $60, to the bond price to get the total value, TV, of the bond on the next interest payment date: TV = $859.76 + $60.00 = $919.76.

(3) Discount this total value back to the purchase date:

$$\text{Value at purchase date (March 1, 2007)} = \frac{\$919.76}{(1 + 0.0775)^{(4/6)}}$$
$$= \$919.76(0.9515)$$
$$= \$875.11.$$

Using a financial calculator, input N = 4/6, I/YR = 7.75, PMT = 0, FV = 919.76, and PV = ? Solve for PV = $875.11.

(4) Therefore, you would have written a check for $875.11 to complete the transaction. Of this amount, $20 = (⅓)($60) would represent accrued interest and $855.11 would represent the bond's basic value. This breakdown would affect both your taxes and those of the seller.

(5) This problem could be solved *very* easily using a spreadsheet or a financial calculator with a bond valuation function.

Chapter 6

(ST-1) a. The average rate of return for each stock is calculated simply by averaging the returns over the 5-year period. The average return for Stock A is

$$r_{\text{Avg A}} = (-18\% + 44\% - 22\% + 22\% + 34\%)/5$$
$$= 12\%.$$

The realized rate of return on a portfolio made up of Stock A and Stock B would be calculated by finding the average return in each year as

$$r_A(\%\text{ of Stock A}) + r_B(\%\text{ of Stock B})$$

and then averaging these annual returns:

Year	Portfolio AB's Return, r_{AB}
2003	(21%)
2004	34
2005	(13)
2006	15
2007	45
	$r_{Avg} = 12\%$

b. The standard deviation of returns is estimated as follows:

$$\text{Estimated } \sigma = S = \sqrt{\frac{\sum_{t=1}^{N}(\bar{r}_t - \bar{r}_{Avg})^2}{n-1}}.$$

For Stock A, the estimated σ is 30%:

$$\sigma_A = \sqrt{\frac{(-18\% - 12\%)^2 + (44\% - 12\%)^2 + (-22\% - 12\%)^2 + (22\% - 12\%)^2 + (34\% - 12\%)^2}{5-1}}$$

$$= 30.265\% \approx 30\%.$$

The standard deviations of returns for Stock B and for the portfolio are similarly determined, and they are as follows:

	Stock A	Stock B	Portfolio AB
Standard deviation	30%	30%	29%

c. Because the risk reduction from diversification is small (σ_{AB} falls only from 30% to 29%), the most likely value of the correlation coefficient is 0.8. If the correlation coefficient were −0.8, the risk reduction would be much larger. In fact, the correlation coefficient between Stocks A and B is 0.8.

d. If more randomly selected stocks were added to a portfolio, σ_P would decline to somewhere in the vicinity of 20%; see Figure 6-7. σ_P would remain constant only if the correlation coefficient were +1.0, which is most unlikely. σ_P would decline to zero only if the correlation coefficient, ρ, were equal to zero and a large number of stocks were added to the portfolio, or if the proper proportions were held in a two-stock portfolio with $\rho = -1.0$.

(ST-2) a.

$$b = (0.6)(0.70) + (0.25)(0.90) + (0.1)(1.30) + (0.05)(1.50)$$
$$= 0.42 + 0.225 + 0.13 + 0.075 = 0.85.$$

b.

$$r_{RF} = 6\%;\ RP_M = 5\%;\ b = 0.85.$$
$$r_p = 6\% + (5\%)(0.85)$$
$$= 10.25\%.$$

c.

$$b_N = (0.5)(0.70) + (0.25)(0.90) + (0.1)(1.30) + (0.15)(1.50)$$
$$= 0.35 + 0.225 + 0.13 + 0.225$$
$$= 0.93.$$
$$r = 6\% + (5\%)(0.93)$$
$$= 10.65\%.$$

Chapter 7

(ST-1) a. For Security A:

P_A	r_A	$P_A r_A$	$(r_A - \hat{r}_A)$	$(r_A - \hat{r}_A)^2$	$P_A(r_A - \hat{r}_A)^2$
0.1	−10%	−1.0%	−25%	625	62.5
0.2	5	1.0	−10	100	20.0
0.4	15	6.0	0	0	0.0
0.2	25	5.0	10	100	20.0
0.1	40	4.0	25	625	62.5

$\hat{r}_A = 15.0\%$ $\sigma_A = \sqrt{165.0} = 12.8\%$

b.
$$w_A = \frac{\sigma_B(\sigma_B - \rho_{AB}\sigma_A)}{\sigma_A^2 + \sigma_B^2 - 2\rho_{AB}\sigma_A\sigma_B}$$
$$= \frac{25.7[25.7 - (-0.5)(12.8)]}{(12.8)^2 + (25.7)^2 - 2(-0.5)(12.8)(25.7)}$$
$$= \frac{824.97}{1{,}153.29} = 0.7153,$$

or 71.53% invested in A, 28.47% in B.

c.
$$\sigma_p = \sqrt{(w_A\sigma_A)^2 + (1 - w_A)^2(\sigma_B)^2 + 2w_A(1 - w_A)\rho_{AB}\sigma_A\sigma_B}$$
$$= \sqrt{(0.75)^2(12.8)^2 + (0.25)^2(25.7)^2 + 2(0.75)(0.25)(-0.5)(12.8)(25.7)}$$
$$= \sqrt{92.16 + 41.28 - 61.68}$$
$$= \sqrt{71.76} = 8.47\%, \text{ when } w_A = 75\%.$$

$$\sigma_p = \sqrt{(0.7153)^2(12.8)^2 + (0.2847)^2(25.7)^2 + 2(0.7153)(0.2847)(-0.5)(12.8)(25.7)}$$
$$= 8.38\%, \text{ when } w_A = 71.53\%. \text{ This is the minimum } \sigma_p.$$

$$\sigma_p = \sqrt{(0.5)^2(12.8)^2 + (0.5)^2(25.7)^2 + 2(0.5)(0.5)(-0.5)(12.8)(25.7)}$$
$$= 11.13\%, \text{ when } w_A = 50\%.$$

$$\sigma_p = \sqrt{(0.25)^2(12.8)^2 + (0.75)^2(25.7)^2 + 2(0.25)(0.75)(-0.5)(12.8)(25.7)}$$
$$= 17.89\%, \text{ when } w_A = 25\%.$$

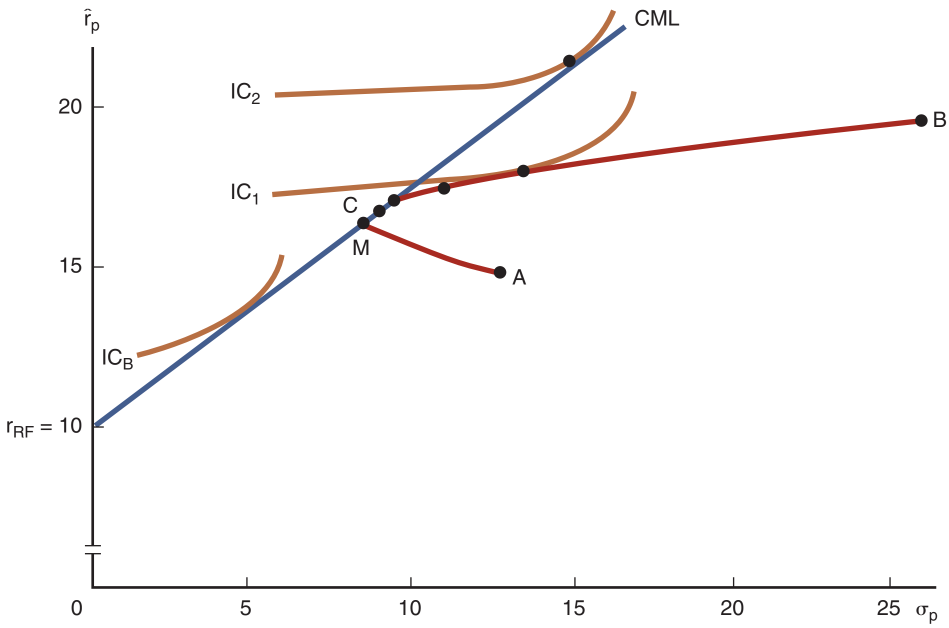
% in A	% in B	$\hat{r}_p$	σ_p
100%	0%	15.00%	12.8%
75	25	16.25	8.5
71.53	28.47	16.42	8.4
50	50	17.50	11.1
25	75	18.75	17.9
0	100	20.00	25.7

Calculations for preceding table:

$$\hat{r}_p = w_A(\hat{r}_A) + (1 - w_A)(\hat{r}_B)$$
$$= 0.75(15) + (0.25)(20) = 16.25\%, \text{ when } w_A = 75\%;$$

$$= 0.7153(15) + 0.2847(20) = 16.42\%, \text{ when } w_A = 71.53\%;$$
$$= 0.5(15) + 0.5(20) = 17.50\%, \text{ when } w_A = 50\%;$$
$$= 0.25(15) + 0.75(20) = 18.75\%, \text{ when } w_A = 25\%.$$

d. See graph below.



e. See indifference curve IC_1 above. At the point where $\hat{r}_p = 18\%$, $\sigma_p = 13.5\%$.

$$\hat{r}_p = w_A(\hat{r}_A) + (1 - w_A)(\hat{r}_B)$$
$$18 = w_A(15) + (1 - w_A)(20)$$
$$= 15w_A + 20 - 20w_A$$
$$5w_A = 2$$
$$w_A = 0.4 \text{ or } 40\%.$$

Therefore, to an approximation, your optimal portfolio would have 40% in A, 60% in B, with $\hat{r}_p = 18\%$ and $\sigma_p = 13.5\%$. (We could get an exact σ_p by using $w_A = 0.4$ in the equation for σ_p.)

f. The existence of the riskless asset would enable you to go to the CAPM. We would draw in the CML as shown on the graph in part d. Now you would hold a portfolio of stocks, borrowing on margin to hold more stocks than your net worth, and move to a higher indifference curve, IC_2.

You can put all of your money into the riskless asset, all in A, all in B, or some in each security. The most logical choices are (1) hold a portfolio of A and B plus some of the riskless asset, (2) hold only a portfolio of A and B, or (3) hold a portfolio of A and B and borrow to leverage the portfolio, assuming you can borrow at the riskless rate.

Reading from the graph, we see that your $\hat{r}_p$ at the point of tangency between your IC_2 and the CML is about 22%. We can use this information to find out how much you invest in the market portfolio and how much you invest in the riskless asset. (It will turn out that you have a *negative* investment in the riskless asset, which means that you borrow rather than lend at the risk-free rate.)

$$\hat{r}_p = w_{RF}(r_{RF}) + (1 - w_{RF})(\hat{r}_M)$$
$$22 = w_{RF}(10) + (1 - w_{RF})(16.8)$$
$$= 10w_{RF} + 16.8 - 16.8w_{RF}$$
$$-6.8w_{RF} = 5.2$$
$$w_{RF} = -0.76 \text{ or } -76\%\text{, which means that you borrow.}$$
$$1 - w_{RF} = 1.0 - (-0.76)$$
$$= +1.76 \text{ or } 176\% \text{ in the market portfolio.}$$

This investor, with \$200,000 of net worth, thus buys stock with a value of \$200,000(1.76) = \$352,000 and borrows \$152,000.

The risk of this leveraged portfolio is

$$\sigma_p = \sqrt{(-0.76)^2(0)^2 + (1.76)^2(8.5)^2 + 2(-0.76)(1.76)(0)(8.5)(0)}$$
$$= \sqrt{(1.76)^2(8.5)^2}$$
$$= (1.76)(8.5) = 15\%.$$

Your indifference curve suggests that you are not very risk averse. A risk-averse investor would have a steep indifference curve (visualize a set of steep curves that were tangent to CML to the left of Point C). This investor would hold some of A and B, combined to form portfolio M, and some of the riskless asset.

g. Given your assumed indifference curve, you would, when the riskless asset becomes available, change your portfolio from the one found in part e (with $\hat{r}_p = 18\%$, $\sigma_p = 13.5\%$) to one with $\hat{r}_p \approx 22.0\%$ and $\sigma_p \approx 15.00\%$.

h.
$$r_A = r_{RF} + (r_M - r_{RF})b_A$$
$$15 = 10 + (16.8 - 10)b_A$$
$$= 10 + (6.8)b_A$$
$$b_A = 0.74.$$
$$20 = 10 + (6.8)b_B$$
$$b_B = 1.47.$$

Note that the 16.8% value for r_M was approximated from the graph. Also, note that this solution *assumes* that you can borrow at $r_{RF} = 10\%$. This is a basic—but questionable—CAPM assumption. If the borrowing rate is *above* r_{RF}, then CML would turn down to the right of Point M.

Chapter 8

(ST-1) The first step is to solve for g, the unknown variable, in the constant growth equation. Since D_1 is unknown but D_0 is known, substitute $D_0(1 + g)$ as follows:

$$\hat{P}_0 = P_0 = \frac{D_1}{r_s - g} = \frac{D_0(1 + g)}{r_s - g}$$

$$\$36 = \frac{\$2.40(1 + g)}{0.12 - g}.$$

Solving for g, we find the growth rate to be 5%:

$$\$4.32 - \$36g = \$2.40 + \$2.40g$$

$$\$38.4g = \$1.92$$
$$g = 0.05 = 5\%.$$

The next step is to use the growth rate to project the stock price 5 years hence:

$$\hat{P}_5 = \frac{D_0(1+g)^6}{r_s - g}$$
$$= \frac{\$2.40(1.05)^6}{0.12 - 0.05}$$
$$= \$45.95.$$

$$(\text{Alternatively, } \hat{P}_5 = \$36(1.05)^5 = \$45.95.)$$

Therefore, Ewald Company's expected stock price 5 years from now, $\hat{P}_5$, is $45.95.

(ST-2) a. (1) Calculate the PV of the dividends paid during the supernormal growth period:

$$D_1 = \$1.1500(1.15) = \$1.3225;$$
$$D_2 = \$1.3225(1.15) = \$1.5209;$$
$$D_3 = \$1.5209(1.13) = \$1.7186.$$

$$\text{PVD} = \$1.3225/(1.12) + \$1.5209/(1.12)^2 + \$1.7186/(1.12)^3$$
$$= \$3.6167 \approx \$3.62.$$

(2) Find the PV of Snyder's stock price at the end of Year 3:

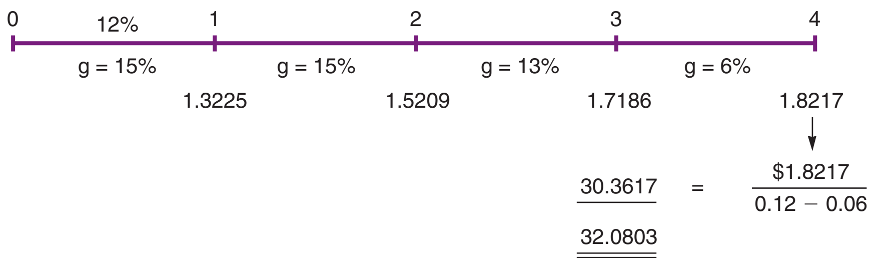
$$\hat{P}_3 = \frac{D_4}{r_s - g} = \frac{D_3(1+g)}{r_s - g}$$
$$= \frac{\$1.7186(1.06)}{0.12 - 0.06}$$
$$= \$30.36.$$

$$\text{PV } \hat{P}_3 = \$30.36/(1.12)^3 = \$21.61.$$

(3) Sum the two components to find the value of the stock today:

$$\hat{P}_0 = \$3.62 + \$21.61 = \$25.23.$$

Alternatively, the cash flows can be placed on a time line as follows:



Enter the cash flows into the cash flow register ($CF_0 = 0$, $CF_1 = 1.3225$, $CF_2 = 1.5209$, $CF_3 = 32.0803$) and I/YR = 12, and press the NPV key to obtain $\hat{P}_0 = \$25.23$.

b.

$$\hat{P}_1 = \$1.5209/(1.12) + \$1.7186/(1.12)^2 + \$30.36/(1.12)^3$$
$$= \$26.9311 \approx \$26.93.$$
(Calculator solution: \$26.93.)

$$\hat{P}_2 = \$1.7186/1.12) + \$30.36/(1.12)^2$$
$$= \$28.6429 \approx \$28.64.$$
(Calculator solution: \$28.64.)

c.

