APPENDIX B

Solutions to Concept Checks

B.1 INTRODUCTION

Chapter 1—The Investment Environment

1. The real assets are patents, customer goodwill, and the university education. These assets enable individuals or firms to produce goods or services that yield profits or income. Lease obligations are simply claims to pay or receive income and do not in themselves create new wealth. Similarly, the $5 bill is only a paper claim on the government and does not produce wealth.
2. The borrower has a financial liability, the loan owed to the bank. The bank treats the loan as a financial asset.
3. Individual reader's response.
4. Since the new technology enables investors to trade and perform research for themselves, the need for financial intermediaries will decline. Part of the service intermediaries now offer is a lower-cost method for investors to participate in securities markets. This part of the intermediaries' service would be less sought after.

Chapter 2—Financial Markets and Instruments

1. The bond equivalent yield is .07. Therefore, $P = \$1{,}000/[1 + .0007 \times 1(182/365)] = \$999.65$. (NB: The minute yield of .07 percent leaves the two values, bond equivalent yield and effective annual rate, indistinguishable, so we use a dated rate of 3.94 percent.) The price of a 3.94 percent bill is $980.73 or 1.9646 percent, which annualizes to 3.9789 percent.
2. If the bond is selling below par, it is unlikely that the issuer will find it optimal to call the bond at par, when it can instead buy the bond in the secondary market for less than par. Therefore, it makes sense to assume that the bond will remain alive until its maturity date. In contrast, premium bonds are vulnerable to call because the issuer can acquire them by paying only par value. Hence it is likely that the bonds will repay principal at the first call date, and the yield to first call is the statistic of interest.
3. *a.* You are entitled to a prorated share of dividend payments and to vote in any of Teck's shareholder meetings.

   b. Your potential gain is unlimited because Teck's stock price has no upper bound.

   c. Your outlay was $\$50 \times 100 = \$5{,}000$. Because of limited liability, this is the most you can lose.
4. The market-value-weighted index return is calculated by computing the increase in value of the stock portfolio. The portfolio of the two stocks starts with an initial value of $100 million + $500 million = $600 million and falls in value to $110 million + $400 million = $510 million, a loss of 90/600 = .15, or 15 percent. The index portfolio return is a weighted

average of the returns on each stock with weights of $\frac{1}{6}$ on XYZ and $\frac{5}{6}$ on ABC (weights proportional to relative investments). Because the return on XYZ is 10 percent, while that on ABC is −20 percent, the index portfolio return, is $\frac{1}{6} \times 10\% + \frac{5}{6} \times (-20\%) = -15$ percent, equal to the return on the market-value-weighted index.

5. The price-weighted index increases from 62.5 [(100 + 25)/2] to 65 [(110 + 20)/2], a gain of 4 percent. An investment of one share in each company requires an outlay of $125 that would increase in value to $130, for a return of 4 percent (5/125), which equals the return to the price-weighted index.
6. The payoff to the option is $11 per share at maturity. The option costs $5.90 per share. The dollar gain per share is therefore $5.10. The put option will expire worthless; for the rest of them there is also a loss—for example, the January 80 put costs $5.30, but only returns $2 at expiry, losing $3.30.

Chapter 3—Trading on Securities Markets

1. *a.* Used cars trade in direct search markets when individuals advertise in local newspapers and in dealer markets at used-car lots or automobile dealers.

   b. Paintings trade in broker markets when clients commission brokers to buy or sell art for them, in dealer markets at art galleries, and in auction markets.

   c. Rare coins trade mostly in dealer markets in coin shops, but they also trade in auctions and in direct search markets when individuals advertise they want to buy or sell coins.
2. Several factors combined to reduce the value of a seat of the exchange. The success of ECNs promised to redirect trading volume away from the exchange to cheaper venues, which would reduce the value of the right to trade on the exchange. Decimalization reduced bid–ask spreads and thus the advantage to institutional traders who could benefit from the spread. The dramatic stock market decline of 2000–2003 also arrested projections of growth in trading volume.
3. $$\frac{100P - \$4{,}000}{100P} = .4$$
$$100P - \$4{,}000 = 40P$$
$$60P = \$4{,}000$$
$$P = \$66.67 \text{ per share}$$
4. The investor will purchase 150 shares, with a rate of return as follows:

Year-End Change in Price	Repayment of Year-End Value of Shares	Principal and Interest	Investor's Rate of Return
30%	19,500	$5,450	40.5%
No change	15,000	5,450	−4.5%
−30%	10,500	5,450	−49.5%

5. *a.* Once Dot Bomb stock goes up to $110, your balance sheet will be:

Assets		Liabilities and Owner's Equity	
Cash		Short position in Dot Bomb	$110,000
T-bills	50,000	Equity	40,000

b. Solving

$$\frac{\$150{,}000 - 1{,}000P}{1{,}000P} = .4$$

yields P = \$107.14 per share.

A.1. Using equation 3A.1, we again have \$71,429 against a total asset value of \$125,000; using equation 3A.2, the price (P) of ACE is

$$300P \times 1.3 = \$125{,}000 - \$71{,}429 = \$53{,}571 \text{ or } P = \$137.36$$

If ACE rises to \$60, margin requires total assets of \$23,400 (for the short sale) plus \$71,429 (again) or \$94,829; since assets comprise \$85,000 + 500P, for P the price of SNC, then the minimum price is

$$500P = \$94{,}829 - \$85{,}000 = \$9{,}829 \text{ or } P = \$19.66$$

B.2 PORTFOLIO THEORY

Chapter 4—Return and Risk: Analyzing the Historical Record

1. *a.*
$$\begin{aligned} 1 + R &= (1 + r)(1 + i) \\ &= (1.03)(1.08) \\ &= 1.1124 \\ R &= 11.24\% \end{aligned}$$

b.
$$\begin{aligned} 1 + R &= (1.03)(1.10) \\ &= 1.133 \\ R &= 13.3\% \end{aligned}$$

2. *a.* EAR = $(1 + .01)^{12} - 1 = .1268 = 12.68\%$

b. EAR = $e^{.12} - 1 = .1275 = 12.75\%$

Choose the continuously compounded rate for its higher EAR.

3. Number of bonds bought is 27,000/900 = 30

Interest Rates	Probability	Year-end Bond Price	HPR	End-of-Year Value
High	.2	\$850	(75 + 850)/900 − 1 = .0278	(75 + 850)30 = \$27,750
Unchanged	.5	915	.1000	\$29,700
Low	.3	985	.1778	\$31,800
Expected rate of return			.1089	
Expected end-of-year dollar value				\$29,940
Risk premium			.0589	

4. *a.* Arithmetic return = (1/3)[.0983 − .3300 + .3506] = .0396 = 3.96%

b. Geometric average = $(1.093 \times .67 \times 1.3506)^{.5} - 1 = -.0055 = -0.55\%$

c. Standard deviation = 28.09%

d. Sharpe ratio (3.96 − 6)/28.09 = −0.073

5. The probability of a more extreme bad month, with return below −15%, is much lower: NORMDIST(−15, 1, 6, TRUE) = .00383. Alternatively, we can note that −15% is 16/6 standard deviations below the mean return, and use the standard normal function to compute NORMSDIST(−16/6) = .00383.

6. Skewness = −1.54313

   Kurtosis = 2.814387

7. From the return data for the stocks and the T-bills in the online appendix we find that the average excess return for the years 1957–1975 is 2.96% and the standard deviation 17.50%.

Chapter 5—Capital Allocation to Risky Assets

1. The investor is taking on exchange rate risk by investing in a pound-denominated asset. If the exchange rate moves in the investor's favour, the investor will benefit and will earn more from the U.K. bill than the Canadian bill. For example, if both the Canadian and U.K. interest rates are 5 percent, and the current exchange rate is \$2 per pound, a \$2 investment today can buy one pound, which can be invested in England at a certain rate of 5 percent, for a year-end value of 1.05 pounds. If the year-end exchange rate is \$2.10 per pound, the 1.05 pounds can be exchanged for 1.05 × \$2.10 = \$2.205 for a rate of return in dollars of $1 + r$ = \$2.205/\$2.00 = 1.1025, or 10.25 percent, more than is available from Canadian bills. Therefore, if the investor expects favourable exchange rate movements, the U.K. bill is a speculative investment. Otherwise, it is a gamble.

2. For the $A = 4$ investor, the utility of the risky portfolio is

$$\begin{aligned} U &= .20 - \tfrac{1}{2} \times 4 \times .2^2 \\ &= .12 \end{aligned}$$

   while the utility of bills is

$$\begin{aligned} U &= .07 - \tfrac{1}{2} \times 4 \times 0 \\ &= .07 \end{aligned}$$

   The investor will prefer the risky portfolio to bills. (Of course, a mixture of bills and the portfolio might be even better, but that is not a choice here.)

   For the $A = 8$ investor, the utility of the risky portfolio is

$$\begin{aligned} U &= .20 - \tfrac{1}{2} \times 8 \times .2^2 \\ &= .04 \end{aligned}$$

   while the utility of bills is again .07. The more risk-averse investor therefore prefers the risk-free alternative.

3. The less risk-averse investor has a flatter indifference curve. An increase in risk requires less increase in expected return to restore utility to the original level.

4. Holding 50 percent of your invested capital in Ready Assets means that your investment proportion in the risky portfolio is reduced from 70 percent to 50 percent.

   Your risky portfolio is constructed to invest 54 percent in BC and 46 percent in CT. Thus the proportion of BC in your overall portfolio is .5 × .54 = 27 percent, and the dollar value of your position in BC is \$300,000 × .27 = \$81,000.

