Chapter 5
Risk and return

■ Instructor's resources

Overview

This chapter focuses on the fundamentals of the risk and return relationship of assets and their valuation. For the single asset held in isolation, risk is measured with the probability distribution and its associated statistics: the mean, the standard deviation, and the coefficient of variation. The concept of diversification is examined by measuring the risk of a portfolio of assets that are perfectly positively correlated, perfectly negatively correlated, and those that are uncorrelated. Next, the chapter looks at international diversification and its effect on risk. The Capital Asset Pricing Model (CAPM) is then presented as a valuation tool for securities and as a general explanation of the risk–return tradeoff involved in all types of financial transactions. Chapter 5 highlights the importance of understanding the relationship of risk and return when making professional and personal decisions.

Study Guide

The following **Study Guide** examples are suggested for classroom presentation:

Example	Topic
4	Risk attitudes
6	Graphic determination of beta
12	Impact of market changes on return

■ Suggested answer to chapter opening critical thinking question

Venture capital is a form of private equity in which capital is raised in private markets as opposed to the public markets. How can the venture capitalists eventually capitalise on their investments?

Venture capital firms investing in new and promising technologies and start-up companies must find a buyer in order to capitalise on their investment. The 'exit' or 'selling out' is often achieved via an initial public offering (IPO). Another option is to sell their stake in the company to another venture capital firm or private-equity firm.

■ Answers to Review Questions

1. *Risk* is defined as the chance of financial loss, as measured by the variability of expected returns associated with a given asset. A decision-maker should evaluate an investment by measuring the chance of loss, or risk, and comparing the expected risk to the expected return. Some assets are considered risk free; the most ordinary examples are RSA Treasury issues.

2. The *return on an investment* (total gain or loss) is the change in value plus any cash distributions over a defined time period. It is expressed as a percent of the beginning-of-the-period investment. The formula is:

$$\text{Return} = \frac{[(\text{ending value} - \text{initial value}) + \text{cash distribution}]}{\text{initial value}}$$

   Realised return requires the asset to be purchased and sold during the time periods the return is measured. *Unrealised return* is the return that could have been realised if the asset had been purchased and sold during the time period the return was measured.

3. a. The *risk-averse* financial manager requires an increase in return for a given increase in risk.
   b. The *risk-indifferent* manager requires no change in return for an increase in risk.
   c. The *risk-seeking* manager accepts a decrease in return for a given increase in risk.

   Most financial managers are risk averse.

4. *Scenario analysis* evaluates asset risk by using more than one possible set of returns to obtain a sense of the variability of outcomes. The range is found by subtracting the pessimistic outcome from the optimistic outcome. The larger the range, the greater the risk associated with the asset.

5. The decision-maker can get an estimate of project risk by viewing a plot of the probability distribution, which relates probabilities to expected returns and shows the degree of dispersion of returns. The more spread out the distribution, the greater the variability or risk associated with the return stream.

6. The *standard deviation* of a distribution of asset returns is an absolute measure of dispersion of risk around the mean or expected value. A higher standard deviation indicates a greater project risk. With a larger standard deviation, the distribution is more dispersed and the outcomes have a higher variability, resulting in higher risk.

7. The *coefficient of variation* is another indicator of asset risk, however this measures relative dispersion. It is calculated by dividing the standard deviation by the expected value. The coefficient of variation may be a better basis than the standard deviation for comparing risk of assets with differing expected returns.

8. An *efficient portfolio* is one that maximises return for a given risk level or minimises risk for a given level of return. *Return of a portfolio* is the weighted average of returns on the individual component assets:

$$\hat{r}_p = \sum_{j=1}^{n} w_j \times \hat{r}_j$$

   where:

   n = number of assets,
   w_j = weight of individual assets,
   $\hat{k}_j$ = expected returns.

The *standard deviation of a portfolio* is not the weighted average of component standard deviations; the risk of the portfolio as measured by the standard deviation will be smaller. It is calculated by applying the standard deviation formula to the portfolio assets:

$$\sigma_{rp} = \sqrt{\sum_{i=1}^{n} \frac{(r_i - \bar{r})^2}{(n-1)}}$$

9. The *correlation* between asset returns is important when evaluating the effect of a new asset on the portfolio's overall risk. Returns on different assets moving in the same direction are *positively correlated*, while those moving in opposite directions are *negatively correlated*. Assets with high positive correlation increase the variability of portfolio returns; assets with high negative correlation reduce the variability of portfolio returns. When negatively correlated assets are brought together through diversification, the variability of the expected return from the resulting combination can be less than the variability or risk of the individual assets. When one asset has high returns, the other's returns are low and vice versa. Therefore, the result of diversification is to reduce risk by providing a pattern of stable returns.

   Diversification of risk in the asset selection process allows the investor to reduce overall risk by combining negatively correlated assets so that the risk of the portfolio is less than the risk of the individual assets in it. Even if assets are not negatively correlated, the lower the positive correlation between them, the lower their resulting portfolio return variability.

10. The inclusion of foreign assets in a domestic company's portfolio reduces risk for two reasons. When returns from foreign-currency-denominated assets are translated into rands, the correlation of returns of the portfolio's assets is reduced. Also, if the foreign assets are in countries that are less sensitive to the RSA business cycle, the portfolio's response to market movements is reduced.

    When the rand *appreciates* relative to other currencies, the rand value of a foreign-currency-denominated portfolio *declines* and results in lower returns in rand terms. If this appreciation is due to better performance of the RSA economy, foreign-currency-denominated portfolios generally have lower returns in local currency as well, further contributing to reduced returns.

    Political risks result from possible actions by the host government that are harmful to foreign investors or possible political instability that could endanger foreign assets. This form of risk is particularly high in developing countries. Companies diversifying internationally may have assets seized or the return of profits blocked.

11. The *total risk* of a security is the combination of nondiversifiable risk and diversifiable risk. *Diversifiable risk* refers to the portion of an asset's risk attributable to firm-specific, random events (strikes, litigation, loss of key contracts, etc.) that can be eliminated by diversification. *Nondiversifiable risk* is attributable to market factors affecting all firms (war, inflation, political events, etc.). Some argue that nondiversifiable risk is the only relevant risk because diversifiable risk can be eliminated by creating a portfolio of assets that is not perfectly positively correlated.

12. *Beta* measures nondiversifiable risk. It is an index of the degree of movement of an asset's return in response to a change in the market return. The beta coefficient for an asset can be found by plotting the asset's historical returns relative to the returns for the market. By using statistical techniques, the '*characteristic line'* is fit to the data points. The slope of this line is beta. Beta coefficients for actively traded shares are published in the *Value Line Investment Survey*, in brokerage reports, and several online sites. The beta of a portfolio is calculated by finding the weighted average of the betas of the individual component assets.

13. The equation for the capital asset pricing model is:

$$r_j = R_F + [b_j \times (r_m - R_F)],$$

where:

r_j = the required (or expected) return on asset j
R_F = the rate of return required on a risk-free security (a U.S. Treasury bill)
b_j = the beta coefficient or index of nondiversifiable (relevant) risk for asset j
r_m = the required return on the market portfolio of assets (the market return)

The security market line (SML) is a graphical presentation of the relationship between the amount of systematic risk associated with an asset and the required return. Systematic risk is measured by beta and is on the horizontal axis while the required return is on the vertical axis.

14. a. If there is an increase in inflationary expectations, the security market line will show a parallel shift upward in an amount equal to the expected increase in inflation. The required return for a given level of risk will also rise.
    b. The slope of the SML (the beta coefficient) will be less steep if investors become less risk-averse, and a lower level of return will be required for each level of risk.

15. The CAPM provides financial managers with a link between risk and return. Because it was developed to explain the behaviour of securities' prices in efficient markets and uses historical data to estimate required returns, it may not reflect future variability of returns. While studies have supported the CAPM when applied in active securities' markets, it has not been found to be generally applicable to real corporate assets. However, the CAPM can be used as a conceptual framework to evaluate the relationship between risk and return.

■ Suggested answer to critical thinking question for Focus on Practice

There is a difference between international mutual funds and global mutual funds. How might that difference affect their correlation with U.S. equity mutual funds?

The difference between global funds and international funds is that global funds can invest in shares and bonds around the world, including U.S. securities, whereas international funds invest in shares and bonds around the world but *not* U.S securities. Therefore, global funds are more likely to be correlated with U.S. equity mutual funds, since a significant portion of their portfolios are likely to be U.S. equities. An investor seeking increased international diversification in a portfolio should consider international funds over global funds or increase the portion of the portfolio devoted to global funds if seeking diversification through global funds.