Year	Dividend Yield	+	Capital Gains Yield	=	Total Return
1	$\frac{\$1.3225}{\$25.23} \approx 5.24\%$	+	$\frac{\$26.93 - \$25.23}{\$25.23} \approx 6.74\%$	$\approx$	12%.
2	$\frac{\$1.5209}{\$26.93} \approx 5.65\%$	+	$\frac{\$28.64 - \$26.93}{\$26.93} \approx 6.35\%$	$\approx$	12%.
3	$\frac{\$1.7186}{\$28.64} \approx 6.00\%$	+	$\frac{\$30.36 - \$28.64}{\$28.64} \approx 6.00\%$	$\approx$	12%.

Chapter 9

(ST-1) The option will pay off \$60 − \$42 = \$18 if the stock price is up. The option pays off zero if the stock price is down. Find the number of shares in the hedge portfolio:

$$N = \frac{C_u - C_d}{P_u - P_d} = \frac{\$18 - \$0}{\$60 - \$30} = 0.60.$$

With 0.6 shares, the stock's payoff will be either 0.6(\$60) = \$36 or 0.6(\$30) = \$18. The portfolio's payoff will be \$36 − \$18 = \$18, or \$18 − 0 = \$18.

The present value of \$18 at the daily compounded risk-free rate is PV = \$18/[1 + (0.05/365)]^{365} = \$17.12.

The option price is the current value of the stock in the portfolio minus the PV of the payoff:

$$V = 0.6(\$40) - \$17.12 = \$6.88.$$

(ST-2)

$$d_1 = \frac{\ln(P/X) + [r_{RF} + (\sigma^2/2)]t}{\sigma\sqrt{t}}$$
$$= \frac{\ln(\$22/\$20) + [0.05 + (0.49/2)](0.5)}{0.7\sqrt{0.5}}$$
$$= 0.4906.$$
$$d_2 = d_1 - \sigma(t)^{0.5} = 0.4906 - 0.7(0.5)^{0.5} = -0.0044.$$
$$N(d_1) = 0.6881 \text{ (from Excel NORMSDIST function)}.$$
$$N(d_2) = 0.4982 \text{ (from Excel NORMSDIST function)}.$$
$$V = P[N(d_1)] - Xe^{-r_{RF}t}[N(d_2)]$$
$$= \$22(0.6881) - \$20e^{(-0.05)(0.5)}(0.4982)$$
$$= \$5.42.$$

Chapter 10

(ST-1) a. Component costs are as follows:

Debt at $r_d = 9\%$:

$$r_d(1 - T) = 9\%(0.6) = 5.4\%.$$

Preferred with F = 5%:

$$r_{ps} = \frac{\text{Preferred dividend}}{P_{ps}(1 - F)} = \frac{\$9}{\$100(0.95)} = 9.5\%.$$

Common with DCF:

$$r_s = \frac{D_1}{P_0} + g = \frac{\$3.922}{\$60} + 6\% = 12.5\%.$$

Common with CAPM:

$$r_s = 6\% + 1.3(5\%) = 12.5\%.$$

b.

$$\begin{aligned} \text{WACC} &= w_d r_d(1 - T) + w_{ps} r_{ps} + w_{ce} r_s \\ &= 0.25(9\%)(1 - T) + 0.15(9.5\%) + 0.60(12.5\%) \\ &= 10.275\%. \end{aligned}$$

Chapter 11

(ST-1) a. **Payback:**

To determine the payback, construct the cumulative cash flows for each project:

	Cumulative Cash Flows	
Year	Project X	Project Y
0	($10,000)	($10,000)
1	(3,500)	(6,500)
2	(500)	(3,000)
3	2,500	500
4	3,500	4,000

$$\text{Payback}_X = 2 + \frac{\$500}{\$3,000} = 2.17 \text{ years}$$

$$\text{Payback}_Y = 2 + \frac{\$3,000}{\$3,500} = 2.86 \text{ years}$$

Net present value (NPV):

$$\text{NPV}_X = -\$10,000 + \frac{\$6,500}{(1.12)^1} + \frac{\$3,000}{(1.12)^2} + \frac{\$3,000}{(1.12)^3} + \frac{\$1,000}{(1.12)^4} = \$966.01.$$

$$\text{NPV}_Y = -\$10,000 + \frac{\$3,500}{(1.12)^1} + \frac{\$3,500}{(1.12)^2} + \frac{\$3,500}{(1.12)^3} + \frac{\$3,500}{(1.12)^4} = \$630.72.$$

Alternatively, using a financial calculator, input the cash flows into the cash flow register, enter I = 12, and then press the NPV key to obtain $\text{NPV}_X = \$966.01$ and $\text{NPV}_Y = \$630.72$.

Internal rate of return (IRR):

To solve for each project's IRR, find the discount rates that equate each NPV to zero:

$$IRR_X = 18.0\%;$$
$$IRR_Y = 15.0\%.$$

Modified internal rate of return (MIRR):

To obtain each project's MIRR, begin by finding each project's terminal value (TV) of cash inflows:

$$TV_X = \$6{,}500(1.12)^3 + \$3{,}000(1.12)^2 + \$3{,}000(1.12)^1 + \$1{,}000 = \$17{,}255.23;$$
$$TV_Y = \$3{,}500(1.12)^3 + \$3{,}500(1.12)^2 + \$3{,}500(1.12)^1 + \$3{,}500 = \$16{,}727.65.$$

Now, each project's MIRR is the discount rate that equates the PV of the TV to each project's cost, \$10,000:

$$MIRR_X = 14.61\%;$$
$$MIRR_Y = 13.73\%.$$

b. The following table summarizes the project rankings by each method:

	Project That Ranks Higher
Payback	X
NPV	X
IRR	X
MIRR	X

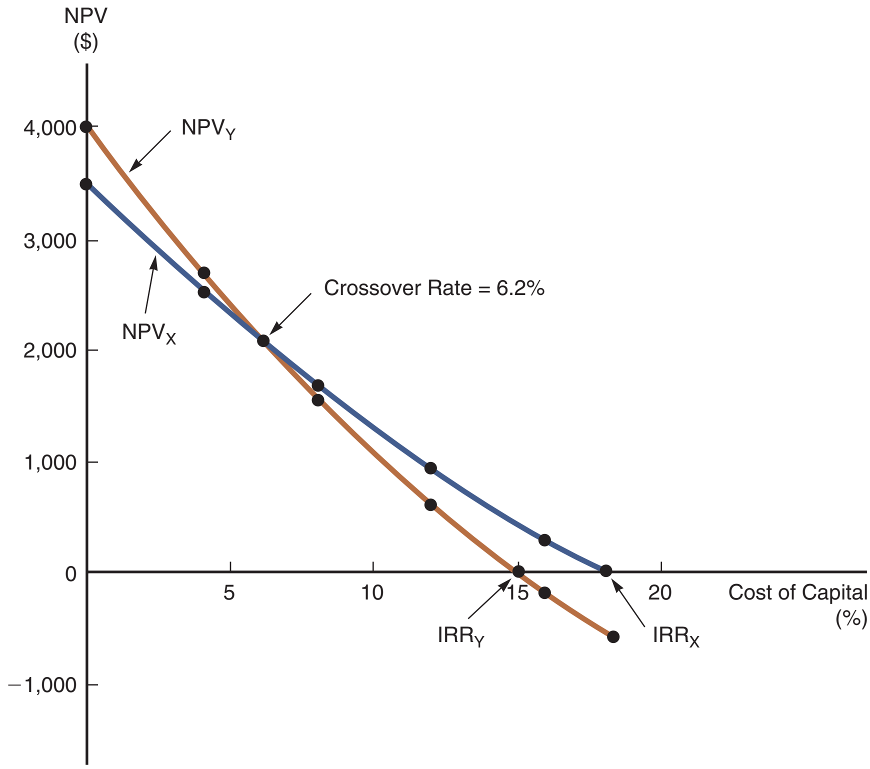
Note that all methods rank Project X over Project Y. In addition, both projects are acceptable under the NPV, IRR, and MIRR criteria. Thus, both projects should be accepted if they are independent.

c. In this case, we would choose the project with the higher NPV at $r = 12\%$, or Project X.

d. To determine the effects of changing the cost of capital, plot the NPV profiles of each project. The crossover rate occurs at about 6% to 7% (6.2%). See the graph on the next page.

If the firm's cost of capital is less than 6.2%, a conflict exists because $NPV_Y > NPV_X$, but $IRR_X > IRR_Y$. Therefore, if r were 5%, a conflict would exist. Note, however, that when $r = 5.0\%$, $MIRR_X = 10.64\%$ and $MIRR_Y = 10.83\%$; hence, the modified IRR ranks the projects correctly, even if r is to the left of the crossover point.

NPV Profiles for Project X and Y



Cost of Capital	NPV_X	NPV_Y
0%	$3,500	4,000
4	2,545	2,705
12	1,707	1,592
16	966	631
18	307	(206)
18	5	(585)

e. The basic cause of the conflict is differing reinvestment rate assumptions between NPV and IRR. NPV assumes that cash flows can be reinvested at the cost of capital, while IRR assumes reinvestment at the (generally) higher IRR. The high reinvestment rate assumption under IRR makes early cash flows especially valuable, and hence short-term projects look better under IRR.

Chapter 12

(ST-1) **a. Estimated Investment Requirements:**

Price	($50,000)
Modification	(10,000)
Change in net working capital	(2,000)
Total investment	($62,000)

b. **Operating Cash Flows:**

	Year 1	Year 2	Year 3
1. After-tax cost savings[a]	$12,000	$12,000	$12,000
2. Depreciation[b]	19,800	27,000	9,000
3. Depreciation tax savings[c]	7,920	10,800	3,600
Operating cash flow (1+3)	$19,920	$22,800	$15,600

[a]$20,000(1 − T).

[b]Depreciable basis = $60,000; the MACRS percentage allowances are 0.33, 0.45, and 0.15 in Years 1, 2, and 3, respectively; hence, depreciation in Year 1 = 0.33($60,000) = $19,800, and so on. There will remain $4,200, or 7%, undepreciated after Year 3; it would normally be taken in Year 4.

[c]Depreciation tax savings = T(Depreciation) = 0.4($19,800) = $7,920 in Year 1, and so on.

c. **Termination Cash Flow:**

Salvage value	$20,000
Tax on salvage value[a]	(6,320)
Net working capital recovery	2,000
Termination cash flow	$15,680

[a]Calculation of tax on salvage value:
Book value = Depreciation basis − Accumulated depreciation
= $60,000 − $55,000 = $4,200

Sales price	$20,000
Less book value	4,200
Taxable income	$15,800
Tax at 40%	$ 6,320

d. **Project NPV:**

	0	1	2	3
	10%			
Project Cash Flows	−62,000	19,920	22,800	31,280

$$\text{NPV} = -\$62{,}000 + \frac{\$19{,}920}{(1.10)^1} + \frac{\$22{,}800}{(1.10)^2} + \frac{\$31{,}280}{(1.10)^3}$$

$$= -\$1{,}547.$$

Alternatively, using a financial calculator, input the cash flows into the cash flow register, enter I/YR = 10, and then press the NPV key to obtain NPV = −$1,547. Because the earthmover has a negative NPV, it should not be purchased.

(ST-2) a. First, find the expected cash flows:

Year	Expected Cash Flows				
0	0.2(−$100,000)	+0.6(−$100,000)	+0.2(−$100,000)	=	($100,000)
1	0.2($20,000)	+0.6($30,000)	+0.2($40,000)	=	$30,000
2					$30,000
3					$30,000
4					$30,000
5					$30,000
5*	0.2($0)	+0.6($20,000)	+0.2($30,000)	=	$18,000

Next, determine the NPV based on the expected cash flows:

$$\text{NPV} = -\$100{,}000 + \frac{\$30{,}000}{(1.10)^1} + \frac{\$30{,}000}{(1.10)^2} + \frac{\$30{,}000}{(1.10)^3}$$

$$+ \frac{\$30{,}000}{(1.10)^4} + \frac{\$48{,}000}{(1.10)^5} = \$24{,}900.$$

Alternatively, using a financial calculator, input the cash flows in the cash flow register, enter I/YR = 10, and then press the NPV key to obtain NPV = $24,900.

b. For the worst case, the cash flow values from the cash flow column farthest on the left are used to calculate NPV:

$$\text{NPV} = -\$100{,}000 + \frac{\$20{,}000}{(1.10)^1} + \frac{\$20{,}000}{(1.10)^2} + \frac{\$20{,}000}{(1.10)^3}$$

$$+ \frac{\$20{,}000}{(1.10)^4} + \frac{\$20{,}000}{(1.10)^5} = -\$24{,}184.$$

Similarly, for the best case, use the values from the column farthest on the right. Here the NPV is $70,259.

If the cash flows are perfectly dependent, then the low cash flow in the first year will mean a low cash flow in every year. Thus, the probability of the worst case occurring is the probability of getting the $20,000 net cash flow in Year 1, or 20%. If the cash flows are independent, the cash flow in each year can be low, high, or average, and the probability of getting all low cash flows will be

$$0.2(0.2)(0.2)(0.2)(0.2) = 0.2^5 = 0.00032 = 0.032\%.$$

c. The base-case NPV is found using the most likely cash flows and is equal to $26,142. This value differs from the expected NPV of $24,900 because the Year 5 cash flows are not symmetric. Under these conditions, the NPV distribution is as follows:

P	NPV
0.2	($24,184)
0.6	26,142
0.2	70,259

Thus, the expected NPV is 0.2(−$24,184) + 0.6($26,142) + 0.2($70,259) = $24,900. As is always the case, the expected NPV is the same as the NPV of the expected cash flows found in part a. The standard deviation is $29,904:

$$\begin{aligned}\sigma^2_{\text{NPV}} &= 0.2(-\$24{,}184 - \$24{,}900)^2 + 0.6(-\$26{,}142 - \$24{,}900)^2 \\ &\quad + 0.2(-\$70{,}259 - \$24{,}900)^2 \\ &= \$894{,}261{,}126. \\ \sigma_{\text{NPV}} &= \sqrt{\$894{,}261{,}126} = \$29{,}904.\end{aligned}$$

The coefficient of variation, CV, is $29,904/$24,900 = 1.20.