5. In the expected return–standard deviation plane, all portfolios that are constructed from the same risky and risk-free funds (with various proportions) lie on a line from the risk-free rate through the risky fund. The slope of this CAL (capital allocation line) is the same

everywhere; hence the reward-to-variability ratio is the same for all of these portfolios. Formally, if you invest a proportion, y, in a risky fund with expected return, $E(r_P)$, and standard deviation, σ_P, and the remainder, $1 - y$, in a risk-free asset with a sure rate, r_f, then the portfolio's expected return and standard deviation are

$$E(r_C) = r_f + y[E(r_P) - r_f]$$
$$\sigma_C = y\sigma_P$$

and therefore the reward-to-variability ratio of this portfolio is

$$S_C = \frac{E(r_C) - r_f}{\sigma_C} = \frac{y[E(r_P) - r_f]}{y\sigma_P} = \frac{E(r_P) - r_f}{\sigma_P}$$

which is independent of the proportion, y.

6. If all the investment parameters remain unchanged, the only reason for an investor to decrease the investment proportion in the risky asset is an increase in the degree of risk aversion. If you think that this is unlikely, then you have to reconsider your faith in your assumptions. Perhaps the S&P/TSX Composite is not a good proxy for the optimal risky portfolio. Perhaps investors expect a higher real rate on T-bills..

A.1. *a.* $U(W) = \sqrt{W}$
$U(50{,}000) = \sqrt{50{,}000}$
$= 223.61$
$U(150{,}000) = 387.30$

b. $E(U) = .5 \times 223.61 + .5 \times 387.30$
$= 305.45$

c. We must find W_{CE} that has utility level 305.45. Therefore
$U(W_{CE}) = 305.45$
$W_{CE} = 305.45^2$
$= \$93{,}301$

d. Yes. The certainty equivalent of the risky venture is less than the expected outcome of $100,000.

e. The certainty equivalent of the risky venture to this investor is greater than it was for the log utility investor considered in the text. Hence this utility function displays less risk aversion.

Chapter 6—Optimal Risky Portfolios

1. *a.* The first term will be $w_D \times w_D \times \sigma^2_D$, since this is the element in the top corner of the matrix (σ^2_D) times the term on the column border (w_D) times the term on the row border (w_D). Applying this rule to each term of the covariance matrix results in the sum $w^2_D\sigma^2_D + w_Dw_E\text{Cov}(r_E,r_D) + w_Ew_D\text{Cov}(r_D,r_E) + w^2_E\sigma^2_E$, which is the same as equation 6.5, since $\text{Cov}(r_E,r_D) = \text{Cov}(r_D,r_E)$.

b. The bordered covariance matrix is:

	w_X	w_Y	w_Z
w_X	σ^2_X	$\text{Cov}(r_X, r_Y)$	$\text{Cov}(r_X, r_Z)$
w_Y	$\text{Cov}(r_Y, r_X)$	σ^2_Y	$\text{Cov}(r_Y, r_Z)$
w_Z	$\text{Cov}(r_Z, r_X)$	$\text{Cov}(r_Z, r_Y)$	σ^2_Z

There are nine terms in the covariance matrix. Portfolio variance is calculated, from these nine terms:

$$\begin{aligned}\sigma^2_p &= w^2_X\sigma^2_X + w^2_Y\sigma^2_Y + w^2_Z\sigma^2_Z \\ &\quad + w_Xw_Y\,\text{Cov}(r_X,r_Y) + w_Yw_X\,\text{Cov}(r_Y,r_X) \\ &\quad + w_Xw_Z\,\text{Cov}(r_X,r_Z) + w_Zw_X\,\text{Cov}(r_Z,r_X) \\ &\quad + w_Yw_Z\,\text{Cov}(r_Y,r_Z) + w_Zw_Y\,\text{Cov}(r_Z,r_Y) \\ &= w^2_X\sigma^2_X + w^2_Y\sigma^2_Y + w^2_Z\sigma^2_Z \\ &\quad + 2w_Xw_Y\,\text{Cov}(r_X,r_Y) + 2w_Xw_Z\,\text{Cov}(r_X,r_Z) + 2w_Yw_Z\,\text{Cov}(r_Y,r_Z)\end{aligned}$$

2. The parameters of the opportunity set are $E(r_D) = .08$, $E(r_E) = .13$, $\sigma_D = .12$, $\sigma_E = .20$, and $\rho(D,E) = .25$. From the standard deviations and the correlation coefficient we generate the covariance matrix:

Fund	***D***	***E***
D	.0144	.006
E	.006	.04

The *global minimum-variance* portfolio is constructed so that

$$\begin{aligned}w_D &= [\sigma^2_E - \text{Cov}(r_D,r_E)] \div [\sigma^2_D + \sigma^2_E - 2\,\text{Cov}(r_D,r_E)] \\ &= (.04 - .006) \div (.0144 + .04 - 2 \times .006) = .8019 \\ w_E &= 1 - w_D = .1981\end{aligned}$$

Its expected return and standard deviation are

$$\begin{aligned}E(r_P) &= .8019 \times .08 + .1981 \times .13 = .0899 \text{ or } 8.99\% \\ \sigma_P &= [w^2_D\sigma^2_D + w^2_E\sigma^2_E + 2w_Dw_E\,\text{Cov}(r_D,r_E)]^{1/2} \\ &= [.8019^2 \times .0144 + .1981^2 \times .04 + 2 \times .8019 \times .1981 \times .006]^{1/2} \\ &= .1129 \text{ or } 11.29\%\end{aligned}$$

For the other points we simply increase w_D from .10 to .90 in increments of .10; accordingly, w_E ranges from .90 to .10 in the same increments. We substitute these portfolio proportions in the formulas for expected return and standard deviation. Note that for w_D or w_E equal to 1.0, the portfolio parameters equal those of the fund.

We then generate the following table:

w_E	w_D	$E(r)$	σ
0.0	1.0	8.0	12.00
0.1	0.9	8.5	11.46
0.2	0.8	9.0	11.29
0.3	0.7	9.5	11.48
0.4	0.6	10.0	12.03
0.5	0.5	10.5	12.88
0.6	0.4	11.0	13.99
0.7	0.3	11.5	15.30
0.8	0.2	12.0	16.76
0.9	0.1	12.5	18.34
1.0	0.0	13.0	20.00
0.1981	0.8019	8.99	11.29 minimum variance portfolio

You can now draw your graph.

3. *a.* The computations of the opportunity set of the two stock funds are like those of question 6 and will not be shown here. You should perform these computations, however, in order to give a graphical solution to part (*a*). Note that the covariance between the funds is

$$\begin{aligned}\text{Cov}(r_A, r_B) &= \rho(A, B) \times \sigma_A + \sigma_B \\ &= -.2 \times .20 \times .60 = -.0240\end{aligned}$$

b. The proportions in the optimal risky portfolio are given by

$$\begin{aligned}w_A &= \frac{(.10 - .50).60^2 - (.30 - .05)(-.0240)}{(.10 - .05).60^2 + (.30 - .05).20^2 - .30(-.0240)} \\ &= .6818 \\ w_B &= 1 - w_A = .3182\end{aligned}$$

The expected return and standard deviation of the optimal risky portfolio are

$$\begin{aligned}E(r_P) &= .6818 \times .10 + .3182 \times .30 = .1636 \\ \sigma_P &= [.6818^2 \times .20^2 + .3182^2 \times .60^2 + 2 \times .6818 \times .3182(-.0240)]^{1/2} \\ &= .2113\end{aligned}$$

Note that in this case the standard deviation of the optimal risky portfolio is smaller than the standard deviation of fund *A*. Note also that portfolio *P* is not the global minimum-variance portfolio. The proportions of the latter are given by

$$\begin{aligned}w_A &= [.60^2 - (-.0240)] \div [.60^2 + .20^2 - 2(-.0240)] = .8571 \\ w_B &= 1 - w_A = .1429\end{aligned}$$

With these proportions, the standard deviation of the minimum-variance portfolio is

$$\begin{aligned}\sigma(\text{min}) &= [.8571^2 \times .20^2 + .1429^2 \times .60^2 + 2 \times .8571 \times .1429 \times (-.0240)]^{1/2} \\ &= .1757\end{aligned}$$

which is smaller than that of the optimal risky portfolio.

c. The CAL is the line from the risk-free rate through the optimal risky portfolio. This line represents all efficient portfolios that combine T-bills with the optimal risky portfolio. The slope of the CAL is

$$\begin{aligned}S &= [E(r_P) - r_f]/\sigma_P \\ &= (.1636 - .05)/.2113 = .5376\end{aligned}$$

d. Given a degree of risk aversion, *A,* an investor will choose a proportion, *y,* in the optimal risky portfolio of

$$\begin{aligned}y &= [E(r_P) - r_f]/(A\sigma^2{}_P) \\ &= (.1636 - .05)/(5 \times .2113^2) = .5089\end{aligned}$$

This means that the optimal risky portfolio, with the given data, is attractive enough for an investor with $A = 5$ to invest 50.89 percent of his or her wealth in it. Since fund *A* makes up 68.18 percent of the risky portfolio and fund *B* 31.82 percent, the investment proportions for this investor are

Fund *A*:	$5089 \times 68.18 =$	34.70%
Fund *B*:	$.5089 \times 31.12 =$	16.19%
	Total	50.89%

4. Efficient frontiers derived by portfolio managers depend on forecasts of the rates of return on various securities and estimates of risk, that is, the covariance matrix. The forecasts themselves do not control outcomes. Thus preferring managers with rosier forecasts (northwesterly frontiers) is tantamount to rewarding the bearers of good news and punishing the bearers of bad news. What we should do is reward bearers of *accurate* news. Thus, if you get a glimpse of the frontiers (forecasts) of portfolio managers on a regular basis, what you want to do is develop the track record of their forecasting accuracy and steer your advisees toward the more accurate forecaster. Their portfolio choices will, in the long run, outperform the field.

