3. The fundamental relationships between international financial variables:
   a. Absolute and relative purchasing power parity, PPP
   b. Interest rate parity, IRP
   c. Unbiased forward rates, UFR

   Absolute purchasing power parity states that $1 should have the same purchasing power in each country. This means that an orange costs the same whether you buy it in New York or in Tokyo.

   Relative purchasing power parity means that the expected percentage change in exchange rates between the currencies of two countries is equal to the difference in their inflation rates.

   Interest rate parity implies that the percentage difference between the forward exchange rate and the spot exchange rate is equal to the interest rate differential. We showed how covered interest arbitrage forces this relationship to hold.

   The unbiased forward rates condition indicates that the current forward rate is a good predictor of the future spot exchange rate.
4. International capital budgeting. We showed that the basic foreign exchange relationships imply two other conditions:
   a. Uncovered interest parity
   b. The international Fisher effect

   By invoking these two conditions, we learned how to estimate NPVs in foreign currencies and how to convert foreign currencies into dollars to estimate NPV in the usual way.
5. Exchange rate and political risk. We described the various types of exchange rate risk and discussed some commonly used approaches to managing the effect of fluctuating exchange rates on the cash flows and value of the international firm. We also discussed political risk and some ways of managing exposure to it.

Chapter Review and Self-Test Problems

22.1 **Relative Purchasing Power Parity** The inflation rate in the United States is projected at 3 percent per year for the next several years. The New Zealand inflation rate is projected to be 5 percent during that time. The exchange rate is currently NZ$ 1.66. Based on relative PPP, what is the expected exchange rate in two years?

22.2 **Covered Interest Arbitrage** The spot and 360-day forward rates on the Swiss franc are SF 2.1 and SF 1.9, respectively. The risk-free interest rate in the United States is 6 percent, and the risk-free rate in Switzerland is 4 percent. Is there an arbitrage opportunity here? How would you exploit it?

Answers to Chapter Review and Self-Test Problems

22.1 Based on relative PPP, the expected exchange rate in two years, $E(S_2)$, is:

$$E(S_2) = S_0 \times [1 + (h_{NZ} - h_{US})]^2$$

where h_{NZ} is the New Zealand inflation rate. The current exchange rate is NZ$ 1.66, so the expected exchange rate is:

$$\begin{aligned} E(S_2) &= \text{NZ\$ } 1.66 \times [1 + (.05 - .03)]^2 \\ &= \text{NZ\$ } 1.66 \times 1.02^2 \\ &= \text{NZ\$ } 1.73 \end{aligned}$$

22.2 Based on interest rate parity, the forward rate should be (approximately):

$$\begin{aligned} F_1 &= S_0 \times [1 + (R_{FC} - R_{US})] \\ &= 2.1 \times [1 + (.04 - .06)] \\ &= 2.06 \end{aligned}$$

Because the forward rate is actually SF 1.9, there is an arbitrage opportunity.

To exploit the arbitrage opportunity, you first note that dollars are selling for SF 1.9 each in the forward market. Based on IRP, this is too cheap because they should be selling for SF 2.06. So you want to arrange to buy dollars with Swiss francs in the forward market. To do this, you can:

1. Today: Borrow, say, $1 million for 360 days. Convert it to SF 2.1 million in the spot market, and buy a forward contract at SF 1.9 to convert it back to dollars in 360 days. Invest the SF 2.1 million at 4 percent.
2. In one year: Your investment has grown to SF 2.1 million × 1.04 = SF 2.184 million. Convert this to dollars at the rate of SF 1.9 = $1. You will have SF 2.184 million/1.9 = $1,149,474. Pay off your loan with 6 percent interest at a cost of $1 million × 1.06 = $1,060,000 and pocket the difference of $89,474.

Concepts Review and Critical Thinking Questions

1. Spot and Forward Rates Suppose the exchange rate for the Swiss franc is quoted as SF 1.50 in the spot market and SF 1.53 in the 90-day forward market.
- **a.** Is the dollar selling at a premium or a discount relative to the franc?
- **b.** Does the financial market expect the franc to strengthen relative to the dollar? Explain.
- **c.** What do you suspect is true about relative economic conditions in the United States and Switzerland?