Chapter 13

(ST-1) a. NPV of each demand scenario:

		Future Cash Flows			
0	Probability	Year 1	Year 2	NPV This Scenario	Probability × NPV
	25%	$13	$13	$13.13	$3.28
−$8	50%	$7	$7	$3.38	$1.69
	25%	$1	$1	−$6.37	−$1.59
				Expected NPV of future CFs =	$3.38

NPV high-demand scenario:

$$\text{NPV} = -\$8 + \frac{\$13}{(1 + 0.15)} + \frac{\$13}{(1 + 0.15)^2} = \$13.13.$$

NPV medium-demand scenario:

$$\text{NPV} = -\$8 + \frac{\$7}{(1 + 0.15)} + \frac{\$7}{(1 + 0.15)^2} = \$3.38.$$

NPV low-demand scenario:

$$\text{NPV} = -\$8 + \frac{\$1}{(1 + 0.15)} + \frac{\$1}{(1 + 0.15)^2} = -\$6.37.$$

Expected NPV = 0.25($13.13) + 0.50($3.38) + 0.25(−$6.37) = $3.38 million.

b. NPV of operating cash flows if accept the additional project when optimal:

Probability	Future Operating Cash Flows (Discount at WACC) Year 1	Year 2	Year 3	Year 4	NPV This Scenario	Probability × NPV
25%	$13	$13	$13	$13	$37.11	$9.28
50%	$7	$7	$7	$7	$19.98	$9.99
25%	$1	$1	$0	$0	$1.63	$0.41
					Expected NPV of future operating CFs =	$19.68

NPV of operating cash flows, high-demand scenario:

$$\text{NPV} = \frac{\$13}{(1+0.15)} + \frac{\$13}{(1+0.15)^2} + \frac{\$13}{(1+0.15)^3} + \frac{\$13}{(1+0.15)^4} = \$37.11.$$

NPV of operating cash flows, medium-demand scenario:

$$\text{NPV} = \frac{\$7}{(1+0.15)} + \frac{\$7}{(1+0.15)^2} + \frac{\$7}{(1+0.15)^3} + \frac{\$7}{(1+0.15)^4} = \$19.98.$$

NPV of operating cash flows, low-demand scenario:

$$\text{NPV} = \frac{\$1}{(1+0.15)} + \frac{\$1}{(1+0.15)^2} = \$1.63.$$

$$\begin{aligned}\text{Expected NPV of operating cash flows} &= 0.25(\$37.11) + 0.50(\$19.98) \\ &\quad + 0.25(\$1.63) \\ &= \$19.68 \text{ million.}\end{aligned}$$

Find NPV of costs, discounted at risk-free rate:

Cost of Implementing Project Now and Additional Project at Year 2 (Discount at Risk-Free Rate)

0	Probability	Year 1	Year 2	NPV This Scenario	Probability × NPV
	25%	$0	−$8	−$15.12	−$3.78
−$8	50%	$0	−$8	−$15.12	−$7.56
	25%	$0	$0	−$8.00	−$2.00
				Expected NPV of future operating CFs =	−$13.34

NPV of costs of high-demand scenario:

$$\text{NPV} = -\$8 + \frac{\$0}{(1+0.06)} + \frac{-\$8}{(1+0.06)^2} = -\$15.12.$$

NPV of costs of medium-demand scenario:

$$\text{NPV} = -\$8 + \frac{\$0}{(1 + 0.06)} + \frac{-\$8}{(1 + 0.06)^2} = -\$15.12.$$

NPV of costs of low-demand scenario:

$$\text{NPV} = -\$8 + \frac{\$0}{(1 + 0.06)} + \frac{\$0}{(1 + 0.06)^2} = -\$8.00.$$

$$\begin{aligned}\text{Expected NPV of costs} &= 0.25(-\$15.12) + 0.50(-\$15.12) + 0.25(-\$8.00)\\ &= -\$13.34 \text{ million.}\end{aligned}$$

$$\begin{aligned}\begin{matrix}\text{Expected NPV}\\ \text{of project}\end{matrix} &= \begin{matrix}\text{Expected NPV of}\\ \text{operating cash flows}\end{matrix} - \begin{matrix}\text{Expected NPV}\\ \text{of costs}\end{matrix}\\ &= \$19.68 - \$13.34 = \$6.34.\end{aligned}$$

c. Find the expected NPV of the additional project's operating cash flows, which is analogous to the "stock price" in the Black-Scholes model:

Future Operating Cash Flows of Additional Project (Discount at WACC)

0	Probability	Year 1	Year 2	Year 3	Year 4	NPV of This Scenario	Probability × NPV
	25%	$0	$0	$13	$13	$15.98	$4.00
	50%	$0	$0	$7	$7	$8.60	$4.30
	25%	$0	$0	$1	$1	$1.23	$0.31
						Expected NPV future operating CFs =	$8.60

NPV of operating cash flows, high-demand scenario:

$$\text{NPV} = \frac{\$0}{(1 + 0.15)} + \frac{\$0}{(1 + 0.15)^2} + \frac{\$13}{(1 + 0.15)^3} + \frac{\$13}{(1 + 0.15)^4} = \$15.98.$$

NPV of operating cash flows, medium-demand scenario:

$$\text{NPV} = \frac{\$0}{(1 + 0.15)} + \frac{\$0}{(1 + 0.15)^2} + \frac{\$7}{(1 + 0.15)^3} + \frac{\$7}{(1 + 0.15)^4} = \$8.60.$$

NPV of operating cash flows, low-demand scenario:

$$\text{NPV} = \frac{\$0}{(1 + 0.15)} + \frac{\$0}{(1 + 0.15)^2} + \frac{\$1}{(1 + 0.15)^3} + \frac{\$1}{(1 + 0.15)^4} = \$1.23.$$

$$\begin{aligned}\begin{matrix}\text{Expected NPV of additional project's}\\ \text{operating cash flows}\end{matrix} &= 0.25(\$15.98) + 0.50(\$8.60)\\ &\quad + 0.25(\$1.23)\\ &= \$8.60 \text{ million.}\end{aligned}$$

The inputs for the Black-Scholes model are $r_{RF} = 0.06$, $X = 8$, $P = 8.6$, $t = 2$, and $\sigma^2 = 0.156$. Using these inputs, the value of the option, V, is

$$d_1 = \frac{\ln(P/X) + \left[r_{RF} + \frac{\sigma^2}{2}\right]^t}{\sigma\sqrt{t}} = \frac{\ln(8.6/8) + \left[0.06 + \frac{0.156}{2}\right]^2}{\sqrt{0.156}\sqrt{2}} = 0.62461.$$

$$d_2 = d_1 - \sigma\sqrt{t} = 0.62641 - \sqrt{0.156}\sqrt{2} = 0.06604.$$

$$V = P[N(d_1)] - Xe^{-r_{RF}t}[N(d_2)] = 8.6(0.73389) - 8e^{-0.06(2)}(0.52633)$$
$$= \$2.58 \text{ million.}$$

The total value is the value of the original project (from part a) and the value of the growth option:

$$\text{Total value} = \$3.38 + \$2.58 = \$5.96 \text{ million.}$$

Chapter 14

(ST-1) To solve this problem, we will define ΔS as the change in sales and g as the growth rate in sales, and then we use the three following equations:

$$\Delta S = S_0 g;$$
$$S_1 = S_0(1 + g);$$
$$AFN = (A^*/S_0)(DS) - (L^*/S_0)(DS) - MS_1(1 - d).$$

Set AFN = 0, substitute in known values for A^*/S_0, L^*/S_0, M, d, and S_0, and then solve for g:

$$\begin{aligned}
0 &= 1.6(\$100g) - 0.4(\$100g) - 0.10[\$100(1 + g)](0.55)\\
&= \$160g - \$40g - 0.055(\$100 + \$100g)\\
&= \$160g - \$40g - \$5.5 - \$5.5g\\
\$114.5g &= \$5.5\\
g &= \$5.5/\$114.5 = 0.048 = 4.8\%\\
&= \text{Maximum growth rate without external financing.}
\end{aligned}$$

(ST-2) Assets consist of cash, marketable securities, receivables, inventories, and fixed assets. Therefore, we can break the A^*/S_0 ratio into its components—cash/sales, inventories/sales, and so forth. Then,

$$\frac{A^*}{S_0} = \frac{A^* - \text{Inventories}}{S_0} + \frac{\text{Inventories}}{S_0} = 1.6.$$

We know that the inventory turnover ratio is sales/inventories = 3 times, so inventories/sales = 1/3 = 0.3333. Further, if the inventory turnover ratio can be increased to 4 times, then the inventory/sales ratio will fall to 1/4 = 0.25, a difference of 0.3333 − 0.2500 = 0.0833. This, in turn, causes the A^*/S_0 ratio to fall from $A^*/S_0 = 1.6$ to $A^*/S_0 = 1.6 - 0.0833 = 1.5167$. This change has two effects: First, it changes the AFN equation, and second, it means that Barnsdale currently has excessive inventories. Because it is costly to hold excess inventories, Barnsdale will want to reduce its inventory holdings by not replacing inventories until the excess amounts have been used. We can account for this by setting up the revised AFN equation (using the new A^*/S_0 ratio), estimating the funds that will be needed next year if no excess inventories are currently on hand, and then subtracting out the excess inventories which are currently on hand:

Present Conditions:

$$\frac{\text{Sales}}{\text{Inventories}} = \frac{\$100}{\text{Inventories}} = 3,$$

so

$$\text{Inventories} = \$100/3 = \$33.3 \text{ million at present.}$$

New Conditions:

$$\frac{\text{Sales}}{\text{Inventories}} = \frac{\$100}{\text{Inventories}} = 4,$$

so

$$\text{New level of inventories} = \$100/4 = \$25 \text{ million.}$$

Therefore,

$$\text{Excess inventories} = \$33.3 - \$25 = \$8.3 \text{ million.}$$

Forecast of Funds Needed, First Year:

$$\text{DS in first year} = 0.2(\$100 \text{ million}) = \$20 \text{ million.}$$

$$\begin{aligned} \text{AFN} &= 1.5167(\$20) - 0.4(\$20) - 0.1(0.55)(\$120) - \$8.3 \\ &= \$30.3 - \$8 - \$6.6 - \$8.3 \\ &= \$7.4 \text{ million.} \end{aligned}$$

Forecast of Funds Needed, Second Year:

$$\Delta\text{S in second year} = gS_1 = 0.2(\$120 \text{ million}) = \$24 \text{ million.}$$

$$\begin{aligned} \text{AFN} &= 1.5137(\$24) - 0.4(\$24) - 0.1(0.55)(\$144) \\ &= \$36.4 - \$9.6 - \$7.9 \\ &= \$18.9 \text{ million.} \end{aligned}$$

(ST-3) a.
$$\begin{aligned} \text{Full capacity sales} &= \frac{\text{Current sales}}{\text{Percentage of capacity at which FA were operated}} \\ &= \frac{\$36{,}000}{0.75} = \$48{,}000. \end{aligned}$$

$$\begin{aligned} \text{Percentage increase} &= \frac{\text{New sales} - \text{Old sales}}{\text{Old sales}} \\ &= \frac{\$48{,}000 - \$36{,}000}{\$36{,}000} = 0.33 \\ &= 33\%. \end{aligned}$$

Therefore, sales could expand by 33% before Van Auken Lumber would need to add fixed assets.

b. **Van Auken Lumber: Pro Forma Income Statement for December 31, 2008 (Thousands of Dollars)**

	2007	Forecast Basis	Pro Forma 2008
Sales	\$36,000	1.25(Sales$_{07}$)	\$45,000
Operating costs	30,783	85.508%(Sales$_{08}$)	38,479
EBIT	\$ 5,217		\$ 6,521
Interest	717	12%(Debt$_{07}$)	1,017
EBT	\$ 4,500		\$ 5,504
Taxes (40%)	1,800		2,202
Net income	\$ 2,700		\$ 3,302
Dividends (60%)	\$ 1,620		\$ 1,981
Additions to RE	\$ 1,080		\$ 1,321

Van Auken Lumber: Pro Forma Balance Sheet for December 31, 2008 (Thousands of Dollars)

	2007	Percent of 2008 Sales	Additions	2008	AFN	2008 after AFN
Cash	\$ 1,800	5.000%		\$ 2,250		\$ 2,250
Receivables	10,800	30.000		13,500		13,500
Inventories	12,600	35.000		15,750		15,750
Total current assets	\$25,200			\$31,500		\$31,500
Net fixed assets	21,600			21,600[a]		21,600
Total assets	\$46,800			\$53,100		\$53,100
Accounts payable	\$ 7,200	20.000		\$ 9,000		\$ 9,000
Notes payable	3,472			3,472	+2,549	6,021
Accruals	2,520	7.000		3,150		3,150
Total current liabilities	\$13,192			\$15,622		\$18,171
Mortgage bonds	5,000			5,000		5,000
Common stock	2,000			2,000		2,000
Retained earnings	26,608		1,321[b]	27,929		27,929
Total liabilities and equity	\$46,800			\$50,551		\$53,100
AFN =				\$ 2,549		

[a]From part a we know that sales can increase by 33% before additions to fixed assets are needed.

[b]See income statement.

Chapter 15

(ST-1) a. $$V_{op} = \frac{FCF(1+g)}{WACC - g} = \frac{\$100{,}000(1+0.07)}{0.11 - 0.07} = \$2{,}675{,}000.$$

b. $$\begin{aligned}\text{Total value} &= \text{Value of operations} + \text{Value of nonoperating assets}\\ &= \$2{,}675{,}000 + \$325{,}000 = \$3{,}000{,}000.\end{aligned}$$

c. $$\begin{aligned}\text{Value of equity} &= \text{Total value} - \text{Value of debt}\\ &= \$3{,}000{,}000 - \$1{,}000{,}000 = \$2{,}000{,}000.\end{aligned}$$

d. $$\begin{aligned}\text{Price per share} &= \text{Value of equity/Number of shares}\\ &= \$2{,}000{,}000/50{,}000 = \$40.\end{aligned}$$

Chapter 16

(ST-1) a. $S = P_0n = \$30(600{,}000) = \$18{,}000{,}000.$

$V = D + S = \$2{,}000{,}000 + \$18{,}000{,}000 = \$20{,}000{,}000.$

b. $D/V = \$2{,}000{,}000/\$20{,}000{,}000 = 0.10.$

$S/V = \$18{,}000{,}000/\$20{,}000{,}000 = 0.90.$

$$\begin{aligned} \text{WACC} &= (D/V)r_d(1 - T) + (S/V)r_s \\ &= (0.10)(10\%)(0.60) + (0.90)(15\%) = 14.1\%. \end{aligned}$$

c. $\text{WACC} = (0.50)(12\%)(0.60) + (0.50)(18.5\%) = 12.85\%.$

Since $g = 0$, FCF = NOPAT.

$$\begin{aligned} V &= \text{FCF/WACC} = \text{NOPAT}(1 - T)/0.1285 = \$4{,}700{,}000(0.60)/0.1285 \\ &= \$21{,}945{,}525.292. \end{aligned}$$

$D = w_d(V) = 0.50(\$21{,}945{,}525.292) = \$10{,}972{,}762.646.$

Since it started with \$2 million debt, it will issue

$\$8{,}972{,}762.646 = \$10{,}972{,}762.646 - \$2{,}000{,}000.$

$S = V - D = \$21{,}945{,}525.292 - \$10{,}972{,}762.646 = \$10{,}972{,}762.646.$

$$\begin{aligned} \text{New } P &= (S + D - D_0)/n_0 \\ &= (\$10{,}972{,}762.646 + \$10{,}972{,}762.646 - \$2{,}000{,}000)/600{,}000 \\ &= \$33.243. \end{aligned}$$

It used the proceeds of the new debt, \$8,972,762.646, to repurchase X shares of stock at a price of \$33.243 per share. The number of shares it will repurchase is $X = \$8{,}972{,}762.646/\$33.243 = 269{,}914.347 \approx 269{,}914$. Therefore, there are $600{,}000 - 269{,}914 = 330{,}086$. As a check the stock price should equal the market value of equity, S, divided by the number of shares: $P_0 = \$10{,}972{,}762.646/330{,}086 = \$33.242$.

