

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

- 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.
- 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?
- 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?
 - Its 2-year risk premium is the same as the second alternative.
 - The standard deviation of its 2-year return is the same.
 - Its annualized standard deviation is lower.
 - Its Sharpe ratio is higher.
 - It is relatively more attractive to investors who have lower degrees of risk aversion.

Intermediate

- You have \$5,000 to invest for the next year and are considering three alternatives:
 - A money market fund with an average maturity of 30 days offering a current yield of 6% per year.
 - A 1-year savings deposit at a bank offering an interest rate of 7.5%.
 - 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?
- Use Figure 5.1 in the text to analyze the effect of the following on the level of real interest rates:
 - Businesses become more pessimistic about future demand for their products and decide to reduce their capital spending.
 - Households are induced to save more because of increased uncertainty about their future Social Security benefits.
 - The Federal Reserve Board undertakes open-market purchases of U.S. Treasury securities in order to increase the supply of money.
- 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.
 - Which is the safer investment?
 - Which offers the higher expected return?
 - If you expect the rate of inflation to be 3% over the next year, which is the better investment? Why?
 - 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

7. Suppose your expectations regarding the stock price are as follows:

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

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?

15. An economy is making a rapid recovery from steep recession, and businesses foresee a need for large amounts of capital investment. Why would this development affect real interest rates?

Challenge Problems 16 and 17 are more difficult. You may need to review the definitions of call and put options in Chapter 2.

Challenge

16. You are faced with the probability distribution of the HPR on the stock market index fund given in Spreadsheet 5.1 of the text. Suppose the price of a put option on a share of the index fund with exercise price of \$110 and time to expiration of 1 year is \$12.
- What is the probability distribution of the HPR on the put option?
 - What is the probability distribution of the HPR on a portfolio consisting of one share of the index fund and a put option?
 - In what sense does buying the put option constitute a purchase of insurance in this case?
17. Take as given the conditions described in the previous problem, and suppose the risk-free interest rate is 6% per year. You are contemplating investing \$107.55 in a 1-year CD and simultaneously buying a call option on the stock market index fund with an exercise price of \$110 and expiration of 1 year. What is the probability distribution of your dollar return at the end of the year?

1. Given \$100,000 to invest, what is the expected risk premium in dollars of investing in equities versus risk-free T-bills (U.S. Treasury bills) based on the following table?

| Action | Probability | Expected Return |
|----------------------------|-------------|-----------------|
| Invest in equities | .6 | \$50,000 |
| | .4 | -\$30,000 |
| Invest in risk-free T-bill | 1.0 | \$ 5,000 |

2. Based on the scenarios below, what is the expected return for a portfolio with the following return profile?

| | Market Condition | | |
|----------------|------------------|--------|------|
| | Bear | Normal | Bull |
| Probability | .2 | .3 | .5 |
| Rate of return | -25% | 10% | 24% |

Use the following scenario analysis for Stocks X and Y to answer CFA Problems 3 through 6 (round to the nearest percent).

| | Bear Market | Normal Market | Bull Market |
|-------------|-------------|---------------|-------------|
| Probability | 0.2 | 0.5 | 0.3 |
| Stock X | -20% | 18% | 50% |
| Stock Y | -15% | 20% | 10% |

- What are the expected rates of return for Stocks X and Y?
- What are the standard deviations of returns on Stocks X and Y?
- Assume that of your \$10,000 portfolio, you invest \$9,000 in Stock X and \$1,000 in Stock Y. What is the expected return on your portfolio?



6. Probabilities for three states of the economy and probabilities for the returns on a particular stock in each state are shown in the table below.

| State of Economy | Probability of Economic State | Stock Performance | Probability of Stock Performance in Given Economic State |
|------------------|-------------------------------|-------------------|----------------------------------------------------------|
| Good | .3 | Good | .6 |
| | | Neutral | .3 |
| | | Poor | .1 |
| Neutral | .5 | Good | .4 |
| | | Neutral | .3 |
| | | Poor | .3 |
| Poor | .2 | Good | .2 |
| | | Neutral | .3 |
| | | Poor | .5 |

What is the probability that the economy will be neutral *and* the stock will experience poor performance?

7. An analyst estimates that a stock has the following probabilities of return depending on the state of the economy:

| State of Economy | Probability | Return |
|------------------|-------------|--------|
| Good | .1 | 15% |
| Normal | .6 | 13 |
| Poor | .3 | 7 |

What is the expected return of the stock?

E-Investments Exercises

Inflation and Rates

- The Federal Reserve Bank of St. Louis has information available on interest rates and economic conditions. A publication called *Monetary Trends* contains graphs and tables with information about current conditions in the capital markets. Go to the Web site www.stls.frb.org and click on *Research & Data* on the menu at the top of the page. Find the most recent issue of *Monetary Trends* in the *Publications* section and answer these questions.
 - What is the professionals' consensus forecast for inflation for the next 2 years? (Use the *Federal Reserve Bank of Philadelphia* line on the graph to answer this.)
 - What do consumers expect to happen to inflation over the next 2 years? (Use the *University of Michigan* line on the graph to answer this.)
 - Have real interest rates increased, decreased, or remained the same over the last 2 years?
 - What has happened to short-term nominal interest rates over the last 2 years? What about long-term nominal interest rates?
 - What are the most recently available levels of 3-month and 10-year yields on Treasury securities?
- The International Monetary Fund (IMF) publishes information on inflation rates and other economic and financial indicators for many countries. Go to the Web site www.imf.org and select *Data and Statistics* on the menu at the top of the page. Click on *Data* and then choose *World Economic Outlook Databases (WEO)*. Select the most recent version of the WEO and download data *By Countries for Developing Asia*. Select