■ Suggested answer to critical thinking question for Focus on Ethics

Is 'hitting the numbers' an appropriate goal, given the Chapter 1 contrast of profit and shareholder wealth maximisation? If not, why do executives emphasise it?

The presentation in Chapter 1 of our textbook is clear (and see also the moral imperative in the Chapter 1 ethics focus box): managers are to maximise shareholder wealth, not profits. Shareholder wealth encompasses cash flow amount, timing, and risk – all of which are missed by an earnings per share (EPS) focus. Further, to the extent that managers focus on profit, they should target long-run economic profit, not next quarter's EPS. Really, there are only two justifications for management attention on EPS: (1) profits are a large and a necessary part of operating cash flows (think of the indirect approach to the statement of cash flows, in the operating section); and (2) investors may use EPS changes to enable reevaluation of the company's business strategy and trend line. (In Chapter 7, you will be presented with the price-earnings multiple approach to share valuation.)

■ Answers to Warm-up exercises

E5-1. Total annual return

Answer: $$K_1 = \frac{C_1 + P_1 - P_0}{P_0} = \frac{\$0 + \$12{,}000{,}000 - \$10{,}000{,}000}{\$10{,}000{,}000} = 20\%$$

Logistics, Ltd doubled the annual rate of return predicted by the analyst. The negative net income is irrelevant to the problem.

E5-2. Expected return

Answer:

Analyst	**Probability**	**Return**	**Weighted value**
1	0.35	5%	1.75%
2	0.05	–5%	–0.25%
3	0.20	10%	2.0%
4	0.40	3%	1.2%
Total	1.00	Expected return	4.70%

E5-3. Comparing the risk of two investments

Answer: $CV_1 = 0.10 \div 0.15 = 0.6667$ $\qquad CV_2 = 0.05 \div 0.12 = 0.4167$

Based solely on standard deviations, Investment 2 has lower risk than Investment 1. Based on coefficients of variation, Investment 2 is still less risky than Investment 1. Since the two investments have different expected returns, using the coefficient of variation to assess risk is better than simply comparing standard deviations because the coefficient of variation considers the relative size of the expected returns of each investment.

E5-4. Computing the expected return of a portfolio

Answer:

$$r_p = (0.45 \times 0.038) + (0.40 \times 0.124) + (0.15 \times 0.175)$$
$$= (0.0171) + (0.0496) + (0.02625) = 0.09205 = 9.29\%$$

The portfolio is expected to have a return of approximately 9.3%.

E5-5. Calculating a portfolio beta

Answer:

$$\text{Beta} = (0.20 \times 1.15) + (0.10 \times 0.85) + (0.15 \times 1.60) + (0.20 \times 1.35) + (0.35 \times 1.85)$$
$$= 0.2300 + 0.0850 + 0.2400 + 0.2700 + 0.6475 = 1.4725$$

E5-6. Calculating the required rate of return

Answer:

a. Required return = 0.05 + 1.8 (0.10 – 0.05) = 0.05 + 0.09 = 0.14

b. Required return = 0.05 + 1.8 (0.13 – 0.05) = 0.05 + 0.144 = 0.194

c. Although the risk-free rate does not change, as the market return increases, the required return on the asset rises by 180% of the change in the market's return.

■ Solutions to Problems

P5-1. LG 1: Rate of return: $r_t = \frac{(P_t - P_{t-1} + C_t)}{P_{t-1}}$

Basic

a. **Investment X:** Return $= \frac{(\text{R}21{,}000 - \text{R}20{,}000 + \text{R}1{,}500)}{\text{R}20{,}000} = 12.50\%$

Investment Y: Return $= \frac{(\text{R}55{,}000 - \text{R}55{,}000 + \text{R}6{,}800)}{\text{R}55{,}000} = 12.36\%$

b. Investment X should be selected because it has a higher rate of return for the same level of risk.

P5-2. LG 1: Return calculations: $r_t = \frac{(P_t - P_{t-1} + C_t)}{P_{t-1}}$

Basic

Investment	Calculation	r_t(%)
A	(R1,100 – R800 – R100) ÷ R800	25.00
B	(R118,000 – R120,000 + R15,000) ÷ R120,000	10.83
C	(R48,000 – R45,000 + R7,000) ÷ R45,000	22.22
D	(R500 – R600 + R80) ÷ R600	–3.33
E	(R12,400 – R12,500 + R1,500) ÷ R12,500	11.20

P5-3. LG 1: Risk preferences

Intermediate

a. The risk-indifferent manager would accept Investments X and Y because these have higher returns than the 12% required return and the risk doesn't matter.

b. The risk-averse manager would accept Investment X because it provides the highest return and has the lowest amount of risk. Investment X offers an increase in return for taking on more risk than what the firm currently earns.

c. The risk-seeking manager would accept Investments Y and Z because he or she is willing to take greater risk without an increase in return.

d. Traditionally, financial managers are risk averse and would choose Investment X, since it provides the required increase in return for an increase in risk.

P5-4. LG 2: Risk analysis

Intermediate

a.

Expansion	Range
A	24% – 16% = 8%
B	30% – 10% = 20%

b. Project A is less risky, since the range of outcomes for A is smaller than the range for Project B.

c. Since the most likely return for both projects is 20% and the initial investments are equal, the answer depends on your risk preference.

d. The answer is no longer clear, since it now involves a risk–return tradeoff. Project B has a slightly higher return but more risk, while A has both lower return and lower risk.

P5-5. LG 2: Risk and probability

Intermediate

a.

Camera	Range
R	30% – 20% = 10%
S	35% – 15% = 20%

b

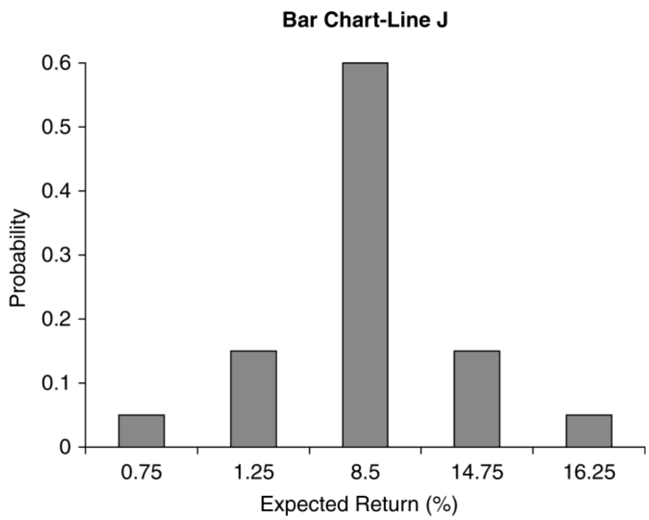
	Possible Outcomes	**Probability** P_{ri}	**Expected Return** r_i	**Weighted value (%)**$(r_i \times P_{ri})$
Camera R	Pessimistic	0.25	20	5.00
	Most likely	0.50	25	12.50
	Optimistic	0.25	30	7.50
		1.00	Expected return	25.00
Camera S	Pessimistic	0.20	15	3.00
	Most likely	0.55	25	13.75
	Optimistic	0.25	35	8.75
		1.00	Expected return	25.50

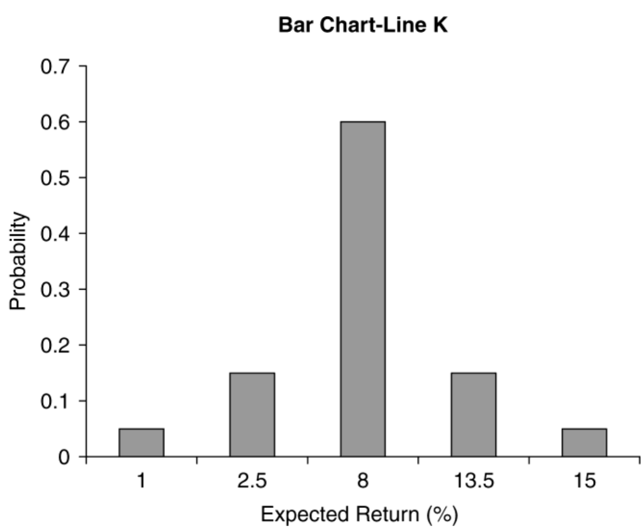
c. Camera S is considered more risky than Camera R because it has a much broader range of outcomes. The risk–return tradeoff is present because Camera S is more risky and also provides a higher return than Camera R.

P5-6. LG 2: Bar charts and risk

Intermediate

a.





b.