(ST-2) a. LIC's current cost of equity is

$$r_s = 6\% + 1.5(4\%) = 12\%.$$

b. LIC's unlevered beta is

$$b_U = 1.5/[1 + (1 - 0.40)(25\%/75\%)] = 1.5/1.2 = 1.25.$$

c. LIC's levered beta at $D/S = 60\%/40\% = 1.5$ is

$$b = 1.25[1 + (1 - 0.40)(60/40)] = 2.375.$$

LIC's new cost of capital will be

$$r_s = 6\% + (2.375)(4\%) = 15.5\%.$$

Chapter 17

(ST-1) a. Value of unleveraged firm, $V_U = \text{EBIT}(1 - T)/r_{sU}$:

$$\begin{aligned} \$12 &= \$2(1 - 0.4)r_{sU} \\ \$12 &= \$1.2/r_{sU} \\ r_{sU} &= \$1.2/\$12 = \$10.0\%. \end{aligned}$$

Therefore, r_{sU} = WACC = 10.0%.

b. Value of leveraged firm according to MM mode with taxes:

$$V_L = V_U + TD.$$

As shown in the following table, value increases continuously with debt, and the optimal capital structure consists of 100% debt. Note: The table is not necessary to answer this question, but the data (in millions of dollars) are necessary for part c of this problem.

Debt, D	V_U	TD	$V_L = V_U + TD$
$ 0.0	$12.0	$0.0	$12.0
2.5	12.0	1.0	13.0
5.0	12.0	2.0	14.0
7.5	12.0	3.0	15.0
10.0	12.0	4.0	16.0
12.5	12.0	5.0	17.0
15.0	12.0	6.0	18.0
20.0	12.0	8.0	20.0

c. With financial distress costs included in the analysis, the value of the leveraged firm now is

$$V_L = V_U + TD - PC,$$

where

V_U + TD = value according to MM after-tax model.
P = probability of financial distress.
C = present value of distress costs.

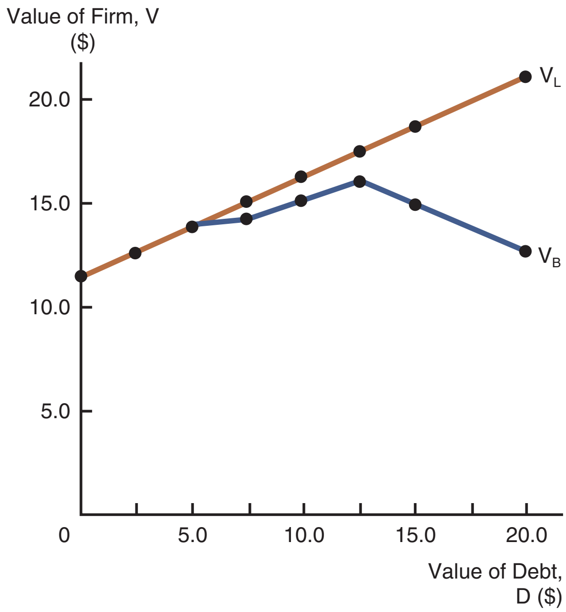
D	V_U + TD	P	PC = (P)$8	$V_L = V_U + TD - PC$
$ 0.0	$12.0	0.0000	$0.00	$12.0
2.5	13.0	0.0000	0.00	13.0
5.0	14.0	0.0125	0.10	13.9
7.5	15.0	0.0250	0.20	14.8
10.0	16.0	0.0625	0.50	15.5
12.5	17.0	0.1250	1.00	16.0
15.0	18.0	0.3125	2.50	15.5
20.0	20.0	0.7500	6.00	14.0

Note: All dollar amounts are in millions.

Optimal debt level*:* D = $12.5 million.
Maximum value of firm*:* V = $16.0 million.
Optimal debt/value ratio*:* D/V = $12.5/$16 = 78%.

d. The value of the firm versus debt value with and without financial distress costs is plotted next (millions of dollars):

$$V_L = \text{Value without financial distress costs.}$$
$$V_B = \text{Value with financial distress costs.}$$



Chapter 18

(ST-1) a.

Projected net income	\$2,000,000
Less projected capital investments	800,000
Available residual	\$1,200,000
Shares outstanding	200,000

$$\text{DPS} = \$1{,}200{,}000/200{,}000 \text{ shares} = \$6 = D_1.$$

b.

$$\text{EPS} = \$2{,}000{,}000/200{,}000 \text{ shares} = \$10.$$
$$\text{Payout ratio} = \text{DPS/EPS} = \$6/\$10 = 60\%, \text{ or}$$
$$\text{Total dividends/NI} = \$1{,}200{,}000/\$2{,}000{,}000 = 60\%.$$

c.

$$\text{Currently, } P_0 = \frac{D_1}{r_s - g} = \frac{\$6}{0.14 - 0.05} = \frac{\$6}{0.09} = \$66.67.$$

Under the former circumstances, D_1 would be based on a 20% payout on \$10 EPS, or \$2. With $r_s = 14\%$ and $g = 12\%$, we solve for P_0:

$$P_0 = \frac{D_1}{r_s - g} = \frac{\$2}{0.14 - 0.12} = \frac{\$2}{0.02} = \$100.$$

Although CMC has suffered a severe setback, its existing assets will continue to provide a good income stream. More of these earnings should now be passed on to the shareholders, as the slowed internal growth has reduced the need for funds. However, the net result is a 33% decrease in the value of the shares.

Chapter 19

(ST-1) a. $$\text{Proceeds per share} = (1 - 0.07)(\$20) = \$18.60.$$

$$\text{Required proceeds after direct costs: \$30 million} + \$800{,}000 = \$30.8 \text{ million.}$$
$$\text{Number of shares} = \$30.8 \text{ million}/\$18.60 \text{ per share} = 1.656 \text{ million shares.}$$

b. $$\text{Amount left on table} = (\text{Closing price} - \text{offer price})(\text{Number of shares})$$
$$= (\$22 - \$20)(1.656 \text{ million}) = \$3.312 \text{ million.}$$

c. $$\text{Underwriting cost} = 0.07(\$20)(1.656) = \$2.318 \text{ million.}$$
$$\text{Total costs} = \$0.800 + \$2.318 + \$3.312 = \$6.430 \text{ million.}$$

Chapter 20

(ST-1) a. **Cost of Leasing:**

	Year 0	Year 1	Year 2	Year 3	Year 4
Lease payment	($10,000)	($10,000)	($10,000)	($10,000)	$0
Payment tax savings	4,000	4,000	4,000	4,000	0
Net cash flow	($ 6,000)	($ 6,000)	($ 6,000)	($ 6,000)	$0
PV cost of leasing @ 6% =	($22,038)				

b. **Cost of Owning:**

In our solution, we will consider the $40,000 cost as a Year 0 outflow rather than including all the financing cash flows. The net effect is the same since the PV of the financing flows, when discounted at the after-tax cost of debt, is the cost of the asset.

	Year 0	Year 1	Year 2	Year 3	Year 4
Net purchase price	($40,000)				
Maintenance cost		($1,000)	($1,000)	($1,000)	($1,000)
Maintenance tax savings		400	400	400	400
Depreciation tax savings		5,280	7,200	2,400	1,120
Residual value					10,000
Residual value tax					(4,000)
Net cash flow	($40,000)	$4,680	$6,600	$1,800	$6,520
PV cost of owning @ 6% =	($23,035)				

Since the present value of the cost of leasing is less than the present value of the cost of owning, the truck should be leased. Specifically, the NAL is $23,035 − $22,038 = $997.

c. Use the cost of debt because most cash flows are fixed by contract and consequently are relatively certain; thus lease cash flows have about the same risk as the firm's debt. Also, leasing is considered as a substitute for debt. Use an after-tax cost rate to account for interest tax deductibility.

d. The firm could increase the discount rate on the residual value cash flow. Note that since the firm plans to replace the truck after 4 years, the residual value is treated as an inflow in the cost of owning analysis. This makes it reasonable to raise the discount rate for analysis purposes. However, had the firm planned to continue using the truck, then we would have had to place the estimated residual value as an additional Year 4 outflow in the leasing section, but without a tax adjustment. Then, higher risk would have been reflected in a *lower* discount rate. This is all very ad hoc, which is why analysts often prefer to use one discount rate throughout the analysis.

Chapter 21

(ST-1) First issue: 10-year straight bonds with a 6% coupon.

Second issue: 10-year bonds with 4.5% annual coupon with warrants. Both bonds issued at par \$1,000. Value of warrants = ?

First issue: N = 10; PV = −1000, PMT = 60, FV = 1000, and solve for I/YR = r_d = 6%. (Since it sold for par, we should know that r_d = 6%.)

Second issue: \$1,000 = Bond + Warrants. This bond should be evaluated at 6% (since we know the first issue sold at par) to determine its present value: N = 10; I/YR = r_d = 6; PMT = 45, FV = 1000, and solve for PV = \$889.60.

The value of the warrants can be determined as the difference between \$1,000 and the second bond's present value.

Value of warrants = \$1,000 − \$889.6 = \$110.40.

Chapter 22

(ST-1) **The Calgary Company: Alternative Balance Sheets**

	Restricted (40%)	Moderate (50%)	Relaxed (60%)
Current assets (% of sales)	\$1,200,000	\$1,500,000	\$1,800,000
Fixed assets	600,000	600,000	600,000
Total assets	\$1,800,000	\$2,100,000	\$2,400,000
Debt	\$ 900,000	\$1,050,000	\$1,200,000
Equity	900,000	1,050,000	1,200,000
Total liabilities and equity	\$1,800,000	\$2,100,000	\$2,400,000

The Calgary Company: Alternative Income Statements

	Restricted	Moderate	Relaxed
Sales	\$3,000,000	\$3,000,000	\$3,000,000
EBIT	450,000	450,000	450,000
Interest (10%)	90,000	105,000	120,000
Earnings before taxes	\$ 360,000	\$ 345,000	\$ 330,000
Taxes (40%)	144,000	138,000	132,000
Net income	\$ 216,000	\$ 207,000	\$ 198,000
ROE	24.0%	19.7%	16.5%

(ST-2) a. and b.

Income Statements for Year Ended December 31, 2007 (Thousands of Dollars)

	Vanderheiden Press a	Vanderheiden Press b	Herrenhouse Publishing a	Herrenhouse Publishing b
EBIT	$ 30,000	$ 30,000	$ 30,000	$ 30,000
Interest	12,400	14,400	10,600	18,600
Taxable income	$ 17,600	$ 15,600	$ 19,400	$ 11,400
Taxes (40%)	7,040	6,240	7,760	4,560
Net income	$ 10,560	$ 9,360	$ 11,640	$ 6,840
Equity	$100,000	$100,000	$100,000	$100,000
Return on equity	10.56%	9.36%	11.64%	6.84%

The Vanderheiden Press has a higher ROE when short-term interest rates are high, whereas Herrenhouse Publishing does better when rates are lower.

c. Herrenhouse's position is riskier. First, its profits and return on equity are much more volatile than Vanderheiden's. Second, Herrenhouse must renew its large short-term loan every year, and if the renewal comes up at a time when money is very tight, when its business is depressed, or both, then Herrenhouse could be denied credit, which could put it out of business.

Chapter 23

(ST-1) a. The hypothetical bond in the futures contract has an annual coupon of 6% (paid semiannually) and a maturity of 20 years. At a price of 97-13 (this is the percent of par), a $1,000 par bond would have a price of $1,000(97 + 13/32)/100 = $974.0625. To find the yield, N = 40; PMT = 30; FV = 1000; PV = −974.0625; solve for I/YR = 3.1143% per 6 months. The nominal annual yield is 2(3.1143%) = 6.2286%.

b. In this situation, the firm would be hurt if interest rates were to rise by September, so it would use a short hedge or sell futures contracts. Because futures contracts are for $100,000 in Treasury bonds, the value of a futures contract is $97,406.25 and the firm must sell $5,000,000/$97,406.25 = 51.33 ≈ 51 contracts to cover the planned $5,000,000 September bond issue. Because futures maturing in June are selling for 97 $^{13}/_{32}$ of par, the value of Wansley's futures is about 51($97,406.25) = $4,967,718.75. Should interest rates rise by September, Wansley will be able to repurchase the futures contracts at a lower cost, which will help offset their loss from financing at the higher interest rate. Thus, the firm has hedged against rising interest rates.

c. The firm would now pay 13% on the bonds. With a 12% coupon rate, the PV of the new issue is only N = 40; I = 13/2 = 6.5; PMT = −0.12/2(5,000,000) = −300,000; FV = −5,000,000; and solve for PV = $4,646,361.83. Therefore, the new bond issue would bring in only $4,646,361.83, so the cost of the bond issue due to rising rates is $5,000,000 − $4,646,361.83 = $353,638.17.

However, the value of the short futures position began at $4,967,718.75. Now, if interest rates increased by 1 percentage point, the yield on the futures would go up to 7.2286% (7.2286 = 6.2286 + 1). The value of the futures contract is N = 40; I = 7.2286/2 = 3.6143 (from part a); PMT = 3000; FV = 100,000; and solve for PV = \$87,111.04 per contract. With 51 contracts, the value of the futures position is \$4,442,663.04. (Note: If you don't round in any previous calculations, the PV is \$4,442,668.38.)

Because Wansley Company sold the futures contracts for \$4,967,718.75, and will, in effect, buy them back at \$4,442,668.04, the firm would make a profit of \$4,967,718.75 − \$4,442,668.04 = \$525,050.71 on the transaction, ignoring transaction costs.

Thus, the firm gained \$525,050.71 on its futures position, but lost \$353,638.17 on its underlying bond issue. On net, it gained \$525,050.71 − \$353,638.17 = \$171,412.54.