2. Purchasing Power Parity Suppose the rate of inflation in Mexico will run about 3 percent higher than the U.S. inflation rate over the next several years. All other things being the same, what will happen to the Mexican peso versus dollar exchange rate? What relationship are you relying on in answering?

3. Exchange Rates The exchange rate for the Australian dollar is currently A$1.40. This exchange rate is expected to rise by 10 percent over the next year.
- **a.** Is the Australian dollar expected to get stronger or weaker?
- **b.** What do you think about the relative inflation rates in the United States and Australia?
- **c.** What do you think about the relative nominal interest rates in the United States and Australia? Relative real rates?

4. Yankee Bonds Which of the following most accurately describes a Yankee bond?
- **a.** A bond issued by General Motors in Japan with the interest payable in U.S. dollars
- **b.** A bond issued by General Motors in Japan with the interest payable in yen
- **c.** A bond issued by Toyota in the United States with the interest payable in yen
- **d.** A bond issued by Toyota in the United States with the interest payable in dollars
- **e.** A bond issued by Toyota worldwide with the interest payable in dollars

5. **Exchange Rates** Are exchange rate changes necessarily good or bad for a particular company?
6. **International Risks** Duracell International confirmed in October 1995 that it was planning to open battery-manufacturing plants in China and India. Manufacturing in these countries allows Duracell to avoid import duties of between 30 and 35 percent that have made alkaline batteries prohibitively expensive for some consumers. What additional advantages might Duracell see in this proposal? What are some of the risks to Duracell?
7. **Multinational Corporations** Given that many multinationals based in many countries have much greater sales outside their domestic markets than within them, what is the particular relevance of their domestic currency?
8. **Exchange Rate Movements** Are the following statements true or false? Explain why.
   a. If the general price index in Great Britain rises faster than that in the United States, we would expect the pound to appreciate relative to the dollar.
   b. Suppose you are a German machine tool exporter and you invoice all of your sales in foreign currency. Further suppose that the German monetary authorities begin to undertake an expansionary monetary policy. If it is certain that the easy money policy will result in higher inflation rates in Germany relative to those in other countries, then you should use the forward markets to protect yourself against future losses resulting from the deterioration in the value of the deutsche mark.
   c. If you could accurately estimate differences in the relative inflation rates of two countries over a long period of time, while other market participants were unable to do so, you could successfully speculate in spot currency markets.
9. **Exchange Rate Movements** Some countries encourage movements in their exchange rate relative to those of some other country as a short-term means of addressing foreign trade imbalances. For each of the following scenarios, evaluate the impact the announcement would have on an American importer and an American exporter doing business with the foreign country.
   a. Officials in the administration of the United States government announce that they are comfortable with a rising deutsche mark relative to the dollar.
   b. British monetary authorities announce that they feel the pound has been driven too low by currency speculators relative to the dollar.
   c. The Brazilian government announces that it will print billions of new cruzeiros and inject them into the economy in an effort to reduce the country's 40 percent unemployment rate.
10. **International Capital Market Relationships** We discussed five international capital market relationships: relative PPP, IRP, UFR, UIP, and the international Fisher effect. Which of these would you expect to hold most closely? Which do you think would be most likely to be violated?

Questions and Problems

Basic
(Questions 1–13)

1. **Using Exchange Rates** Take a look back at Figure 22.1 to answer the following questions:
   a. If you have $100, how many euros can you get?
   b. How much is one euro worth?
   c. If you have five million euros, how many dollars do you have?

Basic
(*continued*)

d. Which is worth more, a New Zealand dollar or a Singapore dollar?
e. Which is worth more, a Mexican peso or a Chilean peso?
f. How many Swiss francs can you get for a euro? What do you call this rate?
g. Per unit, what is the most valuable currency of those listed? The least valuable?

2. **Using the Cross-Rate** Use the information in Figure 22.1 to answer the following questions:
a. Which would you rather have, $100 or £100? Why?
b. Which would you rather have, FF 100 or £100? Why?
c. What is the cross-rate for French francs in terms of British pounds? For British pounds in terms of French francs?