5. The parameters are $E(r) = .15$, $\sigma = .60$, and the correlation between any pair of stocks is $\rho = .5$.

a. The portfolio expected return is invariant to the size of the portfolio because all stocks have identical expected returns. The standard deviation of a portfolio with $n = 25$ stocks is

$$\begin{aligned}\sigma_P &= [\sigma^2(1/n) + \rho \times \sigma^2(n - 1)/n]^{1/2} \\ &= [.60^2/25 + .5 \times .60^2 \times 24/25]^{1/2} = .4327\end{aligned}$$

b. Because the stocks are identical, efficient portfolios are equally weighted. To obtain a standard deviation of 43 percent, we need to solve for n:

$$\begin{aligned}.43^2 &= .60^2/n + .5 \times .60^2(n - 1)/n \\ .1849n &= .3600 + .1800n - .1800 \\ n &= \frac{.1800}{.0049} = 36.73\end{aligned}$$

Thus we need 37 stocks and will come in slightly under target.

c. As n gets very large, the variance of an efficient (equally weighted) portfolio diminishes, leaving only the variance that comes from the covariances among stocks, that is,

$$\sigma_P = \sqrt{\rho \times \sigma^2} = \sqrt{.5 \times 60^2} = .4243$$

Note that with 25 stocks we came within 84 basis points of the systematic risk, that is, the nonsystematic risk of a portfolio of 25 stocks is 84 basis points. With 37 stocks the standard deviation is .4300, of which nonsystematic risk is 57 basis points.

d. If the risk-free rate is 10 percent, then the risk premium on any-size portfolio is $15 - 10 = 5$ percent. The standard deviation of a well-diversified portfolio is (practically) 42.43 percent; hence, the slope of the CAL is

$$S = 5/42.43 = .1178$$

B.3 EQUILIBRIUM IN CAPITAL MARKETS

Chapter 7—The Capital Asset Pricing Model

1. We can characterize the entire population by two representative investors. One is the "uninformed" investor, who does not engage in security analysis and holds the market portfolio, whereas the other optimizes using the Markowitz algorithm with input from security analysis. The uninformed investor does not know what input the informed investor uses to make portfolio purchases. The uninformed investor knows, however, that if the other investor is informed the market portfolio proportions will be optimal. Therefore to depart from these proportions would constitute an uninformed bet, which will, on average, reduce the efficiency of diversification with no compensating improvement in expected returns.

2. *a.* From equation 7.2, $\overline{A} = \dfrac{.0424}{.1742^2} = 1.397.$

b. If $\overline{A} = 1.5$ then the risk premium should be $1.5 \times .1742^2 = .0455$, or 4.55%.

3. The portfolio β, which is

$$\begin{aligned}\beta_P &= w_{\text{BCE}}\beta_{\text{BCE}} + w_{\text{RIM}}\beta_{\text{RIM}} \\ &= .25 \times 1.1 + .75 \times 1.25 = 1.2125\end{aligned}$$

As the market risk premium, $E(r_m) - r_f$, is .08, the portfolio risk premium will be

$$\begin{aligned}E(r_P) - r_f &= \beta_P[E(r_m) - r_f] \\ &= 1.2125 \times .08 = .097 \text{ or } 9.7\%\end{aligned}$$

4. The alpha of a stock is its expected return in excess of that required by the CAPM.

$$\begin{aligned}\alpha &= E(r) - [r_f + \beta[E(r_m) - r_f]] \\ \alpha_{\text{XYZ}} &= .12 - [.05 + 1.0(.11 - .05)] = .01 \\ \alpha_{\text{ABC}} &= .13 - [.05 + 1.5(.11 - .05)] = -.01\end{aligned}$$

ABC plots below the SML, while XYZ plots above.

5. *a.* Required rate: $8 + 1.3 \times (16 - 8) = 18.4\%$. *b.* Yes.

Chapter 8—Index Models and the Arbitrage Pricing Theory

1. *a.* Total market capitalization is 3,000 + 1,940 + 1,360 = 6,300. Therefore, the mean excess return of the index portfolio is

$$\frac{3{,}000}{6{,}300} \times 10 + \frac{1{,}940}{6{,}300} \times 2 + \frac{1{,}360}{6{,}300} \times 17 = 9.05\% = .0905$$

b. The covariance between stocks *A* and *B* equals

$$\text{Cov}(R_A, R_B) = \beta_A\beta_B\sigma_M^2 = 1 \times .2 \times .25^2 = .0125$$

c. The covariance between stock *B* and the index portfolio equals

$$\text{Cov}(R_B, R_M) = \beta_B\sigma_M^2 = .2 \times .25^2 = .0125$$

d. The total variance of *B* equals

$$\sigma_B^2 = \text{Var}(\beta_B R_M + e_B) = \beta_B^2\sigma_M^2 + \sigma^2(e_B)$$

Systematic risk equals $\beta_B^2\sigma_M^2 = .2^2 \times .25^2 = .0025$. Thus the firm-specific variance of *B* equals

$$\sigma^2(e_B) = \sigma_B^2 - \beta_B^2\sigma_M^2 = .30^2 - .2^2 \times .25^2 = .0875$$

2. The variance of each stock is $\beta^2\sigma_M^2 + \sigma^2(e)$.
For stock *A*, we obtain

$$\begin{aligned}\sigma_A^2 &= .9^2(.20)^2 + .3^2 = .1224 \\ \sigma_A &= .35\end{aligned}$$

For stock *B*,

$$\begin{aligned}\sigma_B^2 &= 1.1^2(.20)^2 + .1^2 = .0584 \\ \sigma_B &= .24\end{aligned}$$

The covariance is

$$\beta_A\beta_B\sigma_M^2 = .9 \times 1.1 \times .2^2 = .0396$$

3. $\sigma^2(e_P) = (\frac{1}{2})^2[\sigma^2(e_A) + \sigma^2(e_B)]$
$= \frac{1}{4}(.3^2 + .1^2)$
$= \frac{1}{4}(.09 + .01)$
$= .025$

Therefore

$$\sigma(e_P) = .158$$

4. BCE's alpha is related to the CAPM alpha by

$$\alpha_{\text{BCE}} = \alpha_{\text{CAPM}} + (1 - \beta)r_f$$

For BCE, $\alpha_{\text{BCE}} = .99$ percent, $\beta = .19$, and we are told that r_f was .1 percent. Thus

$$\begin{aligned}\alpha_{\text{CAPM}} &= .99 - 2(1 - .19).1 \\ &= .91\%\end{aligned}$$

BCE still performed well relative to the market and the index model. It beat its "benchmark" return by an average of .91 percent per month.

5. With these lower-risk premiums, the expected return on the stock will be lower:

$$E(r) = 4\% + 1.8 \times 4\% + .7 \times 2\% = 12.6\%$$

6. *a.* For $n = 10$, the nonsystematic standard deviation is

$$\sqrt{\frac{.3}{10}} = .173$$

b. For $n = 100$, the nonsystematic standard deviation is

$$\sqrt{\frac{.3}{100}} = .054$$

c. For $n = 1{,}000$, the nonsystematic standard deviation is

$$\sqrt{\frac{.3}{1{,}000}} = .017$$

d. For $n = 10{,}000$, the nonsystematic standard deviation is

$$\sqrt{\frac{.3}{10{,}000}} = .005$$

Clearly, for large diversified portfolios, nonsystematic risk is inconsequential.

7. *a.* This portfolio is not well diversified. The weight on the first security does not decline as n increases. Regardless of how much diversification there is in the rest of the portfolio, you will not shed the firm-specific risk of this security.

b. This portfolio is well diversified. Even though some stocks have three times the weight as other stocks ($1.5/n$ versus $.5/n$), the weight on all stocks approaches zero as n increases. The impact of any individual stock's firm-specific risk will approach zero as n becomes ever larger.

8. A portfolio consisting of two-thirds of portfolio *A* and one-third of the risk-free asset will have the same beta as portfolio *E*, but an expected return of $(\frac{1}{3} \times 4 + \frac{2}{3} \times 10) = 8\%$, less than that of portfolio *E*. Therefore one can earn arbitrage profits by shorting the combination of portfolio *A* and the safe asset and buying portfolio *E*.

9. The equilibrium return is $E(r) = r_f + \beta_{P1}[E(r_1) - r_f] + \beta_{P2}[E(r_2) - r_f]$.

Using the data in Example 8.4,

$$E(r) = 4 + .2 \times (10 - 4) + 1.4 \times (12 - 4) = 16.4\%$$

10. *a.* For Alberta residents, the stock is not a hedge. When their economy does poorly (low energy prices), the stock also does poorly, aggravating their problems.

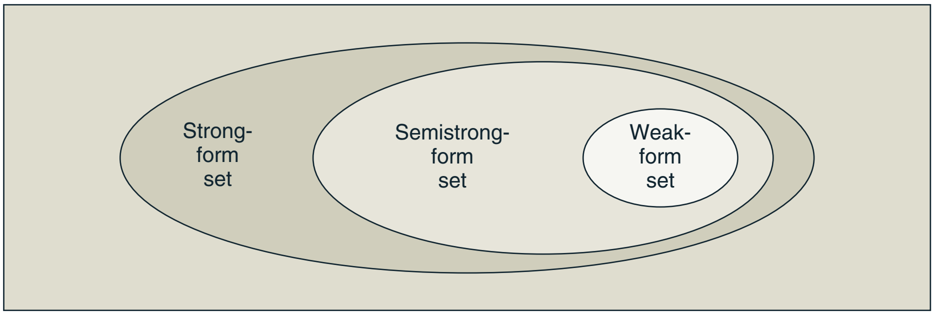
b. For Nova Scotia residents, the stock is a hedge. When energy prices increase, the stock will provide greater wealth with which to purchase energy.

c. If energy consumers (who are willing to bid up the price of the stock for its hedge value) dominate the economy, high-oil-beta stocks will have lower expected rates of return than would be predicted by the simple CAPM.