Chapter 24

(ST-1) a. Distribution to priority claimants (millions of dollars):

Total proceeds from the sale of assets	\$1,150
Less:	
1. First mortgage (paid from sale of fixed assets)	700
2. Second mortgage (paid from sale of fixed assets after satisfying first mortgage: \$750 − \$700 = \$50)	50
3. Fees and expenses of bankruptcy	1
4. Wages due to workers	60
5. Taxes due	90
Funds available for distribution to general creditors	\$ 249

b. Distribution to general creditors (millions of dollars):

General Creditor Claims	Amount of Claim	Pro Rata Distribution[a]	Distribution after Subordinate Adjustment[b]	% of Original Claim Received
Unsatisfied second mortgage	\$ 350	\$ 60	\$ 60	28%[c]
Accounts payable	100	17	17	17
Notes payable	300	52	86	29
Debentures	500	86	86	17
Subordinated debentures	200	34	0	0
Total	\$1,450	\$249	\$249	

Notes:
[a]Pro rata distribution: \$249/\$1,450 = 0.172 = 17.2%.
[b]Subordinated debentures are subordinated to notes payable. Unsatisfied portion of notes payable is greater than subordinated debenture distribution, so subordinated debentures receive \$0.
[c]Includes \$50 from sale of fixed assets received in priority distribution.

Total distribution to second mortgage holders: \$50 + \$60 = \$110 million.

Total distribution to holders of notes payable: \$86 million.

Total distribution to holders of subordinated debentures: \$0 million.

Total distribution to common stockholders: \$0 million.

Chapter 25

(ST-1) a. The unlevered cost of equity based on the pre-merger required rate of return and pre-merger capital structure is

$$\begin{aligned} r_{sU} &= w_d r_d + w_s r_{sL} \\ &= 0.25(6\%) + 0.75(10\%) \\ &= 9\%. \end{aligned}$$

The post-horizon levered cost of equity is

$$\begin{aligned} r_{sL} &= r_{sU} + (r_{sU} - r_d)(D/S) \\ &= 9\% + (9\% - 7\%)(0.35/0.65) \\ &= 10.077\%. \end{aligned}$$

$$\begin{aligned} \text{WACC} &= w_d r_d(1 - T) + w_s r_s \\ &= 0.35(7\%)(1 - 0.40) + 0.65(10.077\%) \\ &= 8.02\%. \end{aligned}$$

b. The horizon value of unlevered operations is

$$\begin{aligned} \text{Horizon value } U_3 &= \text{FCF}_3(1 + g)/(r_{sU} - g) \\ &= [\$25(1.05)]/(0.09 - 0.05) \\ &= \$656.250 \text{ million.} \end{aligned}$$

$$\begin{aligned} \text{Unlevered } V_{op} &= \frac{\$10}{1.09} + \frac{\$20}{(1.09)^2} + \frac{\$25 + \$656.25}{(1.09)^3} \\ &= \$552.058 \text{ million.} \end{aligned}$$

Tax shields in Years 1 through 3 are

$$\begin{aligned} \text{Tax saving} &= \text{Interest} \times T; \\ TS_1 &= \$28.00(0.40) = \$11.200 \text{ million;} \\ TS_2 &= \$24.00(0.40) = \$9.600 \text{ million;} \\ TS_3 &= \$20.28(0.40) = \$8.112 \text{ million.} \end{aligned}$$

$$\begin{aligned} HV_{TS,3} &= TS_3(1 + g)/(r_{sU} - g) \\ &= [\$8.112(1.05)]/(0.09 - 0.05) \\ &= \$212.940 \text{ million.} \end{aligned}$$

$$\begin{aligned} \text{Value of tax shield} &= \frac{\$11.2}{1.09} + \frac{\$9.6}{(1.09)^2} + \frac{\$8.112 + \$212.940}{(1.09)^3} \\ &= \$189.048 \text{ million.} \end{aligned}$$

$$\begin{aligned} \text{Total value} &= \text{Unlevered } V_{op} + \text{Value of tax shield} \\ &= \$552.058 + \$189.048 \\ &= \$741.106. \end{aligned}$$

Chapter 26

(ST-1)

$$\begin{aligned} \frac{\text{Euros}}{\text{C\$}} &= \frac{\text{Euros}}{\text{US\$}} \times \frac{\text{US\$}}{\text{C\$}} \\ &= \frac{0.98}{\$1} \times \frac{\$1}{1.5} = \frac{0.98}{1.5} = 0.6533 \text{ euro per Canadian dollar.} \end{aligned}$$

appendix b

Answers to End-of-Chapter Problems

We present here some intermediate steps and final answers to selected end-of-chapter problems. Please note that your answer may differ slightly from ours due to rounding differences. Also, although we hope not, some of the problems may have more than one correct solution, depending on what assumptions are made in working the problem. Finally, many of the problems involve some verbal discussion as well as numerical calculations; this verbal material is not presented here.

(2-1) FV_5 = \$16,105.10.

(2-2) PV = \$1,292.10.

(2-3) I/YR = 8.01%.

(2-4) N = 11.01 years.

(2-5) N = 11 years.

(2-6) FVA_5 = \$1,725.22;
$FVA_{5\ Due}$ = \$1,845.99.

(2-7) PV = \$923.98; FV = \$1,466.24.

(2-8) PMT = \$444.89; EAR = 12.6825%.

(2-9) a. \$530.
b. \$561.80.
c. \$471.70.
d. \$445.00.

(2-10) a. \$895.42.
b. \$1,552.92.
c. \$279.20.
d. \$160.99.

(2-11) a. N = 10.24 ≈ 10 years.
b. N = 7.27 ≈ 7 years.
c. N = 4.19 ≈ 4 years.
d. N = 1.00 ≈ 1 year.

(2-12) a. \$6,374.97.
b. \$1,105.13.
c. \$2,000.00.
d. (1) \$7,012.46.
(2) \$1,160.38.
(3) \$2,000.00.

(2-13) a. \$2,457.83.
b. \$865.90.
c. \$2,000.00.
d. (1) \$2,703.61.
(2) \$909.19.
(3) \$2,000.00.

(2-14) a. PV_A = \$1,251.25.
PV_B = \$1,300.32.
b. PV_A = \$1,600.
PV_B = \$1,600.

(2-15) a. 7%.
b. 7%.
c. 9%.
d. 15%.

(2-16) a. \$881.17.
b. \$895.42.
c. \$903.06.
d. \$908.35.

(2-17) a. \$279.20.
b. \$276.84.
c. \$443.72.

(2-18) a. \$5,272.32.
b. \$5,374.07.

(2-19) a. Universal, EAR = 7%.
Regional, EAR = 6.14%.

(2-20) a. PMT = \$6,594.94.
$Interest_1$ = \$2,500.
$Interest_2$ = \$2,090.51.
b. \$13,189.87.
c. \$8,137.27.

(2-21) a. I =14.87% ≈ 15%.

(2-22) I = 7.18%.
(2-23) I = 9%.
(2-24) a. $33,872.11.
b. (1) $26,243.16.
(2) $0.
(2-25) N = 14.77 ≈ 15 years.
(2-26) 6 years; $1,106.01.
(2-27) (1) $1,428.57.
(2) $714.29.
(2-28) $893.26.
(2-29) $984.88.
(2-30) 57.18%.
(2-31) a. $1,432.02.
b. $93.07.
(2-32) I_{NOM} = 15.19%.
(2-33) PMT = $36,949.61.
(2-34) First PMT = $9,736.96.
(3-1) 5.8%.
(3-2) 25%.
(3-3) $1,000,000.
(3-4) $2,500,000.
(3-5) $3,600,000.
(3-6) $20,000,000.
(3-7) Tax = $107,855; NI = $222,145; Marginal tax rate = 39%; Average tax rate = 33.8%.
(3-8) a. Tax = $3,575,000.
b. Tax = $350,000.
c. Tax = $105,000.
(3-9) AT&T preferred stock = 5.37%; Florida bond = 5%.
(3-10) NI = $450,000; NCF = $650,000.
(3-11) a. $2,400,000.
b. NI = $0; NCF = $3,000,000.
c. NI = $1,350,000; NCF = $2,100,000.
(3-12) a. NOPAT = $90,000,000.
b. $NOWC_{06}$ = $210,000,000; $NOWC_{07}$ = $192,000,000.
c. Operating $capital_{06}$ = $460,000,000; Operating $capital_{07}$ = $492,000,000.
d. FCF = $58,000,000.
(3-13) Refund = $120,000.
Future taxes = $0; $0; $40,000; $60,000; $60,000.
(4-1) AR = $400,000.
(4-2) D/A = 40%.
(4-3) M/B = 10.
(4-4) P/E = 16.0.
(4-5) ROE = 12%.
(4-6) S/TA = 5; TA/E = 1.5.
(4-7) CL = $2,000,000; Inv = $1,000,000.
(4-8) Net profit margin = 2%; D/A = 40%.
(4-9) $262,500; 1.19×.
(4-10) TIE = 3.86×.
(4-11) A/P = $90,000; Inv = $90,000;
FA = $138,000.
(4-12) Sales = $2,592,000; DSO = 36.33 days.
(4-13) a. Current ratio = 1.98×;
DSO = 76 days;
Total assets turnover = 1.7×;
Debt ratio = 61.9%.
(4-14) a. Quick ratio = 0.8×; DSO = 37 days; ROE = 13.1%;
Debt ratio = 54.8%.
(5-1) $928.39.
(5-2) 12.48%.
(5-3) 8.55%.
(5-4) 7%; 7.33%.
(5-5) 2.5%.
(5-6) 0.3%.
(5-7) $1,085.80.
(5-8) YTM = 6.62%; YTC = 6.49%.
(5-9) a. 5%: V_L = $1,518.98; V_S = $1,047.62.
8%: V_L = $1,171.19; V_S = $1,018.52.
12%: V_L = $863.78; V_S = $982.14.
(5-10) a. YTM at $829 = 13.98%;
YTM at $1,104 = 6.50%.
(5-11) 14.82%.
(5-12) a. 10.37%.
b. 10.91%.

c. -0.54%.
d. 10.15%.
(5-13) 8.65%.
(5-14) 10.78%.
(5-15) YTC = 6.47%.
(5-16) a. 10-year, 10% coupon = 6.75%;
10-year zero = 9.75%;
5-year zero = 4.76%;
30-year zero = 32.19%;
$100 perpetuity = 14.29%.
(5-17) C_0 = $1,012.79; Z_0 = $693.04;
C_1 = $1,010.02; Z_1 = $759.57;
C_2 = $1,006.98; Z_2 = $832.49;
C_3 = $1,003.65; Z_3 = $912.41;
C_4 = $1,000.00; Z_4 = $1,000.00.
(5-18) 5.8%.
(5-19) 1.5%.
(5-20) 6.0%.
(5-21) a. $1,251.22.
b. $898.94.
(5-22) a. 8.02%.
b. 7.59%.
(5-23) a. $r_1 = 9.20\%$; $r_5 = 7.20\%$.
(6-1) b = 1.12.
(6-2) r = 10.90%.
(6-3) $\hat{r}_M = 11\%$; $r_s = 12.2\%$.
(6-4) $\hat{r} = 11.40\%$; $\sigma = 26.69\%$; CV = 2.34.
(6-5) a. $\hat{r}_M = 13.5\%$; $\hat{r}_j = 11.6\%$.
b. $\sigma_M = 3.85\%$; $\sigma_j = 6.22\%$.
c. $CV_M = 0.29$; $CV_j = 0.54$.
(6-6) a. $b_A = 1.40$.
b. $r_A = 15\%$.
(6-7) a. $r_i = 15.5\%$.
b. (1) $r_M = 15\%$; $r_i = 16.5\%$.
(2) $r_M = 13\%$; $r_i = 14.5\%$.
c. (1) $r_i = 18.1\%$.
(2) $r_i = 14.2\%$.
(6-8) $b_N = 1.16$.
(6-9) $b_p = 0.7625$; $r_P = 12.1\%$.
(6-10) $b_N = 1.1250$.
(6-11) 4.5%.
(6-12) a. $\bar{r}_A = 11.30\%$; $\bar{r}_B = 11.30\%$.
b. $\bar{r}_p = 11.30\%$.
c. $\sigma_A = 20.8\%$; $\sigma_B = 20.8\%$;
$\sigma_P = 20.1\%$.
d. $CV_A = 1.84$; $CV_B = 1.84$;
$CV_p = 1.78$.
(6-13) a. $b_X = 1.3471$; $b_Y = 0.6508$.
b. $r_X = 12.7355\%$; r_Y = 9.254%.
c. $r_p = 12.04\%$.
(7-1) 1.4.
(7-2) 12%.
(7-3) 15.96%.
(7-4) 45.9%.
(7-5) a. $r_i = r_{RF} + (r_M - r_{RF})\dfrac{\rho_{iM}\sigma_i}{\sigma_M}$.
(7-6) a. 14.15%.
b. 16.45%.
(7-7) a. b = 0.56.
b. X: 10.6%; 13.1%.
M: 12.1%; 22.6%.
c. 8.6%.
(7-8) a. b = 0.62.
(8-1) D_1 = $1.5750; D_3 = $1.7364;
D_5 = $2.1011.
(8-2) $\hat{P}_0$ = $18.75.
(8-3) $\hat{P}_1$ = $22.00; $\hat{r}_s = 15.50\%$.
(8-4) $r_{ps} = 10\%$.
(8-5) $50.50.
(8-6) g = 9%.
(8-7) $\hat{P}_3$ = $27.32.
(8-8) a. 13.3%.
b. 10%.
c. 8%.
d. 5.7%.
(8-9) $25.26.
(8-10) a. $r_C = 10.6\%$; $r_D = 7\%$.
(8-11) $25.03.
(8-12) $\hat{P}_0$ = $19.89.
(8-13) a. $125.
b. $83.33.
(8-14) a. 7%.
b. 5%.
c. 12%.
(8-15) a. (1) $9.50.
(2) $13.33.
b. (1) Undefined.
(8-16) a. $\hat{P}_0$ = $21.43.
b. $\hat{P}_0$ = $26.47.
c. $\hat{P}_0$ = $32.14.
d. $\hat{P}_0$ = $40.54.