	Market acceptance	Probability P_{ri}	Expected return r_i	Weighted value $(r_i \times P_{ri})$
Line J	Very poor	0.05	0.0075	0.000375
	Poor	0.15	0.0125	0.001875
	Average	0.60	0.0850	0.051000
	Good	0.15	0.1475	0.022125
	Excellent	0.05	0.1625	0.008125
		1.00	Expected return	0.083500
Line K	Very poor	0.05	0.010	0.000500
	Poor	0.15	0.025	0.003750
	Average	0.60	0.080	0.048000
	Good	0.15	0.135	0.020250
	Excellent	0.05	0.150	0.007500
		1.00	Expected return	0.080000

c. Line K appears less risky due to a slightly tighter distribution than line J, indicating a lower range of outcomes.

P5-7. LG 2: Coefficient of variation: $CV = \frac{\sigma_r}{\bar{r}}$

Basic

a. **A** $CV_A = \frac{7\%}{20\%} = 0.3500$

B $CV_B = \frac{9.5\%}{22\%} = 0.4318$

C $CV_C = \frac{6\%}{19\%} = 0.3158$

D $CV_D = \frac{5.5\%}{16\%} = 0.3438$

b. Asset C has the lowest coefficient of variation and is the least risky relative to the other choices.

P5-8. LG 2: Standard deviation versus coefficient of variation as measures of risk

Basic

a. Project A is least risky based on range with a value of 0.04.

b. Project A is least risky based on standard deviation with a value of 0.029. Standard deviation is not the appropriate measure of risk since the projects have different returns.

c. **A** $CV_A = \frac{0.029}{0.12} = 0.2417$

B $CV_B = \frac{0.032}{0.125} = 0.2560$

C $CV_C = \frac{0.035}{0.13} = 0.2692$

D $CV_D = \frac{0.030}{0.128} = 0.2344$

In this case Project D is the best alternative since it provides the least amount of risk for each percent of return earned. Coefficient of variation is probably the best measure in this instance since it provides a standardised method of measuring the risk–return tradeoff for investments with differing returns.

P5-9. LG 2: Personal finance: Rate of return, standard deviation, coefficient of variation

Challenge

a.

	Share price			Variance
Year	Beginning	End	Returns	(Return–Average Return)^2
2006	14.36	21.55	50.07%	0.0495
2007	21.55	64.78	200.60%	1.6459
2008	64.78	72.38	11.73%	0.3670
2009	72.38	91.80	26.83%	0.2068

b.	Average return	72.31%	
c.	Sum of variances	2.2692	
		3	Sample divisor (n – 1)
		0.7564	Variance
		86.97%	Standard deviation
d.		1.20	Coefficient of variation

e. The share price of Idion has definitely gone through some major price changes over this time period. It would have to be classified as a volatile security having an upward price trend over the past four years. Note how comparing securities on a *CV* basis allows the investor to put the share in proper perspective. The share is riskier than what Mike normally buys but if he believes that Idion will continue to rise then he should include it.

P5-10. LG 2: Assessing return and risk

Challenge

a. Project 257

(1) Range: 1.00 – (–0.10) = 1.10

(2) Expected return: $\overline{r} = \sum_{i=1}^{n} r_i \times P_{ri}$

Rate of return r_i	Probability P_{ri}	Weighted value $r_i \times P_{ri}$	Expected return $\overline{r} = \sum_{i=1}^{n} r_i \times P_{ri}$
–0.10	0.01	–0.001	
0.10	0.04	0.004	
0.20	0.05	0.010	
0.30	0.10	0.030	
0.40	0.15	0.060	
0.45	0.30	0.135	
0.50	0.15	0.075	
0.60	0.10	0.060	
0.70	0.05	0.035	
0.80	0.04	0.032	
1.00	0.01	0.010	
	1.00		0.450

(3) Standard deviation: $\sigma = \sqrt{\sum_{i=1}^{n} (r_i - \overline{r})^2 \times P_{ri}}$

r_i	$\overline{r}$	$r_i - \overline{r}$	$(r_i - \overline{r})^2$	P_{ri}	$(r_i - \overline{r})^2 \times P_{ri}$
–0.10	0.450	–0.550	0.3025	0.01	0.003025
0.10	0.450	–0.350	0.1225	0.04	0.004900
0.20	0.450	–0.250	0.0625	0.05	0.003125
0.30	0.450	–0.150	0.0225	0.10	0.002250
0.40	0.450	–0.050	0.0025	0.15	0.000375
0.45	0.450	0.000	0.0000	0.30	0.000000
0.50	0.450	0.050	0.0025	0.15	0.000375
0.60	0.450	0.150	0.0225	0.10	0.002250
0.70	0.450	0.250	0.0625	0.05	0.003125
0.80	0.450	0.350	0.1225	0.04	0.004900
1.00	0.450	0.550	0.3025	0.01	0.003025
					0.027350

$\sigma_{\text{Project 257}} = \sqrt{0.027350} = 0.165378$

(4) $CV = \dfrac{0.165378}{0.450} = 0.3675$

b. Project 432

(1) Range: 0.50 – 0.10 = 0.40

(2) Expected return: $\bar{r} = \sum_{i=1}^{n} r_i \times P_{ri}$

Rate of return r_i	**Probability** P_{ri}	**Weighted value** $r_i \times P_{ri}$	**Expected return** $\bar{r} = \sum_{i=1}^{n} r_i \times P_{ri}$
0.10	0.05	0.0050	
0.15	0.10	0.0150	
0.20	0.10	0.0200	
0.25	0.15	0.0375	
0.30	0.20	0.0600	
0.35	0.15	0.0525	
0.40	0.10	0.0400	
0.45	0.10	0.0450	
0.50	0.05	0.0250	
	1.00		0.300

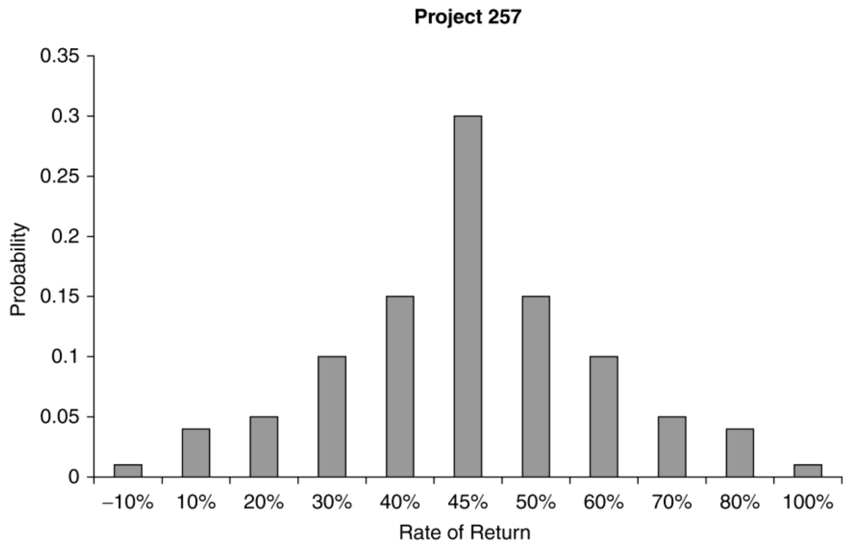
(3) Standard deviation: $\sigma = \sqrt{\sum_{i=1}^{n} (r_i - \bar{r})^2 \times P_{ri}}$

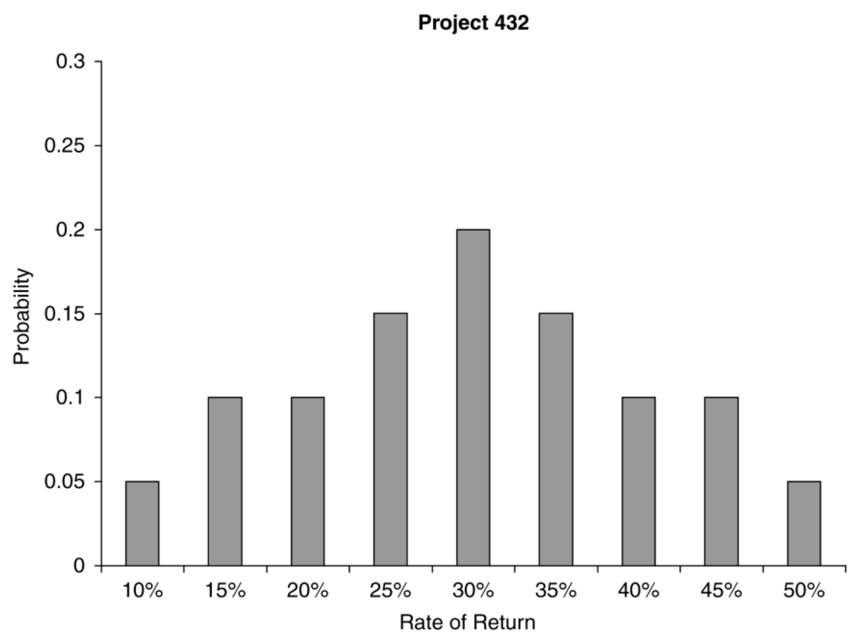
r_i	$\bar{r}$	$r_i - \bar{r}$	$(r_i - \bar{r})^2$	P_{ri}	$(r_i - \bar{r})^2 \times P_{ri}$
0.10	0.300	–0.20	0.0400	0.05	0.002000
0.15	0.300	–0.15	0.0225	0.10	0.002250
0.20	0.300	–0.10	0.0100	0.10	0.001000
0.25	0.300	–0.05	0.0025	0.15	0.000375
0.30	0.300	0.00	0.0000	0.20	0.000000
0.35	0.300	0.05	0.0025	0.15	0.000375
0.40	0.300	0.10	0.0100	0.10	0.001000
0.45	0.300	0.15	0.0225	0.10	0.002250
0.50	0.300	0.20	0.0400	0.05	0.002000
					0.011250

