Solutions to Self-Test Questions and Problems

Note: Except for Chapter 1, we do not show an answer for ST-1 problems because they are verbal rather than quantitative in nature.

CHAPTER 1

ST-1 Refer to the marginal glossary definitions or relevant chapter sections to check your responses.

CHAPTER 2

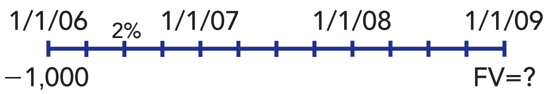
ST-2 a.

$1,000 is being compounded for 3 years, so your balance on January 1, 2009, 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.

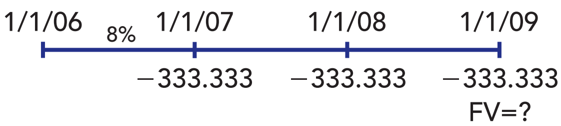
b.



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

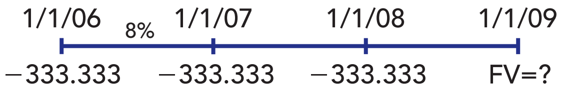
Alternatively, using a financial calculator, input N = 12, I/YR = 2, PV = −1000, PMT = 0, and FV = ? Solve for FV = $1,268.24.

c.



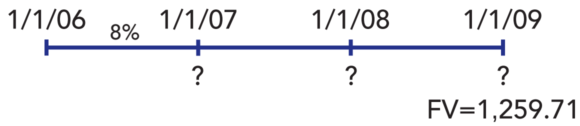
Using a financial calculator, input N = 3, I/YR = 8, PV = 0, PMT = −333.333, and FV = ? Solve for FV = $1,082.13.

d.



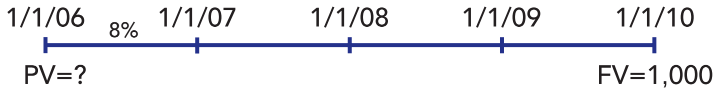
Using a financial calculator in begin mode, input N = 3, I/YR = 8, PV = 0, PMT = −333.333, and FV = ? Solve for FV = $1,168.70.

e.



Using a financial calculator, input N = 3, I/YR = 8, PV = 0, FV = 1259.71, and PMT = ? Solve for PMT = −$388.03. Therefore, you would have to make 3 payments of $388.03 each beginning on January 1, 2007.

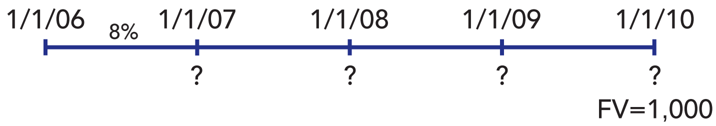
ST-3 a. Set up a time line like the one in the preceding problem:



Note that your deposit will grow for 4 years at 8 percent. The deposit on January 1, 2006, is the PV, and the FV is $1,000. Using a financial calculator, input N = 4, I/YR = 8, PMT = 0, FV = 1000, and PV = ? Solve for PV = −$735.03.

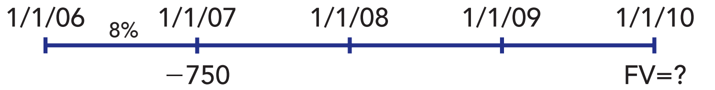
$$PV = \frac{FV_N}{(1 + I)^N} = \frac{\$1{,}000}{(1.08)^4} = \$735.03$$

b.



Here we are dealing with a 4-year annuity whose first payment occurs 1 year from today, on 1/1/07, and whose future value must equal $1,000. You should modify the time line to help visualize the situation. Using a financial calculator, input N = 4, I/YR = 8, PV = 0, FV = 1000, and PMT = ? Solve for PMT = −$221.92.

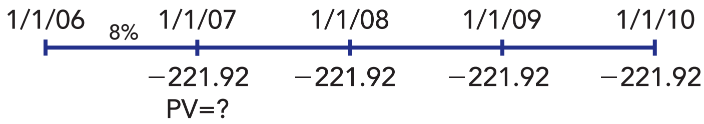
c. This problem can be approached in several ways. Perhaps the simplest is to ask this question: "If I received $750 on 1/1/07 and deposited it to earn 8 percent, would I have the required $1,000 on 1/1/10?" The answer is no.



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

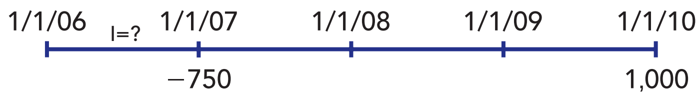
This indicates that you should let your father make the payments of $221.92 rather than accept the lump sum of $750.

You could also compare the $750 with the PV of the payments as shown here:

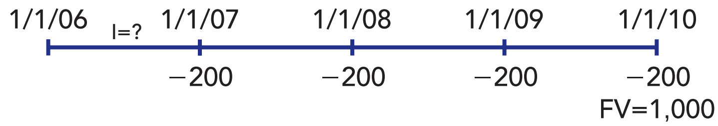


Using a financial calculator, input N = 4, I/YR = 8, PMT = −221.92, FV = 0, and PV = ? Solve for PV = $735.03.

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 $735.03 PV of the annuity, you were finding the value of the annuity *today*, on January 1, 2006. You were comparing $735.03 today with the lump sum of $750 one year from now. This is, of course, invalid. What you should have done was take the $735.03, recognize that this is the PV of an annuity as of January 1, 2006, multiply \$735.03 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 of \$221.92 rather than take the lump sum on January 1, 2007.

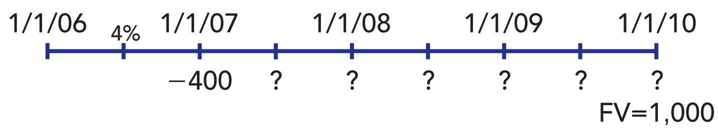
d.


Using a financial calculator, input N = 3, PV = −750, PMT = 0, FV = 1000, and I/YR = ? Solve for I/YR = 10.0642%.

e.


Using a financial calculator, input N = 4, PV = 0, PMT = −200, FV = 1000, and I/YR = ? Solve for I/YR = 15.09%.

You might be able to find a borrower willing to offer you a 15 percent 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:

$$FV_6 = PV(1.04)^6 = \$400(1.2653) = \$506.13$$

This means that on January 1, 2010, you need an additional sum of \$493.87:

$$\$1{,}000.00 - \$506.13 = \$493.87$$

This will be accumulated by making 6 equal payments that earn 8 percent compounded semiannually, or 4 percent each 6 months. Using a financial calculator, input N = 6, I/YR = 4, PV = 0, FV = 493.87, and PMT = ? Solve for PMT = −\$74.46.

Alternatively, input N = 6, I/YR = 4, PV = −400, FV = 1000, and PMT = ? Solve for PMT = −\$74.46.

g.
$$\text{Effective annual rate} = \left(1 + \frac{I_{NOM}}{M}\right)^M - 1.0$$
$$= \left(1 + \frac{0.08}{2}\right)^2 - 1 = (1.04)^2 - 1$$
$$= 1.0816 - 1 = 0.0816 = 8.16\%$$
$$\text{APR} = I_{PER} \times M$$
$$= 0.04 \times 2 = 0.08 = 8\%$$

ST-4 Bank A's effective annual rate is 8.24 percent:

$$\text{Effective annual rate} = \left(1 + \frac{0.08}{4}\right)^4 - 1.0$$
$$= (1.02)^4 - 1 = 1.0824 - 1$$
$$= 0.0824 = 8.24\%$$

Now Bank B must have the same effective annual rate:

$$\left(1 + \frac{I_{NOM}}{12}\right)^{12} - 1.0 = 0.0824$$
$$\left(1 + \frac{I_{NOM}}{12}\right)^{12} = 1.0824$$

$$1 + \frac{I_{NOM}}{12} = (1.0824)^{1/12}$$

$$1 + \frac{I_{NOM}}{12} = 1.00662$$

$$\frac{I_{NOM}}{12} = 0.00662$$

$$I_{NOM} = 0.07944 = 7.94\%$$

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

CHAPTER 3

ST-2

a.

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

b. NCF = NI + DEP and AMORT
= \$2,400,000 + \$1,000,000 = \$3,400,000

c. NOPAT = EBIT(1 − T)
= \$5,000,000(0.6)
= \$3,000,000

d. OCF = NOPAT + DEP and AMORT
= EBIT(1 − T) + DEP and AMORT
= \$5,000,000(0.6) + \$1,000,000
= \$4,000,000

e. NOWC = Current assets − Non-interest-bearing current liabilities
= \$14,000,000 − \$4,000,000
= \$10,000,000

f. Operating capital_{BOY} = \$24,000,000

Operating capital_{EOY} = NOWC + Net fixed assets
= \$10,000,000 + \$15,000,000
= \$25,000,000

Δ in Operating capital = \$25,000,000 − \$24,000,000
= \$1,000,000

Note that the investment in operating capital must include depreciation so the investment is calculated as follows:

Investment in operating capital = \$1,000,000 + \$1,000,000
= \$2,000,000

FCF = Operating cash flow − Investment in operating capital
= \$4,000,000 − \$2,000,000
= \$2,000,000

g. Retained earnings at the end of the year can be calculated as follows:

Balance of retained earnings_{BOY}	\$4,500,000
Add: Net income*	2,400,000
Less: Common dividends	1,200,000
Balance of retained earnings_{EOY}	\$5,700,000

*Net income was calculated in part a.