(8-17) b. PV = \$5.29.
d. \$30.01.
(8-18) a. D_5 = \$3.52.
b. $\hat{P}_0$ = \$39.42.
c. Dividend yield t = 0, 5.10%; t = 5, 7.00%.
(8-19) $\hat{P}_0$ = \$54.11.
(9-1) \$5; \$2.
(9-2) \$27.00; \$37.00.
(9-3) \$1.67.
(9-4) \$3.70.
(9-5) \$1.90.
(9-6) \$2.39.
(9-7) \$1.91.
(10-1) a. 13%.
b. 10.4%.
c. 8.45%.
(10-2) 5.2%.
(10-3) 9%.
(10-4) 5.41%.
(10-5) 13.33%.
(10-6) 10.4%.
(10-7) 9.17%.
(10-8) 13%.
(10-9) 7.2%.
(10-10) a. 16.3%.
b. 15.4%.
c. 16%.
(10-11) a. 8%.
b. \$2.81.
c. 15.81%.
(10-12) a. g = 3%.
b. EPS_1 = \$5.562.
(10-13) 16.1%.
(10-14) $(1 - T)r_d$ = 5.57%.
(10-15) a. \$15,000,000.
b. 8.4%.
(10-16) Short-term debt = 11.14%; Long-term debt = 22.03%; Common equity = 66.83%.
(10-17) $w_{d(Short)}$ = 0%; $w_{d(Long)}$ = 20%; w_{ps} = 4%; w_{ce} = 76%; r_d(After-tax) = 7.2%; r_{ps} = 11.6%; $r_s \approx$ 17.5%.
(11-1) NPV = \$7,486.68.
(11-2) IRR = 16%.
(11-3) MIRR = 13.89%.
(11-4) PI = 1.14.
(11-5) 4.34 years.
(11-6) DPP = 6.51 years.
(11-7) 5%: NPV_A = \$16,108,952; NPV_B = \$18,300,939.
10%: NPV_A = \$12,836,213; NPV_B = \$15,954,170.
15%: NPV_A = \$10,059,587; NPV_B = \$13,897,838.
(11-8) NPV_T = \$409; IRR_T = 15%; $MIRR_T$ = 14.54%; Accept.
NPV_P = \$3,318; IRR_P = 20%; $MIRR_P$ = 17.19%; Accept.
(11-9) NPV_E = \$3,861; IRR_E = 18%; NPV_G = \$3,057; IRR_G = 18%; Purchase electric-powered forklift; it has a higher NPV.
(11-10) NPV_S = \$814.33; NPV_L = \$1,675.34; IRR_S = 15.24%; IRR_L = 14.67%; $MIRR_S$ = 13.77%; $MIRR_L$ = 13.46%; PI_S = 1.081; PI_L = 1.067.
(11-11) $MIRR_X$ = 13.59%; $MIRR_Y$ = 13.10%.
(11-12) a. NPV = \$136,578; IRR = 19.22%.
(11-13) b. IRR_A = 18.1%; IRR_B = 24.0%.
c. 10%: NPV_A = \$283.34; NPV_B = \$178.60.
17%: NPV_A = \$31.05; NPV_B = \$75.95.
d. (1) $MIRR_A$ = 14.07%; $MIRR_B$ = 15.89%.
(2) $MIRR_A$ = 17.57%; $MIRR_B$ = 19.91%.
(11-14) a. \$0; −\$10,250,000; \$1,750,000.
b. 16.07%.
(11-15) a. NPV_A = \$18,108,510; NPV_B = \$13,946,117; IRR_A = 15.03%; IRR_B = 22.26%.
b. NPV_Δ = \$4,162,393; IRR_Δ = 11.71%.
(11-16) Extended NPV_A = \$12.76 million; NPV_B = \$9.26 million.

EAA_A = \$2.26 million; EAA_B = \$1.64 million.

(11-17) Machine A; Extended NPV_A = \$4.51 million.
EAA_A = \$0.85 million; EAA_B = \$0.69 million.

(11-18) NPV of 360-6 = \$22,256.
Extended NPV of 190-3 = \$20,070.
EAA of 360-6 = \$5,723.30;
EAA of 190-3 = \$5,161.02.

(11-19) d. 7.61%; 15.58%.

(11-20) a. Undefined.
b. NPV_C = −\$911,067; NPV_F = −\$838,834.

(11-21) a. A = 2.67 years; B = 1.5 years.
b. A = 3.07 years; B = 1.825 years.
c. NPV_A = \$12,739,908; choose both.
d. NPV_A = \$18,243,813; choose A.
e. NPV_B = \$8,643,390; choose B.
f. 13.53%.
g. $MIRR_A$ = 21.93%; $MIRR_B$ = 20.96%.

(11-22) a. 3 years.
b. No.

(12-1) \$12,000,000.

(12-2) \$2,600,000.

(12-3) \$4,600,000.

(12-4) a. −\$126,000.
b. \$42,518; \$47,579; \$34,926.
c. \$50,702.
d. NPV = \$10,841; Purchase.

(12-5) a. (\$89,000).
b. \$26,220; \$30,300; \$20,100.
c. \$24,380.
d. NPV = −\$6,704; Don't purchase.

(12-6) a. NPV = \$106,537.

(12-7) E(NPV) = \$3 million; σ_{NPV} = \$23.622 million; CV_{NPV} = 7.874.

(12-8) a. Expected CF_A = \$6,750; Expected CF_B = \$7,650; CV_A = 0.0703.
b. NPV_A = \$10,036; NPV_B = \$11,624.

(12-9) a. E(IRR) ≅ 15.3%.
b. \$38,589.

(12-10) a. \$117,779.
b. σ_{NPV} = \$445,060; CV_{NPV} = 3.78.

(13-1) a. \$1.074 million.
b. \$2.96 million.

(13-2) a. \$4.6795 million.
b. \$3.208 million.

(13-3) a. −\$19 million.
b. \$9.0981 million.

(13-4) a. −\$2.113 million.
b. \$1.973 million.
c. −\$70,222.
d. \$565,090.
e. \$1.116 million.

(13-5) a. \$2,562.
b. ENPV = \$9,786; Value of growth option = \$7,224.

(13-6) P = \$18.646 million; X = \$20 million; t = 1; r_{RF} = 0.08; σ^2 = 0.0687;
V = \$2.028 million.

(13-7) P = \$10.479 million; X = \$9 million; t = 2; r_{RF} = 0.06; σ^2 = 0.0111;
V = \$2.514 million.

(13-8) P = \$18,646; X = \$20,000; t = 2; V = \$5,009.

(14-1) AFN = \$410,000.

(14-2) AFN = \$610,000.

(14-3) AFN = \$200,000.

(14-4) ΔS = \$68,965.52.

(14-5) a. \$480,000.
b. \$18,750.

(14-6) AFN = \$360.

(14-7) a. \$13.44 million.
b. Notes payable = \$31.44 million.

(14-8) a. Total assets = \$33,534; AFN = \$2,128.
b. Notes payable = \$4,228.

(14-9) a. AFN = \$128,783.
b. Notes payable = \$284,783.

(15-1) FCF = \$37.0.

(15-2) $V_{op} = \$6{,}000{,}000$.
(15-3) V_{op} at 2009 = \$15,000.
(15-4) $V_{op} = \$160{,}000{,}000$.
MVA = −\$40,000,000.
(15-5) \$259,375,000.
(15-6) a. $HV_2 = \$2{,}700{,}000$.
b. \$2,303,571.43.
(15-7) a. \$713.33.
b. \$527.89.
c. \$43.79.
(15-8) \$416 million.
(15-9) \$46.90.
(15-10) a. \$34.96 million.
b. \$741.152 million.
c. \$699.20 million.
d. \$749.10 million.
e. \$50.34.
(16-1) 20,000.
(16-2) 1.0.
(16-3) 3.6%.
(16-4) \$300 million.
(16-5) \$30.
(16-6) 40 million.
(16-7) a. ΔProfit = \$850,000; Return = 21.25% > r_s = 15%.
b. $Q_{BE,Old} = 40$; $Q_{BE,New} = 45.45$.
(16-8) a. $ROE_C = 15\%$; $\sigma_C = 11\%$.
(16-9) a. V = \$3,348,214.
b. \$16.74.
c. \$1.84.
d. 10%.
(16-10) 30% debt: WACC = 11.14%;
V = \$101.023 million.
50% debt: WACC = 11.25%;
V = \$100 million.
70% debt: WACC = 11.94%;
V = \$94.255 million.
(16-11) a. 0.870.
b. b = 1.218; r_s = 10.872%.
c. WACC = 8.683%; V = \$103.188 million.
(16-12) 11.45%.
(17-1) \$500 million.
(17-2) \$821 million.
(17-3) \$620.68 million.
(17-4) a. b_U = 1.13.
b. r_{sU} = 15.625%; 5.625%.
c. 16.62%; 18.04%; 20.23%.
d. 20.23%.
(17-5) a. $V_U = V_L$ = \$20 million.
b. r_{sU} = 10%; r_{sL} = 15%.
c. S_L = \$10 million.
d. $WACC_U$ = 10%; $WACC_L$ = 10%.
(17-6) a. V_U = \$12 million; V_L = \$16 million.
b. r_{sU} = 10%; r_{sL} = 15%.
c. S_L = \$6 million.
d. $WACC_U$ = 10%; $WACC_L$ = 7.5%.
(17-7) a. V_U = \$12 million.
b. V_L = \$15.33 million.
c. \$3.33 million versus \$4 million.
d. V_L = \$20 million; \$0.
e. V_L = \$16 million; \$4 million.
f. V_L = \$16 million; \$4 million.
(17-8) a. V_U = \$12.5 million.
b. V_L = \$16 million; r_{sL} = 15.7%.
c. V_L = \$14.5 million; r_{sL} = 14.9%.
(17-9) a. $V_U = V_L$ = \$14,545,455.
b. At D = \$6 million: r_{sL} = 14.51%; WACC = 11.0%.
c. V_U = \$8,727,273; V_L = \$11,127,273.
d. At D = \$6 million: r_{sL} = 14.51%; WACC = 8.63%.
e. D = V = \$14,545,455.
(17-10) a. V = \$3.29 million.
b. D = \$1.71 million; yield = 8.1%.
c. V = \$3.23 million; D = \$1.77 million; yield = 6.3%.
(18-1) Payout = 55%.
(18-2) Payout = 20%.
(18-3) Payout = 52%.
(18-4) V_{op} = \$175 million; n = 8.75 million.
(18-5) P_0 = \$60.
(18-6) \$3,250,000.

(18-7) n = 4,000; EPS = \$5.00; DPS = \$1.50; P = \$40.00.

(18-8) D_0 = \$3.44.

(18-9) Payout = 31.39%.

(18-10) a. (1) \$3,960,000.
(2) \$4,800,000.
(3) \$9,360,000.
(4) Regular = \$3,960,000; Extra = \$5,400,000.

(18-11) a. \$6,000,000.
b. DPS = \$2.00; Payout = 25%.
c. \$5,000,000.
d. No.
e. 50%.
f. \$1,000,000.
g. \$8,333,333.

(19-1) a. \$700,000.
b. \$3,700,000.
c. −\$2,300,000.

(19-2) \$964,115.

(19-3) a. 2007: \$12,000; \$6,000; \$90,000.
b. Edelman: g_{EPS} = 8.0%; g_{DPS} = 7.4%.
e. 2007: \$3.00; \$1.50; \$22.50.
f. Kennedy: 15.00%; Strasburg: 13.64%.
g. 2007: Kennedy: 50%; Strasburg: 50%.
h. Kennedy: 43%; Strasburg: 37%.
i. Kennedy: 8×; Strasburg: 8.67×.

(19-4) a. A–T call cost = \$2,640,000.
b. Flotation cost = \$1,600,000.
c. \$1,920,000; \$768,000.
d. \$3,472,000.
e. New tax savings = \$16,000.
Lost tax savings = \$19,200.
f. \$360,000.
g. PV = \$9,109,413.
h. \$5,637,413.

(19-5) a. NPV = \$2,717,128.

(20-1) a. (1) 50%.
(2) 60%.
(3) 50%.

(20-2) Cost of owning = −\$127; cost of leasing = −\$128.

(20-3) a. Energen: Debt/TA = 50%.
Hastings: Debt/TA = 33%.
b. TA = \$200.

(20-4) a. NAL = \$108,048.

(20-5) a. Cost of leasing = \$637,692.
Cost of owning = \$713,242.

(21-1) \$196.36.

(21-2) 25 shares.

(21-3) a. (1) −\$5, or \$0.
(2) \$0.
(3) \$5.
(4) \$75.
d. 10%; \$100.

(21-4) Premium = 10%: \$46;
Premium = 30%: \$55.

(21-5) a. 14.1%.
b. \$12 million before tax.
c. \$331.89.
d. Value as a straight bond = \$699.25; value in conversion = \$521.91.
f. Value as a straight bond = \$1,000.00; value in conversion = \$521.91.

(21-6) b. Plan 1: 49%; Plan 2: 53%; Plan 3: 53%.
c. Plan 1: \$0.59; Plan 2: \$0.64; Plan 3: \$0.88.
d. Plan 1: 19%; Plan 2: 19%; Plan 3: 50%.

(21-7) a. Year = 7; CV_7 = \$1,210.422; CF_7 = \$1,290.422.
b. 10.20%.

(22-1) \$3,000,000.

(22-2) A/R = \$59,500.

(22-3) r_{NOM} = 75.26%; EAR = 109.84%.

(22-4) EAR = 8.49%.

(22-5) \$7,500,000.

(22-6) a. DSO = 28 days.
b. A/R = \$70,000.
c. A/R = \$55,000.

(22-7) a. 73.74%.
b. 14.90%.
c. 32.25%.
d. 21.28%.
e. 29.80%.

(22-8) a. 45.15%.

(22-9) Nominal cost = 14.90%; Effective cost = 15.89%.

(22-10) 14.91%.

(22-11) a. 83 days.
b. \$356,250.
c. 4.87×.

(22-12) a. 69.5 days.
b. (1) 1.875×.
(2) 11.25%.
c. (1) 46.5 days.
(2) 2.1262×.
(3) 12.76%.

(22-13) a. ROE_T = 11.75%; ROE_M = 10.80%;
ROE_R = 9.16%.

(22-14) a. Feb. surplus = \$2,000.
b. \$164,000.

(22-15) a. \$100,000.
c. (1) \$300,000.
(2) Nominal cost = 37.24%;
Effective cost = 44.59%.
d. Nominal cost = 24.83%;
Effective cost = 27.86%.

(22-16) a. 14.35%.

(22-17) a. \$300,000.

(23-1) Net payment = LIBOR + 0.2%.

(23-2) r_d = 7.01%.

(23-3) r_d = 5.96%.

(23-4) Net to Carter = 9.95% fixed.
Net to Brence = LIBOR + 3.05% floating.

(23-5) a. Sell 105 contracts.
b. Bond = −\$1,414,552.69;
Futures = +\$1,951,497.45;
Net = \$536,944.76.

(24-1) AP = \$375,000; NP = \$750,000; SD = \$750,000;
Stockholders = \$343,750.

(24-2) a. Total assets: \$327 million.
b. Income: \$7 million.
c. Before: \$15.6 million.
After: \$13.0 million.
d. Before: 35.7%.
After: 64.2%.

(24-3) a. \$0.
b. First mortgage holders: \$300,000.
Second mortgage holders: \$100,000 plus \$12,700 as a general claimant.
c. Trustee's expenses: \$50,000.
Wages due: \$30,000.
Taxes due: \$40,000.
d. *Before subordination:*
Accounts payable = \$6,350.
Notes payable = \$22,860.
Second mortgage = \$12,700 + \$100,000.
Debentures = \$25,400.
Sub. debentures = \$12,700.
After subordination:
Notes payable = \$35,560.
Sub. debentures = \$0.

(24-4) a. \$0 for stockholders.
b. AP = 24%; NP = 100%;
WP = 100%;
TP = 100%; Mortgage = 85%.
Subordinated debentures = 9%;
Trustee = 100%.

(25-1) P_0 = \$25.26.

(25-2) P_0 = \$41.54.

(25-3) \$25.26 to \$41.54.

(25-4) Value of equity = \$43.60 million.

(25-5) a. $V_{op\ Unlevered}$ = \$32.02 million; $V_{Tax\ shields}$ = \$11.50 million.
b. V_{op} = \$43.52 million; max = \$33.52 million.