$\sigma_{\text{Project 432}} = \sqrt{0.011250} = 0.106066$

(4) $CV = \dfrac{0.106066}{0.300} = 0.3536$

c. Bar Charts





d. Summary statistics

	Project 257	**Project 432**
Range	1.100	0.400
Expected return ($\overline{r}$)	0.450	0.300
Standard deviation (σ_r)	0.165	0.106
Coefficient of variation (*CV*)	0.3675	0.3536

Since Projects 257 and 432 have differing expected values, the coefficient of variation should be the criterion by which the risk of the asset is judged. Since Project 432 has a smaller *CV*, it is the opportunity with lower risk.

P5-11. LG 2: Integrative – expected return, standard deviation, and coefficient of variation
Challenge

a. Expected return: $\bar{r} = \sum_{i=1}^{n} r_i \times P_{ri}$

	Rate of return r_i	Probability P_{ri}	Weighted value $r_i \times P_{ri}$	Expected return $\bar{r} = \sum_{i=1}^{n} r_i \times P_{ri}$
Asset F	0.40	0.10	0.04	
	0.10	0.20	0.02	
	0.00	0.40	0.00	
	–0.05	0.20	–0.01	
	–0.10	0.10	–0.01	
				0.04
Asset G	0.35	0.40	0.14	
	0.10	0.30	0.03	
	–0.20	0.30	–0.06	
				0.11
Asset H	0.40	0.10	0.04	
	0.20	0.20	0.04	
	0.10	0.40	0.04	
	0.00	0.20	0.00	
	–0.20	0.10	–0.02	
				0.10

Asset G provides the largest expected return.

b. Standard deviation: $\sigma = \sqrt{\sum_{i=1}^{n} (r_i - \bar{r})^2 x P_{ri}}$

	$r_i - \bar{r}$	$(r_i - \bar{r})^2$	P_{ri}	σ^2	σ_r
Asset F	0.40 – 0.04 = 0.36	0.1296	0.10	0.01296	
	0.10 – 0.04 = 0.06	0.0036	0.20	0.00072	
	0.00 – 0.04 = –0.04	0.0016	0.40	0.00064	
	–0.05 – 0.04 = –0.09	0.0081	0.20	0.00162	
	–0.10 – 0.04 = –0.14	0.0196	0.10	0.00196	
				0.01790	0.1338
Asset G	0.35 – 0.11 = 0.24	0.0576	0.40	0.02304	
	0.10 – 0.11 = –0.01	0.0001	0.30	0.00003	
	–0.20 – 0.11 = –0.31	0.0961	0.30	0.02883	
				0.05190	0.2278
Asset H	0.40 – 0.10 = 0.30	0.0900	0.10	0.009	
	0.20 – 0.10 = 0.10	0.0100	0.20	0.002	
	0.10 – 0.10 = 0.00	0.0000	–0.40	0.000	
	0.00 – 0.10 = –0.10	0.0100	0.20	0.002	
	–0.20 – 0.10 = –0.30	0.0900	0.10	0.009	
				0.022	0.1483

Based on standard deviation, Asset G appears to have the greatest risk, but it must be measured against its expected return with the statistical measure coefficient of variation, since the three assets have differing expected values. An incorrect conclusion about the risk of the assets could be drawn using only the standard deviation.

c. Coefficient of variation $= \frac{\text{standard deviation } (\sigma)}{\text{expected value}}$

Asset F: $CV = \frac{0.1338}{0.04} = 3.345$

Asset G: $CV = \frac{0.2278}{0.11} = 2.071$

Asset H: $CV = \frac{0.1483}{0.10} = 1.483$

As measured by the coefficient of variation, Asset F has the largest relative risk.

P5-12. LG 2: Normal probability distribution

Challenge

a. Coefficient of variation: $CV = \sigma_r \div \bar{r}$

Solving for standard deviation: $0.75 = \sigma_r \div 0.189$

$$\sigma_r = 0.75 \times 0.189 = 0.14175$$

b. (1) 68% of the outcomes will lie between ±1 standard deviation from the expected value:

$$+1\sigma = 0.189 + 0.14175 = 0.33075$$
$$-1\sigma = 0.189 - 0.14175 = 0.04725$$

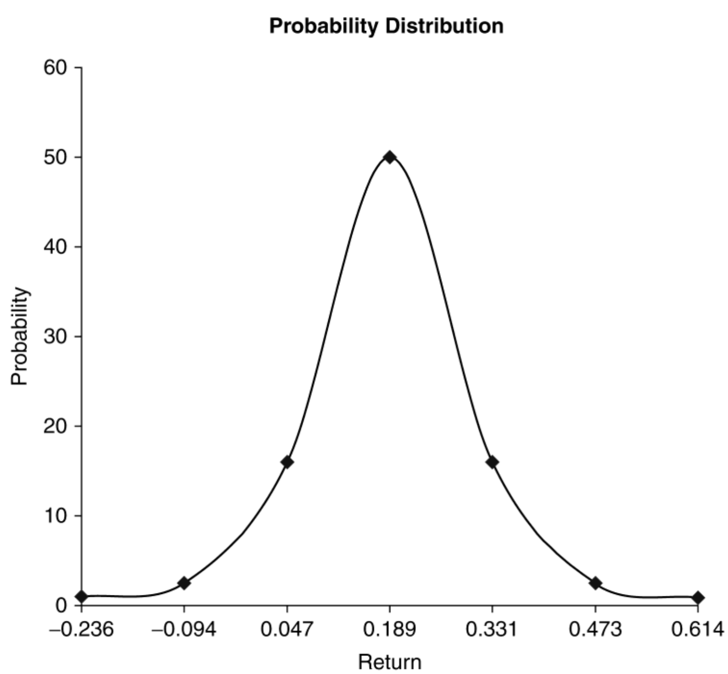
(2) 95% of the outcomes will lie between ± 2 standard deviations from the expected value:

$$+2\sigma = 0.189 + (2 \times 0.14175) = 0.4725$$
$$-2\sigma = 0.189 - (2 \times 0.14175) = -0.0945$$

(3) 99% of the outcomes will lie between ±3 standard deviations from the expected value:

$$+3\sigma = 0.189 + (3 \times 0.14175) = 0.61425$$
$$-3\sigma = 0.189 - (3 \times 0.14175) = -0.23625$$

c.



P5-13. LG 3: Personal finance: Portfolio return and standard deviation

Challenge

a. Expected portfolio return for each year: $r_p = (w_L \times r_L) + (w_M \times r_M)$

Year	Asset L $(w_L \times r_L)$	+	Asset M $(w_M \times r_M)$		Expected portfolio return r_p
2010	(14% × 0.40 = 5.6%)	+	(20% × 0.60 = 12.0%)	=	17.6%
2011	(14% × 0.40 = 5.6%)	+	(18% × 0.60 = 10.8%)	=	16.4%
2012	(16% × 0.40 = 6.4%)	+	(16% × 0.60 = 9.6%)	=	16.0%
2013	(17% × 0.40 = 6.8%)	+	(14% × 0.60 = 8.4%)	=	15.2%
2014	(17% × 0.40 = 6.8%)	+	(12% × 0.60 = 7.2%)	=	14.0%
2015	(19% × 0.40 = 7.6%)	+	(10% × 0.60 = 6.0%)	=	13.6%

b. Portfolio return: $r_p = \dfrac{\sum_{j=1}^{n} w_j \times r_j}{n}$

$$r_p = \frac{17.6 + 16.4 + 16.0 + 15.2 + 14.0 + 13.6}{6} = 15.467 = 15.5\%$$

c. Standard deviation: $\sigma_{rp} = \sqrt{\sum_{i=1}^{n} \dfrac{(r_i - \bar{r})^2}{(n-1)}}$

$$\sigma_{rp} = \sqrt{\frac{\begin{bmatrix}(17.6\% - 15.5\%)^2 + (16.4\% - 15.5\%)^2 + (16.0\% - 15.5\%)^2 \\ + (15.2\% - 15.5\%)^2 + (14.0\% - 15.5\%)^2 + (13.6\% - 15.5\%)^2\end{bmatrix}}{6-1}}$$

$$\sigma_{rp} = \sqrt{\frac{\begin{bmatrix}(2.1\%)^2 + (0.9\%)^2 + (0.5\%)^2 \\ + (-0.3\%)^2 + (-1.5\%)^2 + (-1.9\%)^2\end{bmatrix}}{5}}$$

$$\sigma_{rp} = \sqrt{\frac{(.000441 + 0.000081 + 0.000025 + 0.000009 + 0.000225 + 0.000361)}{5}}$$

$$\sigma_{rp} = \sqrt{\frac{0.001142}{5}} = \sqrt{0.000228\%} = 0.0151 = 1.51\%$$

d. The assets are negatively correlated.

e. Combining these two negatively correlated assets reduces overall portfolio risk.

