Answers to Warm-Up Exercises

E8-1. Total annual return

Answer: (\$0 + \$12,000 − \$10,000) ÷ \$10,000 = \$2,000 ÷ \$10,000 = 20%

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

E8-2. 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%

E8-3. Comparing the risk of two investments

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

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.

E8-4. Computing the expected return of a portfolio

Answer: $r_p = (0.45 \times 0.038) + (0.4 \times 0.123) + (0.15 \times 0.174)$

$= (0.0171) + (0.0492) + (0.0261 = 0.0924 = 9.24\%$

The portfolio is expected to have a return of approximately 9.2%.

E8-5. Calculating a portfolio beta

Answer:

Beta = (0.20 × 1.15) + (0.10 × 0.85) + (0.15 × 1.60) + (0.20 × 1.35) + (0.35 × 1.85)

= 0.2300 + 0.0850 + 0.2400 + 0.2700 + 0.6475 = 1.4725

E8-6. 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

P8-1. Rate of return: $r_t = \frac{(P_t - P_{t-1} + C_t)}{P_{t-1}}$

LG 1; Basic

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

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

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

P8-2. Return calculations: $r_t = \frac{(P_t - P_{t-1} + C_t)}{P_{t-1}}$

LG 1; Basic

Investment	**Calculation**	r_t**(%)**
A	(\$1,100 – \$800 – \$100) ÷ \$800	25.00
B	(\$118,000 – \$120,000 + \$15,000) ÷ \$120,000	10.83
C	(\$48,000 – \$45,000 + \$7,000) ÷ \$45,000	22.22
D	(\$500 – \$600 + \$80) ÷ \$600	–3.33
E	(\$12,400 – \$12,500 + \$1,500) ÷ \$12,500	11.20

P8-3. Risk preferences

LG 1; Intermediate

a. The risk-neutral 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.

P8-4. Risk analysis

LG 2; 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.

P8-5. Risk and probability

LG 2; Intermediate

a.

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

b.

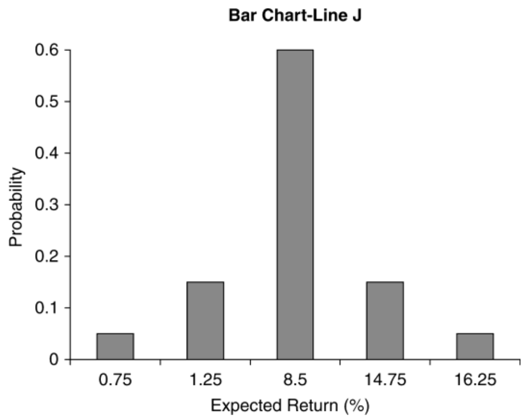
	Possible Outcomes	Probability P_{ri}	Expected Return r_i	Weighted Value (%)($r_i \times P_{ri}$)
Camera R	Pessimistic	0.25	20	5.00%
	Most likely	0.50	25	12.50%
	Optimistic	0.25	30	7.50%
		1.00	Expected return	25.00%
Camera S	Pessimistic	0.20	15	3.00%
	Most likely	0.55	25	13.75%
	Optimistic	0.25	35	8.75%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

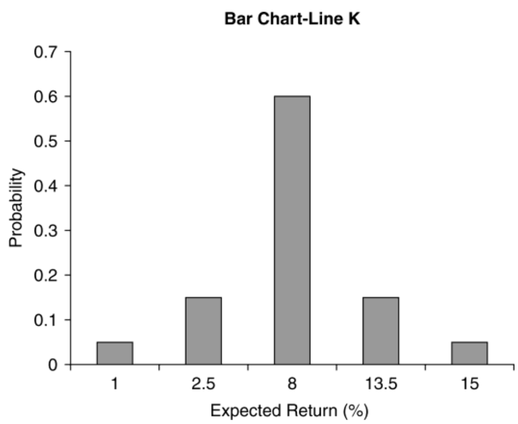
c. Camera S is considered more risky than Camera R because it has a much broader range of outcomes. The risk-return tradeoff is present because Camera S is more risky and also provides a higher return than Camera R.

P8-6. Bar charts and risk

LG 2; 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.

P8-7. Coefficient of variation: $CV = \frac{\sigma_r}{\bar{r}}$

LG 2; 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.

P8-8. Standard deviation versus coefficient of variation as measures of risk

LG 2; Basic

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

b. The standard deviation measure fails to take into account both the volatility and the return of the investment. Investors would prefer higher return but less volatility, and the coefficient of variation provices a measure that takes into account both aspects of investors' preferences. Project D has the lowest CV, so it is the least risky investment relative to the return provided.

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 standardized method of measuring the risk-return tradeoff for investments with differing returns.

P8-9. Personal finance: Rate of return, standard deviation, coefficient of variation

LG 2; Challenge

a.

	Stock Price			Variance
Year	Beginning	End	Returns	(Return–Average Return)^2
2009	14.36	21.55	50.07%	0.0495
2010	21.55	64.78	200.60%	1.6459
2011	64.78	72.38	11.73%	0.3670
2012	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 stock price of Hi-Tech, Inc. 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 4 years. Note how comparing securities on a *CV* basis allows the investor to put the stock in proper perspective. The stock is riskier than what Mike normally buys but if he believes that Hi-Tech, Inc. will continue to rise then he should include it. The coefficient of variation, however, is greater than the 0.90 target.

P8-10. Assessing return and risk

LG 2; Challenge

a. Project 257

(1) Range: 1.00 – (–0.10) = 1.10

(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	0.01	–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) $CV = \frac{0.165378}{0.450} = 0.3675$

Project 432

(1) Range: 0.50 – 0.10 = 0.40

(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	0.05	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

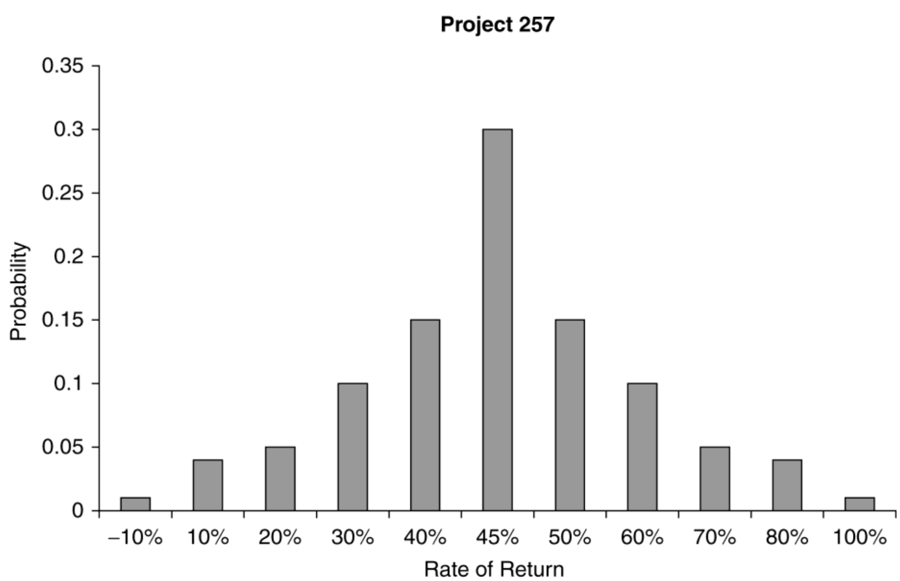
(3) Standard deviation: $\sigma = \sqrt{\sum_{i=1}^{n}(r_i - \overline{r})^2 \times P_{ri}}$