Chapter 9—Market Efficiency

1. *a.* A high-level manager might well have private information about the firm. Her ability to trade profitably on that information is not surprising. This ability does not violate weak-form efficiency: The abnormal profits are not derived from an analysis of past price and trading data. If they were, this would indicate that there is valuable information that can be gleaned from such analysis. But this ability does violate strong-form efficiency. Apparently, there is some private information that is not already reflected in stock prices.

b. The information sets that pertain to the weak, semistrong, and strong form of the EMH can be described by the following illustration:



The weak-form information set includes only the history of prices and volumes. The semistrong-form set includes the weak-form set *plus* all publicly available information. In turn, the strong-form set includes the semistrong set *plus* insiders' information. It is illegal to act on the incremental information (insiders' private information). The direction of *valid* implication is

$$\text{Strong-form EMH} \rightarrow \text{Semistrong-form EMH} \rightarrow \text{Weak-form EMH}$$

The reverse-direction implication is *not* valid. For example, stock prices may reflect all past price data (weak-form efficiency) but may not reflect revelant fundamental data (semistrong-form inefficiency).

2. If *everyone* follows a passive strategy, sooner or later prices will fail to reflect new information. At this point there are profit opportunities for active investors who uncover mispriced securities. As they buy and sell these assets, prices again will be driven to fair levels.

3. Predictably declining CARs do violate the EMH. If one can predict such a phenomenon, a profit opportunity emerges: sell (or short-sell) the affected stocks on an event date just before their prices are predicted to fall.

4. The answer depends on your prior beliefs about market efficiency. Legg Mason's record has been incredibly strong. On the other hand, with so many funds in existence, it is less surprising that *some* fund would appear to be consistently superior after the fact. Still, Legg Mason's record was so good that, even accounting for its selection as the "winner" of an investment contest, it still appears too good to be attributed to chance.

Chapter 10—Behavioural Finance and Technical Analysis

1. Conservatism implies that investors will at first respond too slowly to new information, leading to trends in prices. Representativeness can lead them to extrapolate trends too far into the future and overshoot intrinsic value. Eventually, when the pricing error is corrected, we observe a reversal.

2. Out-of-favour stocks will exhibit low prices relative to various proxies for intrinsic value such as earnings. Because of regret avoidance, these stocks will need to offer a more attractive rate of return to induce investors to hold them. Thus, low-P/E stocks might on average offer higher rates of return.

3. At liquidation, price will equal NAV. This puts a limit on fundamental risk. Investors need only carry the position for a few months to profit from the elimination of the discount. Moreover, as the liquidation date approaches, the discount should dissipate. This greatly limits the risk that the discount can move against the investor. At the announcement of impending liquidation, the discount should immediately disappear, or at least shrink considerably.

4. Suppose a stock had been selling in a narrow trading range around $50 for a substantial period and later increased in price. Now the stock falls back to a price near $50. Potential buyers might recall the price history of the stock and remember that, the last time the stock fell so low, they missed an opportunity for large gains when it later advanced. They might then view $50 as a good opportunity to buy. Therefore, buying pressure will materialize as the stock price falls to $50, which will create a support level.

5. By the time the news of the recession affects bond yields, it also ought to affect stock prices. The market should fall *before* the confidence index signals that the time is ripe to sell.

Chapter 11—Empirical Evidence on Security Returns

1. The SCL is estimated for each stock; hence we need to estimate 100 equations. Our sample consists of 60 monthly rates of return for each of the 100 stocks and for the market index. Thus each regression is estimated with 60 observations. Equation 11.1 in the text shows that when stated in excess return form, the SCL should pass through the origin, that is, have a zero intercept.

2. When the SML has a positive intercept and its slope is less than the mean excess return on the market portfolio, it is flatter than predicted by the CAPM. Low-beta stocks therefore have yielded returns that, on average, were higher than they should have been on the basis of their beta. Conversely, high-beta stocks were found to have yielded, on average, lower returns than they should have on the basis of their betas. The positive coefficient on γ_2 implies that stocks with higher values of firm-specific risk had on average higher returns. This pattern, of course, violates the predictions of the CAPM.

3. *a.* According to equation 11.5, γ_0 is the average return earned on a stock with zero beta and zero firm-specific risk. According to the CAPM, this should be the risk-free rate, which for the 1946–1955 period was 9 basis points, or .09 percent per month (see Table 11.1). According to the CAPM, γ_1 should equal the average market risk premium, which for the 1946–1955 period was 103 basis points, or 1.03 percent per month. Finally, the CAPM predicts that γ_3, the coefficient on firm-specific risk, should be zero.

b. A positive coefficient on beta-squared would indicate that the relationship between risk and return is nonlinear. High-beta securities would provide expected returns more than proportional to risk. A positive coefficient on $\sigma(e)$ would indicate that firm-specific risk affects expected return, a direct contradiction of the CAPM and APT.

B.4 FIXED-INCOME SECURITIES

Chapter 12—Bond Prices and Yields

1. The callable bond will sell at the *lower* price. Investors will not be willing to pay as much if they know that the firm retains a valuable option to reclaim the bond for the call price if interest rates fall.
2. At a semiannual interest rate of 3 percent, the bond is worth $40 × PA(3%, 60) + $1,000 × PF(3%, 60) = $1,276.76, which results in a capital gain of $276.76. This exceeds the capital loss of $189.29 ($1,000 − $810.71) when the interest rate increases to 5 percent.
3. Yield to maturity exceeds current yield, which exceeds coupon rate. An example is the 8 percent coupon bond with a yield to maturity of 10 percent per year (5 percent per half-year). Its price is $810.71, and therefore its current yield is 80/810.71 = .0987 or 9.87 percent, which is higher than the coupon rate but lower than the yield to maturity.
4. The bond with the 6 percent coupon rate currently sells for 30 × PA(3.5%, 20) + 1,000 × PF(3.5%, 20) = $928.94. If the interest rate immediately drops to 6 percent (3% per half-year), the bond price will rise to $1,000, for a capital gain of $71.06, or 7.65 percent. The 8 percent coupon bond currently sells for $1,071.06. If the interest rate falls to 6 percent, the present value of the *scheduled* payments increases to $1,148.77. However, the bond will be called at $1,100, for a capital gain of only $28.94, or 2.70 percent.
5. The current price of the bond can be derived from the yield to maturity. Using your calculator, set: n = 40 (semiannual periods); payment = $45 per period; future value = $1,000; interest rate = 4% per semiannual period. Calculate present value as $1,098.96. Now we can calculate yield to call. The time to call is five years, or 10 semiannual periods. The price at which the bond will be called is $1,050. To find yield to call, we set: n = 10 (semiannual periods); payment = $45 per period; future value = $1,050; present value = $1,098.96. Calculate yield to call as 3.72 percent per half a year or 7.44 percent annually.
6. Price = $70 × PA(8%, 1) + $1,000 × PF(8%, 1) = $990.74

$$\text{Rate of return to investor} = \frac{\$70 + (\$990.74 - \$982.17)}{\$982.17} = .080$$
$$= 8\%$$

7. At the lower yield, the bond price will be $631.67 [$n$ = 29, i = 7%, FV = $1,000, PMT = $40]. Therefore, total after-tax income is:

Coupon	$40 × (1 − .36) =	$25.60
Imputed interest	($553.66 − $549.69) × (1 − .36) =	2.54
Capital gains	($631.67 − $553.66) × (1 − .20) =	62.41
Total income after taxes		$90.55

Rate of return = 90.55/549.69 = .165 = 16.5 percent.

8. It should receive a positive coefficient. A high ratio of equity to debt is a good omen for a firm that should raise its credit rating.
9. The coupon payment is $45. There are 20 semiannual periods. The final payment is assumed to be $500. The present value of expected cash flows is $650. The yield to maturity is 6.31 percent semiannual or annualized, 12.63 percent, bond equivalent yield.

Chapter 13—The Term Structure of Interest Rates

1. The price of the 3-year bond paying a $40 coupon is

$$\frac{40}{1.05} + \frac{40}{1.062} + \frac{1040}{1.073} = 38.095 + 35.600 + 848.950 = \$922.65$$

At this price, the yield to maturity is 6.945 percent [n = 3; PV = (−)922.65; FV = 1,000; PMT = 40]. This bond's yield to maturity is closer to that of the 3-year zero-coupon bond than is the yield to maturity of the 10 percent coupon bond in Example 13.1. This makes sense: this bond's coupon rate is lower than that of the bond in Example 13.1. A greater fraction of its value is tied up in the final payment in the third year, and so it is not surprising that its yield is closer to that of a pure 3-year zero-coupon security.

2. We compare two investment strategies in a manner similar to Example 13.2:

Buy and hold 4-year zero = buy 3-year zero; roll proceeds into 1-year bond

$$(1 + y_4)^4 = (1 + y_3)^3 \times (1 + r_4)$$
$$1.08^4 = 1.07^3 \times (1 + r_4)$$

which implies that $r_4 = 1.08^4/1.07^3 - 1 = .11056 = 11.056\%$. Now we confirm that the yield on the 4-year zero is a geometric average of the discount factors for the next three years:

$$1 + y_4 = [(1 + r_1) \times (1 + r_2) \times (1 + r_3) \times (1 + r_4)]^{1/4}$$
$$1.08 = [1.05 \times 1.0701 \times 1.09025 \times 1.11056]^{1/4}$$

3. The 3-year bond can be bought today for $\$1{,}000/1.07^3 = \$816.30$. Next year, it will have a remaining maturity of two years. The short rate in year 2 will be 7.01 percent and the short rate in year 3 will be 9.025 percent. Therefore, the bond's yield to maturity next year will be related to these short rates according to

$$(1 + y_2)^2 = 1.0701 \times 1.09025 = 1.1667$$

and its price next year will be $\$1{,}000/(1 + y_2)^2 = \$1{,}000/1.1667 = \$857.12$. The one-year holding-period rate of return is therefore ($857.12 − $816.30)/$816.30 = .05, or 5 percent.

4. The n-period *spot* rate is the yield to maturity on a zero-coupon bond with a maturity of n periods. The *short* rate for period n is the *one-period* interest rate that will prevail in period n. Finally, the *forward* rate for period n is the short rate that would satisfy a "breakeven condition" equating the total returns on two n-period investment strategies. The first strategy is an investment in an n-period zero-coupon bond; the second is an investment in an $n - 1$ period zero-coupon bond "rolled over" into an investment in a one-period zero. Spot rates and forward rates are observable today, but because interest rates evolve with uncertainty, future short rates are not. *In the special case* in which there is no uncertainty in future interest rates, the forward rate calculated from the yield curve would equal the short rate that will prevail in that period.

5. 9 percent.

6. The risk premium will be zero.

7. If issuers wish to issue long-term bonds, they will be willing to accept higher expected interest costs on long bonds over short bonds. This willingness combines with investors' demands for higher rates on long-term bonds to reinforce the tendency toward a positive liquidity premium.

8. In general, from equation 14.7, $(1 + y_n)^n = (1 + y_{n-1})^{n-1} \times (1 + f_n)$. In this case, $(1 + y_4)^4 = (1.07)^3 \times (1 + f_4)$. If $f_4 = .07$, then $(1 + y_4)^4 = (1.07)^4$ and $y_4 = .07$. If f_4 is greater than .07, then y_4 also will be greater, and conversely if f_4 is less than .07, then y_4 will be as well.

9. The 3-year yield to maturity is $\left(\dfrac{1{,}000}{816.30}\right)^{1/3} - 1 = .07 = 7.0$ percent.

The forward rate for the third year is therefore

$$f_3 = \frac{(1 + y_3)^3}{(1 + y_2)^2} - 1 = \frac{1.07^3}{1.06^2} - 1 = .0903 = 9.03\%$$

(Alternatively, note that the ratio of the price of the 2-year zero to the price of the 3-year zero is $1 + f_3 = 1.0903$.) To construct the synthetic loan, buy one 2-year maturity zero, and sell 1.0903 3-year maturity zeros. Your initial cash flow is zero, your cash flow at time 2 is +$1,000, and your cash flow at time 3 is −$1,090.30, which corresponds to the cash flows on a 1-year forward loan commencing at time 2 with an interest rate of 9.03 percent.

Chapter 14—Managing Bond Portfolios

1. Use Table 14.3 with a semiannual discount rate of 4.5 percent.

	Period	Time Until Payment (years)	Cash Flow	PV of CF (discount rate = 5% per period)	Weight	Weight × Time
A. 8% coupon bond	1	0.5	40	38.278	0.0390	0.0195
	2	1.0	40	36.629	0.0373	0.0373
	3	1.5	40	35.052	0.0357	0.0535
	4	2.0	1040	872.104	0.8880	1.7761
Sum:				982.062	1.0000	1.8864
B. Zero-coupon	1	0.5	0	0.000	0.0000	0.0000
	2	1.0	0	0.000	0.0000	0.0000
	3	1.5	0	0.000	0.0000	0.0000
	4	2.0	1000	838.561	1.0000	2.0000
Sum:				838.561	1.0000	2.0000

The duration of the 8 percent coupon bond rises to 1.8864 years. Price increases to $982.062. The duration of the zero-coupon bond is unchanged at two years, although its price also increases (to $838.561) when the interest rate falls.

2. *a.* If the interest rate increases from 9 percent to 9.05 percent, the bond price falls from $982.062 to $981.177. The percentage change in price is −.09019 percent.

b. Using the initial semiannual rate of 4.5 percent, the duration formula would predict a price change of

$$-\frac{1.8864}{1.045} \times .0005 = -.000903 = -.0930\%$$

which is almost the same answer that we obtained from direct computation in part (*a*).

3. The duration of a level perpetuity is $(1 + y)/y$ or $1 + 1/y$, which clearly falls as y increases. Tabulating duration as a function of y we get:

	D
.01	101 years
.02	51
.05	21
.10	11
.20	6
.25	5
.40	3.5

4. Potential gains and losses are proportional to both duration *and* portfolio size. The dollar loss on a fixed-income portfolio resulting from an increase in the portfolio's yield to maturity is, from equation 14.2, $D \times P \times \Delta y/(1 + y)$, where P is the initial market value of the portfolio. Hence $D \times P$ must be equated for immunization.

5. The perpetuity's duration now would be 1.08/.08 = 13.5. We need to solve the following equation for w:

$$w \times 2 + (1 - w) \times 13.5 = 6$$

Therefore $w = .6522$.

6. Dedication would be more attractive. Cash flow matching eliminates the need for rebalancing and thus saves transaction costs.

7. The 30-year 8 percent coupon bond will provide a stream of coupons of \$80 per half-year, which, invested at the assumed rate of 7 percent per half-year, will accumulate to \$165.60. The bond will sell in two years at a price equal to \$80 × annuity factor(8.3%, 28) + \$1,000 × PV factor(8.3%, 28), or \$967.73, for a capital gain of \$42.73. The total two-year income is \$42.73 + \$169.60 = \$208.33, for a two-year return of \$208.33/\$925 = .2252, or 22.52 percent. Based on this scenario, the 20-year 10 percent coupon bond of the example offers a higher return for a two-year horizon.

8. The trigger point is $\$10M/(1.12)^3 = \$7.118M$.

9. Macaulay's duration is defined as the weighted average of the time until receipt of each bond payment. Modified duration is defined as Macaulay's duration divided by $1 + y$ (where y is yield per payment period, e.g., a semiannual yield if the bond pays semiannual coupons). One can demonstrate that for a straight bond, modified duration equals the percentage change in bond price per change in yield. Effective duration captures this last property of modified duration. It is *defined* as percentage change in bond price per change in market interest rates. Effective duration for a bond with embedded options requires a valuation method that allows for such options in computing price changes. Effective duration cannot be related to a weighted average of times until payments, since those payments are themselves uncertain.

B.5 EQUITIES

Chapter 15—Macroeconomic and Industry Analysis

1. The downturn in the auto industry will reduce the demand for the product of this economy. The economy will, at least in the short term, enter a recession. This would suggest that

a. GDP will fall.

b. The unemployment rate will rise.

c. The government deficit will increase. Income tax receipts will fall, and government expenditures on social welfare programs probably will increase.

d. Interest rates should fall. The contraction in the economy will reduce the demand for credit. Moreover, the lower inflation rate will reduce nominal interest rates.

2. Expansionary fiscal policy coupled with expansionary monetary policy will stimulate the economy, with the loose monetary policy keeping down interest rates.

3. A traditional demand-side interpretation of the tax cuts is that the resulting increase in after-tax income increased consumption demand and stimulated the economy. A supply-side interpretation is that the reduction in marginal tax rates made it more attractive for businesses to invest and for individuals to work, thereby increasing economic output.

4. With fixed costs of $2 million and variable costs of $1.5 per unit, firm C has variable costs of $7.5, $9, and $10.5 million in each scenario; the corresponding total costs are $9.5, $11, and $12.5 million. Thus, the profits for firm C are $.5, $1, and $1.5 million under recession, normal, and expansion scenarios. Firm C has the lowest fixed cost and highest variable costs. It should be least sensitive to the business cycle. In fact, it is. Its profits are highest of the three firms in recessions but lowest in expansions. We conclude that the higher the operating leverage, the higher is the resulting business risk; operating leverage increases the sensitivity of operating income to economic conditions.

5. *a.* Newspapers will do best in an expansion when advertising volume is increasing.

b. Machine tools are a good investment at the trough of a recession, just as the economy is about to enter an expansion and firms may need to increase capacity.

c. Beverages are defensive investments, with demand that is relatively insensitive to the business cycle. Therefore, they are relatively attractive investments if a recession is forecast.

d. Timber is a good investment at a peak period, when natural resource prices are high and the economy is operating at full capacity.

Chapter 16—Equity Evaluation Models

1. *a.* Dividend yield = $2.15/50 = 4.3%

Capital gains yield = (59.77 − 50)/50 = 19.54%

Total return = 4.3% + 19.54% = 23.84%

b. k = 6% + 1.15 (14% − 6%) = 15.2%

c. V_0 = ($2.15 + $59.77)/1.152 = $53.75, which exceeds the market price. This would indicate a "buy" opportunity.

d. P = $50 = (OI − .08 × $20)/(1 × .152); therefore, OI = .152 × $50 + .08 × $20 = $9.2 (million). V (assets) = $D + S$ = $20 + $50 × 1 = $70 (millions).

2. *a.* $E(D_1)/(k - g)$ = $2.15/(.152 −.112) = $53.75

b. $E(P_1) = P_0(1 + g)$ = $53.75(1.112) = $59.77

c. The expected capital gain equals $59.77 − $53.75 = $6.02, for a percentage gain of 11.2 percent. The dividend yield is $E(D_1)/P_0$ = $2.15/53.75 = 4 percent, for an HPR of 4% + 11.2% = 15.2 percent.

3. *a.* g = ROE × b = .20 × .60 = .12

$D_1 = (1 - b)E_1$ = (1 − .60) × $5 = $2

$P_0 = D_1/(k - g)$ = $2/(.125 − .12) = $400

PVGO = $P_0 - E_1/k$ = $400 − $5/.12 = $360 due to ROE of .20 versus k of .125

b. g = .10 × .60 = .06

P_0 = $2/(.15 − .06) = $22.22

PVGO = $22.22 − $5/.15 = −$11.11

This stock needs new management that will cut the plowback ratio to zero, giving P_0 = $5/.15 = $33.33.