P5-14. LG 3: Portfolio analysis

Challenge

a. Expected portfolio return:

Alternative 1: 100% Asset F

$$r_P = \frac{16\% + 17\% + 18\% + 19\%}{4} = 17.5\%$$

Alternative 2: 50% Asset F + 50% Asset G

Year	Asset F ($w_F \times r_F$)	+	Asset G ($w_G \times r_G$)		Portfolio return r_p
2010	(16% × 0.50 = 8.0%)	+	(17% × 0.50 = 8.5%)	=	16.5%
2011	(17% × 0.50 = 8.5%)	+	(16% × 0.50 = 8.0%)	=	16.5%
2012	(18% × 0.50 = 9.0%)	+	(15% × 0.50 = 7.5%)	=	16.5%
2013	(19% × 0.50 = 9.5%)	+	(14% × 0.50 = 7.0%)	=	16.5%

$$r_p = \frac{16.5\% + 16.5\% + 16.5\% + 16.5\%}{4} = 16.5\%$$

Alternative 3: 50% Asset F + 50% Asset H

Year	Asset F ($w_F \times r_F$)	+	Asset H ($w_H \times r_H$)	Portfolio return r_p
2010	(16% × 0.50 = 8.0%)	+	(14% × 0.50 = 7.0%)	15.0%
2011	(17% × 0.50 = 8.5%)	+	(15% × 0.50 = 7.5%)	16.0%
2012	(18% × 0.50 = 9.0%)	+	(16% × 0.50 = 8.0%)	17.0%
2013	(19% × 0.50 = 9.5%)	+	(17% × 0.50 = 8.5%)	18.0%

$$r_p = \frac{15.0\% + 16.0\% + 17.0\% + 18.0\%}{4} = 16.5\%$$

b. Standard deviation: $\sigma_{rp} = \sqrt{\sum_{i=1}^{n} \frac{(r_i - \bar{r})^2}{(n-1)}}$

(1)

$$\sigma_F = \sqrt{\frac{[(16.0\% - 17.5\%)^2 + (17.0\% - 17.5\%)^2 + (18.0\% - 17.5\%)^2 + (19.0\% - 17.5\%)^2]}{4-1}}$$

$$\sigma_F = \sqrt{\frac{[(-1.5\%)^2 + (-0.5\%)^2 + (0.5\%)^2 + (1.5\%)^2]}{3}}$$

$$\sigma_F = \sqrt{\frac{(0.000225 + 0.000025 + 0.000025 + 0.000225)}{3}}$$

$$\sigma_F = \sqrt{\frac{0.0005}{3}} = \sqrt{.000167} = 0.01291 = 1.291\%$$

(2)

$$\sigma_{FG} = \sqrt{\frac{[(16.5\% - 16.5\%)^2 + (16.5\% - 16.5\%)^2 + (16.5\% - 16.5\%)^2 + (16.5\% - 16.5\%)^2]}{4-1}}$$

$$\sigma_{FG} = \sqrt{\frac{[(0)^2 + (0)^2 + (0)^2 + (0)^2]}{3}}$$

$$\sigma_{FG} = 0$$

(3)

$$\sigma_{FH} = \sqrt{\frac{[(15.0\% - 16.5\%)^2 + (16.0\% - 16.5\%)^2 + (17.0\% - 16.5\%)^2 + (18.0\% - 16.5\%)^2]}{4-1}}$$

$$\sigma_{FH} = \sqrt{\frac{[(-1.5\%)^2 + (-0.5\%)^2 + (0.5\%)^2 + (1.5\%)^2]}{3}}$$

$$\sigma_{FH} = \sqrt{\frac{[(0.000225 + 0.000025 + 0.000025 + 0.000225)]}{3}}$$

$$\sigma_{FH} = \sqrt{\frac{0.0005}{3}} = \sqrt{0.000167} = 0.012910 = 1.291\%$$

c. Coefficient of variation: $CV = \sigma_r \div \overline{r}$

$$CV_F = \frac{1.291\%}{17.5\%} = 0.0738$$

$$CV_{FG} = \frac{0}{16.5\%} = 0$$

$$CV_{FH} = \frac{1.291\%}{16.5\%} = 0.0782$$

d. Summary:

	r_p: Expected value of portfolio	**σ_{rp}**	**CV_p**
Alternative 1 (*F*)	17.5%	1.291%	0.0738
Alternative 2 (*FG*)	16.5%	0	0.0
Alternative 3 (*FH*)	16.5%	1.291%	0.0782

Since the assets have different expected returns, the coefficient of variation should be used to determine the best portfolio. Alternative 3, with positively correlated assets, has the highest coefficient of variation and therefore is the riskiest. Alternative 2 is the best choice; it is perfectly negatively correlated and therefore has the lowest coefficient of variation.

P5-15. LG 4: Correlation, risk, and return

Intermediate

a. (1) Range of expected return: between 8% and 13%
(2) Range of the risk: between 5% and 10%

b. (1) Range of expected return: between 8% and 13%
(2) Range of the risk: 0 < risk < 10%

c. (1) Range of expected return: between 8% and 13%
(2) Range of the risk: 0 < risk < 10%

P5-16. LG 1, 4: Personal finance: International investment returns

Intermediate

a) Pt(1000 x 24.75) 24,750 – Pt-1(1000 x 20.50)20,500/20,500 = 20,73%

b) Pt = 24,750 Mt / 2.85 = R8,684
Pt-1 = 20,500 Mt / 2.40 = R8,542

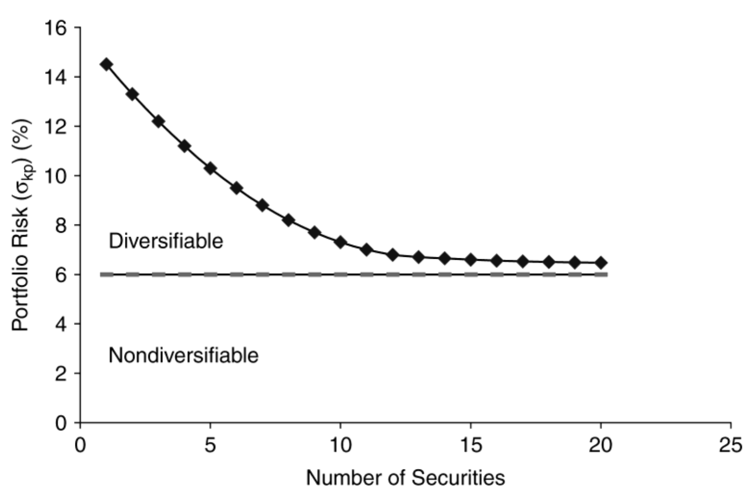
c) R8,684 – R8,542/R8,542 = 1,66%

d. The two returns differ due to the change in the exchange rate between the metical and the rand. The metical had depreciation (and thus the rand appreciated) between the purchase date and the sale date, causing a decrease in total return. The answer in part (c) is the more important of the two returns for Themba. An investor in foreign securities will carry exchange-rate risk.