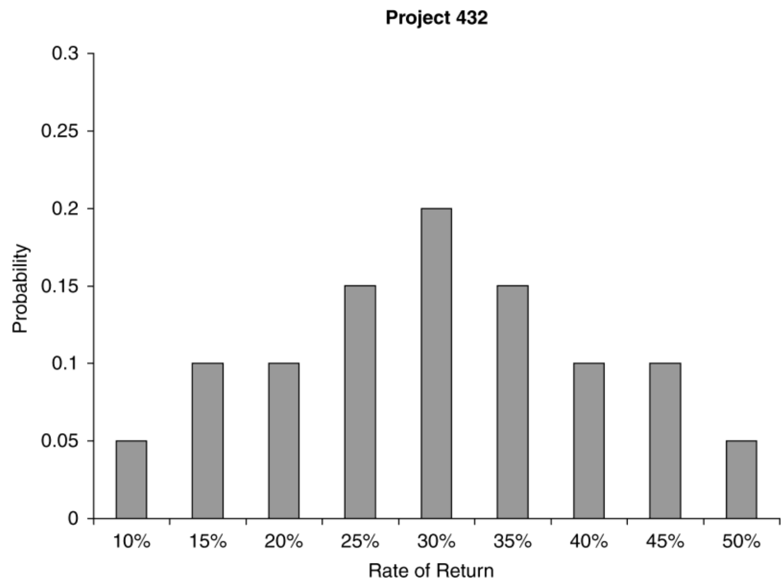
r_i	$\overline{r}$	$r_i - \overline{r}$	$(r_i - \overline{r})^2$	P_{ri}	$(r_i - \overline{r})^2 \times P_{ri}$
0.10	0.300	−0.20	0.0400	0.05	0.002000
0.15	0.300	−0.15	0.0225	0.10	0.002250
0.20	0.300	−0.10	0.0100	0.10	0.001000
0.25	0.300	−0.05	0.0025	0.15	0.000375
0.30	0.300	0.00	0.0000	0.20	0.000000
0.35	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) $CV = \frac{0.106066}{0.300} = 0.3536$

b. Bar Charts





c. Summary statistics

	Project 257	Project 432
Range	1.100	0.400
Expected return ($\bar{r}$)	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.

P8-11. Integrative—expected return, standard deviation, and coefficient of variation

LG 2; 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

Continued

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 $= \dfrac{\text{standard deviation } (\sigma)}{\text{expected value}}$

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

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

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

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

P8-12. Normal probability distribution

LG 2; Challenge

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

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:

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

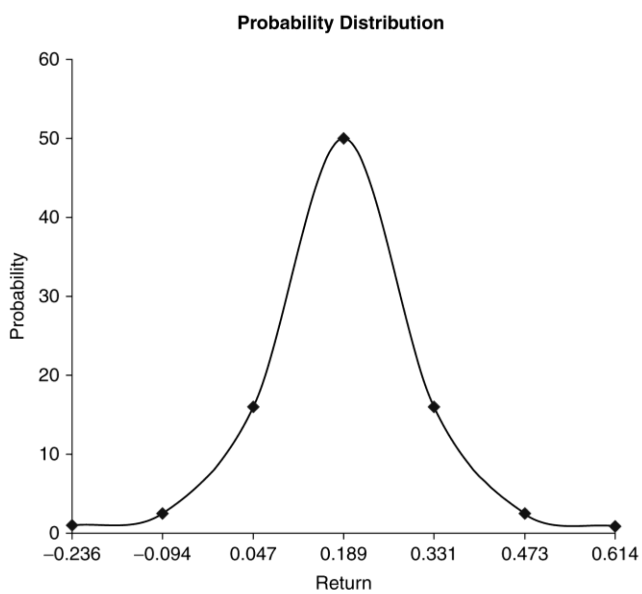
$-2\sigma = 0.189 - (2 \times 0.14175) = -0.0945$

(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.