(25-6) a. 10.96%.
b. (All in millions) FCF_1 = \$23.12, TS_1 = \$14.00; FCF_3 = \$12.26, TS_3 = \$16.45; FCF_5 = \$23.83, TS_5 = \$18.90.
c. HV_{TS} = \$510.68 million; HV_{UL} = \$643.89 million.
d. Value of equity = \$508.57 million.

(26-1) 12.358 yen per peso.

(26-2) f_t = \$0.00907.

(26-3) 1 euro = \$0.9091 or \$1 = 1.1 euro.

(26-4) 0.6667 pound per dollar.

(26-5) 1.5152 SFr.

(26-6) 2.4 Swiss francs per pound.

(26-7) $r_{NOM-U.S.}$ = 4.6%.

(26-8) 117 pesos.

(26-9) +\$250,000.

(26-10) b. \$18,148.00.

(26-11) a. \$1,659,000.
b. \$1,646,000.
c. \$2,000,000.

(26-12) b. f_t = \$0.7994.

(26-13) \$468,837,209.

(26-14) a. \$52.63; 20%.
b. 1.5785 SF per U.S.\$.
c. 41.54 Swiss francs; 16.92%.

appendix c

Selected Equations and Data

Chapter 1

$$\text{Value} = \frac{FCF_1}{(1 + WACC)^1} + \frac{FCF_2}{(1 + WACC)^2} + \frac{FCF_3}{(1 + WACC)^3} + \cdots + \frac{FCF_\infty}{(1 + WACC)^\infty}.$$

Chapter 2

$$FV_N = PV(1 + I)^N.$$

$$PV = \frac{FV_N}{(1 + I)^N}.$$

$$FVA_N = PMT\left[\frac{(1 + I)^N}{I} - \frac{1}{I}\right] = PMT\left[\frac{(1 + I)^N - 1}{I}\right].$$

$$FVA_{due} = FVA_{ordinary}(1 + I).$$

$$PVA_N = PMT\left[\frac{1}{I} - \frac{1}{I(1 + I)^N}\right] = PMT\left[\frac{1 - \frac{1}{(1 + I)^N}}{I}\right].$$

$$PVA_{N\ due} = PVA_{ordinary}(1 + I).$$

$$\text{PV of a perpetuity} = \frac{PMT}{I}.$$

$$PV_{\text{Uneven stream}} = \sum_{t=1}^{N} \frac{CF_t}{(1 + I)^t}.$$

$$FV_{\text{Uneven stream}} = \sum_{t=1}^{N} CF_t(1 + I)^{N-t}.$$

$$I_{PER} = \frac{I_{NOM}}{M}.$$

$$APR = (I_{PER})M.$$

Number of periods = NM.

$$FV_N = PV(1 + I_{PER})^{\text{Number of periods}} = PV\left(1 + \frac{I_{NOM}}{M}\right)^{MN}.$$

$$EFF\% = \left(1 + \frac{I_{NOM}}{M}\right)^{M} - 1.0.$$

Chapter 3

EBIT = Earnings before interest and taxes = Sales revenues − Operating costs.

EBITDA = Earnings before interest, taxes, depreciation, and amortization
= EBIT + Depreciation + Amortization.

Net cash flow = Net income + Depreciation and amortization.

NOWC = Net operating working capital
= Operating current assets − Operating current liabilities
= (Cash + Accounts receivable + Inventories)
− (Accounts payable + Accruals).

Total net operating capital = Net operating working capital
+ Operating long−term assets.

NOPAT = Net operating profit after taxes = EBIT(1 − Tax rate).

Free cash flow (FCF) = NOPAT − Net investment in operating capital
= NOPAT − (Current year's total net operating capital
− Previous year's total net operating capital).

Operating cash flow = NOPAT + Depreciation and amortization.

$$\begin{matrix}\text{Gross investment in} \\ \text{operating capital}\end{matrix} = \begin{matrix}\text{Net investment} \\ \text{in operating capital}\end{matrix} + \text{Depreciation.}$$

FCF = Operating cash flow − Gross investment in operating capital.

$$\text{Return on invested capital (ROIC)} = \frac{\text{NOPAT}}{\text{Total net operating capital}}.$$

MVA = Market value of stock − Equity capital supplied by shareholders
= (Shares outstanding)(Stock price) − Total common equity.

$$\text{MVA} = \text{Total market value} - \text{Total investor-supplied capital}$$
$$= (\text{Market value of stock} + \text{Market value of debt}) - \text{Total investor-supplied capital.}$$

$$\text{EVA} = \text{Net operating profit after taxes (NOPAT)} - \text{After-tax dollar cost of capital used to support operations}$$
$$= \text{EBIT}(1 - \text{Tax rate}) - (\text{Total net operating capital})(\text{WACC}).$$

$$\text{EVA} = (\text{Total net operating capital})(\text{ROIC} - \text{WACC}).$$

Chapter 4

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}.$$

$$\text{Quick, or acid test, ratio} = \frac{\text{Current assets} - \text{Inventories}}{\text{Current liabilities}}.$$

$$\text{Inventory turnover ratio} = \frac{\text{Sales}}{\text{Inventories}}.$$

$$\text{DSO} = \text{Days sales outstanding} = \frac{\text{Receivables}}{\text{Average sales per day}} = \frac{\text{Receivables}}{\text{Annual sales}/365}.$$

$$\text{Fixed assets turnover ratio} = \frac{\text{Sales}}{\text{Net fixed assets}}.$$

$$\text{Total assets turnover ratio} = \frac{\text{Sales}}{\text{Total assets}}.$$

$$\text{Debt ratio} = \frac{\text{Total liabilities}}{\text{Total assets}}.$$

$$\text{D/E} = \frac{\text{D/A}}{1 - \text{D/A}}, \text{ and } \text{D/A} = \frac{\text{D/E}}{1 + \text{D/E}}.$$

$$\text{Equity multiplier} = \frac{\text{Total assets}}{\text{Common equity}} = \frac{\text{A}}{\text{E}}.$$

$$\text{Debt ratio} = 1 - \frac{1}{\text{Equity multiplier}}.$$

$$\text{Times-interest-earned (TIE) ratio} = \frac{\text{EBIT}}{\text{Interest charges}}.$$

$$\text{EBITDA coverage ratio} = \frac{\text{EBITDA} + \text{Lease payments}}{\text{Interest} + \text{Principal payments} + \text{Lease payments}}.$$

$$\text{Profit margin on sales} = \frac{\text{Net income available to common stockholders}}{\text{Sales}}.$$

$$\text{Return on total assets (ROA)} = \frac{\text{Net income available to common stockholders}}{\text{Total assets}}.$$

$$\text{Basic earning power (BEP) ratio} = \frac{\text{EBIT}}{\text{Total assets}}.$$

$$\text{ROA} = \text{Profit margin} \times \text{Total assets turnover}.$$

$$\text{ROA} = \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}}.$$

$$\begin{array}{c}\text{Return on common}\\ \text{equity (ROE)}\end{array} = \frac{\text{Net income available to common stockholders}}{\text{Common equity}}.$$

$$\begin{aligned}\text{ROE} &= \text{ROA} \times \text{Equity multiplier}\\ &= \text{Profit margin} \times \text{Total assets turnover} \times \text{Equity multiplier}\\ &= \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}} \times \frac{\text{Total assets}}{\text{Common equity}}.\end{aligned}$$

$$\text{Price/earnings (P/E) ratio} = \frac{\text{Price per share}}{\text{Earnings per share}}.$$

$$\text{Price/cash flow ratio} = \frac{\text{Price per share}}{\text{Cash flow per share}}.$$

$$\text{Book value per share} = \frac{\text{Common equity}}{\text{Shares outstanding}}.$$

$$\text{Market/book (M/B) ratio} = \frac{\text{Market price per share}}{\text{Book value per share}}.$$

Chapter 5

$$V_B = \sum_{t=1}^{N} \frac{INT}{(1 + r_d)^t} + \frac{M}{(1 + r_d)^N}.$$

$$\text{Price of callable bond} = \sum_{t=1}^{N} \frac{INT}{(1 + r_d)^t} + \frac{\text{Call price}}{(1 + r_d)^N}.$$

$$\text{Current yield} = \frac{\text{Annual interest}}{\text{Bond's current price}}.$$

$$V_B = \sum_{t=1}^{2N} \frac{INT/2}{(1 + r_d/2)^t} + \frac{M}{(1 + r_d/2)^{2N}}.$$

$$r_d = r^* + IP + DRP + LP + MRP.$$

$$r_{RF} = r^* + IP.$$

$$r_d = r_{RF} + DRP + LP + MRP.$$

$$IP_N = \frac{I_1 + I_2 + \cdots + I_N}{N}.$$

Chapter 6

$$\text{Expected rate of return} = \hat{r} = \sum_{i=1}^{n} P_i r_i.$$

$$\text{Historical average, } \bar{r}_{Avg} = \frac{\sum_{t=1}^{n} \bar{r}_t}{n}.$$

$$\text{Variance} = \sigma^2 = \sum_{i=1}^{n} (r_i - \hat{r})^2 P_i.$$

$$\text{Standard deviation} = \sigma = \sqrt{\sum_{i=1}^{n} (r_i - \hat{r})^2 P_i}.$$

$$\text{Historical estimated } \sigma = S = \sqrt{\frac{\sum_{t=1}^{n} (\bar{r}_t - \bar{r}_{Avg})^2}{n - 1}}.$$

$$CV = \frac{\sigma}{\hat{r}}.$$

$$\hat{r}_p = \sum_{i=1}^{n} w_i \hat{r}_i.$$

$$\sigma_p = \sqrt{\sum_{i=1}^{n} (r_{pi} - \hat{r}_p)^2 P_i}.$$

$$\text{Estimated } \rho = R = \frac{\sum_{t=1}^{n} (\bar{r}_{i,t} - \bar{r}_{i,Avg})(\bar{r}_{j,t} - \bar{r}_{j,Avg})}{\sqrt{\sum_{t=1}^{n} (\bar{r}_{i,t} - \bar{r}_{i,Avg})^2 \sum_{t=1}^{n} (\bar{r}_{j,t} - \bar{r}_{j,Avg})^2}}.$$

$$\text{COV}_{iM} = \rho_{iM}\sigma_i\sigma_M.$$

$$b_i = \left(\frac{\sigma_i}{\sigma_M}\right)\rho_{iM} = \frac{\text{COV}_{iM}}{\sigma_M^2}.$$

$$b_p = \sum_{i=1}^{n} w_i b_i.$$

Required return on stock market $= r_M$.

Market risk premium $= RP_M = r_M - r_{RF}$.

$$RP_i = (r_M - r_{RF})b_i = (RP_M)b_i.$$

$$\text{SML} = r_i = r_{RF} + (r_M - r_{RF})b_i = r_{RF} + RP_M b_i.$$

Chapter 7

$$\hat{r}_p = w_A\hat{r}_A + (1 - w_A)\hat{r}_B.$$

$$\text{Portfolio SD} = \sigma_p = \sqrt{w_A^2\sigma_A^2 + (1 - w_A)^2\sigma_B^2 + 2w_A(1 - w_A)\rho_{AB}\sigma_A\sigma_B}.$$

$$\text{Minimum} = \text{risk portfolio: } w_A = \frac{\sigma_B(\sigma_B - \rho_{AB}\sigma_A)}{\sigma_A^2 + \sigma_B^2 - 2\rho_{AB}\sigma_A\sigma_B}.$$

$$\hat{r}_p = \sum_{i=1}^{N}(w_i\hat{r}_i).$$

$$\sigma_p^2 = \sum_{i=1}^{N}\sum_{j=1}^{N}(w_i w_j \sigma_i \sigma_j \rho_{ij}).$$

$$\sigma_p^2 = \sum_{i=1}^{N} w_i \sigma_i^2 + \sum_{i=1}^{N}\sum_{\substack{j=1 \\ j \neq i}}^{N} 2w_i\sigma_i w_j\sigma_j\rho_{ij}.$$

$$\sigma_p = \sqrt{(1 - w_{RF})^2\sigma_M^2} = (1 - w_{RF})\sigma_M.$$

$$\text{CML: } \hat{r}_p = r_{RF} + \left(\frac{\hat{r}_M - r_{RF}}{\sigma_M}\right)\sigma_p.$$

$$r_i = r_{RF} + \frac{(r_M - r_{RF})}{\sigma_M}\left(\frac{\text{Cov}(r_i, r_M)}{\sigma_M}\right) = r_{RF} + (r_M - r_{RF})\left(\frac{\text{Cov}(r_i, r_M)}{\sigma_M^2}\right).$$

$$b_i = \frac{\text{Covariance between Stock i and the market}}{\text{Variance of market returns}}$$

$$= \frac{\text{Cov}(r_i, r_M)}{\sigma_M^2} = \frac{\rho_{iM}\sigma_i\sigma_M}{\sigma_M^2} = \rho_{iM}\left(\frac{\sigma_i}{\sigma_M}\right).$$

$$SML = r_i = r_{RF} + (r_M - r_{RF})b_i = r_{RF} + (RP_M)b_i.$$

$$\sigma_i^2 = b_i^2\sigma_M^2 + \sigma_{e_i}^2.$$

$$r_i = r_{RF} + (r_1 - r_{RF})b_{i1} + \cdots + (r_j - r_{RF})b_{ij}.$$

$$r_i = r_{RF} + a_i + b_i(r_M - r_{RF}) + c_i(r_{SMB}) + d_i(r_{HML}).$$

Chapter 8

$$\hat{P}_0 = \text{PV of expected future dividends} = \sum_{t=1}^{\infty} \frac{D_t}{(1 + r_s)^t}.$$

$$\hat{P}_0 = \frac{D_0(1 + g)}{r_s - g} = \frac{D_1}{r_s - g}.$$

$$\hat{r}_s = \frac{D_1}{P_0} + g.$$

$$\text{Capital gains yield} = \frac{\hat{P}_1 - P_0}{P_0}.$$

$$\text{Dividend yield} = \frac{D_1}{P_0}.$$

$$\text{For a zero growth stock, } \hat{P}_0 = \frac{D}{r_s}.$$

$$\text{Horizon value} = \hat{P}_N = \frac{D_{N+1}}{r_s - g}.$$

$$V_p = \frac{D_p}{r_p}.$$

$$\hat{r}_p = \frac{D_p}{V_p}.$$

$$\bar{r}_s = \text{Actual dividend yield} + \text{Actual capital gains yield}.$$

Chapter 9

$$\text{Exercise value} = \text{Current price of stock} - \text{Strike price}.$$

$$\text{Number of stock shares in hedged portfolio} = N = \frac{C_u - C_d}{P_u - P_d}.$$

$$V = P[N(d_1)] - Xe^{-r_{RF}t}[N(d_2)].$$

$$d_1 = \frac{\ln(P/X) + [r_{RF} + (\sigma^2/2)]t}{\sigma\sqrt{t}}.$$

$$d_2 = d_1 - \sigma\sqrt{t}.$$

Chapter 10

After-tax component cost of debt = $r_d(1 - T)$.