CHAPTER 4

ST-2 Billingsworth paid $2 in dividends and retained $2 per share. Because 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 Billingsworth has $120 million of debt, its debt ratio must be 33.3 percent:

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

ST-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) $$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} = 3.0$$
$$= \frac{\text{Current assets}}{\$105.5} = 3.0$$
$$\text{Current assets} = 3.0(\$105.5) = \$316.5 \text{ million}$$

(3) $$\text{Total assets} = \text{Current assets} + \text{Fixed assets}$$
$$= \$316.5 + \$283.5 = \$600 \text{ million}$$

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

(5) $$\text{ROE} = \text{ROA} \times \frac{\text{Assets}}{\text{Equity}}$$
$$12.0\% = 8.3333\% \times \frac{\$600}{\text{Equity}}$$
$$\text{Equity} = \frac{(8.3333\%)(\$600)}{12.0\%}$$
$$= \$416.67 \text{ million}$$

(6) $$\text{Current assets} = \text{Cash and equivalents} + \text{Accounts receivable} + \text{Inventories}$$
$$\$316.5 = \$100.0 + \$111.1 + \text{Inventories}$$
$$\text{Inventories} = \$105.4 \text{ million}$$
$$\text{Quick ratio} = \frac{\text{Current assets} - \text{Inventories}}{\text{Current liabilities}}$$
$$= \frac{\$316.5 - \$105.4}{\$105.5} = 2.00$$

(7) Total assets = Total claims = \$600 million

$$\text{Current liabilities} + \text{Long-term debt} + \text{Equity} = \$600 \text{ million}$$

$$\$105.5 + \text{Long-term debt} + \$416.67 = \$600 \text{ million}$$

$$\text{Long-term debt} = \$600 - \$105.5 - \$416.67 = \$77.83 \text{ million}$$

Note: We could have found equity as follows:

$$\text{ROE} = \frac{\text{Net income}}{\text{Equity}}$$

$$12.0\% = \frac{\$50}{\text{Equity}}$$

$$\text{Equity} = \$50/0.12$$

$$= \$416.67 \text{ million}$$

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

b. Kaiser's average sales per day were \$1,000/365 = \$2.74 million. Its DSO was 40.55, so A/R = 40.55(\$2.74) = \$111.1 million. Its new DSO of 30.4 would cause A/R = 30.4(\$2.74) = \$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) New equity = Old equity − Stock bought back

$$= \$416.7 - \$27.8$$

$$= \$388.9 \text{ million}$$

Thus,

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

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

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

(2)

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

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

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

(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 6

ST-2 a. Average inflation over 4 years = (2% + 2% + 2% + 4%)/4 = 2.5%

b.
$$\begin{aligned} T_4 &= r_{RF} + MRP_4 \\ &= r^* + IP_4 + MRP_4 \\ &= 3\% + 2.5\% + (0.1)3\% \\ &= 5.8\% \end{aligned}$$

c.
$$\begin{aligned} C_{4,\ BBB} &= r^* + IP_4 + MRP_4 + DRP + LP \\ &= 3\% + 2.5\% + 0.3\% + 1.3\% + 0.5\% \\ &= 7.6\% \end{aligned}$$

d.
$$\begin{aligned} T_8 &= r^* + IP_8 + MRP_8 \\ &= 3\% + (3 \times 2\% + 5 \times 4\%)/8 + 0.7\% \\ &= 3\% + 3.25\% + 0.7\% \\ &= 6.95\% \end{aligned}$$

e.
$$\begin{aligned} C_{8,\ BBB} &= r^* + IP_8 + MRP_8 + DRP + LP \\ &= 3\% + 3.25\% + 0.7\% + 1.3\% + 0.5\% \\ &= 8.75\% \end{aligned}$$

f.
$$\begin{aligned} T_9 &= r^* + IP_9 + MRP_9 \\ 7.3\% &= 3\% + IP_9 + 0.8\% \\ IP_9 &= 3.5\% \\ 3.5\% &= (3 \times 2\% + 5 \times 4\% + X)/9 \\ 31.5\% &= 6\% + 20\% + X \\ 5.5\% &= X \\ X &= \text{Inflation in Year 9} = 5.5\% \end{aligned}$$

ST-3 $T_1 = 6\%$; $T_2 = 6.2\%$; $T_3 = 6.3\%$; MRP = 0

a. Yield of 1-year security, 1 year from now is calculated as follows:

$$\begin{aligned} 2 \times 6.2\% &= 6\% + X \\ 12.4\% &= 6\% + X \\ 6.4\% &= X \end{aligned}$$

b. Yield of 1-year security, 2 years from now is calculated as follows:

$$\begin{aligned} 3 \times 6.3\% &= 2 \times 6.2\% + X \\ 18.9\% &= 12.4\% + X \\ 6.5\% &= X \end{aligned}$$

c. Yield of 2-year security, 1 year from now is calculated as follows:

$$\begin{aligned} 3 \times 6.3\% &= 6\% + 2X \\ 18.9\% &= 6\% + 2X \\ 12.9\% &= 2X \\ 6.45\% &= X \end{aligned}$$

CHAPTER 7

ST-2 a. Pennington's bonds were sold at par; therefore, the original YTM equaled the coupon rate of 12 percent.

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

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. Current yield = Annual coupon payment/Price

= $120/$1,182.56

= 0.1015 = 10.15%

Capital gains yield = Total yield – Current yield

= 10% – 10.15% = –0.15%

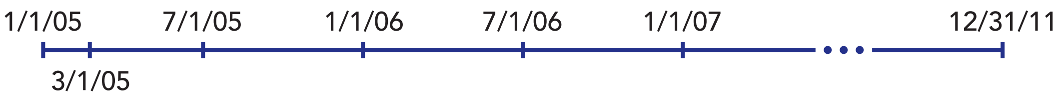
Total return = 10%

d. 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 = YTM = 14.00%.

Current yield = $120/$916.42 = 13.09%

Capital gains yield = 14% – 13.09% = 0.91%

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



Thus, on March 1, 2005, there were $13\frac{2}{3}$ 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, 2005. 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 (March 1, 2005): 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 $875.11 to complete the transaction. Of this amount, ($\frac{1}{3}$)($60) = $20 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, such as the HP-12C or the HP-17BII. This is explained in the calculator manual under the heading "Bond Calculations."

ST-3 a. (1) $100,000,000/10 = $10,000,000 per year, or $5 million each 6 months. Because the $5 million will be used to retire bonds immediately, no interest will be earned on it.

(2) VDC will purchase bonds on the open market if they're selling at less than par. So, the sinking fund payment will be less than $5,000,000 each period.

b. The debt service requirements will decline. As the amount of bonds outstanding declines, so will the interest requirements (amounts given in millions of dollars). If the bonds are called at par, the total bond service payments are calculated as follows:

Semiannual Payment Period (1)	Sinking Fund Payment (2)	Outstanding Bonds on Which Interest Is Paid (3)	Interest Payment[a] (4)	Total Bond Service (2) + (4) = (5)
1	$5	$100	$6.0	$11.0
2	5	95	5.7	10.7
3	5	90	5.4	10.4
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
20	5	5	0.3	5.3

[a] Interest is calculated as (0.5)(0.12)(Column 3); for example: Interest in Period 2 = (0.5)(0.12)($95) = $5.7.

The company's total cash bond service requirement will be $21.7 million per year for the first year. For both options, interest will decline by 0.12($10,000,000) = $1,200,000 per year for the remaining years. The total debt service requirement for the open market purchases cannot be precisely determined, but the amounts would be less than what's shown in Column 5 of the table above.

c. Here we have a 10-year, 7 percent annuity whose compound value is $100 million, and we are seeking the annual payment, PMT. The solution can be obtained with a financial calculator. Input N = 10, I/YR = 7, PV = 0, and FV = 100000000, and press the PMT key to obtain $7,237,750. This amount is not known with certainty as interest rates over time will change, so the amount could be higher (if interest rates fall) or lower (if interest rates rise).

d. Annual debt service costs will be $100,000,000(0.12) + $7,237,750 = $19,237,750.

e. If interest rates rose, causing the bond's price to fall, the company would use open market purchases. This would reduce its debt service requirements.

CHAPTER 8

ST-2 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

$$\begin{aligned} r_{\text{Avg A}} &= (-24.25\% + 18.50\% + 38.67\% + 14.33\% + 39.13\%)/5 \\ &= 17.28\% \end{aligned}$$

The average return for Stock B is

$$\begin{aligned} r_{\text{Avg B}} &= (5.50\% + 26.73\% + 48.25\% + -4.50\% + 43.86\%)/5 \\ &= 23.97\% \end{aligned}$$

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(% of Stock A) + r_B(% of Stock B) and then averaging these annual returns:

Year	Portfolio AB's Return, r_{AB}
2001	(9.38%)
2002	22.62
2003	43.46
2004	4.92
2005	41.50
	r_{Avg} = 20.62%

b. The standard deviation of returns is estimated, using Equation 8-3a, as follows:

$$\text{Estimated } \sigma = S = \sqrt{\frac{\sum_{t=1}^{N}(\bar{r}_t - \bar{r}_{Avg})^2}{N-1}} \qquad \textbf{(8-3a)}$$

For Stock A, the estimated σ is 25.84 percent:

$$\sigma_A = \sqrt{\frac{(-24.25\% - 17.25\%)^2 + (18.50\% - 17.28\%)^2 + (38.67\% - 17.28\%)^2 + (14.33\% - 17.28\%)^2 + (39.13\% - 17.28\%)^2}{5 - 1}}$$

$$= 25.84\%$$

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	25.84%	23.15%	22.96%

c. Because the risk reduction from diversification is small (σ_{AB} falls only to 22.96 percent), 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 0.76.

d. If more randomly selected stocks were added to a portfolio, σ_p would decline to somewhere in the vicinity of 20 percent; see Figure 8-8. 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-3 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. $r_{RF} = 6\%;\ RP_M = 5\%;\ b = 0.85$

$r = 6\% + (5\%)(0.85)$

$= 10.25\%$

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 9

ST-2 a. This is not necessarily true. Because G plows back two-thirds of its earnings, its growth rate should exceed that of D, but D pays higher dividends ($3 versus $1). We cannot say which stock should have the higher price.

b. Again, we just do not know which price would be higher.

c. This is false. The changes in r_d and r_s would have a greater effect on G; its price would decline more.

d. The total expected return for D is $\hat{r}_D = D_1/P_0 + g = 12\% + 0\% = 12\%$. The total expected return for G will have $D_1/P_0 < 12\%$ and $g > 0\%$, but $\hat{r}_G$ should be neither greater nor smaller than D's total expected return, 12 percent, because the two stocks are stated to be equally risky.

e. We have eliminated a, b, c, and d, so e should be correct. On the basis of the available information, D and G should sell at about the same price, $25; thus, $\hat{r}_s = 12\%$ for both D and G. G's current dividend yield is $1/$25 = 4%. Therefore, $g = 12\% - 4\% = 8\%$.

ST-3 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 percent:

$$\$4.32 - \$36g = \$2.40 + \$2.40g$$
$$\$38.4g = \$1.92$$
$$g = 0.05 = 5\%$$

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

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

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

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

ST-4 a. (1) Calculate the PV of the dividends paid during the supernormal growth period:

$$D_1 = \$1.1500(1.15) = \$1.3225$$
$$D_2 = \$1.3225(1.15) = \$1.5209$$
$$D_3 = \$1.5209(1.13) = \$1.7186$$
$$\text{PV D} = \frac{\$1.3225}{1.12} + \frac{\$1.5209}{(1.12)^2} + \frac{\$1.7186}{(1.12)^3}$$
$$= \$1.1808 + \$1.2125 + \$1.2233$$
$$= \$3.6166 \approx \$3.62$$

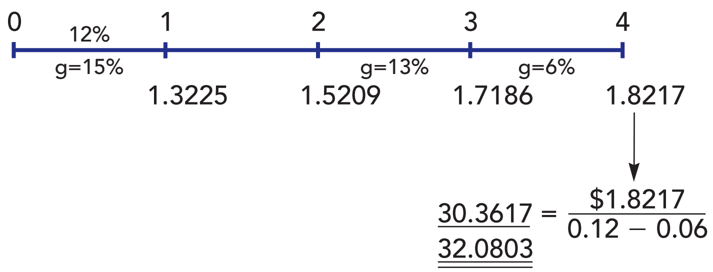
(2) Find the PV of the firm's stock price at the end of Year 3:

$$\hat{P}_3 = \frac{D_4}{r_s - g} = \frac{D_3(1+g)}{r_s - g}$$
$$= \frac{\$1.7186(1.06)}{0.12 - 0.06}$$
$$= \$30.36$$
$$\text{PV } \hat{P}_3 = \frac{\$30.36}{(1.12)^3} = \$21.61$$

(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 and I/YR = 12, and press the NPV key to obtain $P_0 = \$25.23$.

b. $$\hat{P}_1 = \frac{\$1.5209}{1.12} + \frac{\$1.7186}{(1.12)^2} + \frac{\$30.36}{(1.12)^2}$$
$$= \$1.3579 + \$1.3701 + \$24.2028$$
$$= \$26.9308 \approx \$26.93$$

(Calculator solution: \$26.93)

$$\hat{P}_2 = \frac{\$1.7186}{1.12} + \frac{\$30.36}{1.12}$$
$$= \$1.5345 + \$27.1071$$
$$= \$28.6416 \approx \$28.64$$

(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 10

ST-2 a. Component costs are as follows:

Common: $$r_s = \frac{D_1}{P_0} + g = \frac{D_0(1+g)}{P_0} + g$$
$$= \frac{\$3.60(1.09)}{\$54} + 0.09$$
$$= 0.0727 + 0.09 = 16.27\%$$

Preferred: $$r_p = \frac{\text{Preferred dividend}}{P_p} = \frac{\$11}{\$95} = 11.58\%$$

Debt at r_d = 12%: $r_d(1 - T) = 12\%(0.6) = 7.20\%$

b. WACC calculation:

$$\text{WACC} = w_d r_d(1 - T) + w_p r_p + w_c r_s$$
$$= 0.25(7.2\%) + 0.15(11.58\%) + 0.60(16.27\%) = 13.30\%$$

c. LEI should accept Projects A, B, C, and D. It should reject Project E because its rate of return does not exceed the WACC of funds needed to finance it.

CHAPTER 11

ST-2 a. *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/YR = 12, and then press the NPV key to obtain NPV_X = \$966.01 and 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:

$$MIRR_X = 14.61\%$$

$$MIRR_Y = 13.73\%$$

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

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

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

Discounted payback:
To determine the discounted payback, construct the cumulative discounted cash flows at the firm's WACC of 12 percent for each project:

Project X

Years	0	1	2	3	4
Cash flow	−10,000	6,500	3,000	3,000	1,000
Discounted cash flow	−10,000	5,803.57	2,391.58	2,135.34	635.52
Cumulative discounted cash flow	−10,000	−4,196.43	−1,804.85	+330.49	+966.01

$$\text{Discounted Payback}_X = 2 + \$1{,}804.85/\$2{,}135.34 = 2.85 \text{ years}$$

Project Y

Years	0	1	2	3	4
Cash flow	−10,000	3,500	3,500	3,500	3,500
Discounted cash flow	−10,000	3,125.00	2,790.18	2,491.23	2,224.31
Cumulative discounted cash flow	−10,000	−6,875.00	−4,084.82	−1,593.59	+630.72

$$\text{Discounted Payback}_Y = 3 + \$1{,}593.59/\$2{,}224.31 = 3.72 \text{ years}$$

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

	Project That Ranks Higher
NPV	X
IRR	X
MIRR	X
Payback	X
Discounted payback	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.

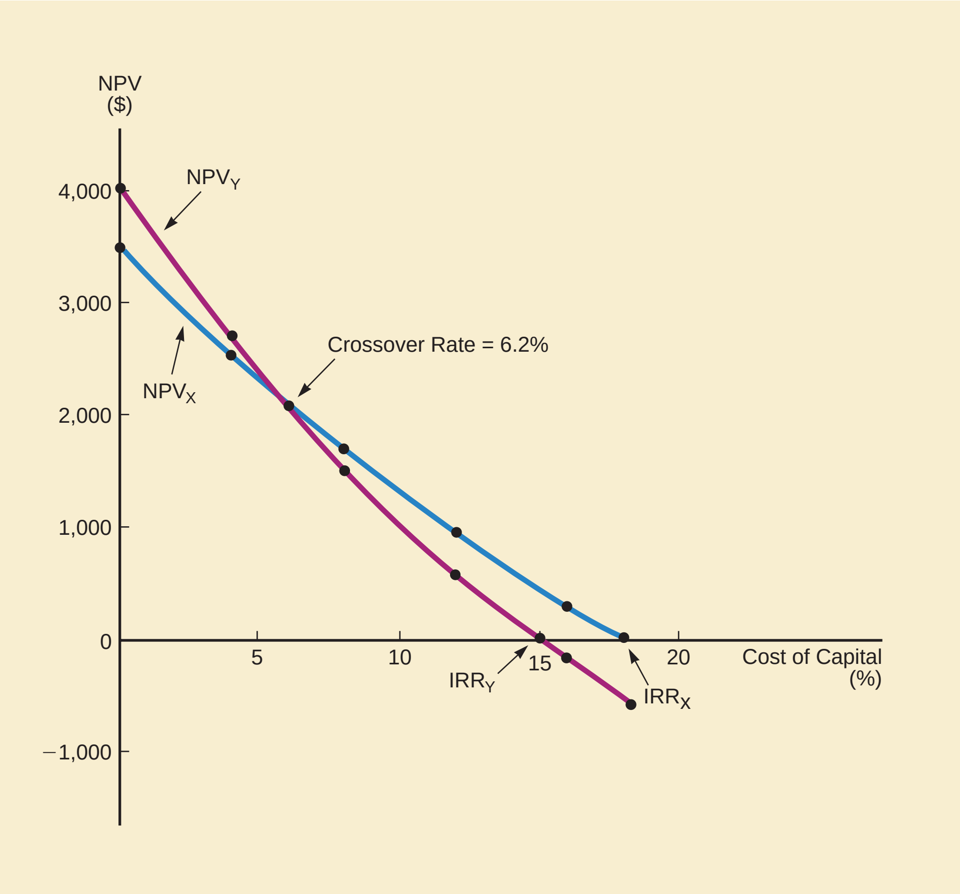
c. In this case, we would choose the project with the higher NPV at r = 12%, or Project X.