3. **Forward Exchange Rates** Use the information in Figure 22.1 to answer the following questions:
a. What is the six-month forward rate for the Japanese yen in yen per U.S. dollar? Is the yen selling at a premium or a discount? Explain.
b. What is the three-month forward rate for German deutsche marks in U.S. dollars per deutsche mark? Is the dollar selling at a premium or a discount? Explain.
c. What do you think will happen to the value of the dollar relative to the yen and the deutsche mark, based on the information in the figure? Explain.

4. **Using Spot and Forward Exchange Rates** Suppose the spot exchange rate for the Canadian dollar is Can$1.30 and the six-month forward rate is Can$1.27.
a. Which is worth more, a U.S. dollar or a Canadian dollar?
b. Assuming absolute PPP holds, what is the cost in the United States of an Elkhead beer if the price in Canada is Can$2.19? Why might the beer actually sell at a different price in the United States?
c. Is the U.S. dollar selling at a premium or a discount relative to the Canadian dollar?
d. Which currency is expected to appreciate in value?
e. Which country do you think has higher interest rates—the United States or Canada? Explain.

5. **Cross-Rates and Arbitrage** Suppose the Japanese yen exchange rate is ¥110 = $1, and the British pound exchange rate is £1 = $1.60.
a. What is the cross-rate in terms of yen per pound?
b. Suppose the cross-rate is ¥160 = £1. Is there an arbitrage opportunity here? If there is, explain how to take advantage of the mispricing.

6. **Interest Rate Parity** Use Figure 22.1 to answer the following questions. Suppose interest rate parity holds, and the current six-month risk-free rate in the United States is 3.5 percent. What must the six-month risk-free rate be in France? In Japan? In Switzerland?

7. **Interest Rates and Arbitrage** The treasurer of a major U.S. firm has $30 million to invest for three months. The annual interest rate in the United States is .40 percent per month. The interest rate in Great Britain is .70 percent per month. The spot exchange rate is £.59, and the three-month forward rate is £.61. Ignoring transactions costs, in which country would the treasurer want to invest the company's funds? Why?

8. **Inflation and Exchange Rates** Suppose the current exchange rate for the French franc is FF 7.47. The expected exchange rate in three years is FF 8.05. What is the difference in the annual inflation rates for the United States and

Basic (*continued*)

France over this period? Assume that the anticipated rate is constant for both countries. What relationship are you relying on in answering?

9. **Exchange Rate Risk** Suppose your company imports computer motherboards from Singapore. The exchange rate is given in Figure 22.1. You have just placed an order for 30,000 motherboards at a cost to you of 172.50 Singapore dollars each. You will pay for the shipment when it arrives in 90 days. You can sell the motherboards for $150 each. Calculate your profit if the exchange rate goes up or down by 10 percent over the next 90 days. What is the break-even exchange rate? What percentage rise or fall does this represent in terms of the Singapore dollar versus the U.S. dollar?

10. **Exchange Rates and Arbitrage** Suppose the spot and six-month forward rates on the deutsche mark are DM 1.55 and DM 1.62, respectively. The annual risk-free rate in the United States is 5 percent, and the annual risk-free rate in Germany is 8 percent.
    a. Is there an arbitrage opportunity here? If so, how would you exploit it?
    b. What must the six-month forward rate be to prevent arbitrage?

11. **The International Fisher Effect** You observe that the inflation rate in the United States is 3 percent per year and that T-bills currently yield 3.7 percent annually. What do you estimate the inflation rate to be in:
    a. The Netherlands, if short-term Dutch government securities yield 5 percent per year?
    b. Canada, if short-term Canadian government securities yield 7 percent per year?
    c. France, if short-term French government securities yield 10 percent per year?

12. **Spot versus Forward Rates** Suppose the spot and three-month forward rates for the yen are ¥124 and ¥122, respectively.
    a. Is the yen expected to get stronger or weaker?
    b. What would you estimate is the difference between the inflation rates of the United States and Japan?