4. $V_{2012} = .78/(1.096) + .85/(1.096)^2 + .92/(1.096)^3 + (1.00+P_{2016})/(1.0961)^4$

Now compute the sales price in 2016 using the constant-growth dividend discount model. The growth rate will be g = ROE × b = 9% × .75 = 6.75 percent.

$$P_{2016} = 1.00 \times (1 + g)/(k - g) = \$1.0675/(.096 - .0675) = \$37.46$$

Therefore, V_{2012} = $28.77.

5. *a.* ROE = 12%

$b = \$.50/\$2 = .25$

$g = \text{ROE} \times b = 12\% \times .25 = 3\%$

$P_0 = D_1/(k - g) = \$1.50/(.10 - .03) = \$21.43$

$P_0/E(E_1) = \$21.43/\$2 = 10.71$

b. If $b = .4$, then $.4 \times \$2 = \$.80$ would be reinvested and the remainder of earnings, or $1.20, paid as dividends.

$$g = 12\% \times .4 = 4.8\%$$
$$P_0 = E(D_1)/(k - g) = \$1.20/(.10 - .048) = \$23.08$$
$$P_0/E(E_1) = \$23.08/\$2 = 11.54$$

Chapter 17—Financial Statement Analysis

1. A debt/equity ratio of 1 implies that Mordett will have $50 million of debt and $50 million of equity. Interest expense will be .09 × $50 million, or $4.5 million per year. Mordett's net profits and ROE over the business cycle will therefore be:

		Nodett		Mordett	
Scenario	**EBIT**	**Net Profits**	**ROE**	**Net Profits**[a]	**ROE**[b]
Bad year	$ 5M	$3 million	3%	$ .3 million	.6%
Normal year	10M	6	6%	3.3	6.6%
Good year	15M	9	9%	6.3	12.6%

[a]Mordett's after-tax profits are given by: .6(EBIT − $4.5 million).

[b]Mordett's equity is only $50 million.

2. **Ratio Decomposition Analysis for Mordett Corporation**

	ROE	(1) Net Profit / Pretax Profit	(2) Pretax Profit / EBIT	(3) EBIT / Sales (ROS)	(4) Sales / Assets (ATO)	(5) Assets / Equity	(6) Combined Leverage Factor (2) × (5)
***a.* Bad Year**							
Nodett	.030	.6	1.000	.0625	.800	1.000	1.000
Somdett	.018	.6	.360	.0625	.800	1.667	.600
Mordett	.006	.6	.100	.0625	.800	2.000	.200
***b.* Normal Year**							
Nodett	.060	.6	1.000	.100	1.000	1.000	1.000
Somdett	.068	.6	.680	.100	1.000	1.667	1.134
Mordett	.066	.6	.550	.100	1.000	2.000	1.100
***c.* Good Year**							
Nodett	.090	.6	1.000	.125	1.200	1.000	1.000
Somdett	.118	.6	.787	.125	1.200	1.667	1.311
Mordett	.126	.6	.700	.125	1.200	2.000	1.400

3. GI's ROE in 2013 was 3.03 percent, computed as follows:

$$\text{ROE} = \frac{\$5{,}285}{.5(\$171{,}843 + \$177{,}128)} = .0303 \text{ or } 3.03\%$$

Its P/E ratio was $4 = \frac{\$21}{\$5.285}$ and its P/B ratio was $.12 = \frac{\$21}{\$177}$.

Its earnings yield was 25 percent as against an industry average of 12.5 percent.

Note that in our calculations the earnings yield will not equal ROE/(P/B) because we have computed ROE with average shareholders' equity in the denominator and P/B with end-of-year shareholders' equity in the denominator.

4. **IBX Ratio Analysis**

Year	ROE	(1) Net Profit / Pretax Profit	(2) Pretax Profit / EBIT	(3) EBIT / Sales (ROS)	(4) Sales / Assets (ATO)	(5) Assets / Equity	(6) Combined Leverage Factor (2) × (5)	(7) ROA (3) × (4)
2015	11.4%	.616	.796	7.75%	1.375	2.175	1.731	10.65%
2013	10.2%	.636	.932	8.88%	1.311	1.474	1.374	11.65%

ROE went up despite a decline in operating margin and a decline in the tax burden ratio because of increased leverage and turnover. Note that ROA declined from 11.65 percent in 2013 to 10.65 percent in 2015.

5. LIFO accounting results in lower reported earnings than does FIFO. Fewer assets to depreciate results in lower reported earnings because there is less bias associated with the use of historic cost. More debt results in lower reported earnings because the inflation premium in the interest rate is treated as part of interest expense and not as repayment of principal. If ABC has the same reported earnings as XYZ despite these three sources of downward bias, its real earnings must be greater.

B.6 DERIVATIVE ASSETS

Chapter 18—Options and Other Derivatives Markets: Introduction

1. *a.* Proceeds $= S_T - X = S_T - 14$ if this value is positive; otherwise, the call expires worthless.

Profit = Proceeds − Option price = Proceeds − $2.10

	$S_T = 12$	$S_T = 18$
Proceeds	0	4
Profit	−$2.1	$1.9

b. Proceeds $= X - S_T = 14 - S_T$ if this value is positive; otherwise, the put expires worthless.

Profit = Proceeds − Option price = Proceeds − $1.66

	$S_T = 12$	$S_T = 18$
Proceeds	2	0
Profit	$0.34	−$1.66

2. Before the split, the profits would have been 100 × (18 − 14) = $400. After the split, the profits become 200 × (9 − 7) = $400, the same as before.

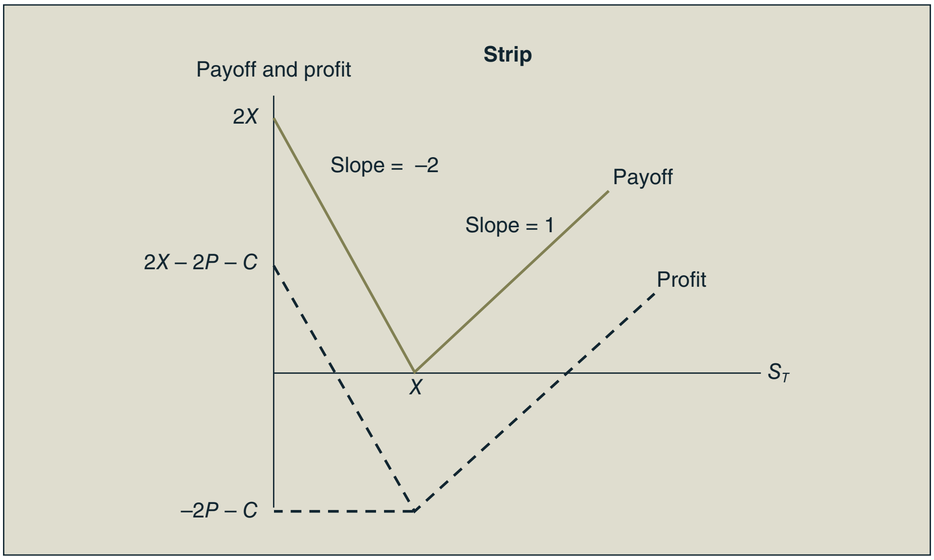
3. *a.* See Figures 18.2 to 18.5 for the call and put buyers and writers respectively.

b. Call buyers and put writers do well when the the stock price increases and poorly when it falls.

c. Call writers and put buyers do well when the the stock price increases and poorly when it falls.