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 percent (6.2 percent). See the accompanying graph.

If the firm's cost of capital is less than 6.2 percent, a conflict exists because $NPV_Y > NPV_X$, but $IRR_X > IRR_Y$. Therefore, if r were 5 percent, 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.

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.

NPV Profiles for Projects X and Y



Cost of Capital	NPV_X	NPV_Y
0%	$3,500	$4,000
4	2,545	2,705
8	1,707	1,592
12	966	631
16	307	(206)
18	5	(585)

CHAPTER 12

ST-2 a. Estimated investment requirements:

Price	($55,000)
Installation	(10,000)
Change in net operating working capital	(2,000)
Total investment	($67,000)

b. Depreciation schedule:
Equipment cost = $65,000; MACRS 3-year class

	YEARS		
	1	2	3
MACRS depreciation rates	33%	45%	15%
Equipment depreciation expense	$21,450	$29,250	$9,750

Note that the remaining book value of the equipment at the end of the project's life is 0.07 × $65,000 = $4,550.

c. Terminal cash flow:

Salvage value	$10,000
Tax on salvage value[a]	(2,180)
Net operating working capital recovery	2,000
Termination cash flow	$ 9,820

[a] Sales price	$10,000
Less book value	4,550
Taxable income	$ 5,450
Tax at 40%	$ 2,180

Book value = Depreciable basis − Accumulated depreciation
= $65,000 − $60,450 = $4,550

d. Net operating cash flows:

	Year 1	Year 2	Year 3
Revenues (4,000 × $50)	$200,000	$200,000	$200,000
Variable costs (70%)	140,000	140,000	140,000
Fixed costs	30,000	30,000	30,000
Depreciation	21,450	29,250	9,750
EBIT	$ 8,550	$ 750	$ 20,250
Taxes (40%)	3,420	300	8,100
NOPAT	$ 5,130	$ 450	$ 12,150
Add back: Depreciation	21,450	29,250	9,750
Operating cash flow	$ 26,580	$ 29,700	$ 21,900

e. Project cash flows:

	0 (11%)	1	2	3
Operating cash flows	−67,000	26,580	29,700	21,900
Terminal cash flow				9,820
Project cash flows	−67,000	26,580	29,700	31,720

f. From the time line shown in part e, the project's NPV can be calculated as follows:

$$\text{NPV} = -\$67{,}000 + \$26{,}580/(1.11)^1 + \$29{,}700/(1.11)^2 + \$31{,}720/(1.11)^3$$
$$= \$4{,}245$$

Alternatively, using a financial calculator, you would enter the following data: CF_0 = −67000; CF_1 = 26580; CF_2 = 29700; CF_3 = 31720; I/YR = 11; and then solve for NPV = $4,245.

Since the NPV is positive, the project should be accepted.

g. Project analysis if unit sales turned out to be 20 percent below forecast:
Initial projection = 4,000 units; however, if unit sales turn out to be only 80 percent of forecast then unit sales = 3,200.

	Year 0	Year 1	Year 2	Year 3
Equipment purchase	−$65,000			
Change in NOWC	−2,000			
Revenues (3,200 × $50)		$160,000	$160,000	$160,000
Variable costs (70%)		112,000	112,000	112,000
Fixed costs		30,000	30,000	30,000
Depreciation		21,450	29,250	9,750
EBIT		−$ 3,450	−$ 11,250	$ 8,250
Taxes (40%)		−1,380	−4,500	3,300
NOPAT		−$ 2,070	−$ 6,750	$ 4,950
Add back: Depreciation		21,450	29,250	9,750
Operating cash flow	−$67,000	$ 19,380	$ 22,500	$ 14,700
Terminal cash flow				9,820
Project cash flows	−$67,000	$ 19,380	$ 22,500	$ 24,520

Project NPV:

0	11% 1	2	3
−67,000	19,380	22,500	24,520

$$\text{NPV} = -\$67{,}000 + \$19{,}380/(1.11)^1 + \$22{,}500/(1.11)^2 + \$24{,}520/(1.11)^3$$
$$= -\$13{,}350$$

Alternatively, using a financial calculator, you would enter the following data: $CF_0 = -67000$; $CF_1 = 19380$; $CF_2 = 22500$; $CF_3 = 24520$; I/YR = 11; and then solve for NPV = −$13,350.

Since the NPV is negative, the project should not be accepted. If unit sales were 20 percent below the forecasted level, the project would no longer be accepted.

h. *Best-case scenario:* Unit sales = 4,800, Variable cost % = 65%.

	Year 0	Year 1	Year 2	Year 3
Equipment purchase	−$65,000			
Change in NOWC	−2,000			
Revenues (4,800 × $50)		$240,000	$240,000	$240,000
Variable costs (65%)		156,000	156,000	156,000
Fixed costs		30,000	30,000	30,000
Depreciation		21,450	29,250	9,750
EBIT		$ 32,550	$ 24,750	$ 44,250
Taxes (40%)		13,020	9,900	17,700
NOPAT		$ 19,530	$ 14,850	$ 26,550
Add back: Depreciation		21,450	29,250	9,750
Operating cash flows	−$67,000	$ 40,980	$ 44,100	$ 36,300
Terminal cash flow				9,820
Project cash flows	−$67,000	$ 40,980	$ 44,100	$ 46,120

Project NPV:

0	11% 1	2	3
−67,000	40,980	44,100	46,120

$$\text{NPV} = -\$67{,}000 + \$40{,}980/(1.11)^1 + \$44{,}100/(1.11)^2 + \$46{,}120/(1.11)^3$$
$$= \$39{,}434$$

Alternatively, using a financial calculator, you would enter the following data: $CF_0 = -67000$; $CF_1 = 40980$; $CF_2 = 44100$; $CF_3 = 46120$; I/YR = 11; and then solve for NPV = $39,434.

Base-case scenario: The NPV was calculated in part f as $4,245.

Worst-case scenario: Unit sales = 3,200; Variable cost % = 75%.

	Year 0	Year 1	Year 2	Year 3
Equipment purchase	−$65,000			
Change in NOWC	−2,000			
Revenues (3,200 × $50)		$160,000	$160,000	$160,000
Variable costs (75%)		120,000	120,000	120,000
Fixed costs		30,000	30,000	30,000
Depreciation		21,450	29,250	9,750
EBIT		−$ 11,450	−$ 19,250	$ 250
Taxes (40%)		−4,580	−7,700	100
NOPAT		−$ 6,870	−$ 11,550	$ 150
Add back: Depreciation		21,450	29,250	9,750
Operating cash flows	−$67,000	$ 14,580	$ 17,700	$ 9,900
Terminal cash flow				9,820
Project cash flows	−$67,000	$ 14,580	$ 17,700	$ 19,720

Project NPV:

0	1	2	3
11%			
−67,000	14,580	17,700	19,720

$$\begin{aligned}\text{NPV} &= -\$67{,}000 + \$14{,}580/(1.11)^1 + \$17{,}700/(1.11)^2 + \$19{,}720/(1.11)^3 \\ &= -\$25{,}080\end{aligned}$$

Alternatively, using a financial calculator, you would enter the following data: CF_0 = −67000; CF_1 = 14580; CF_2 = 17700; CF_3 = 19720; I/YR = 11; and then solve for NPV = −$25,080.

Scenario	Probability	NPV
Best case	25%	$39,434
Base case	50	4,245
Worst case	25	−25,080
	Expected NPV =	$ 5,711

$$\begin{aligned}\sigma_{NPV} &= [0.25[\$39{,}434 - \$5{,}711]^2 + 0.50[\$4{,}245 - \$5{,}711]^2 + 0.25[-\$25{,}080 - \$5{,}711]^2]^{1/2} \\ \sigma_{NPV} &= [\$284{,}310{,}182 + \$1{,}074{,}578 + \$237{,}021{,}420]^{1/2} \\ \sigma_{NPV} &= \$22{,}856 \\ CV_{NPV} &= \$22{,}856/\$5{,}711 = 4.0\end{aligned}$$

i. The project's CV = 4.0, which is significantly larger than the firm's typical project CV. So, the WACC for this project should be adjusted upward, 11% + 3% = 14%.
 To calculate the expected NPV, standard deviation, and coefficient of variation you would recalculate each scenario's NPV by discounting the project cash flows by 14 percent rather than 11 percent.