13. **Expected Spot Rates** Suppose the spot exchange rate for the Hungarian forint is HUF 280. Interest rates in the United States are 3.5 percent per year. They are triple that in Hungary. What do you predict the exchange rate will be in one year? In two years? In five years? What relationship are you using?

Intermediate (Question 14)

14. **Capital Budgeting** You are evaluating a proposed expansion of an existing subsidiary located in Switzerland. The cost of the expansion would be SF 27.0 million. The cash flows from the project would be SF 7.5 million per year for the next five years. The dollar required return is 13 percent per year, and the current exchange rate is SF 1.72. The going rate on Eurodollars is 8 percent per year. It is 7 percent per year on Euroswiss.
    a. What do you project will happen to exchange rates over the next four years?
    b. Based on your answer in (*a*), convert the projected franc flows into dollar flows and calculate the NPV.
    c. What is the required return on franc flows? Based on your answer, calculate the NPV in francs and then convert to dollars.

Challenge (Question 15)

15. **Using the Exact International Fisher Effect** From our discussion of the Fisher effect in Chapter 7, we know that the actual relationship between a nominal rate, R, a real rate, r, and an inflation rate, h, can be written as:

$$1 + r = (1 + R)/(1 + h)$$

This is the *domestic* Fisher effect.

Challenge (*continued*)

a. What is the nonapproximate form of the international Fisher effect?
b. Based on your answer in (a), what is the exact form for UIP? (Hint: Recall the exact form of IRP and use UFR.)
c. What is the exact form for relative PPP? (Hint: Combine your previous two answers.)
d. Recalculate the NPV for the Kihlstrom drill bit project (discussed in Section 22.5) using the exact forms for UIP and the international Fisher effect. Verify that you get precisely the same answer either way.

S&P Problems

STANDARD &POOR'S

1. American Depository Receipts Nestlé S. A. has American Depository Receipts listed on the Nasdaq over-the-counter market. Many ADRs listed on U.S. exchanges are for fractional shares. In the case of Nestlé, 20 ADRs are equal to one registered share of stock. Find the information for Nestlé using the ticker symbol "3NSRGY."

a. Click on the "Mthly. Adj. Prices" link and find Nestlé's closing price for August 2001. Assume the exchange rate on that day was $/SFr 1.624 and Nestlé shares traded for SFr 630. Is there an arbitrage opportunity available? If so, how would you take advantage of it?
b. What exchange rate is necessary to eliminate the arbitrage opportunity available in *a*?
c. Dividend payments made to ADR shareholders are in U.S. dollars. Suppose you own 90 Nestlé ADRs. Assume the current exchange rate is the rate you calculated in *b*. Nestlé declares a dividend of SFr 5.20. What U.S. dollar dividend payment will you receive?

What's On the Web?

22.1 Purchasing Power Parity One of the more famous examples of a violation of absolute purchasing power parity is the Big Mac index calculated by *The Economist.* This index calculates the dollar price of a McDonald's Big Mac in different countries. You can find the Big Mac index by going to www.economist.com, following the "Markets & Data" link and then the "Big Mac index" link. Using the most recent index, which country has the most expensive Big Macs? Which country has the cheapest Big Macs? Why is the price of a Big Mac not the same in every country?

22.2 Inflation and Exchange Rates Go to www.marketvector.com and follow the "Exchange Rates" link. Select the "Australian Dollar" link. Is the U.S. dollar expected to appreciate or depreciate compared to the Australian dollar over the next six months? What is the difference in the annual inflation rates for the United States and Australia over this period? Assume that the anticipated rate is constant for both countries. What relationship are you relying on in answering?

22.3 Interest Rate Parity Go to the *Financial Times* site at www.ft.com, click on the "Markets" link and then the "Currencies" link. Find the current exchange rate between the U.S. dollar and the euro. Next, follow the "Currencies home" link and the "Money rates" link to find the U.S. dollar LIBOR and the Euro LIBOR interest rates. What must the one-year forward rate be to prevent arbitrage? What principle are you relying on in your answer?