

nominal interest rate

real interest rate

effective annual rate (EAR)

annual percentage rate (APR)

dividend yield

risk-free rate

risk premium

excess return

risk aversion

normal distribution

event tree

skew

kurtosis

value at risk (VaR)

expected shortfall (ES)

conditional tail expectation
(CTE)lower partial standard
deviation (LPSD)

Sortino ratio

lognormal distribution

**Key
Terms****Basic**

1. The Fisher equation tells us that the real interest rate approximately equals the nominal rate minus the inflation rate. Suppose the inflation rate increases from 3% to 5%. Does the Fisher equation imply that this increase will result in a fall in the real rate of interest? Explain.
2. You've just stumbled on a new dataset that enables you to compute historical rates of return on U.S. stocks all the way back to 1880. What are the advantages and disadvantages in using these data to help estimate the expected rate of return on U.S. stocks over the coming year?
3. You are considering two alternative 2-year investments: You can invest in a risky asset with a positive risk premium and returns in each of the 2 years that will be identically distributed and uncorrelated, or you can invest in the risky asset for only 1 year and then invest the proceeds in a risk-free asset. Which of the following statements about the first investment alternative (compared with the second) are true?
 - a. Its 2-year risk premium is the same as the second alternative.
 - b. The standard deviation of its 2-year return is the same.
 - c. Its annualized standard deviation is lower.
 - d. Its Sharpe ratio is higher.
 - e. It is relatively more attractive to investors who have lower degrees of risk aversion.

Intermediate

4. You have \$5,000 to invest for the next year and are considering three alternatives:
 - a. A money market fund with an average maturity of 30 days offering a current yield of 6% per year.
 - b. A 1-year savings deposit at a bank offering an interest rate of 7.5%.
 - c. A 20-year U.S. Treasury bond offering a yield to maturity of 9% per year.
 What role does your forecast of future interest rates play in your decisions?
5. Use Figure 5.1 in the text to analyze the effect of the following on the level of real interest rates:
 - a. Businesses become more pessimistic about future demand for their products and decide to reduce their capital spending.
 - b. Households are induced to save more because of increased uncertainty about their future Social Security benefits.
 - c. The Federal Reserve Board undertakes open-market purchases of U.S. Treasury securities in order to increase the supply of money.
6. You are considering the choice between investing \$50,000 in a conventional 1-year bank CD offering an interest rate of 5% and a 1-year "Inflation-Plus" CD offering 1.5% per year plus the rate of inflation.
 - a. Which is the safer investment?
 - b. Which offers the higher expected return?
 - c. If you expect the rate of inflation to be 3% over the next year, which is the better investment? Why?
 - d. If we observe a risk-free nominal interest rate of 5% per year and a risk-free real rate of 1.5% on inflation-indexed bonds, can we infer that the market's expected rate of inflation is 3.5% per year?

**Problem
Sets**

State of the Market	Probability	Ending Price	
			44.5%
Boom	.35	\$140	14.0
Normal growth	.30	110	-16.5
Recession	.35	80	

Use Equations 5.11 and 5.12 to compute the mean and standard deviation of the HPR on stocks.

8. Derive the probability distribution of the 1-year HPR on a 30-year U.S. Treasury bond with an 8% coupon if it is currently selling at par and the probability distribution of its yield to maturity a year from now is as follows:

State of the Economy	Probability	YTM
Boom	.20	11.0%
Normal growth	.50	8.0
Recession	.30	7.0

For simplicity, assume the entire 8% coupon is paid at the end of the year rather than every 6 months.

9. What is the standard deviation of a random variable q with the following probability distribution:

Value of q	Probability
0	.25
1	.25
2	.50

10. The continuously compounded annual return on a stock is normally distributed with a mean of 20% and standard deviation of 30%. With 95.44% confidence, we should expect its actual return in any particular year to be between which pair of values? *Hint: Look again at Figure 5.4.*
- 40.0% and 80.0%
 - 30.0% and 80.0%
 - 20.6% and 60.6%
 - 10.4% and 50.4%
11. Using historical risk premiums over the 1926–2009 period as your guide, what would be your estimate of the expected annual HPR on the S&P 500 stock portfolio if the current risk-free interest rate is 3%?
12. You can find annual holding-period returns for several asset classes at our Web site (www.mheducation.asia/olc/bodie); look for links to Chapter 5. Compute the means, standard deviations, skewness, and kurtosis of the annual HPR of large stocks and long-term Treasury bonds using only the 30 years of data between 1980 and 2009. How do these statistics compare with those computed from the data for the period 1926–1941? Which do you think are the most relevant statistics to use for projecting into the future?
13. During a period of severe inflation, a bond offered a nominal HPR of 80% per year. The inflation rate was 70% per year.
- What was the real HPR on the bond over the year?
 - Compare this real HPR to the approximation $r \approx R - i$.
14. Suppose that the inflation rate is expected to be 3% in the near future. Using the historical data provided in this chapter, what would be your predictions for:
- The T-bill rate?
 - The expected rate of return on large stocks?
 - The risk premium on the stock market?