Best-case scenario:

0	1	2	3
14%			
−67,000	40,980	44,100	46,120

$$\begin{aligned}\text{NPV} &= -\$67{,}000 + \$40{,}980/(1.14)^1 + \$44{,}100/(1.14)^2 + \$46{,}120/(1.14)^3 \\ &= \$34{,}011\end{aligned}$$

Alternatively, using a financial calculator, you would enter the following data: CF_0 = −67000; CF_1 = 40980; CF_2 = 44100; CF_3 = 46120; I/YR = 14; and then solve for NPV = $34,011.

Base-case scenario:

0	1	2	3
14%			
−67,000	26,580	29,700	31,720

$$\begin{aligned}\text{NPV} &= -\$67{,}000 + \$26{,}580/(1.14)^1 + \$29{,}700/(1.14)^2 + \$31{,}720/(1.14)^3 \\ &= \$579\end{aligned}$$

Alternatively, using a financial calculator, you would enter the following data: $CF_0 = -67000$; $CF_1 = 26580$; $CF_2 = 29700$; $CF_3 = 31720$; I/YR = 14; and then solve for NPV = \$579.

Worst-case scenario:

0	14% 1	2	3
−67,000	14,580	17,700	19,720

$$\text{NPV} = -\$67{,}000 + \$14{,}580/(1.14)^1 + \$17{,}700/(1.14)^2 + \$19{,}720/(1.14)^3$$
$$= -\$27{,}281$$

Alternatively, using a financial calculator, you would enter the following data: $CF_0 = -67000$; $CF_1 = 14580$; $CF_2 = 17700$; $CF_3 = 19720$; I/YR = 14; and then solve for NPV = −\$27,281.

Scenario	Probability	NPV
Best case	25%	\$34,011
Base case	50	579
Worst case	25	−27,281
	Expected NPV =	\$ 1,972

$$\sigma_{NPV} = [0.25[\$34{,}011 - \$1{,}972]^2 + 0.50[\$579 - \$1{,}972]^2 + 0.25[-\$27{,}281 - \$1{,}972]^2]^{1/2}$$
$$\sigma_{NPV} = [\$256{,}624{,}380 + \$970{,}225 + \$213{,}934{,}502]^{1/2}$$
$$\sigma_{NPV} = \$21{,}715$$
$$CV_{NPV} = \$21{,}715/\$1{,}972 = 11.0$$

The expected NPV of the project is still positive so the project would still be accepted.

CHAPTER 13

ST-2 a. No abandonment considered; WACC = 12%.

Years	0	1	2	3	NPV
25%	−25,000	18,000	18,000	18,000	\$18,233
50	−25,000	12,000	12,000	12,000	3,822
25	−25,000	−8,000	−8,000	−8,000	−44,215
				Expected NPV =	−\$ 4,585

b. Abandonment considered; WACC = 12 percent.

Years	0	1	2	3	NPV
25%	−25,000	18,000	18,000	18,000	\$18,233
50	−25,000	12,000	12,000	12,000	3,822
25	−25,000	−8,000			
		Abandon project	15,000	0	−20,185
				Expected NPV =	\$ 1,423

c. Value of the abandonment option:

NPV with abandonment	\$1,423
NPV without abandonment	(4,585)
Value of abandonment option	\$6,008

ST-3 a. Machine W:

0	10% 1	2
−500,000	300,000	300,000

$$\text{NPV}_W = -\$500{,}000 + \frac{\$300{,}000}{(1.10)^1} + \frac{\$300{,}000}{(1.10)^2}$$
$$= \$20{,}661.16$$

Machine WW:

0	10% 1	2	3	4
−500,000	165,000	165,000	165,000	165,000

$$NPV_{WW} = -\$500{,}000 + \frac{\$165{,}000}{(1.10)^1} + \frac{\$165{,}000}{(1.10)^2} + \frac{\$165{,}000}{(1.10)^3} + \frac{\$165{,}000}{(1.10)^4}$$
$$= \$23{,}027.80.$$

Since the projects are independent and both have positive NPVs, both projects should be accepted.

b. Since the projects are mutually exclusive, only one project can be accepted. Therefore, Machine WW has the higher NPV and should be chosen.

c(1). Machine W's NPV needs to be recalculated under the assumption that it is repeated in Year 2.

Replacement chain analysis:

Machine W:

0	10% 1	2	3	4
−500,000	300,000	300,000		
		−500,000	300,000	300,000
		−200,000		

$$NPV_W = -\$500{,}000 + \frac{\$300{,}000}{(1.10)^1} + \frac{-\$200{,}000}{(1.10)^2} + \frac{\$300{,}000}{(1.10)^3} + \frac{\$300{,}000}{(1.10)^4}$$
$$= NPV_W = \$37{,}736.49$$

Machine WW:

$NPV_{WW} = \$23{,}027.80$ (NPV remains the same since it's calculated over a 4-year life.)

Since the projects are mutually exclusive but repeatable, Machine W should be chosen because its 4-year NPV is higher than Machine WW's.

c(2). *Equivalent annual annuity analysis:*

Machine W:
Using a financial calculator, enter the following data: N = 2; I/YR = 10; PV = −20661.16; FV = 0; and then solve for EAA_W = PMT = \$11,904.76.

Machine WW:
Using a financial calculator, enter the following data: N = 4; I/YR = 10; PV = −23027.80; FV = 0; and then solve for EAA_{WW} = PMT = \$7,264.60.

The equivalent annual annuity analysis arrives at the same decision as the replacement chain method. EAA_W = \$11,904.76 and EAA_{WW} = \$7,264.60; therefore, Machine W should be chosen if the projects are mutually exclusive and can be repeated indefinitely.

d. Yes. If the two projects can be repeated indefinitely over time but the cash flows are expected to change, then the replacement chain analysis can be used. The analysis would be similar to what was done in part c(1) except that the repeated cash flows would not be identical to the original cash flows.

CHAPTER 14

ST-2 a. The following information is given in the problem:

Q = Units of output (sales) = 5,000
P = Average sales price per unit of output = \$100
F = Fixed operating costs = \$200,000
V = Variable costs per unit = \$50
EBIT = Operating income = \$50,000
Total assets = \$500,000
Common equity = \$500,000

(1) Determine the new EBIT level if the change is made:

$$\text{New EBIT} = P_2(Q_2) - F_2 - V_2(Q_2)$$
$$\text{New EBIT} = \$95(7{,}000) - \$250{,}000 - \$40(7{,}000) = \$135{,}000$$

(2) Determine the incremental EBIT:

$$\Delta\text{EBIT} = \$135{,}000 - \$50{,}000 = \$85{,}000$$

(3) Estimate the approximate rate of return on the new investment:

$$\Delta\text{ROA} = \frac{\Delta\text{EBIT}}{\text{Investment}} = \frac{\$85{,}000}{\$400{,}000} = 21.25\%$$

Since the ROA exceeds Olinde's average cost of capital, this analysis suggests that the firm should go ahead and make the investment.

b. The change would increase the breakeven point. Still, with a lower sales price, it might be easier to achieve the higher new breakeven volume.

$$\text{Old: } Q_{BE} = \frac{F}{P - V} = \frac{\$200{,}000}{\$100 - \$50} = 4{,}000 \text{ units}$$

$$\text{New: } Q_{BE} = \frac{F}{P_2 - V_2} = \frac{\$250{,}000}{\$95 - \$40} = 4{,}545 \text{ units}$$

c. The incremental ROA is

$$\text{ROA} = \frac{\Delta\text{Profit}}{\Delta\text{Sales}} \times \frac{\Delta\text{Sales}}{\Delta\text{Assets}}$$

Using debt financing, the incremental profit associated with the investment is equal to the incremental profit found in part a minus the interest expense incurred as a result of the investment:

$$\begin{aligned}\Delta\text{Profit} &= \text{New profit} - \text{Old profit} - \text{Interest}\\ &= \$135{,}000 - \$50{,}000 - 0.10(\$400{,}000)\\ &= \$45{,}000\end{aligned}$$

The incremental sales is calculated as:

$$\begin{aligned}\Delta\text{Sales} &= P_2Q_2 - P_1Q_1\\ &= \$95(7{,}000) - \$100(5{,}000)\\ &= \$665{,}000 - \$500{,}000\\ &= \$165{,}000\end{aligned}$$

$$\text{ROA} = \frac{\$45{,}000}{\$165{,}000} \times \frac{\$165{,}000}{\$400{,}000} = 11.25\%$$

The return on the new equity investment still exceeds the average cost of capital, so the firm should make the investment.

ST-3 a.

EBIT	$4,000,000
Interest ($2,000,000 × 0.10)	200,000
Earnings before taxes (EBT)	$3,800,000
Taxes (35%)	1,330,000
Net income	$2,470,000

$$\text{EPS} = \$2{,}470{,}000/600{,}000 = \$4.12$$

$$P_0 = \$4.12/0.15 = \$27.47$$

b. $\text{Equity} = 600{,}000 \times \$10 = \$6{,}000{,}000$

$\text{Debt} = \$2{,}000{,}000$

$\text{Total capital} = \$8{,}000{,}000$

$$\begin{aligned}\text{WACC} &= w_d r_d(1 - T) + w_c r_s\\ &= (2/8)(10\%)(1 - 0.35) + (6/8)(15\%)\\ &= 1.63\% + 11.25\%\\ &= 12.88\%\end{aligned}$$

c.