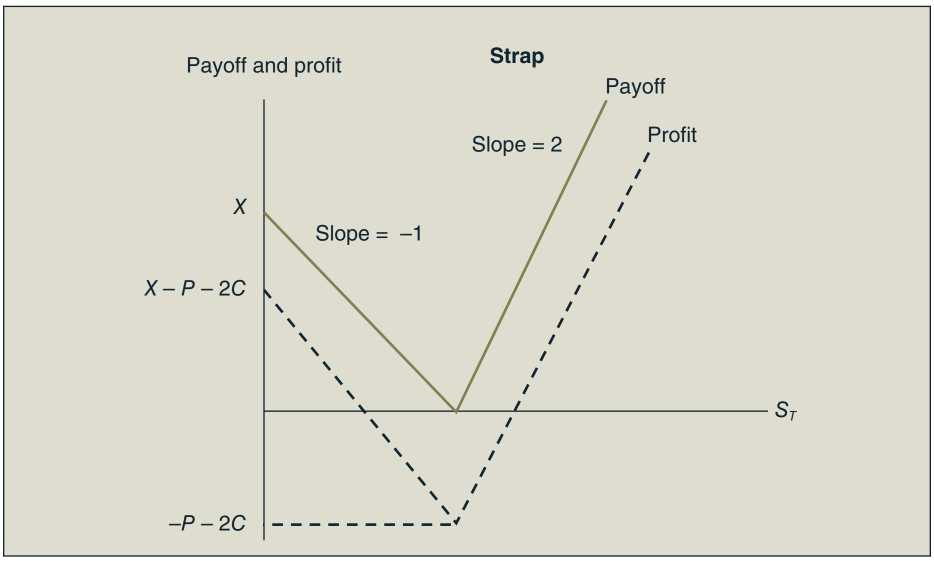
4. **Payoff to a Strip**

	$S_T \leq X$	$S_T > X$
2 puts	$2(X - S_T)$	0
1 call	0	$S_T - X$

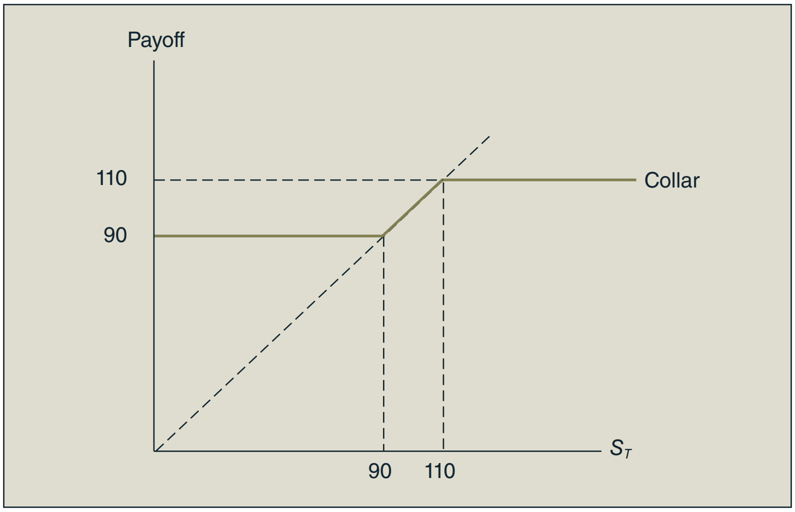


Payoff to a Strap

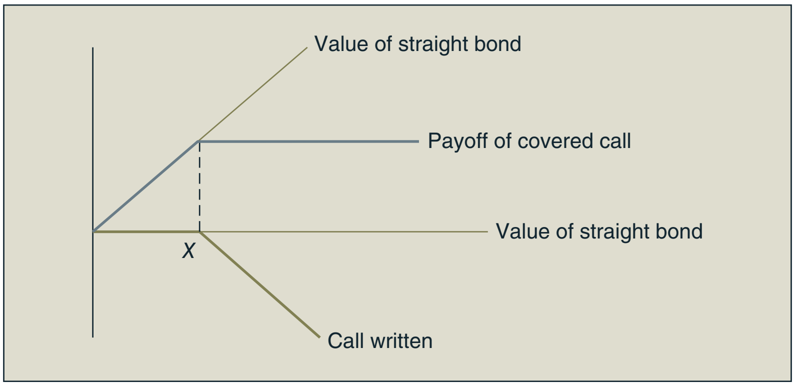
	$S_T \leq X$	$S_T > X$
1 put	$X - S_T$	0
2 calls	0	$2(S_T - X)$



5.



6. The covered call strategy would consist of a straight bond with a call written on the bond. The value of the strategy at option expiration as a function of the value of the straight bond is given in the following figure, which is virtually identical to Figure 18.8.



7. The call option is worth less as call protection is expanded. Therefore, the coupon rate need not be as high.

8. Lower. Investors will accept a lower coupon rate in return for the conversion option.

9. The appropriate calls to replicate the bull CDs have exercise prices equal to 1.05 × 240 × 1.005, and the riskless investment is 1.005/1.03. Investing in a portfolio of \$10/(240 × 1.05) in calls and 1.005/1.03 in the riskless asset yields the largest of 1.005 and $(1 + r_M)/1.05$, which corresponds to the bull CD's return per dollar of par value. The value of the portfolio is 10/252 + 1.005/1.03 = 1.0154, which is the value of the bull CD per unit par value.

10. We still have C/S_0 = \$50/\$1,000 = .05. Since the CD is bullish and offers a .5% minimum, the multiplier is equal to $(r_f - r_{min})/(1 + r_f)$ divided by .05, or (.025/1.03)/.05 = .4854.

Chapter 19—Option Valuation

1.

If Variable Increases	The Value of a Put Option
S	Decreases
X	Increases
σ	Increases
T	Increases
r_f	Decreases
Dividend payouts	Increases

2. The parity relationship assumes that all options are held until expiration and that there are no cash flows until expiration. These assumptions are valid only in the special case of European options on non-dividend-paying stocks. If the stock pays no dividends, the American and European calls are equally valuable, whereas the American put is worth more than the European put. Therefore, although the parity theorem for European options states that

$$P = C - S_0 + \text{PV}(X)$$

in fact, P will be *greater* than this value if the put is American.

3. Because the option now is underpriced, we want to reverse our previous strategy:

		Cash Flow in 1 Year for Each Possible Stock Price	
	Initial Cash Flow	$S = 90$	$S = 120$
1. Buy three options	−16.50	0	30
2. Short-sell one share	100	−90	−120
3. Lend \$83.50 and receive in 1 year	83.50	91.85	91.85
Total	0	1.85	1.85
Present value at 10% = 1.85/1.10 =		1.68	1.68

4. *a.* $C_u - C_d = \$6.984 - 0$

b. $uS_0 - dS_0 = \$110 - \$95 = \$15$

c. 6.984/15 = .4656

d.

	Value in Next Period as Function of Stock Price	
Action Today (time 0)	$dS_0 = \$95$	$uS_0 = \$110$
Buy .4656 shares at price $S_0 = \$100$	\$44.232	\$51.216
Write 1 call at price C_0	0	− 6.984
Total	\$44.232	\$44.232

The portfolio must have a market value equal to the present value of \$44.232.

e. \$44.232/1.05 = \$42.126

f. $.4656 \times \$100 - C_0 = \$42.126$

$C_0 = \$46.56 - \$42.126 = \$4.434$

5. The time interval shrinks but there are proportionally more intervals over the time to expiration. So a given up or down movement over fewer periods is subdivided into correspondingly smaller or larger movements when the number of periods increases. The total volatility (variance) remains unchanged, since it is the sum over the total number of periods.

6. Because $\sigma = .6$, $\sigma^2 = .36$

$$d_1 = \frac{\ln(100/95) + (.10 + .36/2) \times .25}{.6\sqrt{.25}} = .4043$$

$$d_2 = d_1 - .6\sqrt{.25} = .1043$$

$$N(d_1) = .6570, N(d_2) = .5415$$

$$C = 100 \times .6570 - 95e^{-.10 \times .25} \times .5415 = 15.53$$

7. Implied volatility exceeds .5. Given a standard deviation of .5, the option value is $13.70. A higher volatility is needed to justify the actual $15 price.

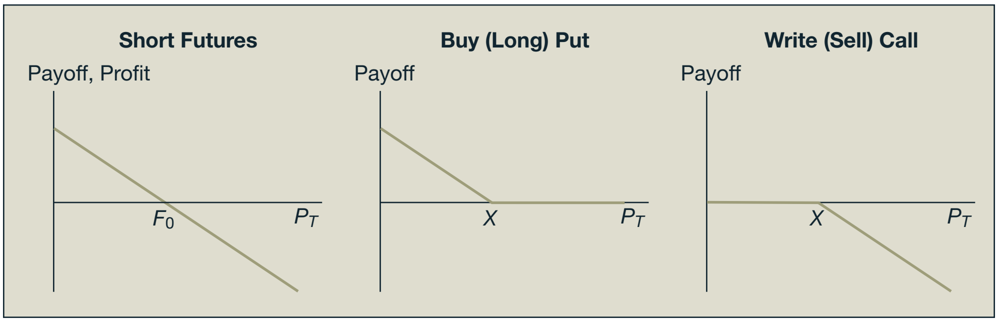
8. Implied volatility exceeds .2783. Given a standard deviation of .2783, the option value is $7. A higher volatility is needed to justify an $8 price. Using Goal Seek, you can confirm that implied volatility at an option price of $8 is .3138.

9. A $1 increase in stock price is a percentage increase of 1/122 = .82 percent. The put option will fall by (.4 × $1) = $.40, a percentage decrease of $.40/$4 = 10 percent. Elasticity is −10/.82 = −12.2.

10. The delta for a call option is $N(d_1)$, which is positive, and in this case is .547. Therefore, for every 10 option contracts you would need to short 547 shares of stock.

Chapter 20—Futures, Forwards, and Swap Markets

1.



2. The clearinghouse has a zero net position in all contracts. Its long and short positions are offsetting, so that net cash flow from marking to market must be zero.

3.

	T-Bond Price in June		
	$114	**$115**	**$116**
Cash flow to purchase bonds (= −2,000P_T)	−$228,000	−$230,000	−$232,000
Profits on long futures position	−$2,000	0	$2,000
Total cash flow	−$230,000	−$230,000	−$230,000

4. The risk would be that the index and the portfolio do not move perfectly together. Thus basis risk involving the spread between the futures price and the portfolio value could persist even if the index futures price were set perfectly relative to the index itself.

5.

Action	Initial CF	Time-T CF
Lend \$800	−\$800	+ \$800 × 1.02 = \$816
Short stock	\$800	$-S_T$ − \$10
Long futures	0	S_T − \$802
	0	\$4

6. Stocks offer a total return (capital gain plus dividends) large enough to compensate investors for the time value of the money tied up in the stock. Soybean prices do not necessarily increase over time. In fact, across a harvest, soybean prices will fall. The returns necessary to make storage economically attractive are lacking.

7. If systematic risk were higher, the appropriate discount rate, k, would increase. Referring to equation 20.5, we conclude that F_0 would fall. Intuitively, the claim to one pound of orange juice is worth less today if its expected price is unchanged, but the risk associated with the value of the claim increases. Therefore, the amount investors are willing to pay today for future delivery is lower.

8. It must have zero beta. If the futures price is an unbiased estimator, then we infer that it has a zero risk premium, which means that beta must be zero.

9. A short futures position of 500 contracts, combined with \$80 million worth of the indexed stock portfolio, will have at maturity a net payoff per unit index of S_T from the portfolio and $F_0 - S_T$ from the short position, or a net of F_0. With the numbers used, this corresponds to \$80,800,000. This is equal to the amount of \$80 million of the stock portfolio times 1.01, the rate of interest, reflecting the parity relation $F_0 = S_0(1 + r_f)^T$.

10. According to interest rate parity, F_0 should be \$2.12. Since the futures price is too high, we should reverse the arbitrage strategy just considered.

	CF Now (\$)	CF in 1 Year
1. Borrow \$2.10 in Canada. Convert to one pound.	+2.10	−2.10(1.06)
2. Lend the one pound in the U.K.	−2.10	1.05 E_1
3. Enter a contract to sell 1.05 pounds at a futures price of \$2.14.	0	(1.05) (2.14 − E_1)
Total	0	.021

11.