P8-13. Personal finance: Portfolio return and standard deviation

LG 3; 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
2013	(14% × 0.40 = 5.6%)	+	(20% × 0.60 = 12.0%)	=	17.6%
2014	(14% × 0.40 = 5.6%)	+	(18% × 0.60 = 10.8%)	=	16.4%
2015	(16% × 0.40 = 6.4%)	+	(16% × 0.60 = 9.6%)	=	16.0%
2016	(17% × 0.40 = 6.8%)	+	(14% × 0.60 = 8.4%)	=	15.2%
2017	(17% × 0.40 = 6.8%)	+	(12% × 0.60 = 7.2%)	=	14.0%
2018	(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.

P8-14. Portfolio analysis

LG 3; 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
2013	$(16\% \times 0.50 = 8.0\%)$	+	$(17\% \times 0.50 = 8.5\%)$	=	16.5%
2014	$(17\% \times 0.50 = 8.5\%)$	+	$(16\% \times 0.50 = 8.0\%)$	=	16.5%
2015	$(18\% \times 0.50 = 9.0\%)$	+	$(15\% \times 0.50 = 7.5\%)$	=	16.5%
2016	$(19\% \times 0.50 = 9.5\%)$	+	$(14\% \times 0.50 = 7.0\%)$	=	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
2013	$(16\% \times 0.50 = 8.0\%)$	+	$(14\% \times 0.50 = 7.0\%)$	15.0%
2014	$(17\% \times 0.50 = 8.5\%)$	+	$(15\% \times 0.50 = 7.5\%)$	16.0%
2015	$(18\% \times 0.50 = 9.0\%)$	+	$(16\% \times 0.50 = 8.0\%)$	17.0%
2016	$(19\% \times 0.50 = 9.5\%)$	+	$(17\% \times 0.50 = 8.5\%)$	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.

P8-15. Correlation, risk, and return

LG 4; 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%

P8-16. Personal finance: International investment returns

LG 1, 4; Intermediate

a. $\text{Return}_{\text{pesos}} = \dfrac{24,750 - 20,500}{20,500} = \dfrac{4,250}{20,500} = 0.20732 = 20.73\%$

b. $\text{Purchase price} \dfrac{\text{Price in pesos}}{\text{Pesos per dollar}} = \dfrac{20.50}{9.21} = \$2.22584 \times 1,000 \text{ shares} = \$2,225.84$

$\text{Sales price} \dfrac{\text{Price in pesos}}{\text{Pesos per dollar}} = \dfrac{24.75}{9.85} = \$2.51269 \times 1,000 \text{ shares} = \$2,512.69$

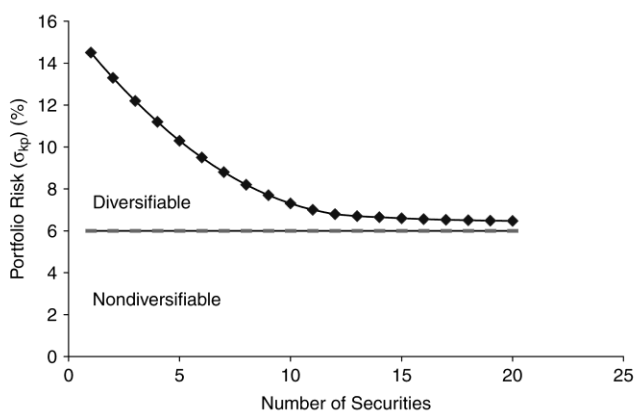
c. $\text{Return}_{\text{pesos}} = \dfrac{2,512.69 - 2,225.84}{2,225.84} = \dfrac{286.85}{2,225.84} = 0.12887 = 12.89\%$

d. The two returns differ due to the change in the exchange rate between the peso and the dollar. The peso had depreciation (and thus the dollar 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 Joe. An investor in foreign securities will carry exchange-rate risk.

P8-17. Total, nondiversifiable, and diversifiable risk

LG 5; Intermediate

a. and b.

