5. Optimal active portfolios constructed from the index model include analyzed securities in proportion to their information ratios. The full risky portfolio is a mixture of the active portfolio and the passive market index portfolio. The index portfolio is used to enhance the diversification of the overall risky position.

6. Practitioners routinely estimate the index model using total rather than excess rates of return. This makes their estimate of alpha equal to $\alpha + r_f(1 - \beta)$.

7. Betas show a tendency to evolve toward 1 over time. Beta forecasting rules attempt to predict this drift. Moreover, other financial variables can be used to help forecast betas.

Related Web sites for this chapter are available at **www.mheducation.asia/olc/bodie**

Key Terms

single-factor model
single-index model
regression equation
residuals
security characteristic line
scatter diagram
information ratio
tracking portfolio

Problem Sets

Basic

1. What are the advantages of the index model compared to the Markowitz procedure for obtaining an efficiently diversified portfolio? What are its disadvantages?
2. What is the basic trade-off when departing from pure indexing in favor of an actively managed portfolio?
3. How does the magnitude of firm-specific risk affect the extent to which an active investor will be willing to depart from an indexed portfolio?
4. Why do we call alpha a "nonmarket" return premium? Why are high-alpha stocks desirable investments for active portfolio managers? With all other parameters held fixed, what would happen to a portfolio's Sharpe ratio as the alpha of its component securities increased?

Intermediate

5. A portfolio management organization analyzes 60 stocks and constructs a mean-variance efficient portfolio using only these 60 securities.
   a. How many estimates of expected returns, variances, and covariances are needed to optimize this portfolio?
   b. If one could safely assume that stock market returns closely resemble a single-index structure, how many estimates would be needed?
6. The following are estimates for two stocks.

Stock	Expected Return	Beta	Firm-Specific Standard Deviation
A	13%	0.8	30%
B	18	1.2	40

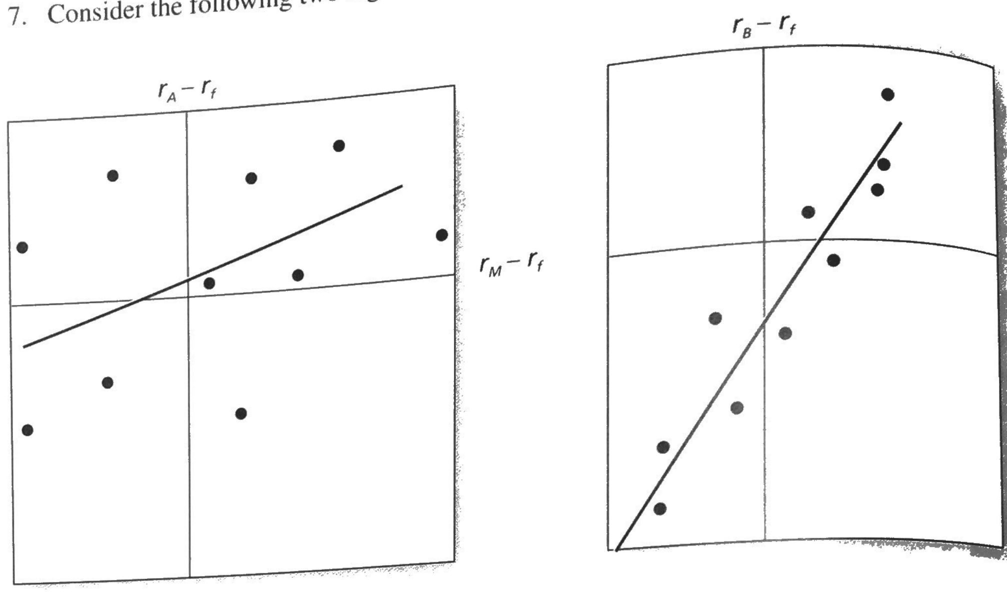
The market index has a standard deviations of 22% and the risk-free rate is 8%.

a. What are the standard deviations of stocks *A* and *B?*
b. Suppose that we were to construct a portfolio with proportions:

Stock *A:*	.30
Stock *B:*	.45
T-bills:	.25

Compute the expected return, standard deviation, beta, and nonsystematic standard deviation of the portfolio.

7. Consider the following two regression lines for stocks *A* and *B* in the following figure.



a. Which stock has higher firm-specific risk?
b. Which stock has greater systematic (market) risk?
c. Which stock has higher R^2?
d. Which stock has higher alpha?
e. Which stock has higher correlation with the market?