	LIBOR		
	7%	8%	9%
As debt payer (LIBOR × \$10 million)	−700,000	−800,000	−900,000
As fixed payer receives \$10 million × (LIBOR −.08)	−100,000	0	+100,000
Net cash flow	−800,000	−800,000	−800,000

Regardless of the LIBOR rate, the firm's net cash outflow equals .08 × bond principal, just as if it had issued a fixed-rate bond with a coupon of 8 percent.

12. The manager would like to hold on to the money market securities because of their attractive relative pricing compared to other short-term assets. However, there is an expectation that rates will fall. The manager can hold this *particular* portfolio of short-term assets and still benefit from the drop in interest rates by entering a swap to pay a short-term interest rate and receive a fixed interest rate. The resulting synthetic fixed-rate portfolio will increase in value if rates do fall.

B.7 ACTIVE PORTFOLIO MANAGEMENT

Chapter 21—Active Management and Performance Measurement

1. Sharpe: $(\bar{r} - \bar{r}_f)/\sigma$

$S_P = (.35 - .06)/.42 = .69$
$S_M = (.28 - .06)/.30 = .733$
Underperform

Alpha: $\bar{r} - [r_f + \beta(\bar{r}_M - \bar{r}_f)]$

$\alpha_P = .35 - [.06 + 1.2(.28 - .06)] = .026$
$\alpha_M = 0$
Outperform

Treynor: $(\bar{r} - \bar{r}_f)/\beta$

$T_P = (.35 - .06)/1.2 = .242$
$T_M = (.28 - .06)/1.0 = .22$
Outperform

Appraisal ratio: $\alpha/\sigma(e)$

$A_P = .026/.18 = .144$
$A_M = 0$
Outperform

2. The t-statistic on α is $.2/2 = .1$. The probability that a manager with a true α of zero could obtain a sample period alpha with a t-statistic of .1 or better by pure luck can be calculated approximately from a table of the normal distribution. The probability is 46 percent.

3. The timer will guess bear or bull markets completely randomly. One-half of all bull markets will be preceded by a correct forecast, and similarly for bear markets. Hence, $P_1 + P_2 - 1 = \frac{1}{2} + \frac{1}{2} - 1 = 0$.

4. Performance attribution:
First compute the new bogey performance as $(.70 \times 5.81) + (.25 \times 1.45) + (.05 \times .48) = 4.45$.

a. Contribution of asset allocation to performance:

Market	(1) Actual Weight in Market	(2) Benchmark Weight in Market	(3) Active or Excess Weight	(4) Market Return (%)	(5) = (3) × (4) Contribution to Performance (%)
Equity	.70	.70	.00	5.81	.00
Fixed-income	.07	.25	−.18	1.45	−.26
Cash	.23	.05	.18	0.48	.09
Contribution of asset allocation					−.17

b. Contribution of selection to total performance:

Market	(1) Portfolio Performance (%)	(2) Index Performance (%)	(3) Excess Performance (%)	(4) Portfolio Weight	(5) = (3) × (4) Contribution (%)
Equity	7.28	5.00	2.28	.70	1.60
Fixed-income	1.89	1.45	0.44	.07	0.03
Contribution of selection within markets			1.63		

Chapter 22—Portfolio Management Techniques

1. The price value of a basis point is still $9,000, as a one basis-point change in the interest rate reduces the value of the $20 million portfolio by .01% × 4.5 = .0045 percent. Therefore, the number of futures needed to hedge the interest rate risk is the same as for a portfolio half the size with double the modified duration.

Chapter 23—Managed Funds

1. $$\text{NAV} = \frac{(\$90{,}686.10 - \$1{,}732.80)}{\$3{,}135.68} = \$28.37$$

2. *a.* Turnover = $160,000 in trades per $1 million of portfolio value = 16 percent.

b. Realized capital gains are $10 × 1,000 = $10,000 on Weston and $2.50 × 4,000 = $10,000 on Teck. The tax owed on the capital gains is therefore .20 × $20,000 = $4,000.

3. *a.* Nondirectional. The shares in the fund and the short position in the index swap constitute a hedged position. The hedge fund is betting that the discount on the closed-end fund will shrink and that it will profit regardless of the general movements in the Indian market.

b. Nondirectional. The value of both positions is driven by the value of Toys 'Я' Us. The hedge fund is betting that the market is undervaluing Petri relative to Toys 'Я' Us, and that as the *relative* values of the two positions come back into alignment, it will profit regardless of the movements in the underlying shares.

c. Directional. This is an outright bet on the price that Generic will eventually command given a successful bid by Pfizer, or better if there is competition.

4. The expected rate of return on the position (in the absence of any knowledge about idiosyncratic risk reflected in the residual) is 3 percent. If the residual turns out to be −4 percent, then the position will lose 1 percent of its value over the month and fall to $1.485 million. The excess return on the market in this month over T-bills would be 5% − 1% = 4 percent, while the excess return on the hedged strategy would be −1% − 1% = −2 percent, so the strategy would plot in panel A as the point (4%, −2%). In panel B, which plots *total* returns on the market and the hedge position, the strategy would plot as the point (5%, −1%).

5. The net investment in the Class A shares after the 4 percent commission is $9,600. If the fund earns a 10 percent return, the investment will grow after n years to $\$9{,}600 \times (1.10)^n$. The Class B shares have no front-end load. However, the net return to the investor after other charges will be only 9.5 percent. In addition, there is a back-end load that reduces the sales proceeds by a percentage equal to (5 – years until sale) until the fifth year, when the back-end load expires.

	Class A Shares	Class B Shares
Horizon	$9,600 × (1.10)^n	$10,000 × (1.095)^n × (1 − Percentage exit fee)
1 year	$10,560	$10,000 × (1.095) × (1 − .04) = $10,512
4 years	$14,055	$10,000 × (1.095)^4 × (1 − .01) = $14,232
10 years	$24,900	$10,000 × (1.095)^8 = $24,782

For a very short horizon such as 1 year, the Class A shares are the better choice. The front-end and back-end loads are equal, but the Class A shares don't have to pay the other fees. For moderate horizons such as 4 years, the Class B shares dominate because the front-end load of the Class A shares is more costly than the other fees and the now-smaller exit fee. For long horizons of 10 years or more, Class A again dominates. In this case, the one-time front-end load is less expensive than the continuing other fees.

6. Out of the 100 top-half managers, 40 are skilled and will repeat their performance next year. The other 60 were just lucky, but we should expect half of them to be lucky again next year, meaning that 30 of the lucky managers will be in the top half next year. Therefore, we should expect a total of 70 managers, or 70 percent of the better performers, to repeat their top-half performance.

A.1. If Eloise keeps her present asset allocation, she will have the following amounts to spend after taxes five years from now:

Tax-Qualified Account			
Bonds:	$50,000(1.1)^5 × .72		= $ 57,978.36
Stocks:	$50,000(1.15)^5 × .72		= $ 72,408.86
		Subtotal	**$130,387.22**

Nonretirement Account			
Bonds:	$50,000(1.072)^5		= $ 70,785.44
Stocks:	$50,000(1.15)^5 − .50 × .28 × [50,000(1.15)^5 − 50,000]		= $ 93,488.36
		Subtotal	**$164,273.80**
		Total	**$294,661.02**

If Eloise shifts all of the bonds into the retirement account and all of the stock into the nonretirement account she will have the following amounts to spend after taxes five years from now:

Tax-Qualified Account		
Bonds:	$100,000(1.1)^5 × .72	= $115,956.72

Nonretirement Account	
Stocks: $100,000(1.15)^5 - .50 \times .28[100,000(1.15)^5 - 100,000]$	= $186,976.72
Total	= **$302,933.44**

Her spending budget will increase by $8,272.42.

A.2. $B_0 \times$ PA(4%, 5 years) = 100,000 implies that B_0 = $22,462.71.

t	R_t	B_t	A_t
0			$100,000.00
1	4%	$22,462.71	$ 81,537.29
2	10%	$23,758.64	$ 65,923.38
3	−8%	$21,017.26	$ 39,640.53
4	25%	$25,261.12	$ 24,289.54
5	0	$24,289.54	0

B.1. The contribution to each fund will be $2,000 per year (i.e., 5 percent of $40,000) in constant dollars. At retirement she will have her guaranteed return fund:

$$\$50{,}000 \times 1.03^{20} + \$2{,}000 \times \text{Annuity factor}(3\%, 20 \text{ years}) = \$144{,}046$$

That is the amount she will have for *sure*.

In addition the expected future value of her stock account is:

$$\$50{,}000 \times 1.06^{20} + \$2{,}000 \times \text{Annuity factor}(6\%, 20 \text{ years}) = \$233{,}928$$

B.2. He has accrued an annuity of .01 × 15 × $15,000 = $2,250 per year for 15 years, starting in 25 years. The PV of this annuity is $2,812.13. PV = $2,250PA(8%, 15) × PF(8%, 25).

Chapter 24—International Investing

1. $1 + r(\text{Cdn}) = [(1 + r_f(\text{UK})] \times (E_1/E_0)$

a. $1 + r(\text{Cdn}) = 1.1 \times 1.0 = 1.10$; $r(\text{Cdn}) = 10\%$

b. $1 + r(\text{Cdn}) = 1.1 \times 1.1 = 1.21$; $r(\text{Cdn}) = 21\%$

2. You must sell forward the number of pounds that you will end up with at the end of the year. However, this value cannot be known with certainty unless the rate of return of the pound-denominated investment is known.

a. 10,000 × 1.20 = 12,000 pounds

b. 10,000 × 1.30 = 13,000 pounds

3. Country selection:

$$(.40 \times 10\%) + (.20 \times 5\%) + (.40 \times 15\%) = 11\%$$

This is a loss of 1.5 percent relative to the EAFE passive benchmark.

Currency selection:

$$(.40 \times 10\%) + [.20 \times (-10\%)] + (.40 \times 30\%) = 14\%$$

This is a loss of 6 percent relative to the EAFE benchmark.