EBIT	\$4,000,000
Interest (\$10,000,000 × 0.12)	1,200,000
Earnings before taxes (EBT)	\$2,800,000
Taxes (35%)	980,000
Net income	\$1,820,000

Shares bought and retired:

$$\Delta N = \Delta Debt/P_0 = \$8{,}000{,}000/\$27.47 = 291{,}227$$

New outstanding shares:

$$N_1 = N_0 - \Delta N = 600{,}000 - 291{,}227 = 308{,}773$$

New EPS:

$$EPS = \$1{,}820{,}000/308{,}773 = \$5.89$$

New price per share:

$$P_0 = \$5.89/0.17 = \$34.65 \text{ versus } \$27.47$$

Therefore, Gentry should change its capital structure.

d. In this case, the company's net income would be higher by (0.12 − 0.10)(\$2,000,000)(1 − 0.35) = \$26,000 because its interest charges would be lower. The new price would be

$$P_0 = \frac{(\$1{,}820{,}000 + \$26{,}000)/308{,}773}{0.17} = \$35.17$$

In the first case, in which debt had to be refunded, the bondholders were compensated for the increased risk of the higher debt position. In the second case, the old bondholders were not compensated; their 10 percent coupon perpetual bonds would now be worth

$$\$100/0.12 = \$833.33$$

or \$1,666,667 in total, down from the old \$2 million, or a loss of \$333,333. The stockholders would have a gain of

$$(\$35.17 - \$34.65)(308{,}773) = \$160{,}562$$

This gain would, of course, be at the expense of the old bondholders. (There is no reason to think that bondholders' losses would exactly offset stockholders' gains.)

e. $TIE = \dfrac{EBIT}{I}$

$$\text{Original TIE} = \frac{\$4{,}000{,}000}{\$200{,}000} = 20 \text{ times}$$

$$\text{New TIE} = \frac{\$4{,}000{,}000}{\$1{,}200{,}000} = 3.33 \text{ times}$$

CHAPTER 15

ST-2 a.

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

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

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

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

Under the former circumstances, D_1 would be based on a 20 percent 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 percent decrease in the value of the shares.

d. If the payout ratio were continued at 20 percent, even after internal investment opportunities had declined, the price of the stock would drop to \$2/(0.14 − 0.06) = \$25 rather than to \$66.67. Thus, an increase in the dividend payout is consistent with maximizing shareholder wealth.

Because of the diminishing nature of profitable investment opportunities, the greater the firm's level of investment, the lower the average ROE. Thus, the more money CMC retains and invests, the lower its average ROE will be. We can determine the average ROE under different conditions as follows:

Old situation (with founder active and a 20 percent payout):

$$g = (1.0 - \text{Payout ratio})(\text{Average ROE})$$
$$12\% = (1.0 - 0.2)(\text{Average ROE})$$
$$\text{Average ROE} = 12\%/0.8 = 15\% > r_s = 14\%$$

Note that the *average* ROE is 15 percent, whereas the *marginal* ROE is presumably equal to 14 percent.

New situation (with founder retired and a 60 percent payout):

$$g = 6\% = (1.0 - 0.6)(\text{ROE})$$
$$\text{ROE} = 6\%/0.4 = 15\% > r_s = 14\%$$

This suggests that the new payout is appropriate and that the firm is taking on investments down to the point at which marginal returns are equal to the cost of capital. Note that if the 20 percent payout was maintained, the *average* ROE would be only 7.5 percent, which would imply a marginal ROE far below the 14 percent cost of capital.

CHAPTER 16

ST-2 **The Calgary Company: Alternative Balance Sheets**

	Restricted (40%)	Moderate (50%)	Relaxed (60%)
Current assets	\$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-3 a. and b.

Income Statements for Year Ended December 31, 2005 (Thousands of Dollars)

	VANDERHEIDEN PRESS		HERRENHOUSE PUBLISHING	
	a	b	a	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 17

ST-2 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:

$$\Delta S = S_0 g$$

$$S_1 = S_0(1 + g)$$

$$AFN = (A^*/S_0)(\Delta S) - (L^*/S_0)(\Delta S) - MS_1(RR)$$

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

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

ST-3 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 Weatherford currently has excessive inventories. Because it is costly to hold excess inventories, Weatherford 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 that 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 next year:

$$\Delta S \text{ in first year} = 0.2(\$100 \text{ million}) = \$20 \text{ million}$$

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

CHAPTER 18

ST-2

$$\begin{aligned} V &= P[N(d_1)] - Xe^{-r_{RF}t}[N(d_2)] \\ &= [\$33(0.63369)] - [\$33(0.95123)(0.55155)] \\ &= \$20.91 - \$17.31 \\ &= \$3.60 \end{aligned}$$

CHAPTER 19

ST-2

$$\frac{\text{Euro}}{\text{C\$}} = \frac{\text{Euros}}{\text{US\$}} \times \frac{\text{US\$}}{\text{C\$}}$$

$$= \frac{1.1215}{\$1} \times \frac{\$1}{1.5291} = \frac{1.1215}{1.5291} = 0.7334 \text{ euro per Canadian dollar}$$

CHAPTER 20

ST-2 a. *Cost of leasing:*

	BEGINNING OF YEAR			
	0	1	2	3
Lease payment (AT)[a]	($ 6,000)	($6,000)	($6,000)	($6,000)
Total PV cost of leasing =	($22,038)			

[a]After-tax payment = $10,000(1 − T) = $10,000(0.6) = $6,000

Using a financial calculator, input the following data after switching your calculator to “BEG” mode: N = 4, I/YR = 6, PMT = 6000, and FV = 0. Then press the PV key to arrive at the answer of ($22,038). Now, switch your calculator back to “END” mode. Note that the interest rate used is the after-tax cost of debt, 10% (1 − T) = 6%.

b. *Cost of owning:*

Depreciable basis = $40,000

Here are the cash flows under the borrow-and-buy alternative:

	END OF YEAR				
	0	1	2	3	4
1. Depreciation schedule					
(a) Depreciable basis		$40,000	$40,000	$40,000	$40,000
(b) Allowance		0.33	0.45	0.15	0.07
(c) Depreciation		13,200	18,000	6,000	2,800
2. Cash flows					
(d) Net purchase price	($40,000)				
(e) Depreciation tax savings		5,280[a]	7,200	2,400	1,120
(f) Maintenance (AT)		(600)	(600)	(600)	(600)
(g) Salvage value (AT)					6,000
(h) Total cash flows	($40,000)	$ 4,680	$ 6,600	$ 1,800	$ 6,520

Total PV cost of owning = ($23,035)

[a]Depreciation(T) = $13,200(0.40) = $5,280

Input the cash flows for the individual years into the cash flow register and enter I/YR = 6, then press the NPV key to arrive at the answer of ($23,035). Because the present value of the cost of leasing is less than that of owning, the truck should be leased: $23,035 − $22,038 = $997, net advantage to leasing.

c. The discount rate is based on the cost of debt because most cash flows are fixed by contract and, consequently, are relatively certain. Thus, the lease cash flows have about the same risk as the firm’s debt. Also, leasing is considered to be a substitute for debt. We use an after-tax cost rate because the cash flows are stated net of taxes.

d. The firm could increase the discount rate on the salvage value cash flow. This would increase the PV cost of owning and make leasing even more advantageous.

CHAPTER 21

ST-2 Time line numbers are in millions of dollars:

0	12% 1	2	3	4
PV = ?	1.5	2.0	3.0	5.0
				TV = 75.0*
				80.0

$$r_s = 6\% + 4\%(1.5)$$
$$= 12\%$$
$$\text{*Terminal CF} = \frac{\$5(1.05)}{0.12 - 0.5} = \$75.00$$

To solve this problem, use your financial calculator to enter the following input data: $CF_0 = 0$; $CF_1 = 1.5$; $CF_2 = 2.0$; $CF_3 = 3.0$; $CF_4 = 80$; and I/YR = 12. Then, solve for NPV = \$55.91 million.

APPENDIX B

Answers to Selected 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.

2-2 PV = $1,292.10.
2-4 N = 11.01 years.
2-6 FVA_5 = $1,725.22; $FVA_{5\ Due}$ = $1,845.99.
2-8 PMT = $444.89; EAR = 12.6825%.
2-10 a. $895.42.
b. $1,552.92.
c. $279.20.
d. $499.99; $867.13.
2-12 b. 7%.
c. 9%.
d. 15%.
2-14 a. $6,374.97.
d(1). $7,012.47.
2-16 $PV_{7\%}$ = $1,428.57; $PV_{14\%}$ = $714.29.
2-18 a. Stream A: $1,251.25.
2-20 Contract 2; PV = $10,717,847.14.
2-22 a. $802.43.
c. $984.88.
2-24 a. $279.20.
b. $276.84.
c. $443.72.
2-26 $17,290.89; $19,734.26.
2-28 I_{NOM} = 7.8771%.
2-30 a. E = 63.74 yrs.; K = 41.04 yrs.
b. $35,825.33.
2-32 $496.11.
2-34 a. PMT = $10,052.87.
b. Yr 3: Int/Pymt = 9.09%;
Princ/Pymt = 90.91%.
2-36 a. $5,308.12.
b. $4,877.09.
2-38 $309,015.
2-40 $9,385.