- a. If you require a risk premium of 8%, how much will you be willing to pay for the portfolio?
 - b. Suppose that the portfolio can be purchased for the amount you found in (a). What will be the expected rate of return on the portfolio?
 - c. Now suppose that you require a risk premium of 12%. What is the price that you will be willing to pay?
 - d. Comparing your answers to (a) and (c), what do you conclude about the relationship between the required risk premium on a portfolio and the price at which the portfolio will sell?
5. Consider a portfolio that offers an expected rate of return of 12% and a standard deviation of 18%. T-bills offer a risk-free 7% rate of return. What is the maximum level of risk aversion for which the risky portfolio is still preferred to bills?
 6. Draw the indifference curve in the expected return–standard deviation plane corresponding to a utility level of .05 for an investor with a risk aversion coefficient of 3. (*Hint: Choose several possible standard deviations, ranging from 0 to .25, and find the expected rates of return providing a utility level of .05. Then plot the expected return–standard deviation points so derived.*)
 7. Now draw the indifference curve corresponding to a utility level of .05 for an investor with risk aversion coefficient $A = 4$. Comparing your answer to Problem 6, what do you conclude?
 8. Draw an indifference curve for a risk-neutral investor providing utility level .05.
 9. What must be true about the sign of the risk aversion coefficient, A , for a risk lover? Draw the indifference curve for a utility level of .05 for a risk lover.

For Problems 10 through 12: Consider historical data showing that the average annual rate of return on the S&P 500 portfolio over the past 80 years has averaged roughly 8% more than the Treasury bill return and that the S&P 500 standard deviation has been about 20% per year. Assume these values are representative of investors' expectations for future performance and that the current T-bill rate is 5%.

10. Calculate the expected return and variance of portfolios invested in T-bills and the S&P 500 index with weights as follows:

W_{bills}	W_{index}
0	1.0
0.2	0.8
0.4	0.6
0.6	0.4
0.8	0.2
1.0	0

11. Calculate the utility levels of each portfolio of Problem 10 for an investor with $A = 2$. What do you conclude?
12. Repeat Problem 11 for an investor with $A = 3$. What do you conclude?

Use these inputs for Problems 13 through 19: You manage a risky portfolio with expected rate of return of 18% and standard deviation of 28%. The T-bill rate is 8%.

13. Your client chooses to invest 70% of a portfolio in your fund and 30% in a T-bill money portfolio. What is the expected value and standard deviation of the rate of return on his portfolio?
14. Suppose that your risky portfolio includes the following investments in the given proportions:

Stock A	25%
Stock B	32%
Stock C	43%

What are the investment proportions of your client's overall portfolio, including the position in T-bills?

15. What is the reward-to-volatility ratio (S) of your risky portfolio? Your client's?
16. Draw the CAL of your portfolio on an expected return–standard deviation diagram. What is the slope of the CAL? Show the position of your client on your fund's CAL.
17. Suppose that your client decides to invest in your portfolio a proportion y of the total investment budget so that the overall portfolio will have an expected rate of return of 16%.
 - a. What is the proportion y ?
 - b. What are your client's investment proportions in your three stocks and the T-bill fund?
 - c. What is the standard deviation of the rate of return on your client's portfolio?
18. Suppose that your client prefers to invest in your fund a proportion y that maximizes the expected return on the complete portfolio subject to the constraint that the complete portfolio's standard deviation will not exceed 18%.
 - a. What is the investment proportion, y ?
 - b. What is the expected rate of return on the complete portfolio?
19. Your client's degree of risk aversion is $A = 3.5$.
 - a. What proportion, y , of the total investment should be invested in your fund?
 - b. What is the expected value and standard deviation of the rate of return on your client's optimized portfolio?
20. Look at the data in Table 6.7 on the average risk premium of the S&P 500 over T-bills, and the standard deviation of that risk premium. Suppose that the S&P 500 is your risky portfolio.
 - a. If your risk-aversion coefficient is $A = 4$ and you believe that the entire 1926–2009 period is representative of future expected performance, what fraction of your portfolio should be allocated to T-bills and what fraction to equity?
 - b. What if you believe that the 1968–1988 period is representative?
 - c. What do you conclude upon comparing your answers to (a) and (b)?
21. Consider the following information about a risky portfolio that you manage, and a risk-free asset: $E(r_P) = 11\%$, $\sigma_P = 15\%$, $r_f = 5\%$.
 - a. Your client wants to invest a proportion of her total investment budget in your risky fund to provide an expected rate of return on her overall or complete portfolio equal to 8%. What proportion should she invest in the risky portfolio, P , and what proportion in the risk-free asset?
 - b. What will be the standard deviation of the rate of return on her portfolio?
 - c. Another client wants the highest return possible subject to the constraint that you limit his standard deviation to be no more than 12%. Which client is more risk averse?
22. Investment Management Inc. (IMI) uses the capital market line to make asset allocation recommendations. IMI derives the following forecasts:
 - Expected return on the market portfolio: 12%.
 - Standard deviation on the market portfolio: 20%.
 - Risk-free rate: 5%.

Samuel Johnson seeks IMI's advice for a portfolio asset allocation. Johnson informs IMI that he wants the standard deviation of the portfolio to equal half of the standard deviation for the market portfolio. Using the capital market line, what expected return can IMI provide subject to Johnson's risk constraint?

For Problems 23 through 26: Suppose that the borrowing rate that your client faces is 9%. Assume that the S&P 500 index has an expected return of 13% and standard deviation of 25%, that $r_f = 5\%$, and that your fund has the parameters given in Problem 21.