P5-17. LG 5: Total, nondiversifiable, and diversifiable risk

Intermediate

a and b

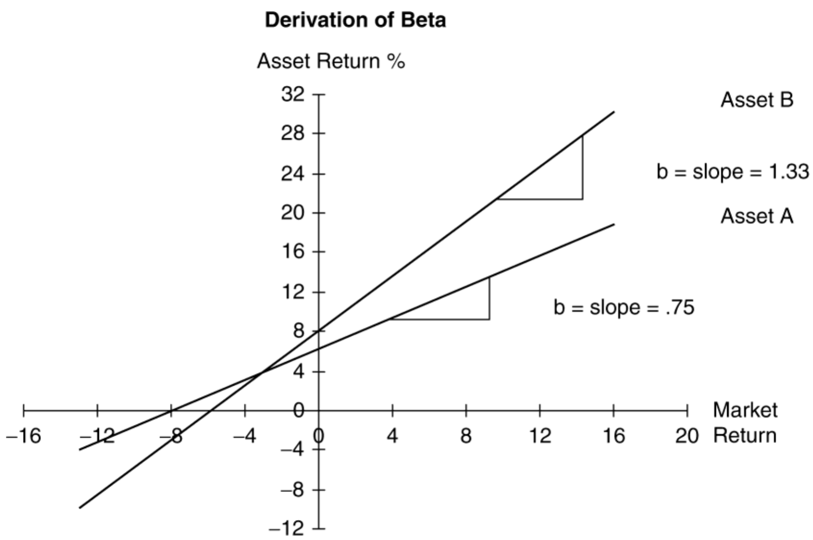


c. Only nondiversifiable risk is relevant because, as shown by the graph, diversifiable risk can be virtually eliminated through holding a portfolio of at least 20 securities that are not positively correlated. David Randall's portfolio, assuming diversifiable risk could no longer be reduced by additions to the portfolio, has 6.47% relevant risk.

P5-18. LG 5: Graphic derivation of beta

Intermediate

a.



b. To estimate beta, the 'rise over run' method can be used: $\text{Beta} = \dfrac{\text{Rise}}{\text{Run}} = \dfrac{\Delta Y}{\Delta X}$

Taking the points shown on the graph:

$$\text{Beta A} = \frac{\Delta Y}{\Delta X} = \frac{12-9}{8-4} = \frac{3}{4} = 0.75$$

$$\text{Beta B} = \frac{\Delta Y}{\Delta X} = \frac{26-22}{13-10} = \frac{4}{3} = 1.33$$

A financial calculator with statistical functions can be used to perform linear regression analysis. The beta (slope) of line A is 0.79; of line B, 1.379.

c. With a higher beta of 1.33, Asset B is more risky. Its return will move 1.33 times for each one point the market moves. Asset A's return will move at a lower rate, as indicated by its beta coefficient of 0.75.

P5-19. LG 5: Interpreting beta

Basic

Effect of change in market return on asset with beta of 1.20:

a. 1.20 × (15%) = 18.0% increase

b. 1.20 × (–8%) = 9.6% decrease

c. 1.20 × (0%) = no change

d. The asset is more risky than the market portfolio, which has a beta of 1. The higher beta makes the return move more than the market.

P5-20. LG 5: Betas

Basic

a and b

Asset	Beta	Increase in market return	Expected impact on asset return	Decrease in market return	Impact on asset return
A	0.50	0.10	0.05	–0.10	–0.05
B	1.60	0.10	0.16	–0.10	–0.16
C	–0.20	0.10	–0.02	–0.10	0.02
D	0.90	0.10	0.09	–0.10	–0.09

c. Asset B should be chosen because it will have the highest increase in return.

d. Asset C would be the appropriate choice because it is a defensive asset, moving in opposition to the market. In an economic downturn, Asset C's return is increasing.

P5-21. LG 5: Personal finance: Betas and risk rankings

Intermediate

a.

	Share	Beta
Most risky	B	1.40
	A	0.80
Least risky	C	–0.30

b and c

Asset	Beta	Increase in market return	Expected impact on asset return	Decrease in market return	Impact on asset return
A	0.80	0.12	0.096	–0.05	–0.04
B	1.40	0.12	0.168	–0.05	–0.07
C	–0.30	0.12	–0.036	–0.05	0.015

d. In a declining market, an investor would choose the defensive share, Share C. While the market declines, the return on C increases.

e. In a rising market, an investor would choose Share B, the aggressive share. As the market rises one point, Share B rises 1.40 points.

P5-22. LG 5: Portfolio betas: $b_p = \sum_{j=1}^{n} w_j \times b_j$

Intermediate

a.

		Portfolio A		Portfolio B	
Asset	**Beta**	w_A	$w_A \times b_A$	w_B	$w_B \times b_B$
1	1.30	0.10	0.130	0.30	0.39
2	0.70	0.30	0.210	0.10	0.07
3	1.25	0.10	0.125	0.20	0.25
4	1.10	0.10	0.110	0.20	0.22
5	0.90	0.40	0.360	0.20	0.18
		b_A =	0.935	b_B =	1.11

b. Portfolio A is slightly less risky than the market (average risk), while Portfolio B is more risky than the market. Portfolio B's return will move more than Portfolio A's for a given increase or decrease in market return. Portfolio B is the more risky.

P5-23. LG 6: Capital asset pricing model (CAPM): $r_j = R_F + [b_j \times (r_m - R_F)]$

Basic

Case	r_j	=	$R_F + [b_j \times (r_m - R_F)]$
A	8.9%	=	5% + [1.30 × (8% – 5%)]
B	12.5%	=	8% + [0.90 × (13% – 8%)]
C	8.4%	=	9% + [–0.20 × (12% – 9%)]
D	15.0%	=	10% + [1.00 × (15% – 10%)]
E	8.4%	=	6% + [0.60 × (10% – 6%)]

P5-24. LG 5, 6: Personal finance: Beta coefficients and the capital asset pricing model

Intermediate

To solve this problem you must take the CAPM and solve for beta. The resulting model is:

$$\text{Beta} = \frac{r - R_F}{r_m - R_F}$$

a. $\text{Beta} = \frac{10\% - 5\%}{16\% - 5\%} = \frac{5\%}{11\%} = 0.4545$

b. $\text{Beta} = \frac{15\% - 5\%}{16\% - 5\%} = \frac{10\%}{11\%} = 0.9091$

c. $\text{Beta} = \frac{18\% - 5\%}{16\% - 5\%} = \frac{13\%}{11\%} = 1.1818$

d. $\text{Beta} = \frac{20\% - 5\%}{16\% - 5\%} = \frac{15\%}{11\%} = 1.3636$

e. If Katherine is willing to take a maximum of average risk then she will be able to have an expected return of only 16%. (r = 5% + 1.0(16% – 5%) = 16%.)

P5-25. LG 6: Manipulating CAPM: $r_j = R_F + [b_j \times (r_m - R_F)]$

Intermediate

a. $r_j = 8\% + [0.90 \times (12\% - 8\%)]$

$r_j = 11.6\%$

b. $15\% = R_F + [1.25 \times (14\% - R_F)]$

$R_F = 10\%$

c. $16\% = 9\% + [1.10 \times (r_m - 9\%)]$

$r_m = 15.36\%$

d. $15\% = 10\% + [b_j \times (12.5\% - 10\%)$

$b_j = 2$

P5-26. LG 1, 3, 5, 6: Personal finance: Portfolio return and beta

Challenge

a. $b_p = (0.20)(0.80) + (0.35)(0.95) + (0.30)(1.50) + (0.15)(1.25)$

$= 0.16 + 0.3325 + 0.45 + 0.1875 = 1.13$

b. $$r_A = \frac{(\text{R}20,000 - \text{R}20,000) + \text{R}1,600}{\text{R}20,000} = \frac{\text{R}1,600}{\text{R}20,000} = 8\%$$

$$r_B = \frac{(\text{R}36,000 - \text{R}35,000) + \text{R}1,400}{\text{R}35,000} = \frac{\text{R}2,400}{\text{R}35,000} = 6.86\%$$

$$r_C = \frac{(\text{R}34,500 - \text{R}30,000) + 0}{\text{R}30,000} = \frac{\text{R}4,500}{\text{R}30,000} = 15\%$$

$$r_D = \frac{(\text{R}16,500 - \text{R}15,000) + \text{R}375}{\text{R}15,000} = \frac{\text{R}1,875}{\text{R}15,000} = 12.5\%$$

c. $$r_P = \frac{(\text{R}107,000 - \text{R}100,000) + \text{R}3,375}{\text{R}100,000} = \frac{\text{R}10,375}{\text{R}100,000} = 10.375\%$$

d. $r_A = 4\% + [0.80 \times (10\% - 4\%)] = 8.8\%$

$r_B = 4\% + [0.95 \times (10\% - 4\%)] = 9.7\%$

$r_C = 4\% + [1.50 \times (10\% - 4\%)] = 13.0\%$

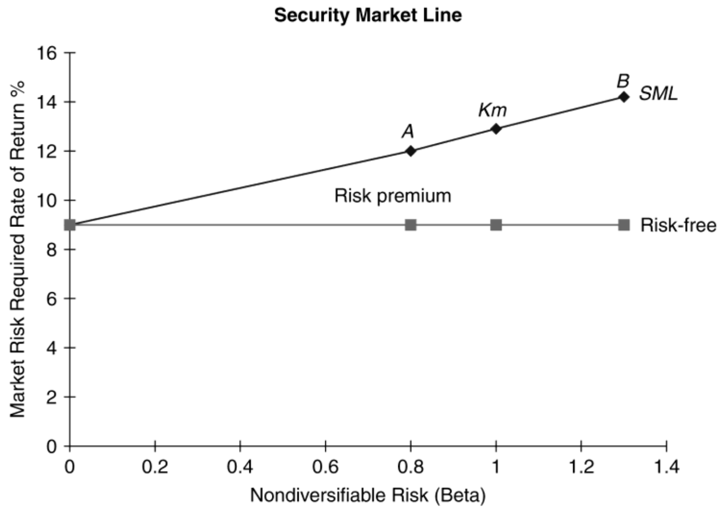
$r_D = 4\% + [1.25 \times (10\% - 4\%)] = 11.5\%$

e. Of the four investments, only C (15% versus 13%) and D (12.5% versus 11.5%) had actual returns that exceeded the CAPM expected return (15% versus 13%). The underperformance could be due to any unsystematic factor that would have caused the firm not to do as well as expected. Another possibility is that the firm's characteristics may have changed such that the beta at the time of the purchase overstated the true value of beta that existed during that year. A third explanation is that beta, as a single measure, may not capture all of the systematic factors that cause the expected return. In other words, there is error in the beta estimate.

P5-27. LG 6: Security market line, SML

Intermediate

a, b, and d



c. $r_j = R_F + [b_j \times (r_m - R_F)]$

Asset A

$r_j = 0.09 + [0.80 \times (0.13 - 0.09)]$

$r_j = 0.122$

Asset B

$r_j = 0.09 + [1.30 \times (0.13 - 0.09)]$

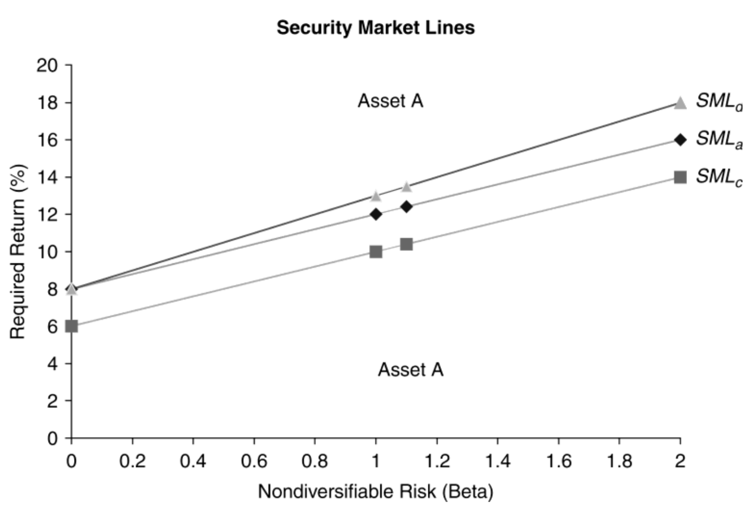
$r_j = 0.142$

d. Asset A has a smaller required return than Asset B because it is less risky, based on the beta of 0.80 for Asset A versus 1.30 for Asset B. The market risk premium for Asset A is 3.2% (12.2% – 9%), which is lower than Asset B's market risk premium (14.2% – 9% = 5.2%).

P5-28. LG 6: Shifts in the security market line

Challenge

a, b, c, d



b. $r_j = R_F + [b_j \times (r_m - R_F)]$

$r_A = 8\% + [1.1 \times (12\% - 8\%)]$

$r_A = 8\% + 4.4\%$

$r_A = 12.4\%$

c. $r_A = 6\% + [1.1 \times (10\% - 6\%)]$

$r_A = 6\% + 4.4\%$

$r_A = 10.4\%$

d. $r_A = 8\% + [1.1 \times (13\% - 8\%)]$

$r_A = 8\% + 5.5\%$

$r_A = 13.5\%$

e. (1) A decrease in inflationary expectations reduces the required return as shown in the parallel downward shift of the SML.

(2) Increased risk aversion results in a steeper slope, since a higher return would be required for each level of risk as measured by beta.

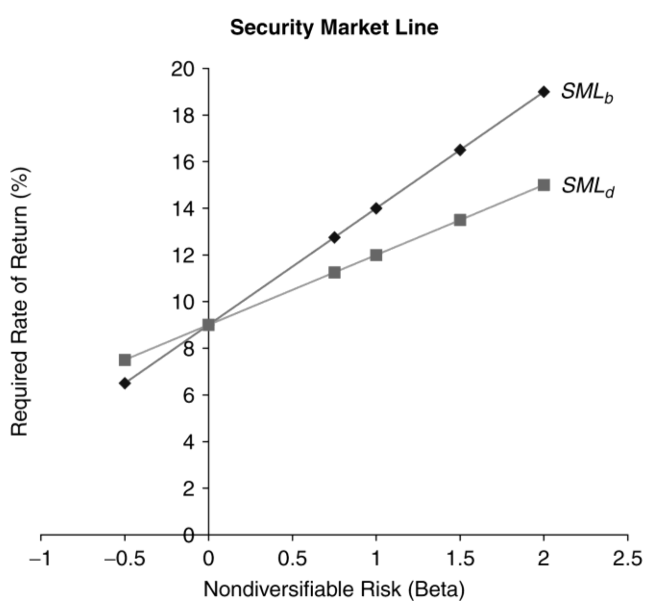
P5-29. LG 6: Integrative-risk, return, and CAPM

Challenge

a.

Project	r_j	=	$R_F + [b_j \times (r_m - R_F)]$		
A	r_j	=	$9\% + [1.5 \times (14\% - 9\%)]$	=	16.5%
B	r_j	=	$9\% + [0.75 \times (14\% - 9\%)]$	=	12.75%
C	r_j	=	$9\% + [2.0 \times (14\% - 9\%)]$	=	19.0%
D	r_j	=	$9\% + [0 \times (14\% - 9\%)]$	=	9.0%
E	r_j	=	$9\% + [(-0.5) \times (14\% - 9\%)]$	=	6.5%

b and d



c. Project A is 150% as responsive as the market.
Project B is 75% as responsive as the market.
Project C is twice as responsive as the market.
Project D is unaffected by market movement.
Project E is only half as responsive as the market, but moves in the opposite direction as the market.

d. See graph for new SML.
$r_A = 9\% + [1.5 \times (12\% - 9\%)] = 13.50\%$
$r_B = 9\% + [0.75 \times (12\% - 9\%)] = 11.25\%$
$r_C = 9\% + [2.0 \times (12\% - 9\%)] = 15.00\%$
$r_D = 9\% + [0 \times (12\% - 9\%)] = 9.00\%$
$r_E = 9\% + [-0.5 \times (12\% - 9\%)] = 7.50\%$

e. The steeper slope of SML_b indicates a higher risk premium than SML_d for these market conditions. When investor risk aversion declines, investors require lower returns for any given risk level (beta).

P5-30. Ethics problem

Intermediate

One way is to ask how the candidate would handle a hypothetical situation. One may gain insight into the moral/ethical framework within which decisions are made. Another approach is to use a pencil-and-paper honesty test – these are surprisingly accurate, despite the obvious notion that the job candidate may attempt to game the exam by giving the 'right' versus the individually accurate responses. Before even administering the situational interview question or the test, ask the candidate to list the preference attributes of the type of company he or she aspires to work for, and see if character and ethics terms emerge in the description. Some companies do credit history checks, after gaining the candidates approval to do so. Using all four of these techniques allows one to 'triangulate' toward a valid and defensible appraisal of a candidate's honesty and integrity.

■ Case

Analysing risk and return on Chargers Products' investments

This case requires students to review and apply the concept of the risk–return tradeoff by analysing two possible asset investments using standard deviation, coefficient of variation, and CAPM.

1. Expected rate of return: $r_t = \dfrac{(P_t - P_{t-1} + C_t)}{P_{t-1}}$

Asset X:

Year	**Cash flow (C_t)**	**Ending value (P_t)**	**Beginning value (P_{t-1})**	**Gain/ Loss**	**Annual rate of return**
2000	R1,000	R22,000	R20,000	R2,000	15.00%
2001	1,500	21,000	22,000	–1,000	2.27
2002	1,400	24,000	21,000	3,000	20.95
2003	1,700	22,000	24,000	–2,000	–1.25

Asset X: (continued)

Year	Cash flow (C_t)	Ending value (P_t)	Beginning value (P_{t-1})	Gain/ Loss	Annual rate of return
2004	1,900	23,000	22,000	1,000	13.18
2005	1,600	26,000	23,000	3,000	20.00
2006	1,700	25,000	26,000	–1,000	2.69
2007	2,000	24,000	25,000	–1,000	4.00
2008	2,100	27,000	24,000	3,000	21.25
2009	2,200	30,000	27,000	3,000	19.26

Average expected return for Asset X = 11.74%

Asset Y:

Year	Cash flow (C_t)	Ending value (P_t)	Beginning value (P_{t-1})	Gain/ Loss	Annual rate of return
2000	R1,50 0	R20,00 0	R20,000	R 0	7.50%
2001	1,600	20,000	20,000	0	8.00
2002	1,700	21,000	20,000	1,000	13.50
2003	1,800	21,000	21,000	0	8.57
2004	1,900	22,000	21,000	1,000	13.81
2005	2,000	23,000	22,000	1,000	13.64
2006	2,100	23,000	23,000	0	9.13
2007	2,200	24,000	23,000	1,000	13.91
2008	2,300	25,000	24,000	1,000	13.75
2009	2,400	25,000	25,000	0	9.60

Average expected return for Asset Y = 11.14%

2. $\sigma_r = \sqrt{\sum_{i=1}^{n}(r_i - \bar{r})^2 \div (n-1)}$

Asset X:

Year	Return r_i	Average return, r	$(r_i - \bar{r})$	$(r_i - \bar{r})^2$
2000	15.00%	11.74%	3.26%	0.001063
2001	2.27	11.74	–9.47	0.008968
2002	20.95	11.74	9.21	0.008482
2003	–1.25	11.74	–12.99	0.016874
2004	13.18	11.74	1.44	0.000207
2005	20.00	11.74	8.26	0.006823

Asset X: (continued)

Year	**Return** r_i	**Average return,** r	$(r_i - \overline{r})$	$(r_i - \overline{r})^2$
2006	2.69	11.74	−9.05	0.008190
2007	4.00	11.74	−7.74	0.005991
2008	21.25	11.74	9.51	0.009044
2009	19.26	11.74	7.52	0.005655
				0.071297

$$\sigma_x = \sqrt{\frac{0.071297}{10-1}} = \sqrt{0.07922} = .0890 = 8.90\%$$

$$CV = \frac{8.90\%}{11.74\%} = 0.76$$

Asset Y:

Year	**Return** r_i	**Average return,** r	$(r_i - \overline{r})$	$(r_i - \overline{r})^2$
2000	7.50%	11.14%	−3.64%	0.001325
2001	8.00	11.14	−3.14	0.000986
2002	13.50	11.14	2.36	0.000557
2003	8.57	11.14	−2.57	0.000660
2004	13.81	11.14	2.67	0.000713
2005	13.64	11.14	2.50	0.000625
2006	9.13	11.14	−2.01	0.000404
2007	13.91	11.14	2.77	0.000767
2008	13.75	11.14	2.61	0.000681
2009	9.60	11.14	−1.54	0.000237
				0.006955

$$\sigma_Y = \sqrt{\frac{0.006955}{10-1}} = \sqrt{0.0773} = 0.0278 = 2.78\%$$

$$CV = \frac{2.78\%}{11.14\%} = 0.25$$

3. Summary statistics:

	Asset X	Asset Y
Expected return	11.74%	11.14%
Standard deviation	8.90%	2.78%
Coefficient of variation	0.76	0.25

Comparing the expected returns calculated in part (a), Asset X provides a return of 11.74%, only slightly above the return of 11.14% expected from Asset Y. The higher standard deviation and coefficient of variation of Investment X indicates greater risk. With just this information, it is difficult to determine whether the 0.60% difference in return is adequate compensation for the difference in risk. Based on this information, however, Asset Y appears to be the better choice.

4. Using the capital asset pricing model, the required return on each asset is as follows:

Capital asset pricing model: $r_j = R_F + [b_j \times (r_m - R_F)]$

Asset	$R_F + [b_j \times (r_m - R_F)]$	=	r_j
X	7% + [1.6 × (10% – 7%)]	=	11.8%
Y	7% + [1.1 × (10% – 7%)]	=	10.3%

From the calculations in part (a), the expected return for Asset X is 11.74%, compared to its required return of 11.8%. On the other hand, Asset Y has an expected return of 11.14% and a required return of only 10.8%. This makes Asset Y the better choice.

5. In part **c**, we concluded that it would be difficult to make a choice between X and Y because the additional return on X may or may not provide the needed compensation for the extra risk. In part **d**, by calculating a required rate of return, it was easy to reject X and select Y. The required return on Asset X is 11.8%, but its expected return (11.74%) is lower; therefore Asset X is unattractive. For Asset Y the reverse is true, and it is a good investment vehicle.

   Clearly, Charger Products is better off using the standard deviation and coefficient of variation, rather than a strictly subjective approach, to assess investment risk. Beta and CAPM, however, provide a link between risk and return. They quantify risk and convert it into a required return that can be compared to the expected return to draw a definitive conclusion about investment acceptability. Contrasting the conclusions in the responses to Questions **c** and **d** above should clearly demonstrate why Allister is better off using beta to assess risk.

6. a. Increase in risk-free rate to 8% and market return to 11%:

Asset	$R_F + [b_j \times (r_m - R_F)]$	=	r_j
X	8% + [1.6 × (11% – 8%)]	=	12.8%
Y	8% + [1.1 × (11% – 8%)]	=	11.3%

   b. Decrease in market return to 9%:

Asset	$R_F + [b_j \times (r_m - R_F)]$	=	r_j
X	7% + [1.6 × (9% – 7%)]	=	10.2%
Y	7% + [1.1 × (9% – 7%)]	=	9.2%

In Situation 1, the required return rises for both assets, and neither has an expected return above the firm's required return.

With Situation 2, the drop in market rate causes the required return to decrease so that the expected returns of both assets are above the required return. However, Asset Y provides a larger return compared to its required return (11.14 − 9.20 = 1.94), and it does so with less risk than Asset X.

■ Spreadsheet Exercise

The answer to Chapter 5's share portfolio analysis spreadsheet problem is located in the Instructor's Resource Center at *www.prenhall.com/irc*.

■ Group exercises

This exercise uses current information from several websites regarding the recent performance of each group's shadow firm. This information is then compared to a relevant index. The time periods for comparison are 1- and 5-years. Calculated annual returns and basic graphical analysis begin the process of comparison. Correlation between the firm and the market is investigated further through the use of the firm's beta, and the risk-free rate as represented by the 3-month Treasury rate. Lastly, the group is asked to graph the firm's SML using the data they calculated.

Accurate and timely information is the first message of this assignment. Students are encouraged to look at several sites and also to search for others. The information content of the different sites can then be compared. This information is then used to get students to see how basic share market analysis is done. As always, parts of this exercise can be modified or dropped at the adopter's discretion. One suggestion is to add other companies to the comparison(s). Also, some of the more complex calculations could be eliminated.

Integrative Case 5: Conti Furniture

Integrative Case 5, Conti Furniture, involves evaluating working capital management of a furniture manufacturer. Operating cycle, cash conversion cycle, and negotiated financing needed are determined and compared with industry practices. The student then analyses the impact of changing the firm's credit terms to evaluate its management of trade receivables before making a recommendation.

1. Operating cycle (OC) = average age of inventory + average collection period
   = 110 days + 75 days
   = 185 days

   Cash conversion cycle(CCC) = OC – average payment period
   = 185 days – 30 days
   = 155 days

   Resources needed $= \frac{\text{Total annual outlays}}{365 \text{ days}} \times \text{CCC}$

   $= \frac{\text{R}26{,}500{,}000}{365} \times 155$ [R1]

   = R11,253,425

2. Industry OC = 83 days + 75 days
   = 158 days

   Industry CCC = 158 days – 39 days
   = 119 days

   Industry resources needed $= \frac{\text{R}26{,}500{,}000}{365} \times 119$

   = R8,639,726

3. Conti Furniture

Negotiated financing	R11,253,425
Less: Industry resources needed	8,639,726
	R2,613,699

   Cost of inefficiency: R2,613,699 × 0.15 = R392,055

4. a. Offering 3/10 net 60:

   Reduction in collection period = 75 days × (1 – 0.4)
   = 45 days

   OC = 83 days + 45 days
   = 128 days

   CCC = 128 days – 39 days
   = 89 days

   Resources needed $= \frac{\text{R}26{,}500{,}000}{365} \times 89 \text{ days}$

   = R6,461,644

   Additional savings = R8,639,726 – R6,461,644 = R2,178,082