3-2 $2,500,000.
3-4 $20,000,000.
3-6 $89,100,000.
3-8 NI = $450,000; NCF = $650,000;
OCF = $650,000.
3-10 a. $2,400,000,000.
b. $4,500,000,000.
c. $5,400,000,000.
d. $1,100,000,000.
3-12 a. $592 million.
b. RE_{04} = $1,374 million.
c. $1,600 million.
d. $15 million.
e. $620 million.
3-14 a. $2,400,000.
b. NI = 0; NCF = $3,000,000.
c. NI = $1,350,000; NCF = $2,100,000.

4-2 D/A = 58.33%.
4-4 M/B = 4.2667.
4-6 ROE = 8%.
4-8 15.31%.
4-10 NI/S = 2%; D/A = 40%.
4-12 TIE = 2.25.
4-14 ROE = 23.1%.
4-16 7.2%.
4-18 6.0.
4-20 $405,682.
4-22 A/P = $90,000; Inv = $90,000; FA = $138,000.
4-24 a. TIE = 11; EBITDA coverage = 9.46;
Profit margin = 3.40%; ROE = 8.57%.

6-2 2.25%.
6-4 1.5%.
6-6 21.8%.
6-8 8.5%.
6-10 6.0%.
6-12 0.35%.
6-14 a. r_1 in Year 2 = 6%.
b. I_1 = 2%; I_2 = 5%.
6-16 14%.
6-18 a. r_1 = 9.20%; r_5 = 7.20%.

7-2 a. 7.11%.
b. 7.22%.
c. $988.46.
7-4 YTM = 6.62%; YTC = 6.49%;
most likely yield = 6.49%.
7-6 a. 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.

7-8 15.03%.
7-10 a. YTM = 9.69%.
b. CY = 8.875%; CGY = 0.816%.
7-12 a. YTM = 8%; YTC = 6.1%.
7-14 10.78%.
7-16 $987.87.
7-18 8.88%.
7-20 a. 8.35%.
b. 8.13%.

8-2 $b_p = 1.12$.
8-4 $r_M = 11\%$; $r = 12.2\%$.
8-6 a. $\hat{r}_Y = 14\%$.
b. $\sigma_X = 12.20\%$.
8-8 b = 1.33.
8-10 4.2%.
8-12 $r_M - r_{RF} = 4.375\%$.
8-14 $b_N = 1.16$.
8-16 $r_p = 11.75\%$.
8-18 a. $0.5 million.
d(2). 15%.
8-20 a. $r_A = 11.30\%$.
c. $\sigma_A = 20.8\%$; $\sigma_p = 20.1\%$.

9-2 $\hat{P}_0 = \$6.25$.
9-4 b. $37.80.
c. $34.09.
9-6 $r_p = 8.33\%$.
9-8 a. $125.
b. $83.33.
9-10 $23.75.
9-12 a(1). $9.50.
a(2). $13.33.
a(3). $21.00.
a(4). $44.00.
b(1). Undefined.
b(2). −$48.00, which is nonsense.
9-14 $\hat{P}_3 = \$27.32$.
9-16 $P_0 = \$19.89$.
9-18 6.25%.
9-20 a. $P_0 = \$54.11$; $D_1/P_0 = 3.55\%$;
CGY = 6.45%.
9-22 $35.00.
9-24 a. $2.01; $2.31; $2.66; $3.06; $3.52.
b. $P_0 = \$39.43$.
c. $D_1/P_{0\ 2006} = 5.10\%$; $CGY_{2006} = 6.9\%$;
$D_1/P_{0\ 2011} = 7.00\%$; $CGY_{2011} = 5\%$.

10-2 $r_p = 8\%$.
10-4 $r_s = 15\%$; $r_e = 16.11\%$.
10-6 a. $r_s = 16.3\%$.
b. $r_s = 15.4\%$.
c. $r_s = 16\%$.
d. $r_{s\ AVG} = 15.9\%$.
10-8 $r_s = 16.51\%$; WACC = 12.79%.
10-10 WACC = 11.4%.
10-12 a. $r_s = 14.40\%$.
b. WACC = 10.62%.
c. Project A.
10-14 11.94%.
10-16 a. g = 8%.
b. $D_1 = \$2.81$.
c. $r_s = 15.81\%$.
10-18 a. $r_d = 7\%$; $r_p = 10.20\%$; $r_s = 15.72\%$.
b. WACC = 13.86%.
c. Projects 1 and 2 will be accepted.
10-20 a. $r_d(1 - T) = 5.4\%$; $r_s = 14.6\%$.
b. WACC = 10.92%.

11-2 IRR = 16%.
11-4 4.34 years.
11-6 a. 5%: $NPV_A = \$3.52$; $NPV_B = \$2.87$.
10%: $NPV_A = \$0.58$; $NPV_B = \$1.04$.
15%: $NPV_A = -\$1.91$; $NPV_B = -\$0.55$.
b. $IRR_A = 11.10\%$; $IRR_B = 13.18\%$.
c. 5%: Choose A; 10%: Choose B; 15%: Do not choose either one.
11-8 a. Without mitigation: NPV = $12.10 million;
With mitigation: NPV = $5.70 million.
11-10 Project A; $NPV_A = \$30.16$.
11-12 $IRR_L = 11.74\%$.
11-14 a. HCC; PV of costs = −$805,009.87.
c. HCC; PV of costs = −$767,607.75.
LCC; PV of costs = −$686,627.14.
11-16 a. $NPV_A = \$14,486,808$; $NPV_B = \$11,156,893$;
$IRR_A = 15.03\%$; $IRR_B = 22.26\%$.
b. Crossover rate ≈ 12%.
11-18 a. No; $PV_{Old} = -\$89,910.08$; $PV_{New} = -\$94,611.45$.
b. $2,470.80.
c. 22.94%.
11-20 $10,239.20.
11-22 $250.01.

12-2 a. $2,600,000.
12-4 b. Accelerated method; $12,781.64.
12-6 a. −$178,000.
b. $52,440; $60,600; $40,200.
c. $48,760.
d. NPV = −$19,549; Do not purchase.
12-8 a. Expected $CF_A = \$6,750$;
Expected $CF_B = \$7,650$; $CV_A = 0.0703$.
b. $NPV_A = \$10,036$; $NPV_B = \$11,624$.
12-10 a. NPV = $37,035.13.
b. NPV = +20%: $77,975.63;
−20%: NPV = −$3,905.37.
c. E(NPV) = $34,800.21;
$\sigma_{NPV} = \$35,967.84$;
CV = 1.03.

13-2 a. Project B; $NPV_B = \$2,679.46$.
b. Project A; $NPV_A = \$3,773.65$.
c. Project A; $EAA_A = \$1,190.48$.

13-4 A; EAA_A = \$1,407.85.
13-6 NPV_A = \$9.93 million.
13-8 EAA_Y = \$7,433.12.
13-10 No, NPV_3 = \$1,307.29.
13-12 a. NPV = \$4.6795 million.
b. No, NPV = \$3.2083 million.
c. 0.

14-2 30% debt and 70% equity.
14-4 $b_U = 1.0435$.
14-6 a(1). −\$60,000.
b. Q_{BE} = 14,000.
14-8 r_s = 17%.
14-10 a. FC_A = \$80,000; V_A = \$4.80/unit; P_A = \$8.00/unit.
14-12 a. EPS_{Old} = \$2.04; New: EPS_D = \$4.74; EPS_S = \$3.27.
b. 339,750 units.
c. $Q_{New, Debt}$ = 272,250 units.

15-2 P_0 = \$60.
15-4 D_0 = \$3.44.
15-6 Payout = 31.39%.
15-8 a. 12%.
b. 18%.
c. 6%; 18%.
d. 6%.
e. 28,800 new shares; \$0.13 per share.

16-2 73 days; 30 days; \$1,178,082.
16-4 a. 83 days.
b. \$356,250.
c. 4.87×.
16-6 a. 32 days.
b. \$288,000.
c. \$45,000.
d(1). 30.
d(2). \$378,000.
16-8 a. ROE_T = 11.75%; ROE_M = 10.80%; ROE_R = 9.16%.
16-10 a. October loan = \$22,800.

17-2 AFN = \$610,000.
17-4 a. \$133.50 million.
b. 39.06%.
17-6 \$67 million; 5.01.
17-8 a. \$480,000.
b. \$18,750.
17-10 \$34.338 million; 34.97 ≈ 35 days.
17-12 a. \$2,500,000,000.
b. 24%.
c. \$24,000,000.
17-14 a. 33%.
b. AFN = \$2,549.

18-2 \$27.00; \$37.00.
18-4 \$1.82.
18-6 b. Futures = +\$4,180,346; Bond = −\$2,203,701; Net = \$1,976,645.

19-2 27.2436 yen per shekel.
19-4 1 euro = \$0.68966 or \$1 = 1.45 euros.
19-8 15 kronas per pound.
19-10 $r_{NOM\text{-}U.S.}$ = 4.6%.
19-12 b. \$1.6488.
19-14 +\$250,000.
19-16 \$468,837,209.

20-2 \$196.36.
20-4 a. $D/A_{J\text{-}H}$ = 50%; $D/A_{M\text{-}E}$ = 67%.
20-6 a. EV = −\$3; EV = \$0; EV = \$4; EV = \$49.
d. 9%; \$90.
20-8 a. PV cost of owning = −\$185,112; PV cost of leasing = −\$187,534; Purchase loom.

21-2 P_0 = \$43.48.
21-4 a. 16.8%.
b. V = \$14.93 million.
21-6 a. 14%.
b. TV = \$1,143.4; V = \$877.2.

C APPENDIX

Selected Equations and Data

CHAPTER 2

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

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

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

$$FVA_{Due} = FVA_{Ordinary}(1 + I)$$

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

$$PVA_{N\ Due} = PVA_{Ordinary}(1 + I)$$

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

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

$$I_{PER} = \frac{I}{M}$$

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

$$\text{Number of periods} = NM$$

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

CHAPTER 3

$$EBIT = \text{Sales revenues} - \text{Operating costs}$$

$$\text{Net cash flow} = \text{Net income} + \text{Depreciation and amortization}$$

$$\begin{matrix}\text{Net operating} \\ \text{working capital}\end{matrix} = \begin{matrix}\text{All current assets} \\ \text{required in operations}\end{matrix} - \begin{matrix}\text{All non-interest-bearing} \\ \text{current liabilities}\end{matrix}$$

$$\begin{matrix}\text{Net operating} \\ \text{working} \\ \text{capital}\end{matrix} = \left(\begin{matrix}\text{Cash} \\ \text{and cash} \\ \text{equivalents}\end{matrix} + \begin{matrix}\text{Accounts} \\ \text{receivable}\end{matrix} + \text{Inventories}\right) - \left(\begin{matrix}\text{Accounts} \\ \text{payable}\end{matrix} + \text{Accruals}\right)$$

$$\text{Total operating capital} = \text{Net operating working capital} + \text{Net fixed assets}$$

$$NOPAT = EBIT(1 - \text{Tax rate})$$

$$\text{Operating cash flow} = NOPAT + \text{Depreciation and amortization}$$

$$FCF = \left[EBIT(1 - T) + \begin{matrix}\text{Depreciation and} \\ \text{amortization}\end{matrix}\right] - \left[\begin{matrix}\text{Capital} \\ \text{expenditures}\end{matrix} + \begin{matrix}\Delta\text{Net operating} \\ \text{working capital}\end{matrix}\right]$$

$$\text{Free cash flow} = \text{Operating cash flow} - \text{Investment in operating capital}$$

$$\begin{aligned}\text{MVA} &= \text{Market value of stock} - \text{Equity capital supplied by shareholders}\\ &= [(\text{Shares outstanding})(\text{Stock price})] - \text{Total common equity}\end{aligned}$$

$$\begin{aligned}\text{EVA} &= \text{NOPAT} - \text{Annual dollar cost of capital}\\ &= (\text{EBIT})(1 - \text{T}) - \left(\begin{matrix}\text{Total investor-supplied}\\ \text{operating capital}\end{matrix} \times \begin{matrix}\text{After-tax percentage}\\ \text{cost of capital}\end{matrix}\right)\end{aligned}$$

CHAPTER 4

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

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

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

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

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

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

$$\text{Debt ratio} = \frac{\text{Total debt}}{\text{Total assets}}$$

$$\text{D/A} = \frac{\text{D/E}}{1 + \text{D/E}}$$

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

$$\text{D/E} = \frac{\text{D/A}}{1 - \text{D/A}}$$

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

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

$$\text{Profit margin on sales} = \frac{\text{Net income}}{\text{Sales}}$$

$$\text{Return on total assets (ROA)} = \frac{\text{Net income}}{\text{Total assets}}$$

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

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

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

$$\text{Return on common equity (ROE)} = \frac{\text{Net income}}{\text{Common equity}}$$

$$\text{ROE} = \text{ROA} \times \text{Equity multiplier}$$

$$= \text{Profit margin} \times \text{Total assets turnover} \times \text{Equity multiplier}$$

$$= \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}} \times \frac{\text{Total assets}}{\text{Common equity}}$$

$$\text{Return on investors' capital} = \frac{\text{Net income} + \text{Interest}}{\text{Debt} + \text{Equity}}$$

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

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

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

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

$$\text{EVA} = \text{Net income} - \left(\text{Equity capital} \times \text{\% Cost of equity capital}\right)$$

$$\text{EVA} = \text{Equity capital} \times (\text{ROE} - \text{\% Cost of equity capital})$$

CHAPTER 6

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

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

Considering cross term, $r_{RF} = r^* + I + (r^* \times I)$. Assume no cross term, unless specified.

$$r = r_{RF} + DRP + LP + MRP$$

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

CHAPTER 7

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

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

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

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

CHAPTER 8

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

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

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

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

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

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

$$\sigma_p = \sqrt{\sum_{j=1}^{N} (r_{pj} - \hat{r}_p)^2 P_j}$$

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

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

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

CHAPTER 9

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

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

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

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

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

$$\text{For a constant growth stock, } \hat{P}_N = P_0(1 + g)^N$$

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

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

$$V_{Company} = \frac{FCF_1}{(1 + WACC)^1} + \frac{FCF_2}{(1 + WACC)^2} + \cdots + \frac{FCF_\infty}{(1 + WACC)^\infty}$$

$$\text{Terminal value} = V_{Company\ at\ t=N} = \frac{FCF_{N+1}}{WACC - g_{FCF}}$$

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

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

CHAPTER 10

$$\text{After-tax component cost of debt} = r_d(1 - T)$$

$$\text{Component cost of preferred stock} = r_p = \frac{D_p}{P_p}$$

$$r_s = \hat{r}_s = r_{RF} + RP = D_1/P_0 + g$$

$$r_s = \text{Bond yield} + \text{Risk premium}$$

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

$$g = (\text{Retention rate})(\text{ROE}) = (1.0 - \text{Payout rate})(\text{ROE})$$

$$RE_{\text{Breakpoint}} = \frac{\text{Addition to retained earnings}}{\text{Equity fraction}}$$

$$\text{WACC} = w_d r_d(1 - T) + w_p r_p + w_c r_s$$

CHAPTER 11

$$\text{NPV} = CF_0 + \frac{CF_1}{(1 + r)^1} + \frac{CF_2}{(1 + r)^2} + \ldots + \frac{CF_N}{(1 + r)^N}$$

$$= \sum_{t=0}^{N} \frac{CF_t}{(1 + r)^t}$$

$$\text{IRR: } \sum_{t=0}^{N} \frac{CF_t}{(1 + \text{IRR})^t} = 0$$

MIRR: PV costs = PV terminal value

$$\sum_{t=0}^{N} \frac{\text{COF}}{(1 + r)^t} = \frac{\sum_{t=0}^{N} \text{CIF}_t(1 + r)^{N-t}}{(1 + \text{MIRR})^N}$$

$$\text{PV costs} = \frac{\text{TV}}{(1 + \text{MIRR})^N}$$

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

CHAPTER 14

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

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

$$EPS = \frac{(S - FC - VC - I)(1 - T)}{\text{Shares outstanding}} = \frac{(EBIT - I)(1 - T)}{\text{Shares outstanding}}$$

$$b_L = b_U[1 + (1 - T)(D/E)]$$

$$b_U = b_L/[1 + (1 - T)(D/E)]$$

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

CHAPTER 15

$$\text{Dividends} = \text{Net income} - [(\text{Target equity ratio})(\text{Total capital budget})]$$

CHAPTER 16

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

$$\text{Inventory conversion period} = \frac{\text{Inventory}}{\text{Cost of goods sold}/365}$$

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

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

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

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

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

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

$$\text{Simple interest rate per day} = \frac{\text{Nominal rate}}{\text{Days in year}}$$

$$\text{Simple interest charge for period} = (\text{Days in period})(\text{Rate per day})(\text{Amount of loan})$$

$$\text{Approximate annual rate}_{\text{Add-on}} = \frac{\text{Interest paid}}{(\text{Amount received})/2}$$

$$APR = (\text{Periods per year})(\text{Rate per period})$$

$$\text{Effective annual rate}_{\text{Add-on}} = (1 + r_d)^N - 1.0$$

CHAPTER 17

$$AFN = \begin{matrix}\text{Required} \\ \text{asset} \\ \text{increase}\end{matrix} - \begin{matrix}\text{Spontaneous} \\ \text{liability} \\ \text{increase}\end{matrix} - \begin{matrix}\text{Increase in} \\ \text{retained} \\ \text{earnings}\end{matrix}$$

$$= (A^*/S_0)\Delta S - (L^*/S_0)\Delta S - MS_1(RR)$$

$$\text{Full capacity sales} = \frac{\text{Actual sales}}{\text{Percentage of capacity at which fixed assets were operated}}$$

$$\text{Target FA/Sales ratio} = \frac{\text{Actual fixed assets}}{\text{Full capacity sales}}$$

$$\text{Required level of FA} = (\text{Target FA/Sales ratio})(\text{Projected sales})$$

CHAPTER 18

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

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

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

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

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

CHAPTER 19

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

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

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

CHAPTER 20

$$\text{Price paid for bond with warrants} = \text{Straight-debt value of bond} + \text{Value of warrants}$$

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

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