8. Consider the two (excess return) index model regression results for *A* and *B:*

$R_A = 1\% + 1.2R_M$

R-square = .576

Residual standard deviation = 10.3%

$R_B = -2\% + .8R_M$

R-square = .436

Residual standard deviation = 9.1%

a. Which stock has more firm-specific risk?
b. Which has greater market risk?
c. For which stock does market movement explain a greater fraction of return variability?
d. If r_f were constant at 6% and the regression had been run using total rather than excess returns, what would have been the regression intercept for stock *A?*

Use the following data for Problems 9 through 14. Suppose that the index model for stocks A and B is estimated from excess returns with the following results:

$$R_A = 3\% + .7R_M + e_A$$
$$R_B = -2\% + 1.2R_M + e_B$$
$$\sigma_M = 20\%; R\text{-square}_A = .20; R\text{-square}_B = .12$$

9. What is the standard deviation of each stock?
10. Break down the variance of each stock to the systematic and firm-specific components.
11. What are the covariance and correlation coefficient between the two stocks?
12. What is the covariance between each stock and the market index?
13. For portfolio *P* with investment proportions of .60 in *A* and .40 in *B,* rework Problems 9, 10, and 12.
14. Rework Problem 13 for portfolio *Q* with investment proportions of .50 in *P,* .30 in the market index, and .20 in T-bills.

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simple version of the expected return–beta relationship holds. But if those distributions change unpredictably, or if investors seek to hedge nonmarket sources of risk to their consumption, the simple CAPM will give way to a multifactor version in which the security's exposure to these nonmarket sources of risk command risk premiums.

9. The consumption-based capital asset pricing model (CCAPM) is a single-factor model in which the market portfolio excess return is replaced by that of a consumption-tracking portfolio. By appealing directly to consumption, the model naturally incorporates consumption-hedging considerations and changing investment opportunities within a single-factor framework.

10. The security market line of the CAPM must be modified to account for labor income and other significant nontraded assets.

11. Liquidity costs and liquidity risk can be incorporated into the CAPM relationship. Investors demand compensation for expected costs of illiquidity as well as the risk surrounding those costs.

Related Web sites for this chapter are available at **www.mheducation.asia/olc/bodie**

Key Terms

homogeneous expectations
market portfolio
mutual fund theorem
market price of risk
beta
expected return–beta relationship
security market line (SML)
alpha
market model
zero-beta portfolio
liquidity
illiquidity

Problem Sets

Basic

1. What must be the beta of a portfolio with $E(r_P) = 18\%$, if $r_f = 6\%$ and $E(r_M) = 14\%$?
2. The market price of a security is \$50. Its expected rate of return is 14%. The risk-free rate is 6% and the market risk premium is 8.5%. What will be the market price of the security if its correlation coefficient with the market portfolio doubles (and all other variables remain unchanged)? Assume that the stock is expected to pay a constant dividend in perpetuity.
3. Are the following true or false? Explain.
   a. Stocks with a beta of zero offer an expected rate of return of zero.
   b. The CAPM implies that investors require a higher return to hold highly volatile securities.
   c. You can construct a portfolio with beta of .75 by investing .75 of the investment budget in T-bills and the remainder in the market portfolio.
4. Here are data on two companies. The T-bill rate is 4% and the market risk premium is 6%.

KAPLAN SCHWESER

Company	\$1 Discount Store	Everything \$5
Forecasted return	12%	11%
Standard deviation of returns	8%	10%
Beta	1.5	1.0

What would be the fair return for each company, according to the capital asset pricing model (CAPM)?

5. Characterize each company in the previous problem as underpriced, overpriced, or properly priced.

KAPLAN SCHWESER

6. What is the expected rate of return for a stock that has a beta of 1.0 if the expected return on the market is 15%?

KAPLAN SCHWESER

   a. 15%.
   b. More than 15%.
   c. Cannot be determined without the risk-free rate.

7. Kaskin, Inc., stock has a beta of 1.2 and Quinn, Inc., stock has a beta of .6. Which of the following statements is *most* accurate?
   a. The expected rate of return will be higher for the stock of Kaskin, Inc., than that of Quinn, Inc.
   b. The stock of Kaskin, Inc., has more total risk than Quinn, Inc.
   c. The stock of Quinn, Inc., has more systematic risk than that of Kaskin, Inc.