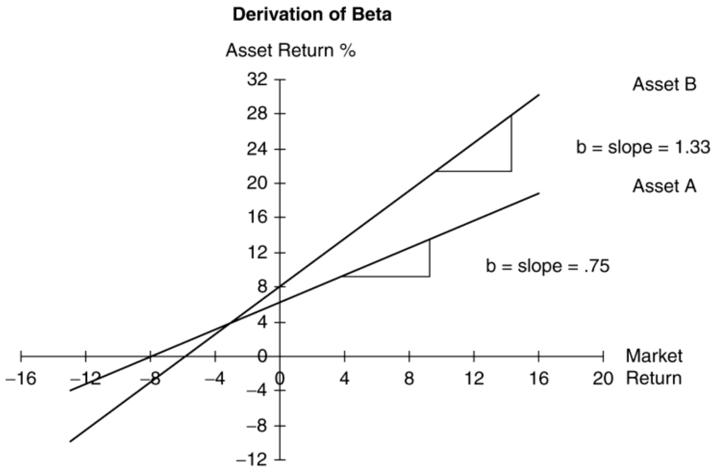


c. Only nondiversifiable risk is relevant because, as shown by the graph, diversifiable risk can be virtually eliminated through holding a portfolio of at least 20 securities that are not positively correlated. David Talbot's portfolio, assuming diversifiable risk could no longer be reduced by additions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

P8-18. Graphic derivation of beta

LG 5; 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.

P8-19. Graphical derivation and interpretation of beta

LG 5; Intermediate

a. With a return range from –60% to + 60%, Biotech Cures, exhibited in Panel B, is the more risky stock. Returns are widely dispersed in this return range regardless of market conditions. By comparison, the returns of Panel A's Cyclical Industries Incorporated only range from about –40% to + 40%. There is less dispersion of returns within this return range.

b. The returns on Cyclical Industries Incorporated's stock are more closely correlated with the market's performance. Hence, most of Cyclical Industries' returns fit around the upward sloping least-squares regression line. By comparison, Biotech Cures has earned returns approaching 60% during a period when the overall market experienced a loss. Even if the market is up, Biotech Cures has lost almost half of its value in some years.

c. On a standalone basis, Biotech Cures Corporation is riskier. However, if an investor was seeking to diversify the risk of their current portfolio, the unique, nonsystematic performance of Biotech Cures Corporation makes it a good addition. Other considerations would be the mean return for both (here Cyclical Industries has a higher return when the overall market return is zero), expectations regarding the overall market performance, and level to which one can use historic returns to accurately forecast stock price behavior.

P8-20. Interpreting beta

LG 5; 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.

P8-21. Betas

LG 5; 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.

P8-22. Personal finance: Betas and risk rankings

LG 5; Intermediate

a.

	Stock	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 stock, Stock C. While the market declines, the return on C increases.

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

P8-23. Personal finance: Portfolio betas: $b_p = \sum_{j=1}^{n} w_j \times b_j$

LG 5; Intermediate

a.

Asset	Beta	Portfolio A w_A	$w_A \times b_A$	Portfolio B 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.

P8-24. Capital asset pricing model (CAPM): $r_j = R_F + [b_j \times (r_m - R_F)]$

LG 6; 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%)]

P8-25. Personal finance: Beta coefficients and the capital asset pricing model

LG 5, 6; 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%.)

P8-26. Manipulating CAPM: $r_j = R_F + [b_j \times (r_m - R_F)]$

LG 6; 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. $15\% = 10\% + [b_j \times (12.5\% - 10\%)$

$b_j = 2$

P8-27. Personal finance: Portfolio return and beta

LG 1, 3, 5, 6: 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. $$r_A = \frac{(\$20{,}000 - \$20{,}000) + \$1{,}600}{\$20{,}000} = \frac{\$1{,}600}{\$20{,}000} = 8\%$$

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

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

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

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

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

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

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

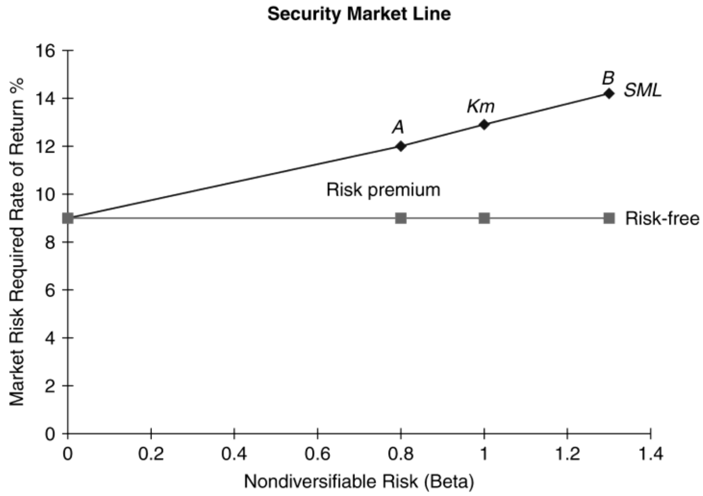
$r_D = 4\% + [1.25 \times (10\% - 4\%)] = 11.5\%$

e. Of the four investments, only C (15% vs. 13%) and D (12.5% vs. 11.5%) had actual returns that exceeded the CAPM expected return (15% vs. 13%). The underperformance could be due to any unsystematic factor that would have caused the firm not 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.

P8-28. Security market line, SML

LG 6; 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

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

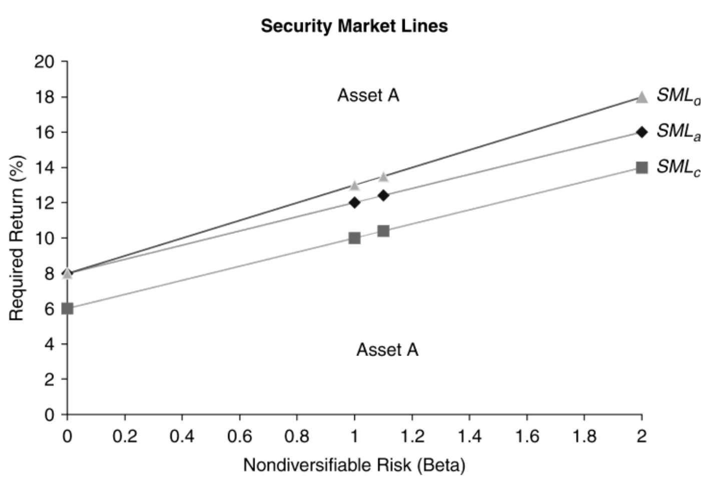
$r_j = 0.142$

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%).

P8-29. Shifts in the security market line

LG 6; 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.

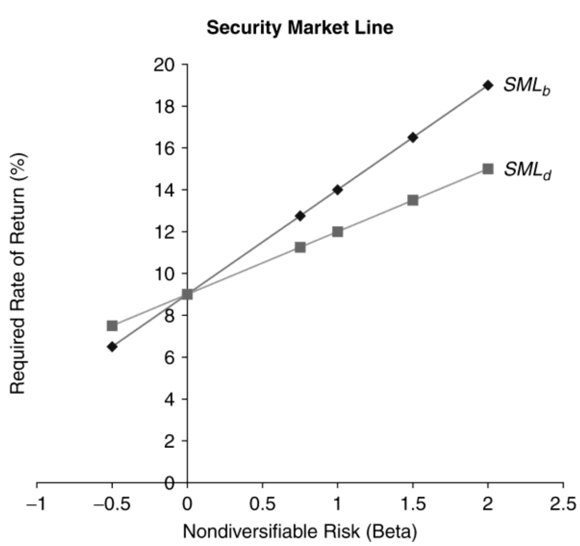
P8-30. Integrative—risk, return, and CAPM

LG 6; 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).

P8-31. Ethics problem

LG 1; Intermediate

Investors expect managers to take risks with their money, so it is clearly not unethical for managers to make risky investments with other people's money. However, managers have a duty to communicate truthfully with investors about the risk that they are taking. Portfolio managers should not take risks that they do not expect to generate returns sufficient to compensate investors for the return variability.