$$M(1 - F) = \sum_{t=1}^{N} \frac{INT(1 - T)}{[1 + r_d(1 - T)]^t} + \frac{M}{[1 + r_d(1 - T)]^N}.$$

$$r_{ps} = \frac{D_{ps}}{P_{ps}(1 - F)}.$$

$$\text{Market equilibrium: Expected rate of return} = \hat{r}_M = \frac{D_1}{P_0} + g = r_{RF} + RP_M$$
$$= r_M = \text{Required rate of return.}$$

CAPM: $r_s = r_{RF} + b_i\,(RP_M)$.

$$\text{DCF: } r_s = \hat{r}_s = \frac{D_1}{P_0} + \text{Expected } g.$$

Bond-yield-plus risk-premium: r_s = Bond yield + Bond risk premium.

g = (Retention rate)(ROE) = (1.0 − Payout rate)(ROE).

$$r_e = \hat{r}_e = \frac{D_1}{P_0(1 - F)} + g.$$

$$\text{WACC} = w_d\, r_d(1 - T) + w_{ps}\, r_{ps} + w_{ce} r_s.$$

Chapter 11

$$\text{NPV} = CF_0 + \frac{CF_1}{(1 + r)^1} + \frac{CF_2}{(1 + r)^2} + \cdots + \frac{CF_N}{(1 + r)^N}$$
$$= \sum_{t=0}^{N} \frac{CF_t}{(1 + r)^t}.$$

$$\text{IRR: } CF_0 + \frac{CF_1}{(1 + IRR)^1} + \frac{CF_2}{(1 + IRR)^2} + \cdots + \frac{CF_N}{(1 + IRR)^N} = 0.$$

$$\text{NPV} = \sum_{t=0}^{n} \frac{CF_t}{(1 + IRR)^t} = 0.$$

MIRR: PV of costs = PV of terminal value.

$$\sum_{t=0}^{N} \frac{COF_t}{(1+r)^t} = \frac{\sum_{t=0}^{N} CIF_t(1+r)^{N-t}}{(1+MIRR)^N}.$$

$$\text{PV of costs} = \frac{\text{Terminal value}}{(1+MIRR)^N}.$$

$$PI = \frac{\text{PV of future cash flows}}{\text{Initial cost}} = \frac{\sum_{t=1}^{N} \frac{CF_t}{(1+r)^t}}{CF_0}.$$

$$\text{Payback} = \begin{array}{c}\text{Number of}\\ \text{years prior to}\\ \text{full recovery}\end{array} + \frac{\begin{array}{c}\text{Unrecovered cost}\\ \text{at start of year}\end{array}}{\begin{array}{c}\text{Cash flow during}\\ \text{full recovery year}\end{array}}.$$

Chapter 12

$$FCF = \begin{array}{c}\text{Investment outlay}\\ \text{cash flow}\end{array} + \begin{array}{c}\text{Operating}\\ \text{cash flow}\end{array} + \begin{array}{c}\text{NOWC}\\ \text{cash flow}\end{array} + \begin{array}{c}\text{Salvage}\\ \text{cash flow}\end{array}.$$

$$NPV = \sum_{t=0}^{N} \frac{NCF_t}{(1+r_{NOM})^t} = \sum_{t=0}^{N} \frac{RCF_t(1+i)^t}{(1+r_r)^t(1+i)^t} = \sum_{t=0}^{N} \frac{RCF_t}{(1+r_r)^t}.$$

$$\text{Expected NPV} = \sum_{i=1}^{n} P_i(NPV_i).$$

$$\sigma_{NPV} = \sqrt{\sum_{i=1}^{n} P_i(NPV_i - \text{Expected NPV})^2}.$$

$$CV_{NPV} = \frac{\sigma_{NPV}}{E(NPV)}.$$

Chapter 13

$$CV = \frac{\sigma(\text{PV of future CF})}{E(\text{PV of future CF})}.$$

$$\text{Variance of project's rate of return: } \sigma^2 = \frac{\ln(CV^2+1)}{t}.$$

Chapter 14

$$\begin{array}{c}\text{Additional}\\ \text{funds}\\ \text{needed}\end{array} = \begin{array}{c}\text{Required}\\ \text{asset}\\ \text{increase}\end{array} - \begin{array}{c}\text{Spontaneous}\\ \text{liability}\\ \text{increase}\end{array} - \begin{array}{c}\text{Increase in}\\ \text{retained}\\ \text{earnings}\end{array}$$

$$\text{AFN} = (\text{A}^*/\text{S}_0)\Delta\text{S} - (\text{L}^*/\text{S}_0)\Delta\text{S} - \text{MS}_1(\text{RR}).$$

$$\begin{array}{c}\text{Full}\\ \text{capacity}\\ \text{sales}\end{array} = \frac{\text{Actual sales}}{\begin{array}{c}\text{Percentage of capacity}\\ \text{at which fixed assets}\\ \text{were operated}\end{array}}.$$

$$\frac{\text{Target fixed assets}}{\text{Sales}} = \frac{\text{Actual fixed assets}}{\text{Full capacity sales}}.$$

$$\text{Required level of fixed assets} = (\text{Target fixed assets/Sales})(\text{Projected sales}).$$

Chapter 15

$$\begin{aligned}\text{V}_{\text{op}} &= \text{Value of operations}\\ &= \text{PV of expected future free cash flows}\\ &= \sum_{t=1}^{\infty}\frac{\text{FCF}_t}{(1+\text{WACC})^t}.\end{aligned}$$

$$\text{Horizon value: } \text{V}_{\text{op(at time N)}} = \frac{\text{FCF}_{\text{N}+1}}{\text{WACC} - g} = \frac{\text{FCF}_{\text{N}}(1+g)}{\text{WACC} - g}.$$

$$\text{Total value} = \text{V}_{\text{op}} + \text{Value of nonoperating assets.}$$

$$\text{Value of equity} = \text{Total value} - \text{Preferred stock} - \text{Debt.}$$

$$\text{Operating profitability (OP)} = \text{NOPAT/Sales.}$$

$$\text{Capital requirements (CR)} = \text{Operating capital/Sales.}$$

$$\begin{aligned}\text{EROIC}_t &= \text{Expected return on invested capital}\\ &= \text{NOPAT}_{t+1}/\text{Capital}_t\\ &= \text{NOPAT}_t(1+g)/\text{Capital}_t.\end{aligned}$$

For constant growth:

$$V_{op(at\ time\ N)} = \text{Capital}_N + \left[\frac{\text{Sales}_N(1+g)}{\text{WACC}-g}\right]\left[\text{OP} - \text{WACC}\left(\frac{\text{CR}}{1+g}\right)\right]$$
$$= \text{Capital}_N + \frac{\text{Capital}_N(\text{EROIC}_N - \text{WACC})}{\text{WACC}-g}.$$

Chapter 16

$$V_{op} = \sum_{t=1}^{\infty} \frac{\text{FCF}_t}{(1+\text{WACC})^t}.$$

$$\text{WACC} = w_d(1-T)r_d + w_{ce}r_s.$$

$$\text{ROIC} = \frac{\text{NOPAT}}{\text{Capital}} = \frac{\text{EBIT}(1-T)}{\text{Capital}}.$$

$$\text{EBIT} = PQ - VQ - F.$$

$$Q_{BE} = \frac{F}{P-V}.$$

$$V_L = D + S.$$

MM, no taxes: $V_L = V_U$.

MM, corporate taxes: $V_L = V_U + TD$.

Miller, corporate and personal taxes: $V_L = V_U = \left[1 - \frac{(1-T_c)(1-T_s)}{(1-T_d)}\right]D.$

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

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

$$r_s = r_{RF} + RP_M(b).$$

$r_s = r_{RF}$ + Premium for business risk + Premium for financial risk.

If $g = 0$: $V_{op} = \frac{\text{FCF}}{\text{WACC}} = \frac{\text{EBIT}(1-T)}{\text{WACC}}.$

Total corporate value $= V_{op}$ + Value of short-term investments.

S = Total corporate value − Value of all debt.

$$D = w_d V_{op}.$$

$S = (1 - w_d)V_{op}$.

Cash raised by issuing debt $= D - D_0$.

$P_{Prior} = S_{Prior}/n_0$.

$P = P_{Prior}$.

$N - n_0 = (D - D_0)/P$.

$n = n_0 - (D - D_0)/P$.

$P = [S + (D - D_0)]/n_0$.

$NI = (EBIT - r_d D)(1 - T)$.

$EPS = NI/n$.

Chapter 17

MM, no taxes:

$$V_L = V_U = \frac{EBIT}{WACC} = \frac{EBIT}{r_{sU}}.$$

$$r_{sL} = r_{sU} + \text{Risk premium} = r_{sU} + (r_{sU} - r_d)(D/S).$$

MM, corporate taxes:

$$V_L = V_U + TD.$$

$$V_U = S = \frac{EBIT(1 - T)}{r_{sU}}.$$

$$r_{sL} = r_{sU} + (r_{sU} - r_d)(1 - T)(D/S).$$

Miller, personal taxes:

$$V_U = \frac{EBIT(1 - T_c)}{r_{sU}} = \frac{EBIT(1 - T_c)(1 - T_s)}{r_{sU}(1 - T_s)}.$$

$$CF_L = (EBIT - I)(1 - T_c)(1 - T_s) + I(1 - T_d).$$

$$V_L = V_U + \left[1 - \frac{(1 - T_c)(1 - T_s)}{(1 - T_d)}\right]D.$$

Ehrhardt & Daves, impact of growth:

$$V_U = \frac{FCF}{r_{sU} - g}.$$

General case:

$$V_L = V_U + V_{\text{Tax shield}}.$$

$$V_{\text{Tax shield}} = \frac{r_d TD}{r_{TS} - g}.$$

$$V_L = V_U + \left(\frac{r_d}{r_{TS} - g}\right)TD.$$

Case for $r_{TS} = r_{sU}$:

$$V_L = V_U + \left(\frac{r_d TD}{r_{sU} - g}\right).$$

$$r_{sL} = r_{sU} + (r_{sU} - r_d)\frac{D}{S}.$$

$$b = b_U + (b_U - b_D)\frac{D}{S}.$$

Chapter 18

Dividends = Net income − [(Target equity ratio)(Total capital budget)].

Chapter 19

Amount left on table = (Closing price − Offer price)(Number of shares).

Chapter 20

NAL = PV cost of owning − PV cost of leasing.

Chapter 21

$$\begin{array}{c}\text{Price paid for}\\ \text{bond with warrants}\end{array} = \begin{array}{c}\text{Straight-debt}\\ \text{value of bond}\end{array} + \begin{array}{c}\text{Value of}\\ \text{warrants}\end{array}.$$

$$\text{Conversion price} = P_c = \frac{\text{Par value of bond given up}}{\text{Shares received}}.$$

$$= \frac{\text{Par value of bond given up}}{\text{CR}}.$$

$$\text{Conversion ratio} = \text{CR} = \frac{\text{Par value of bond given up}}{P_c}.$$

Chapter 22

$$\text{Inventory conversion period} = \frac{\text{Inventory}}{\text{Sales}/365}.$$

$$\text{Receivables collection period} = \text{DSO} = \frac{\text{Receivables}}{\text{Sales}/365}.$$

$$\text{Payables deferral period} = \frac{\text{Payables}}{\text{Cost of goods sold}/365}.$$

$$\begin{matrix}\text{Inventory}\\ \text{conversion}\\ \text{period}\end{matrix} + \begin{matrix}\text{Average}\\ \text{collection}\\ \text{period}\end{matrix} - \begin{matrix}\text{Payables}\\ \text{deferral}\\ \text{period}\end{matrix} = \begin{matrix}\text{Cash}\\ \text{conversion}\\ \text{cycle}\end{matrix}.$$

$$\begin{matrix}\text{Accounts}\\ \text{receivable}\end{matrix} = \begin{matrix}\text{Credit sales}\\ \text{per day}\end{matrix} \times \begin{matrix}\text{Length of}\\ \text{collection period}\end{matrix}.$$

$$\text{ADS} = \frac{(\text{Units sold})(\text{Sales price})}{365} = \frac{\text{Annual sales}}{365}.$$

$$\text{Receivables} = (\text{ADS})(\text{DSO}).$$

$$\begin{matrix}\text{Nominal annual cost}\\ \text{of trade credit}\end{matrix} = \frac{\text{Discount\%}}{100 - \text{Discount\%}} \times \frac{365}{\begin{matrix}\text{Days credit is}\\ \text{outstanding}\end{matrix} - \begin{matrix}\text{Discount}\\ \text{period}\end{matrix}}.$$

Chapter 25

$$r_{sL} = r_{sU} + (r_{sU} - r_d)(D/S).$$

$$r_{sU} = w_s r_{sL} + w_d r_d.$$

$$\text{Tax savings} = (\text{Interest expense})(\text{Tax rate}).$$

$$\text{Horizon value of unlevered firm } (HV_{U,N}) = \frac{FCF_{N+1}}{r_{sU} - g} = \frac{FCF_N(1 + g)}{r_{sU} - g}.$$

$$\begin{matrix}\text{Horizon value of}\\ \text{tax shield } (HV_{TS,N})\end{matrix} = \frac{TS_{N+1}}{r_{sU} - g} = \frac{TS_N(1 + g)}{r_{sU} - g}.$$

$$V_{\text{Unlevered}} = \sum_{t=1}^{N} \frac{FCF_t}{(1 + r_{sU})^t} + \frac{HV_{U,N}}{(1 + r_{sU})^N}.$$

$$V_{\text{Tax shield}} = \sum_{t=1}^{N} \frac{TS_t}{(1 + r_{sU})^t} + \frac{HV_{TS,N}}{(1 + r_{sU})^N}.$$

$$V_{Operations} = V_{Unlevered} + V_{Tax\ shield}.$$

$$\text{FCFE} = \begin{matrix}\text{Free}\\ \text{cash flow}\end{matrix} - \begin{matrix}\text{After-tax}\\ \text{interest expense}\end{matrix} - \begin{matrix}\text{Principal}\\ \text{payments}\end{matrix} + \begin{matrix}\text{Newly issued}\\ \text{debt}\end{matrix}$$

$$= \begin{matrix}\text{Free}\\ \text{cash flow}\end{matrix} - \begin{matrix}\text{Interest}\\ \text{expense}\end{matrix} + \begin{matrix}\text{Interest}\\ \text{tax shield}\end{matrix} + \begin{matrix}\text{Net change}\\ \text{in debt}\end{matrix}.$$

$$HV_{FCFE,N} = \frac{FCFE_{N+1}}{r_{sL} - g} = \frac{FCFE_N(1 + g)}{r_{sL} - g}.$$

$$V_{FCFE} = \sum_{t=1}^{N} \frac{FCFE_t}{(1 + r_{sL})^t} + \frac{HV_{FCFE,N}}{(1 + r_{sL})^N}.$$

$$S = V_{FCFE} + \text{Nonoperating assets}.$$

Chapter 26

$$\frac{\text{Forward exchange rate}}{\text{Spot exchange rate}} = \frac{(1 + r_h)}{(1 + r_f)}.$$

$$P_h = (P_f)(\text{Spot rate}).$$

$$\text{Spot rate} = \frac{P_h}{P_f}.$$

appendix d

Values of the Areas under the Standard Normal Distribution Function

Table A-1 Values of the Areas under the Standard Normal Distribution Function

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4773	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4982	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990