Intermediate

8. You are a consultant to a large manufacturing corporation that is considering a project with the following net after-tax cash flows (in millions of dollars):

Years from Now	After-Tax Cash Flow
0	−40
1–10	15

The project's beta is 1.8. Assuming that $r_f = 8\%$ and $E(r_M) = 16\%$, what is the net present value of the project? What is the highest possible beta estimate for the project before its NPV becomes negative?

9. Consider the following table, which gives a security analyst's expected return on two stocks for two particular market returns:

Market Return	Aggressive Stock	Defensive Stock
5%	−2%	6%
25	38	12

   a. What are the betas of the two stocks?
   b. What is the expected rate of return on each stock if the market return is equally likely to be 5% or 25%?
   c. If the T-bill rate is 6% and the market return is equally likely to be 5% or 25%, draw the SML for this economy.
   d. Plot the two securities on the SML graph. What are the alphas of each?
   e. What hurdle rate should be used by the management of the aggressive firm for a project with the risk characteristics of the defensive firm's stock?

For Problems 10 to 16: If the simple CAPM is valid, which of the following situations are possible? Explain. Consider each situation independently.

10.

Portfolio	Expected Return	Beta
A	20	1.4
B	25	1.2

11.

Portfolio	Expected Return	Standard Deviation
A	30	35
B	40	25

12.

Portfolio	Expected Return	Standard Deviation
Risk-free	10	0
Market	18	24
A	16	12

13.

Portfolio	Expected Return	Standard Deviation
Risk-free	10	0
Market	18	[illegible]
A	20	[illegible]

14.

Portfolio	Expected Return	Beta
Risk-free	10	0
Market	18	1.0
A	16	1.5

15.

Portfolio	Expected Return	Beta
Risk-free	10	0
Market	18	1.0
A	16	0.9

16.

Portfolio	Expected Return	Standard Deviation
Risk-free	10	0
Market	18	24
A	16	22

For Problems 17 to 19 assume that the risk-free rate of interest is 6% and the expected rate of return on the market is 16%.

17. A share of stock sells for \$50 today. It will pay a dividend of \$6 per share at the end of the year. Its beta is 1.2. What do investors expect the stock to sell for at the end of the year?

18. I am buying a firm with an expected perpetual cash flow of \$1,000 but am unsure of its risk. If I think the beta of the firm is .5, when in fact the beta is really 1, how much *more* will I offer for the firm than it is truly worth?

19. A stock has an expected rate of return of 4%. What is its beta?

20. Two investment advisers are comparing performance. One averaged a 19% rate of return and the other a 16% rate of return. However, the beta of the first investor was 1.5, whereas that of the second was 1.
    - *a.* Can you tell which investor was a better selector of individual stocks (aside from the issue of general movements in the market)?
    - *b.* If the T-bill rate were 6% and the market return during the period were 14%, which investor would be the superior stock selector?
    - *c.* What if the T-bill rate were 3% and the market return were 15%?

21. Suppose the rate of return on short-term government securities (perceived to be risk-free) is about 5%. Suppose also that the expected rate of return required by the market for a portfolio with a beta of 1 is 12%. According to the capital asset pricing model:
    - *a.* What is the expected rate of return on the market portfolio?
    - *b.* What would be the expected rate of return on a stock with $\beta = 0$?
    - *c.* Suppose you consider buying a share of stock at \$40. The stock is expected to pay \$3 dividends next year and you expect it to sell then for \$41. The stock risk has been evaluated at $\beta = -.5$. Is the stock overpriced or underpriced?

22. Suppose that borrowing is restricted so that the zero-beta version of the CAPM holds. The expected return on the market portfolio is 17%, and on the zero-beta portfolio it is 8%. What is the expected return on a portfolio with a beta of .6?

23. a. A mutual fund with beta of .8 has an expected rate of return of 14%. If $r_f = 5\%$, and you expect the rate of return on the market portfolio to be 15%, should you invest in this fund? What is the fund's alpha?
    - *b.* What passive portfolio comprised of a market-index portfolio and a money market account would have the same beta as the fund? Show that the difference between the expected rate of return on this passive portfolio and that of the fund equals the alpha from part (*a*).

Challenge

24. Outline how you would incorporate the following into the CCAPM: