8: Relationships among Inflation, Interest Rates, and Exchange Rates

Inflation rates and interest rates can have a significant impact on exchange rates (as explained in Chapter 4) and therefore can influence the value of MNCs. Financial managers of MNCs must understand how inflation and interest rates can affect exchange rates so that they can anticipate how their MNCs may be affected. Given their potential influence on MNC values, inflation and interest rates deserve to be studied more closely.

The specific objectives of this chapter are to:

- explain the purchasing power parity (PPP) theory and its implications for exchange rate changes,
- explain the international Fisher effect (IFE) theory and its implications for exchange rate changes, and
- compare the PPP theory, the IFE theory, and the theory of interest rate parity (IRP), which was introduced in the previous chapter.

Purchasing Power Parity (PPP)

In Chapter 4, the expected impact of relative inflation rates on exchange rates was discussed. Recall from this discussion that when a country's inflation rate rises, the demand for its currency declines as its exports decline (due to its higher prices). In addition, consumers and firms in that country tend to increase their importing. Both of these forces place downward pressure on the high-inflation country's currency. Inflation rates often vary among countries, causing international trade patterns and exchange rates to adjust accordingly. One of the most popular and controversial theories in international finance is the **purchasing power parity (PPP) theory,** which attempts to quantify the inflation–exchange rate relationship.

Interpretations of Purchasing Power Parity

There are two popular forms of PPP theory, each of which has its own implications.

Absolute Form of PPP. The **absolute form of PPP** is based on the notion that without international barriers, consumers shift their demand to wherever prices are lower. It suggests that prices of the same basket of products in two different countries should be equal when measured in a common currency. If a discrepancy in prices as measured by a common currency exists, the demand should shift so that these prices converge.

EXAMPLE If the same basket of products is produced by the United States and the United Kingdom, and the price in the United Kingdom is lower when measured in a common currency, the demand for that basket should increase in the United Kingdom and decline in the United States. Consequently, the actual price charged in each country may be affected, and/or the exchange rate may adjust. Both forces would cause the prices of the baskets to be similar when measured in a common currency. ∎

Realistically, the existence of transportation costs, tariffs, and quotas may prevent the absolute form of PPP. If transportation costs were high in the preceding example, the demand for the baskets of products might not shift as suggested. Thus, the discrepancy in prices would continue.

Relative Form of PPP. The **relative form of PPP** accounts for the possibility of market imperfections such as transportation costs, tariffs, and quotas. This version acknowledges that because of these market imperfections, prices of the same basket of products in different countries will not necessarily be the same when measured in a common currency. It does state, however, that the rate of change in the prices of the baskets should be somewhat similar when measured in a common currency, as long as the transportation costs and trade barriers are unchanged.

E X A M P L E Assume that the United States and the United Kingdom trade extensively with each other and initially have zero inflation. Now assume that the United States experiences a 9 percent inflation rate, while the United Kingdom experiences a 5 percent inflation rate. Under these conditions, PPP theory suggests that the British pound should appreciate by approximately 4 percent, the differential in inflation rates. Thus, the exchange rate should adjust to offset the differential in the inflation rates of the two countries. If this occurs, the prices of goods in the two countries should appear similar to consumers. That is, the relative purchasing power when buying products in one country is similar to when buying products in the other country. ∎

Rationale behind Purchasing Power Parity Theory

If two countries produce products that are substitutes for each other, the demand for the products should adjust as inflation rates differ. In our previous example, the relatively high U.S. inflation should cause U.S. consumers to increase imports from the United Kingdom and British consumers to lower their demand for U.S. goods (since prices of British goods have increased by a lower rate). Such forces place upward pressure on the British pound's value.

The shifting in consumption from the United States to the United Kingdom will continue until the British pound's value has appreciated to the extent that (1) the prices paid for British goods by U.S. consumers are no lower than the prices for comparable products made in the United States and (2) the prices paid for U.S. goods by British consumers are no higher than the prices for comparable products made in the United Kingdom. To achieve this new equilibrium situation, the pound will need to appreciate by approximately 4 percent, as will be verified here.

Given British inflation of 5 percent and the pound's appreciation of 4 percent, U.S. consumers will be paying about 9 percent more for the British goods than they paid in the initial equilibrium state. This is equal to the 9 percent increase in prices of U.S. goods from the U.S. inflation.

Consider a situation in which the pound appreciated by only 1 percent in response to the inflation differential. In this case, the increased price of British goods to U.S. consumers will be approximately 6 percent (5 percent inflation and 1 percent appreciation in the British pound), which is less than the 9 percent increase in the price of U.S. goods to U.S. consumers. Thus, we would expect U.S. consumers to continue to shift their consumption to British goods. Purchasing power parity suggests that the increasing U.S. consumption of British goods by U.S. consumers would persist until the pound appreciated by about 4 percent. Any level of appreciation lower than this would represent more attractive British prices relative to U.S. prices from the U.S. consumer's viewpoint.

From the British consumer's point of view, the price of U.S. goods would have initially increased by 4 percent more than British goods. Thus, British consumers would continue to reduce imports from the United States until the pound appreciated

enough to make U.S. goods no more expensive than British goods. Once the pound appreciated by 4 percent, this would partially offset the increase in U.S. prices of 9 percent from the British consumer's perspective. To be more precise, the net effect is that the prices of U.S. goods would increase by approximately 5 percent to British consumers (9 percent inflation minus the 4 percent savings to British consumers due to the pound's 4 percent appreciation).

Derivation of Purchasing Power Parity

Assume that the price indexes of the home country (h) and a foreign country (f) are equal. Now assume that over time, the home country experiences an inflation rate of I_h, while the foreign country experiences an inflation rate of I_f. Due to inflation, the price index of goods in the consumer's home country (P_h) becomes

$$P_h(1 + I_h)$$

The price index of the foreign country (P_f) will also change due to inflation in that country:

$$P_f(1 + I_f)$$

If $I_h > I_f$, and the exchange rate between the currencies of the two countries does not change, then the consumer's purchasing power is greater on foreign goods than on home goods. In this case, PPP does not exist. If $I_h < I_f$, and the exchange rate between the currencies of the two countries does not change, then the consumer's purchasing power is greater on home goods than on foreign goods. In this case also, PPP does not exist.

The PPP theory suggests that the exchange rate will not remain constant but will adjust to maintain the parity in purchasing power. If inflation occurs and the exchange rate of the foreign currency changes, the foreign price index from the home consumer's perspective becomes

$$P_f(1 + I_f)(1 + e_f)$$

where e_f represents the percentage change in the value of the foreign currency. According to PPP theory, the percentage change in the foreign currency (e_f) should change to maintain parity in the new price indexes of the two countries. We can solve for e_f under conditions of PPP by setting the formula for the new price index of the foreign country equal to the formula for the new price index of the home country, as follows:

$$P_f(1 + I_f)(1 + e_f) = P_h(1 + I_h)$$

Solving for e_f, we obtain

$$1 + e_f = \frac{P_h(1 + I_h)}{P_f(1 + I_f)}$$

$$e_f = \frac{P_h(1 + I_h)}{P_f(1 + I_f)} - 1$$

Since P_h equals P_f (because price indexes were initially assumed equal in both countries), they cancel, leaving

$$e_f = \frac{1 + I_h}{1 + I_f} - 1$$

This formula reflects the relationship between relative inflation rates and the exchange rate according to PPP. Notice that if $I_h > I_f$, e_f should be positive. This implies that the foreign currency will appreciate when the home country's inflation

exceeds the foreign country's inflation. Conversely, if $I_h < I_f$, then e_f should be negative. This implies that the foreign currency will depreciate when the foreign country's inflation exceeds the home country's inflation.

Using PPP to Estimate Exchange Rate Effects

The relative form of PPP can be used to estimate how an exchange rate will change in response to differential inflation rates between countries.

E X A M P L E   Assume that the exchange rate is in equilibrium initially. Then the home currency experiences a 5 percent inflation rate, while the foreign country experiences a 3 percent inflation rate. According to PPP, the foreign currency will adjust as follows:

$$e_f = \frac{1 + I_h}{1 + I_f} - 1$$

$$= \frac{1 + .05}{1 + .03} - 1$$

$$= .0194, \text{ or } 1.94\% \qquad\blacksquare$$

Thus, according to this example, the foreign currency should appreciate by 1.94 percent in response to the higher inflation of the home country relative to the foreign country. If this exchange rate change does occur, the price index of the foreign country will be as high as the index in the home country from the perspective of home country consumers. Even though inflation is lower in the foreign country, appreciation of the foreign currency pushes the foreign country's price index up from the perspective of consumers in the home country. When considering the exchange rate effect, price indexes of both countries rise by 5 percent from the home country perspective. Thus, consumers' purchasing power is the same for foreign goods and home goods.

E X A M P L E   This example examines the situation when foreign inflation exceeds home inflation. Assume that the exchange rate is in equilibrium initially. Then the home country experiences a 4 percent inflation rate, while the foreign country experiences a 7 percent inflation rate. According to PPP, the foreign currency will adjust as follows:

$$e_f = \frac{1 + I_h}{1 + I_f} - 1$$

$$= \frac{1 + .04}{1 + .07} - 1$$

$$= -.028, \text{ or } -2.8\% \qquad\blacksquare$$

Thus, according to this example, the foreign currency should depreciate by 2.8 percent in response to the higher inflation of the foreign country relative to the home country. Even though the inflation is lower in the home country, the depreciation of the foreign currency places downward pressure on the foreign country's prices from the perspective of consumers in the home country. When considering the exchange rate impact, prices of both countries rise by 4 percent. Thus, PPP still exists due to the adjustment in the exchange rate.

Using a Simplified PPP Relationship. A simplified but less precise relationship based on PPP is

$$e_f \cong I_h - I_f$$

That is, the percentage change in the exchange rate should be approximately equal to the differential in inflation rates between the two countries. This simplified formula

is appropriate only when the inflation differential is small or when the value of I_f is close to zero.

## Graphic Analysis of Purchasing Power Parity

Using PPP theory, we should be able to assess the potential impact of inflation on exchange rates. Exhibit 8.1 is a graphic representation of PPP theory. The points on the exhibit suggest that given an inflation differential between the home and the foreign country of X percent, the foreign currency should adjust by X percent due to that inflation differential.

PPP Line. The diagonal line connecting all these points together is known as the **purchasing power parity (PPP) line.** Point A represents our earlier example in which the U.S. (considered the home country) and British inflation rates were assumed to be 9 and 5 percent, respectively, so that $I_h - I_f = 4\%$. Recall that this led to the anticipated appreciation in the British pound of 4 percent, as illustrated by point A. Point B reflects a situation in which the inflation rate in the United Kingdom exceeds the inflation rate in the United States by 5 percent, so that $I_h - I_f = -5\%$. This leads to anticipated depreciation of the British pound by 5 percent, as illustrated by point B. If the exchange rate does respond to inflation differentials as PPP theory suggests, the actual points should lie on or close to the PPP line.

Purchasing Power Disparity. Exhibit 8.2 identifies areas of purchasing power disparity. Assume an initial equilibrium situation, then a change in the inflation rates of the two countries. If the exchange rate does not move as PPP theory suggests, there is a disparity in the purchasing power of the two countries.

Point C in Exhibit 8.2 represents a situation where home inflation (I_h) exceeds foreign inflation (I_f) by 4 percent. Yet, the foreign currency appreciated by only 1 percent

Exhibit 8.1 Illustration of Purchasing Power Parity
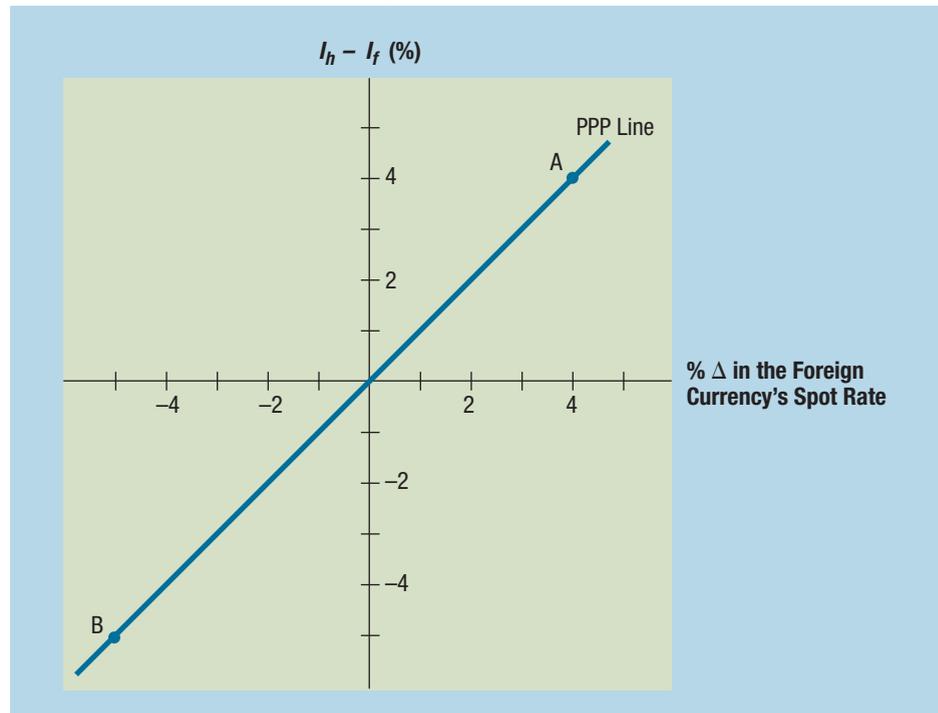
in response to this inflation differential. Consequently, purchasing power disparity exists. Home country consumers' purchasing power for foreign goods has become more favorable relative to their purchasing power for the home country's goods. The PPP theory suggests that such a disparity in purchasing power should exist only in the short run. Over time, as the home country consumers take advantage of the disparity by purchasing more foreign goods, upward pressure on the foreign currency's value will cause point C to move toward the PPP line. All points to the left of (or above) the PPP line represent more favorable purchasing power for foreign goods than for home goods.

Point D in Exhibit 8.2 represents a situation where home inflation is 3 percent below foreign inflation. Yet, the foreign currency has depreciated by only 2 percent. Again, purchasing power disparity exists. The purchasing power for foreign goods has become less favorable relative to the purchasing power for the home country's goods. The PPP theory suggests that the foreign currency in this example should have depreciated by 3 percent to fully offset the 3 percent inflation differential. Since the foreign currency did not weaken to this extent, the home country consumers may cease purchasing foreign goods, causing the foreign currency to weaken to the extent anticipated by PPP theory. If so, point D would move toward the PPP line. All points to the right of (or below) the PPP line represent more favorable purchasing power for home country goods than for foreign goods.

Testing the Purchasing Power Parity Theory

The PPP theory not only provides an explanation of how relative inflation rates between two countries can influence an exchange rate, but it also provides information that can be used to forecast exchange rates.

Conceptual Tests of PPP. One way to test the PPP theory is to choose two countries (say, the United States and a foreign country) and compare the

Exhibit 8.2   Identifying Disparity in Purchasing Power
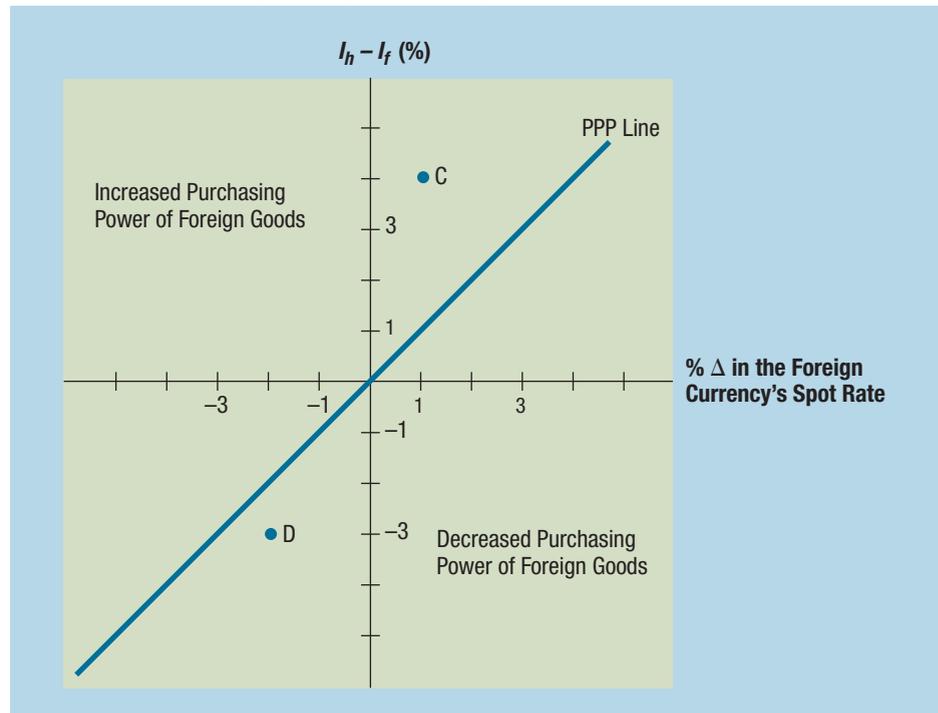
differential in their inflation rates to the percentage change in the foreign currency's value during several time periods. Using a graph similar to Exhibit 8.2, we could plot each point representing the inflation differential and exchange rate percentage change for each specific time period and then determine whether these points closely resemble the PPP line as drawn in Exhibit 8.2. If the points deviate significantly from the PPP line, then the percentage change in the foreign currency is not being influenced by the inflation differential in the manner PPP theory suggests.

As an alternative test, several foreign countries could be compared with the home country over a given time period. Each foreign country will exhibit an inflation differential relative to the home country, which can be compared to the exchange rate change during the period of concern. Thus, a point can be plotted on a graph such as Exhibit 8.2 for each foreign country analyzed. If the points deviate significantly from the PPP line, then the exchange rates are not responding to the inflation differentials in accordance with PPP theory. The PPP theory can be tested for any countries on which inflation information is available.

Statistical Test of PPP. A somewhat simplified statistical test of PPP can be developed by applying regression analysis to historical exchange rates and inflation differentials (see Appendix C for more information on regression analysis). To illustrate, let's focus on one particular exchange rate. The quarterly percentage changes in the foreign currency value (e_f) can be regressed against the inflation differential that existed at the beginning of each quarter, as shown here:

$$e_f = a_0 + a_1\left(\frac{1 + I_{U.S.}}{1 + I_f} - 1\right) + \mu$$

where a_0 is a constant, a_1 is the slope coefficient, and μ is an error term. Regression analysis would be applied to quarterly data to determine the regression coefficients. The hypothesized values of a_0 and a_1 are 0 and 1.0, respectively. These coefficients imply that for a given inflation differential, there is an equal offsetting percentage change in the exchange rate, on average. The appropriate t-test for each regression coefficient requires a comparison to the hypothesized value and division by the standard error (s.e.) of the coefficient as follows:

$$\text{Test for } a_0 = 0: \qquad \text{Test for } a_1 = 1:$$
$$t = \frac{a_0 - 0}{\text{s.e. of } a_0} \qquad\qquad t = \frac{a_1 - 1}{\text{s.e. of } a_1}$$

Then the t-table is used to find the critical t-value. If either t-test finds that the coefficients differ significantly from what is expected, the relationship between the inflation differential and the exchange rate differs from that stated by PPP theory. It should be mentioned that the appropriate lag time between the inflation differential and the exchange rate is subject to controversy.

Results of Tests of PPP. Much research has been conducted to test whether PPP exists. Studies by Mishkin, Adler and Dumas, and Abuaf and Jorion[1] found evidence of significant deviations from PPP that persisted for lengthy periods. A related study by Adler and Lehman[2] provided evidence against PPP even over the long term.

[1]Frederic S. Mishkin, "Are Real Interest Rates Equal Across Countries? An Empirical Investigation of International Parity Conditions," *Journal of Finance* (December 1984): 1345–1357; Michael Adler and Bernard Dumas, "International Portfolio Choice and Corporate Finance: A Synthesis," *Journal of Finance* (June 1983): 925–984; Niso Abuaf and Philippe Jorion, "Purchasing Power in the Long Run," *Journal of Finance* (March 1990): 157–174.
[2]Michael Adler and Bruce Lehman, "Deviations from Purchasing Power Parity in the Long Run," *Journal of Finance* (December 1983): 1471–1487.

Hakkio,[3] however, found that when an exchange rate deviated far from the value that would be expected according to PPP, it moved toward that value. Although the relationship between inflation differentials and exchange rates is not perfect even in the long run, it supports the use of inflation differentials to forecast long-run movements in exchange rates.

Tests of PPP for Each Currency. To further examine whether PPP is valid, Exhibit 8.3 illustrates the relationship between relative inflation rates and exchange rate movements over time. The inflation differential shown in each of the four graphs (each graph represents one foreign currency) is measured as the U.S. inflation rate minus the foreign inflation rate. The annual differential in inflation between the United States and each foreign country is represented on the vertical axis. The annual percentage change in the exchange rate of each foreign currency (relative to the U.S. dollar) is represented on the horizontal axis. The annual inflation differentials and percentage changes in exchange rates from 1982 to 2007 are plotted. If

Exhibit 8.3   Comparison of Annual Inflation Differentials and Exchange Rate Movements for Four Major Countries
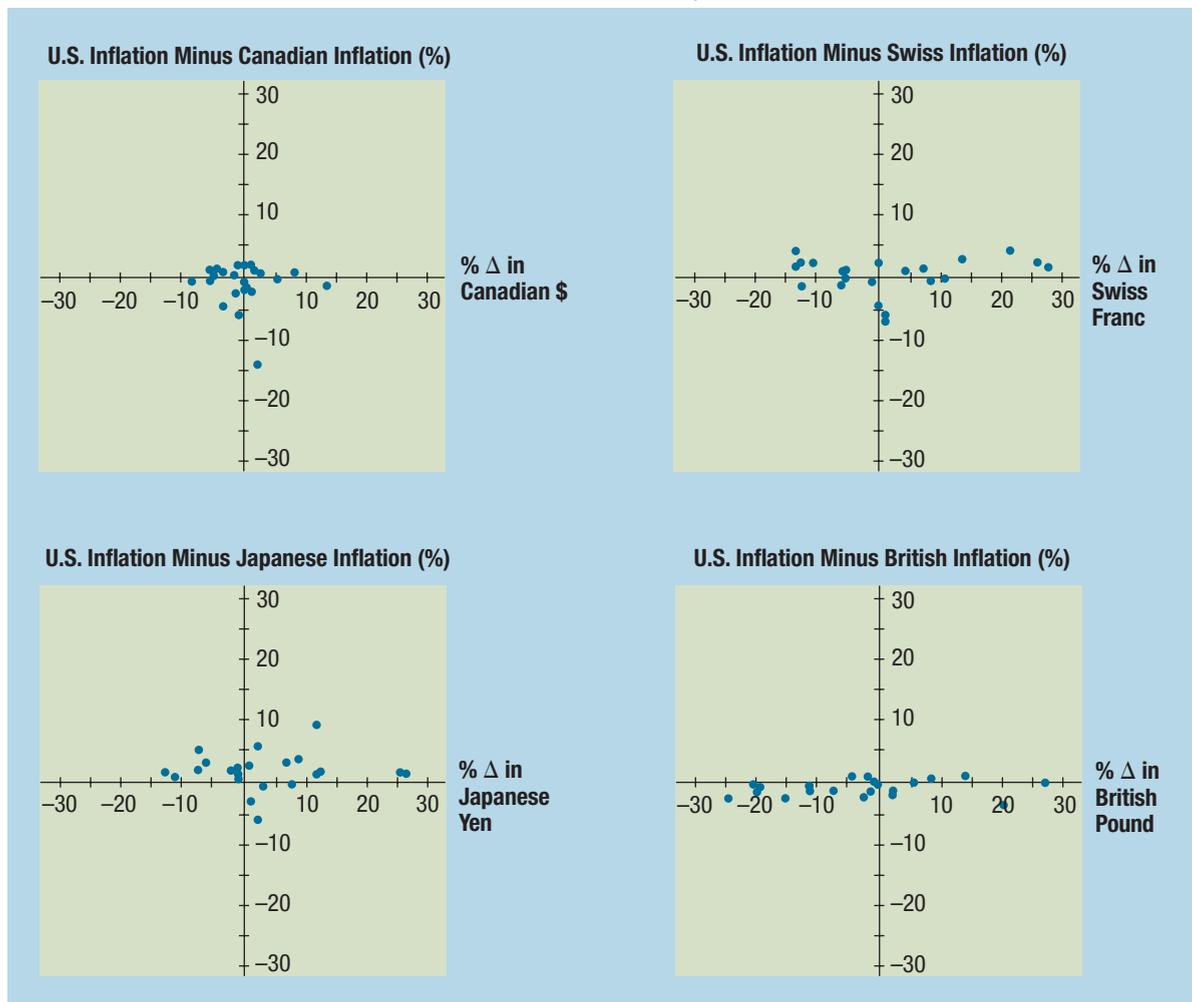
[3]Craig S. Hakkio, "Interest Rates and Exchange Rates—What Is the Relationship?" *Economic Review*, Federal Reserve Bank of Kansas City (November 1986): 33–43.

PPP existed during the period examined, the points plotted on the graph should be near an imaginary 45-degree line, which would split the axes (like the PPP line shown in Exhibit 8.2).

Although each graph shows different results, some general comments apply to all four graphs. The percentage changes in exchange rates are typically much more volatile than the inflation differentials. Thus, the exchange rates are changing to a greater degree than PPP theory would predict. In some years, even the direction of a currency could not have been anticipated by PPP theory. The results in Exhibit 8.3 suggest that the relationship between inflation differentials and exchange rate movements often becomes distorted.

Limitation of PPP Tests. A limitation in testing PPP theory is that the results will vary with the base period used. For example, if 1978 is used as a base period, most subsequent periods will show a relatively overvalued dollar; by contrast, if 1984 is used, the dollar may appear undervalued in subsequent periods.

The base period chosen should reflect an equilibrium position, since subsequent periods are evaluated in comparison to it. Unfortunately, it is difficult to choose such a base period. In fact, one of the main reasons for abolishing fixed exchange rates was the difficulty in identifying an appropriate equilibrium exchange rate.

Why Purchasing Power Parity Does Not Occur

Purchasing power parity does not consistently occur because of confounding effects and because of a lack of substitutes for some traded goods. These reasons are explained next.

Confounding Effects. The PPP theory presumes that exchange rate movements are driven completely by the inflation differential between two countries. Yet, recall from Chapter 4 that a change in a currency's spot rate is influenced by the following factors:

$$e = f(\Delta INF, \Delta INT, \Delta INC, \Delta GC, \Delta EXP)$$

where

e = percentage change in the spot rate
ΔINF = change in the differential between U.S. inflation and the foreign country's inflation
ΔINT = change in the differential between the U.S. interest rate and the foreign country's interest rate
ΔINC = change in the differential between the U.S. income level and the foreign country's income level
ΔGC = change in government controls
ΔEXP = change in expectations of future exchange rates

Since the exchange rate movement is not driven solely by ΔINF, the relationship between the inflation differential and the exchange rate movement is not as simple as suggested by PPP.

E X A M P L E   Assume that Venezuela's inflation rate is 5 percent above the U.S. inflation rate. From this information, PPP theory would suggest that the Venezuelan bolivar should depreciate by about 5 percent against the U.S. dollar. Yet, if the government of Venezuela imposes trade barriers against U.S. exports, Venezuela's consumers and firms will not be able to adjust their spending in reaction to the inflation differential. Therefore, the exchange rate will not adjust as suggested by PPP. ∎

No Substitutes for Traded Goods. The idea behind PPP theory is that as soon as the prices become relatively higher in one country, consumers in the other country will stop buying imported goods and shift to purchasing domestic goods instead. This shift influences the exchange rate. But, if substitute goods are not available domestically, consumers may not stop buying imported goods.

E X A M P L E Reconsider the previous example in which Venezuela's inflation is 5 percent higher than the U.S. inflation rate. If U.S. consumers do not find suitable substitute goods at home, they may continue to buy the highly priced goods from Venezuela, and the bolivar may not depreciate as expected according to PPP theory. ∎

Purchasing Power Parity in the Long Run

Purchasing power parity can be tested over the long run by assessing a "real" exchange rate between two currencies over time. The real exchange rate is the actual exchange rate adjusted for inflationary effects in the two countries of concern. In this way, the exchange rate serves as a measure of purchasing power. If a currency weakens by 10 percent but its home inflation is 10 percent more than inflation in the foreign country, the real exchange rate has not changed. The degree of weakness in the currency is offset by the lower inflationary effects on foreign goods.

If the real exchange rate reverts to some mean level over time, this suggests that it is constant in the long run, and any deviations from the mean are temporary. Conversely, if the real exchange rate follows a random walk, this implies that it moves randomly without any predictable pattern. That is, it does not tend to revert to some mean level and therefore cannot be viewed as constant in the long run. Under these conditions, the notion of PPP is rejected because the movements in the real exchange rate appear to be more than temporary deviations from some equilibrium value.

The study by Abuaf and Jorion,[4] mentioned earlier, tested PPP by assessing the long-run pattern of the real exchange rate. Abuaf and Jorion state that the typical findings rejecting PPP in previous studies are questionable because of limitations in the methods used to test PPP. They suggest that deviations from PPP are substantial in the short run but are reduced by about half in 3 years. Thus, even though exchange rates deviate from the levels predicted by PPP in the short run, their deviations are reduced over the long run.

International Fisher Effect (IFE)

Along with PPP theory, another major theory in international finance is the **international Fisher effect (IFE)** theory. It uses interest rate rather than inflation rate differentials to explain why exchange rates change over time, but it is closely related to the PPP theory because interest rates are often highly correlated with inflation rates. According to the so-called **Fisher effect,** nominal risk-free interest rates contain a real rate of return and anticipated inflation. If investors of all countries require the same real return, interest rate differentials between countries may be the result of differentials in expected inflation.

Relationship with Purchasing Power Parity

Recall that PPP theory suggests that exchange rate movements are caused by inflation rate differentials. If real rates of interest are the same across countries, any difference in nominal interest rates could be attributed to the difference in expected inflation. The IFE theory suggests that foreign currencies with relatively high interest rates

[4]Abuaf and Jorion, "Purchasing Power in the Long Run."

will depreciate because the high nominal interest rates reflect expected inflation. The nominal interest rate would also incorporate the *default risk* of an investment. The following examples focus on investments that are risk free so that default risk will not have to be accounted for.

E X A M P L E   The nominal interest rate is 8 percent in the United States. Investors in the United States expect a 6 percent rate of inflation, which means that they expect to earn a real return of 2 percent over one year. The nominal interest rate in Canada is 13 percent. Given that investors in Canada also require a real return of 2 percent, the expected inflation rate in Canada must be 11 percent. According to PPP theory, the Canadian dollar is expected to depreciate by approximately 5 percent against the U.S. dollar (since the Canadian inflation rate is 5 percent higher). Therefore, U.S. investors would not benefit from investing in Canada because the 5 percent interest rate differential would be offset by investing in a currency that is expected to be worth 5 percent less by the end of the investment period. U.S. investors would earn 8 percent on the Canadian investment, which is the same as they could earn in the United States. ∎

The IFE theory disagrees with the notion introduced in Chapter 4 that a high interest rate may entice investors from various countries to invest there and could place upward pressure on the currency. One way to reconcile the difference is to consider the possible effects on two currencies, one of which is subject to extreme interest rate and inflation conditions.

E X A M P L E   Brazil's prevailing nominal interest rate is frequently very high because of the high inflation there. With inflation levels sometimes exceeding 100 percent annually, people tend to spend now before prices rise. Rather than saving, they are very willing to borrow even at high interest rates to buy products now because the alternative is to defer the purchase and have to pay a much higher price later. Thus, the high nominal interest rate is attributed to the high expected inflation. Given these expectations of high inflation, even interest rates exceeding 50 percent will not entice U.S. investors because they recognize that high inflation could cause Brazil's currency (the Brazilian real) to decline by more than 50 percent in a year, fully offsetting the high interest rate. Thus, the high interest rate in Brazil does not attract investment from U.S. investors and therefore will not cause the Brazilian real to strengthen. Instead, the high interest rate in Brazil may indicate potential depreciation of the Brazilian real, which places downward pressure on the currency's value. This example of Brazil supports the IFE theory.

Now consider a second currency, the Chilean peso. The nominal interest rate in Chile is usually only a few percentage points higher than the nominal interest rate in the United States. Chile normally has relatively low inflation, so U.S. investors are not as concerned that the Chilean peso's value will decline due to inflationary pressure. Therefore, they may attempt to capitalize on the higher interest rate in Chile. In this case, the U.S. investment in Chile may even cause the Chilean peso's value to increase, at least temporarily. This example of Chile does not support the IFE theory. ∎

To reinforce the IFE concept, consider the outcome that would occur if the U.S. investors believed the IFE applied to Chile. The U.S. investors would assume that the slight interest advantage in Chile versus the United States reflected a slightly higher degree of expected inflation in Chile. The slightly higher inflation in Chile would be expected to cause a slight depreciation in the Chilean peso, which would offset the interest rate advantage. Thus, the return to U.S. investors from investing in Chile would be no higher than what they could earn from investing in the United States.

Implications of the IFE for Foreign Investors

The implications are similar for foreign investors who attempt to capitalize on relatively high U.S. interest rates. The foreign investors will be adversely affected by the

effects of a relatively high U.S. inflation rate if they try to capitalize on the high U.S. interest rates.

E X A M P L E   The nominal interest rate is 8 percent in the United States and 5 percent in Japan. The expected real rate of return is 2 percent in each country. The U.S. inflation rate is expected to be 6 percent, while the inflation rate in Japan is expected to be 3 percent.

According to PPP theory, the Japanese yen is expected to appreciate by the expected inflation differential of 3 percent. If the exchange rate changes as expected, Japanese investors who attempt to capitalize on the higher U.S. interest rate will earn a return similar to what they could have earned in their own country. Though the U.S. interest rate is 3 percent higher, the Japanese investors will repurchase their yen at the end of the investment period for 3 percent more than the price at which they sold yen. Therefore, their return from investing in the United States is no better than what they would have earned domestically. ■

The IFE theory can be applied to any exchange rate, even exchange rates that involve two non-U.S. currencies.

E X A M P L E   Given the information in two previous examples, the expected inflation differential between Canada and Japan is 8 percent. According to PPP theory, this inflation differential suggests that the Canadian dollar should depreciate by 8 percent against the yen. Therefore, even though Japanese investors would earn an additional 8 percent interest on a Canadian investment, the Canadian dollar would be valued at 8 percent less by the end of the period. Under these conditions, the Japanese investors would earn a return of 5 percent, which is the same as what they would earn on an investment in Japan. ■

These possible investment opportunities, along with some others, are summarized in Exhibit 8.4. Note that wherever investors of a given country invest their funds, the expected nominal return is the same.

Derivation of the International Fisher Effect

The precise relationship between the interest rate differential of two countries and the expected exchange rate change according to the IFE can be derived as follows. First, the actual return to investors who invest in money market securities (such as short-term bank deposits) in their home country is simply the interest rate offered on those securities. The actual return to investors who invest in a foreign money market security, however, depends on not only the foreign interest rate (i_f) but also the percentage change in the value of the foreign currency (e_f) denominating the security. The formula for the actual or "effective" (exchange-rate-adjusted) return on a foreign bank deposit (or any money market security) is

$$r = (1 + i_f)(1 + e_f) - 1$$

According to the IFE, the effective return on a foreign investment should, on average, be equal to the interest rate on a local money market investment:

$$E(r) = i_h$$

where r is the effective return on the foreign deposit and i_h is the interest rate on the home deposit. We can determine the degree by which the foreign currency must change in order to make investments in both countries generate similar returns. Take the previous formula for what determines r and set it equal to i_h as follows:

$$r = i_h$$
$$(1 + i_f)(1 + e_f) - 1 = i_h$$

Exhibit 8.4 Illustration of the International Fisher Effect (IFE) from Various Investor Perspectives

Investors Residing in	Attempt to Invest in	Expected Inflation Differential (Home Inflation Minus Foreign Inflation)	Expected Percentage Change in Currency Needed by Investors	Nominal Interest Rate to Be Earned	Return to Investors after Considering Exchange Rate Adjustment	Inflation Anticipated in Home Country	Real Return Earned by Investors
Japan	Japan	—	—	5%	5%	3%	2%
	United States	3% − 6% = −3%	−3%	8	5	3	2
	Canada	3% − 11% = −8%	−8	13	5	3	2
United States	Japan	6% − 3% = 3%	3	5	8	6	2
	United States	—	—	8	8	6	2
	Canada	6% − 11% = −5%	−5	13	8	6	2
Canada	Japan	11% − 3% = 8%	8	5	13	11	2
	United States	11% − 6% = 5%	5	8	13	11	2
	Canada	—	—	13	13	11	2

Now solve for e_f:

$$(1 + i_f)(1 + e_f) = 1 + i_h$$

$$1 + e_f = \frac{1 + i_h}{1 + i_f}$$

$$e_f = \frac{1 + i_h}{1 + i_f} - 1$$

As verified here, the IFE theory contends that when $i_h > i_f$, e_f will be positive because the relatively low foreign interest rate reflects relatively low inflationary expectations in the foreign country. That is, the foreign currency will appreciate when the foreign interest rate is lower than the home interest rate. This appreciation will improve the foreign return to investors from the home country, making returns on foreign securities similar to returns on home securities. Conversely, when $i_f > i_h$, e_f will be negative. That is, the foreign currency will depreciate when the foreign interest rate exceeds the home interest rate. This depreciation will reduce the return on foreign securities from the perspective of investors in the home country, making returns on foreign securities no higher than returns on home securities.

Numerical Example Based on the Derivation of IFE. Given two interest rates, the value of e_f can be determined from the formula that was just derived and used to forecast the exchange rate.

E X A M P L E   Assume that the interest rate on a one-year insured home country bank deposit is 11 percent, and the interest rate on a one-year insured foreign bank deposit is 12 percent. For the actual returns of these two investments to be similar from the perspective of investors in the home country, the foreign currency would have to change over the investment horizon by the following percentage:

$$e_f = \frac{1 + i_h}{1 + i_f} - 1$$

$$= \frac{1 + .11}{1 + .12} - 1$$

$$= -.0089, \text{ or } -.89\%$$

The implications are that the foreign currency denominating the foreign deposit would need to depreciate by .89 percent to make the actual return on the foreign deposit equal to 11 percent from the perspective of investors in the home country. This would make the return on the foreign investment equal to the return on a domestic investment. ∎

Simplified Relationship. A more simplified but less precise relationship specified by the IFE is

$$e_f \cong i_h - i_f$$

That is, the percentage change in the exchange rate over the investment horizon will equal the interest rate differential between two countries. This approximation provides reasonable estimates only when the interest rate differential is small.

Graphic Analysis of the International Fisher Effect

Exhibit 8.5 displays the set of points that conform to the argument behind IFE theory. For example, point E reflects a situation where the foreign interest rate exceeds the home interest rate by three percentage points. Yet, the foreign currency has

Exhibit 8.5 Illustration of IFE Line (When Exchange Rate Changes Perfectly Offset Interest Rate Differentials)
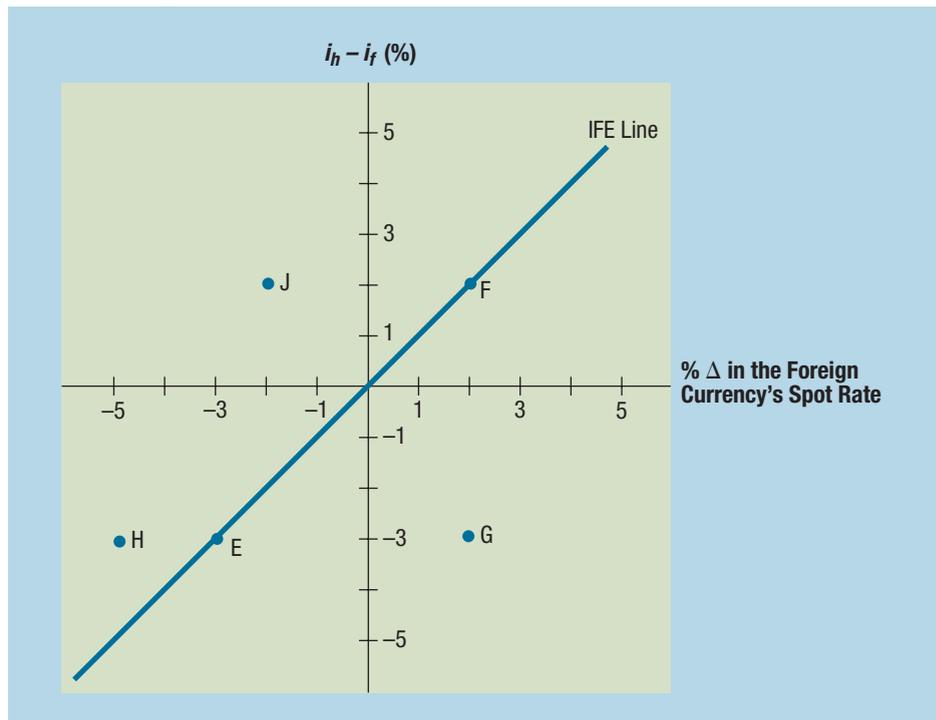
depreciated by 3 percent to offset its interest rate advantage. Thus, an investor setting up a deposit in the foreign country achieves a return similar to what is possible domestically. Point F represents a home interest rate 2 percent above the foreign interest rate. If investors from the home country establish a foreign deposit, they are at a disadvantage regarding the foreign interest rate. However, IFE theory suggests that the currency should appreciate by 2 percent to offset the interest rate disadvantage.

Point F in Exhibit 8.5 also illustrates the IFE from a foreign investor's perspective. The home interest rate will appear attractive to the foreign investor. However, IFE theory suggests that the foreign currency will appreciate by 2 percent, which, from the foreign investor's perspective, implies that the home country's currency denominating the investment instruments will depreciate to offset the interest rate advantage.

Points on the IFE Line. All the points along the so-called **international Fisher effect (IFE) line** in Exhibit 8.5 reflect exchange rate adjustments to offset the differential in interest rates. This means investors will end up achieving the same yield (adjusted for exchange rate fluctuations) whether they invest at home or in a foreign country.

To be precise, IFE theory does not suggest that this relationship will exist continuously over each time period. The point of IFE theory is that if a corporation periodically makes foreign investments to take advantage of higher foreign interest rates, it will achieve a yield that is sometimes above and sometimes below the domestic yield. Periodic investments by a U.S. corporation in an attempt to capitalize on the higher interest rates will, on average, achieve a yield similar to that by a corporation simply making domestic deposits periodically.

Points below the IFE Line. Points below the IFE line generally reflect the higher returns from investing in foreign deposits. For example, point G in Exhibit 8.5 indicates that the foreign interest rate exceeds the home interest rate by 3 percent. In addition, the foreign currency has appreciated by 2 percent. The combination of the higher foreign interest rate plus the appreciation of the foreign currency will cause the foreign yield to be higher than what is possible domestically. If actual data were compiled and plotted, and the vast majority of points were below the IFE line, this would suggest that investors of the home country could consistently increase their investment returns by establishing foreign bank deposits. Such results would refute the IFE theory.

Points above the IFE Line. Points above the IFE line generally reflect returns from foreign deposits that are lower than the returns possible domestically. For example, point H reflects a foreign interest rate that is 3 percent above the home interest rate. Yet, point H also indicates that the exchange rate of the foreign currency has depreciated by 5 percent, more than offsetting its interest rate advantage.

As another example, point J represents a situation in which an investor of the home country is hampered in two ways by investing in a foreign deposit. First, the foreign interest rate is lower than the home interest rate. Second, the foreign currency depreciates during the time the foreign deposit is held. If actual data were compiled and plotted, and the vast majority of points were above the IFE line, this would suggest that investors of the home country would receive consistently lower returns from foreign investments as opposed to investments in the home country. Such results would refute the IFE theory.

Tests of the International Fisher Effect

If the actual points (one for each period) of interest rates and exchange rate changes were plotted over time on a graph such as Exhibit 8.5, we could determine whether the points are systematically below the IFE line (suggesting higher returns from foreign investing), above the line (suggesting lower returns from foreign investing), or evenly scattered on both sides (suggesting a balance of higher returns from foreign investing in some periods and lower foreign returns in other periods).

Exhibit 8.6 is an example of a set of points that tend to support the IFE theory. It implies that returns from short-term foreign investments are, on average, about equal to the returns that are possible domestically. Notice that each individual point reflects a change in the exchange rate that does not exactly offset the interest rate differential. In some cases, the exchange rate change does not fully offset the interest rate differential. In other cases, the exchange rate change more than offsets the interest rate differential. Overall, the results balance out such that the interest rate differentials are, *on average,* offset by changes in the exchange rates. Thus, foreign investments have generated yields that are, on average, equal to those of domestic investments.

If foreign yields are expected to be about equal to domestic yields, a U.S. firm would probably prefer the domestic investments. The firm would know the yield on domestic short-term securities (such as bank deposits) in advance, whereas the yield to be attained from foreign short-term securities would be uncertain because the firm would not know what spot exchange rate would exist at the securities' maturity. Investors generally prefer an investment whose return is known over an investment whose return is uncertain, assuming that all other features of the investments are similar.

Results from Testing the IFE. Whether the IFE holds in reality depends on the particular time period examined. Although the IFE theory may hold dur-

ing some time frames, there is evidence that it does not consistently hold. A study by Thomas[5] tested the IFE theory by examining the results of (1) purchasing currency futures contracts of currencies with high interest rates that contained forward discounts (relative to the spot rates) and (2) selling futures on currencies with low interest rates that contained forward premiums. If the high-interest-rate currencies depreciated and the low-interest-rate currencies appreciated to the extent suggested by the IFE theory, this strategy would not generate significant profits. However, 57 percent of the transactions created by this strategy were profitable. In addition, the average gain was much higher than the average loss. This study indicates that the IFE does not hold.

Statistical Test of the IFE. A somewhat simplified statistical test of the IFE can be developed by applying regression analysis to historical exchange rates and the nominal interest rate differential:

$$e_f = a_0 + a_1\left(\frac{1 + i_{U.S.}}{1 + i_f} - 1\right) + \mu$$

where a_0 is a constant, a_1 is the slope coefficient, and μ is an error term. Regression analysis would determine the regression coefficients. The hypothesized values of a_0 and a_1 are 0 and 1.0, respectively.

The appropriate t-test for each regression coefficient requires a comparison to the hypothesized value and then division by the standard error (s.e.) of the coefficients, as follows:

Exhibit 8.6   Illustration of IFE Concept (When Exchange Rate Changes Offset Interest Rate Differentials on Average)
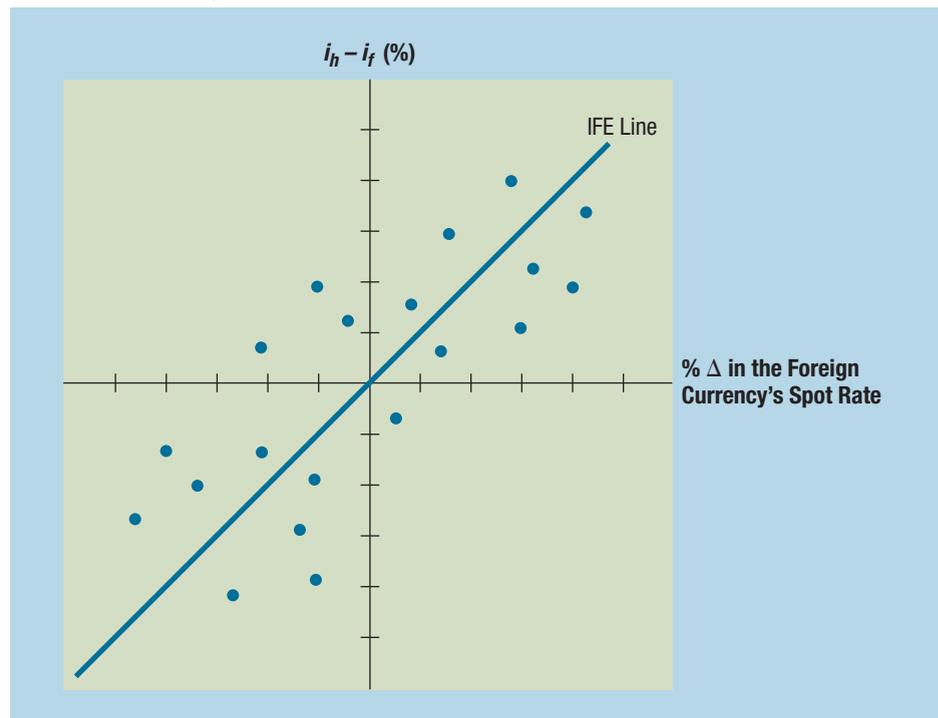
[5]Lee R. Thomas, "A Winning Strategy for Currency-Futures Speculation," *Journal of Portfolio Management* (Fall 1985): 65–69.

$$\text{Test for } a_0 = 0: \qquad \text{Test for } a_1 = 1:$$

$$t = \frac{a_0 - 0}{\text{s.e. of } a_0} \qquad t = \frac{a_1 - 1}{\text{s.e. of } a_1}$$

The t-table is then used to find the critical t-value. If either t-test finds that the coefficients differ significantly from what was hypothesized, the IFE is refuted.

Why the International Fisher Effect Does Not Occur

As mentioned earlier in this chapter, purchasing power parity (PPP) has not held over certain periods. Since the IFE is based on purchasing power parity, it does not consistently hold either. Because exchange rates can be affected by factors other than inflation, exchange rates do not always adjust in accordance with the inflation differential. Assume a nominal interest rate in a foreign country that is 3 percent above the U.S. rate because expected inflation in that country is 3 percent above expected U.S. inflation. Even if these nominal rates properly reflect inflationary expectations, the exchange rate of the foreign currency will react to other factors in addition to the inflation differential. If these other factors put upward pressure on the foreign currency's value, they will offset the downward pressure from the inflation differential. Consequently, foreign investments will achieve higher returns for the U.S. investors than domestic investments will.

Comparison of the IRP, PPP, and IFE Theories

At this point, it may be helpful to compare three related theories of international finance: (1) interest rate parity (IRP), discussed in Chapter 7, (2) purchasing power parity (PPP), and (3) the international Fisher effect (IFE). Exhibit 8.7 summarizes the main themes of each theory. Note that although all three theories relate to the determination of exchange rates, they have different implications. The IRP theory focuses on why the forward rate differs from the spot rate and on the degree of difference that should exist. It relates to a specific point in time. In contrast, the PPP theory and IFE theory focus on how a currency's spot rate will change over time. Whereas PPP theory suggests that the spot rate will change in accordance with inflation differentials,

Exhibit 8.7   Comparison of the IRP, PPP, and IFE Theories
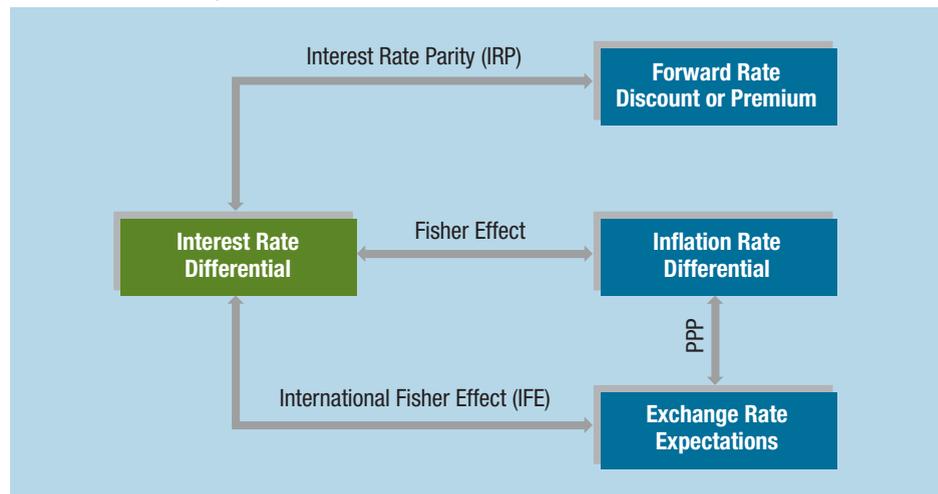
Exhibit 8.7   Comparison of the IRP, PPP, and IFE Theories (continued)

Theory	Key Variables of Theory		Summary of Theory
Interest rate parity (IRP)	Forward rate premium (or discount)	Interest rate differential	The forward rate of one currency with respect to another will contain a premium (or discount) that is determined by the differential in interest rates between the two countries. As a result, covered interest arbitrage will provide a return that is no higher than a domestic return.
Purchasing power parity (PPP)	Percentage change in spot exchange rate	Inflation rate differential	The spot rate of one currency with respect to another will change in reaction to the differential in inflation rates between the two countries. Consequently, the purchasing power for consumers when purchasing goods in their own country will be similar to their purchasing power when importing goods from the foreign country.
International Fisher effect (IFE)	Percentage change in spot exchange rate	Interest rate differential	The spot rate of one currency with respect to another will change in accordance with the differential in interest rates between the two countries. Consequently, the return on uncovered foreign money market securities will, on average, be no higher than the return on domestic money market securities from the perspective of investors in the home country.

IFE theory suggests that it will change in accordance with interest rate differentials. Nevertheless, PPP is related to IFE because expected inflation differentials influence the nominal interest rate differentials between two countries.

Some generalizations about countries can be made by applying these theories. High-inflation countries tend to have high nominal interest rates (due to the Fisher effect). Their currencies tend to weaken over time (because of the PPP and IFE), and the forward rates of their currencies normally exhibit large discounts (due to IRP).

SUMMARY

■ Purchasing power parity (PPP) theory specifies a precise relationship between relative inflation rates of two countries and their exchange rate. In inexact terms, PPP theory suggests that the equilibrium exchange rate will adjust by the same magnitude as the differential in inflation rates between two countries. Though PPP continues to be a valuable concept, there is evidence of sizable deviations from the theory in the real world.

■ The international Fisher effect (IFE) specifies a precise relationship between relative interest rates of two countries and their exchange rates. It suggests that an investor who periodically invests in foreign interest-bearing securities will, on average, achieve a return similar to what is possible domestically. This implies that the exchange rate of the country with high interest rates will depreciate to offset the inter-

est rate advantage achieved by foreign investments. However, there is evidence that during some periods the IFE does not hold. Thus, investment in foreign short-term securities may achieve a higher return than what is possible domestically. If a firm attempts to achieve this higher return, however, it does incur the risk that the currency denominating the foreign security might depreciate against the investor's home currency during the investment period. In this case, the foreign security could generate a lower return than a domestic security, even though it exhibits a higher interest rate.

■ The PPP theory focuses on the relationship between the inflation rate differential and future exchange rate movements. The IFE focuses on the interest rate differential and future exchange rate movements. The theory of interest rate parity (IRP)

focuses on the relationship between the interest rate differential and the forward rate premium (or discount) at a given point in time.

■ If IRP exists, it is not possible to benefit from covered interest arbitrage. Investors can still attempt to benefit from high foreign interest rates if they re-

main uncovered (do not sell the currency forward). But IFE suggests that this strategy will not generate higher returns than what are possible domestically because the exchange rate is expected to decline, on average, by the amount of the interest rate differential.

POINT COUNTER-POINT

Does PPP Eliminate Concerns about Long-Term Exchange Rate Risk?

Point Yes. Studies have shown that exchange rate movements are related to inflation differentials in the long run. Based on PPP, the currency of a high-inflation country will depreciate against the dollar. A subsidiary in that country should generate inflated revenue from the inflation, which will help offset the adverse exchange effects when its earnings are remitted to the parent. If a firm is focused on long-term performance, the deviations from PPP will offset over time. In some years, the exchange rate effects may exceed the inflation effects, and in other years the inflation effects will exceed the exchange rate effects.

Counter-Point No. Even if the relationship between inflation and exchange rate effects is consistent, this does not guarantee that the effects on the firm will

be offsetting. A subsidiary in a high-inflation country will not necessarily be able to adjust its price level to keep up with the increased costs of doing business there. The effects vary with each MNC's situation. Even if the subsidiary can raise its prices to match the rising costs, there are short-term deviations from PPP. The investors who invest in an MNC's stock may be concerned about short-term deviations from PPP because they will not necessarily hold the stock for the long term. Thus, investors may prefer that firms manage in a manner that reduces the volatility in their performance in short-run and long-run periods.

Who Is Correct? Use the Internet to learn more about this issue. Which argument do you support? Offer your own opinion on this issue.

SELF TEST

Answers are provided in Appendix A at the back of the text.

1. A U.S. importer of Japanese computer components pays for the components in yen. The importer is not concerned about a possible increase in Japanese prices (charged in yen) because of the likely offsetting effect caused by purchasing power parity (PPP). Explain what this means.

2. Use what you know about tests of PPP to answer this question. Using the information in the first question, explain why the U.S. importer of Japanese computer components should be concerned about its future payments.

3. Use PPP to explain how the values of the currencies of Eastern European countries might change if those countries experience high inflation, while the United States experiences low inflation.

4. Assume that the Canadian dollar's spot rate is $.85 and that the Canadian and U.S. inflation rates are similar. Then assume that Canada experiences 4 percent inflation, while the United States experiences 3 percent inflation. According to PPP, what will be the new value of the Canadian dollar after it adjusts to the inflationary changes? (You may use the approximate formula to answer this question.)

5. Assume that the Australian dollar's spot rate is $.90 and that the Australian and U.S. one-year interest rates are initially 6 percent. Then assume that the Australian one-year interest rate increases by 5 percentage points, while the U.S. one-year interest rate remains unchanged. Using this information and the international Fisher effect (IFE) theory, forecast the spot rate for one year ahead.

6. In the previous question, the Australian interest rates increased from 6 to 11 percent. According to the IFE, what is the underlying factor that would cause such a change? Give an explanation based on the IFE of the forces that would cause a change in the Australian dollar. If U.S. investors believe in the IFE, will they attempt to capitalize on the higher Australian interest rates? Explain.

QUESTIONS AND APPLICATIONS

1. **PPP.** Explain the theory of purchasing power parity (PPP). Based on this theory, what is a general forecast of the values of currencies in countries with high inflation?

2. **Rationale of PPP.** Explain the rationale of the PPP theory.

3. **Testing PPP.** Explain how you could determine whether PPP exists. Describe a limitation in testing whether PPP holds.

4. **Testing PPP.** Inflation differentials between the United States and other industrialized countries have typically been a few percentage points in any given year. Yet, in many years annual exchange rates between the corresponding currencies have changed by 10 percent or more. What does this information suggest about PPP?

5. **Limitations of PPP.** Explain why PPP does not hold.

6. **Implications of IFE.** Explain the international Fisher effect (IFE). What is the rationale for the existence of the IFE? What are the implications of the IFE for firms with excess cash that consistently invest in foreign Treasury bills? Explain why the IFE may not hold.

7. **Implications of IFE.** Assume U.S. interest rates are generally above foreign interest rates. What does this suggest about the future strength or weakness of the dollar based on the IFE? Should U.S. investors invest in foreign securities if they believe in the IFE? Should foreign investors invest in U.S. securities if they believe in the IFE?

8. **Comparing Parity Theories.** Compare and contrast interest rate parity (discussed in the previous chapter), purchasing power parity (PPP), and the international Fisher effect (IFE).

9. **Real Interest Rate.** One assumption made in developing the IFE is that all investors in all countries have the same real interest rate. What does this mean?

10. **Interpreting Inflationary Expectations.** If investors in the United States and Canada require the same real interest rate, and the nominal rate of interest is 2 percent higher in Canada, what does this imply about expectations of U.S. inflation and Canadian inflation? What do these inflationary expectations suggest about future exchange rates?

11. **PPP Applied to the Euro.** Assume that several European countries that use the euro as their currency experience higher inflation than the United States, while two other European countries that use the euro as their currency experience lower inflation than the United States. According to PPP, how will the euro's value against the dollar be affected?

12. **Source of Weak Currencies.** Currencies of some Latin American countries, such as Brazil and Venezuela, frequently weaken against most other currencies. What concept in this chapter explains this occurrence? Why don't all U.S.-based MNCs use forward contracts to hedge their future remittances of funds from Latin American countries to the United States if they expect depreciation of the currencies against the dollar?

13. **PPP.** Japan has typically had lower inflation than the United States. How would one expect this to affect the Japanese yen's value? Why does this expected relationship not always occur?

14. **IFE.** Assume that the nominal interest rate in Mexico is 48 percent and the interest rate in the United States is 8 percent for one-year securities that are free from default risk. What does the IFE suggest about the differential in expected inflation in these two countries? Using this information and the PPP theory, describe the expected nominal return to U.S. investors who invest in Mexico.

15. **IFE.** Shouldn't the IFE discourage investors from attempting to capitalize on higher foreign interest rates? Why do some investors continue to invest overseas, even when they have no other transactions overseas?

16. **Changes in Inflation.** Assume that the inflation rate in Brazil is expected to increase substantially. How will this affect Brazil's nominal interest rates and the value of its currency (called the real)? If the IFE holds, how will the nominal return to U.S. investors who invest in Brazil be affected by the higher inflation in Brazil? Explain.

17. **Comparing PPP and IFE.** How is it possible for PPP to hold if the IFE does not?

18. **Estimating Depreciation Due to PPP.** Assume that the spot exchange rate of the British pound is $1.73. How will this spot rate adjust according to PPP if the United Kingdom experiences an inflation rate of 7 percent while the United States experiences an inflation rate of 2 percent?

19. **Forecasting the Future Spot Rate Based on IFE.** Assume that the spot exchange rate of the Singapore dollar is $.70. The one-year interest rate is 11 percent in the United States and 7 percent in Singapore. What will the spot rate be in one year according to the IFE? What is the force that causes the spot rate to change according to the IFE?

20. **Deriving Forecasts of the Future Spot Rate.** As of today, assume the following information is available:

	U.S.	Mexico
Real rate of interest required by investors	2%	2%
Nominal interest rate	11%	15%
Spot rate	—	$.20
One-year forward rate	—	$.19

a. Use the forward rate to forecast the percentage change in the Mexican peso over the next year.

b. Use the differential in expected inflation to forecast the percentage change in the Mexican peso over the next year.

c. Use the spot rate to forecast the percentage change in the Mexican peso over the next year.

21. **Inflation and Interest Rate Effects.** The opening of Russia's market has resulted in a highly volatile Russian currency (the ruble). Russia's inflation has commonly exceeded 20 percent per month. Russian interest rates commonly exceed 150 percent, but this is sometimes less than the annual inflation rate in Russia.

a. Explain why the high Russian inflation has put severe pressure on the value of the Russian ruble.

b. Does the effect of Russian inflation on the decline in the ruble's value support the PPP theory? How might the relationship be distorted by political conditions in Russia?

c. Does it appear that the prices of Russian goods will be equal to the prices of U.S. goods from the perspective of Russian consumers (after considering exchange rates)? Explain.

d. Will the effects of the high Russian inflation and the decline in the ruble offset each other for U.S.

importers? That is, how will U.S. importers of Russian goods be affected by the conditions?

22. **IFE Application to Asian Crisis.** Before the Asian crisis, many investors attempted to capitalize on the high interest rates prevailing in the Southeast Asian countries although the level of interest rates primarily reflected expectations of inflation. Explain why investors behaved in this manner. Why does the IFE suggest that the Southeast Asian countries would not have attracted foreign investment before the Asian crisis despite the high interest rates prevailing in those countries?

23. **IFE Applied to the Euro.** Given the conversion of several European currencies to the euro, explain what would cause the euro's value to change against the dollar according to the IFE.

Advanced Questions

24. **IFE.** Beth Miller does not believe that the international Fisher effect (IFE) holds. Current one-year interest rates in Europe are 5 percent, while one-year interest rates in the United States are 3 percent. Beth converts $100,000 to euros and invests them in Germany. One year later, she converts the euros back to dollars. The current spot rate of the euro is $1.10.

a. According to the IFE, what should the spot rate of the euro in one year be?

b. If the spot rate of the euro in one year is $1.00, what is Beth's percentage return from her strategy?

c. If the spot rate of the euro in one year is $1.08, what is Beth's percentage return from her strategy?

d. What must the spot rate of the euro be in one year for Beth's strategy to be successful?

25. **Integrating IRP and IFE.** Assume the following information is available for the United States and Europe:

	U.S.	Europe
Nominal interest rate	4%	6%
Expected inflation	2%	5%
Spot rate	—	$1.13
One-year forward rate	—	$1.10

a. Does IRP hold?

b. According to PPP, what is the expected spot rate of the euro in one year?

c. According to the IFE, what is the expected spot rate of the euro in one year?

d. Reconcile your answers to parts (a) and (c).

26. **IRP.** The one-year risk-free interest rate in Mexico is 10 percent. The one-year risk-free rate in the United States is 2 percent. Assume that interest rate parity exists. The spot rate of the Mexican peso is $.14.

    a. What is the forward rate premium?

    b. What is the one-year forward rate of the peso?

    c. Based on the international Fisher effect, what is the expected change in the spot rate over the next year?

    d. If the spot rate changes as expected according to the IFE, what will be the spot rate in one year?

    e. Compare your answers to (b) and (d) and explain the relationship.

27. **Testing the PPP.** How could you use regression analysis to determine whether the relationship specified by PPP exists on average? Specify the model, and describe how you would assess the regression results to determine if there is a *significant* difference from the relationship suggested by PPP.

28. **Testing the IFE.** Describe a statistical test for the IFE.

29. **Impact of Barriers on PPP and IFE.** Would PPP be more likely to hold between the United States and Hungary if trade barriers were completely removed and if Hungary's currency were allowed to float without any government intervention? Would the IFE be more likely to hold between the United States and Hungary if trade barriers were completely removed and if Hungary's currency were allowed to float without any government intervention? Explain.

30. **Interactive Effects of PPP.** Assume that the inflation rates of the countries that use the euro are very low, while other European countries that have their own currencies experience high inflation. Explain how and why the euro's value could be expected to change against these currencies according to the PPP theory.

31. **Applying IRP and IFE.** Assume that Mexico has a one-year interest rate that is higher than the U.S. one-year interest rate. Assume that you believe in the international Fisher effect (IFE) and interest rate parity. Assume zero transaction costs.

    Ed is based in the United States and attempts to speculate by purchasing Mexican pesos today, investing the pesos in a risk-free asset for a year, and then converting the pesos to dollars at the end of one year. Ed did not cover his position in the forward market.

Maria is based in Mexico and attempts covered interest arbitrage by purchasing dollars today and simultaneously selling dollars one year forward, investing the dollars in a risk-free asset for a year, and then converting the dollars back to pesos at the end of one year.

Do you think the rate of return on Ed's investment will be higher than, lower than, or the same as the rate of return on Maria's investment? Explain.

32. **Arbitrage and PPP.** Assume that locational arbitrage ensures that spot exchange rates are properly aligned. Also assume that you believe in purchasing power parity. The spot rate of the British pound is $1.80. The spot rate of the Swiss franc is 0.3 pounds. You expect that the one-year inflation rate is 7 percent in the United Kingdom, 5 percent in Switzerland, and 1 percent in the United States. The one-year interest rate is 6 percent in the United Kingdom, 2 percent in Switzerland, and 4 percent in the United States. What is your expected spot rate of the Swiss franc in one year with respect to the U.S. dollar? Show your work.

33. **IRP versus IFE.** You believe that interest rate parity and the international Fisher effect hold. Assume that the U.S. interest rate is presently much higher than the New Zealand interest rate. You have receivables of 1 million New Zealand dollars that you will receive in one year. You could hedge the receivables with the one-year forward contract. Or, you could decide to not hedge. Is your expected U.S. dollar amount of the receivables in one year from hedging higher, lower, or the same as your expected U.S. dollar amount of the receivables without hedging? Explain.

34. **IRP, PPP, and Speculating in Currency Derivatives.** The U.S. 3-month interest rate (unannualized) is 1 percent. The Canadian 3-month interest rate (unannualized) is 4 percent. Interest rate parity exists. The expected inflation over this period is 5 percent in the United States and 2 percent in Canada. A call option with a 3-month expiration date on Canadian dollars is available for a premium of $.02 and a strike price of $.64. The spot rate of the Canadian dollar is $.65. Assume that you believe in purchasing power parity.

    a. Determine the dollar amount of your profit or loss from buying a call option contract specifying C$100,000.

    b. Determine the dollar amount of your profit or loss from buying a futures contract specifying C$100,000.

35. **Implications of PPP.** Today's spot rate of the Mexican peso is $.10. Assume that purchasing power parity holds. The U.S. inflation rate over this year is expected to be 7 percent, while the Mexican inflation over this year is expected to be 3 percent. Wake Forest Co. plans to import from Mexico and will need 20 million Mexican pesos in one year. Determine the expected amount of dollars to be paid by the Wake Forest Co. for the pesos in one year.

36. **Investment Implications of IRP and IFE.** The Argentine one-year CD (deposit) rate is 13 percent, while the Mexican one-year CD rate is 11 percent and the U.S. one-year CD rate is 6 percent. All CDs have zero default risk. Interest rate parity holds, and you believe that the international Fisher effect holds.

    Jamie (based in the United States) invests in a one-year CD in Argentina.

    Ann (based in the United States) invests in a one-year CD in Mexico.

    Ken (based in the United States) invests in a one-year CD in Argentina and sells Argentine pesos one year forward to cover his position.

    Juan (who lives in Argentina) invests in a one-year CD in the United States.

    Maria (who lives in Mexico) invests in a one-year CD in the United States.

    Nina (who lives in Mexico) invests in a one-year CD in Argentina.

    Carmen (who lives in Argentina) invests in a one-year CD in Mexico and sells Mexican pesos one year forward to cover her position.

    Corio (who lives in Mexico) invests in a one-year CD in Argentina and sells Argentine pesos one year forward to cover his position.

    Based on this information and assuming the international Fisher effect holds, which person will be expected to earn the highest return on the funds invested? If you believe that multiple persons will tie for the highest expected return, name each of them. Explain.

37. **Investment Implications of IRP and the IFE.** Today, a U.S. dollar can be exchanged for 3 New Zealand dollars. The one-year CD (deposit) rate in New Zealand is 7 percent, and the one-year CD rate in the United States is 6 percent. Interest rate parity exists between the United States and New Zealand. The international Fisher effect exists between the United States and New Zealand. Today a U.S. dollar can be exchanged for 2 Swiss francs. The one-year CD rate in Switzerland is 5 percent. The spot rate of the Swiss franc is the same as the one-year forward rate.

    Karen (based in the United States) invests in a one-year CD in New Zealand and sells New Zealand dollars one year forward to cover her position.

    James (based in the United States) invests in a one-year CD in New Zealand and does not cover his position.

    Brian (based in the United States) invests in a one-year CD in Switzerland and sells Swiss francs one year forward to cover his position.

    Eric (who lives in Switzerland) invests in a one-year CD in Switzerland.

    Sandra (who lives in the United States) invests in a one-year CD in Switzerland and sells Swiss francs one year forward to cover her position.

    Tonya (who lives in New Zealand) invests in a one-year CD in the United States and sells U.S. dollars one year forward to cover her position.

    Based on this information, which person will be expected to earn the highest return on the funds invested? If you believe that multiple persons will tie for the highest expected return, name each of them. Explain.

38. **Real Interest Rates, Expected Inflation, IRP, and the Spot Rate.** The United States and the country of Rueland have the same real interest rate of 3 percent. The expected inflation over the next year is 6 percent in the United States versus 21 percent in Rueland. Interest rate parity exists. The one-year currency futures contract on Rueland's currency (called the ru) is priced at $.40 per ru. What is the spot rate of the ru?

Discussion in the Boardroom

This exercise can be found in Appendix E at the back of this textbook.

Running Your Own MNC

This exercise can be found on the Xtra! website at **http://maduraxtra.swlearning.com**.

BLADES, INC. CASE

Assessment of Purchasing Power Parity

Blades, the U.S.-based roller blades manufacturer, is currently both exporting to and importing from Thailand. The company has chosen Thailand as an export target for its primary product, "Speedos," because of Thailand's growth prospects and the lack of competition from both Thai and U.S. roller blade manufacturers in Thailand. Under an existing arrangement, Blades sells 180,000 pairs of Speedos annually to Entertainment Products, Inc., a Thai retailer. The arrangement involves a fixed, baht-denominated price and will last for 3 years. Blades generates approximately 10 percent of its revenue in Thailand.

Blades has also decided to import certain rubber and plastic components needed to manufacture Speedos because of cost and quality considerations. Specifically, the weak economic conditions in Thailand resulting from recent events have allowed Blades to import components from the country at a relatively low cost. However, Blades did not enter into a long-term arrangement to import these components and pays market prices (in baht) prevailing in Thailand at the time of purchase. Currently, Blades incurs about 4 percent of its cost of goods sold in Thailand.

Although Blades has no immediate plans for expansion in Thailand, it may establish a subsidiary there in the future. Moreover, even if Blades does not establish a subsidiary in Thailand, it will continue exporting to and importing from the country for several years. Due to these considerations, Blades' management is very concerned about recent events in Thailand and neighboring countries, as they may affect both Blades' current performance and its future plans.

Ben Holt, Blades' CFO, is particularly concerned about the level of inflation in Thailand. Blades' export arrangement with Entertainment Products, while allowing for a minimum level of revenue to be generated in Thailand in a given year, prevents Blades from adjusting prices according to the level of inflation in Thailand. In retrospect, Holt is wondering whether Blades should have entered into the export arrangement at all. Because Thailand's economy was growing very fast when Blades agreed to the arrangement, strong consumer spending there resulted in a high level of inflation and high interest rates. Naturally, Blades would have preferred an agreement whereby the price per pair of Speedos would be adjusted for the Thai level of inflation. However, to take advantage of the growth opportunities in Thailand, Blades accepted the arrangement when Entertainment Products insisted on a fixed price level. Currently, however, the baht is freely floating, and Holt is wondering how a relatively high level of Thai inflation may affect the baht-dollar exchange rate and, consequently, Blades' revenue generated in Thailand.

Ben Holt is also concerned about Blades' cost of goods sold incurred in Thailand. Since no fixed-price arrangement exists and the components are invoiced in Thai baht, Blades has been subject to increases in the prices of rubber and plastic. Holt is wondering how a potentially high level of inflation will impact the baht-dollar exchange rate and the cost of goods sold incurred in Thailand now that the baht is freely floating.

When Holt started thinking about future economic conditions in Thailand and the resulting impact on Blades, he found that he needed your help. In particular, Holt is vaguely familiar with the concept of purchasing power parity (PPP) and is wondering about this theory's implications, if any, for Blades. Furthermore, Holt also remembers that relatively high interest rates in Thailand will attract capital flows and put upward pressure on the baht.

Because of these concerns, and to gain some insight into the impact of inflation on Blades, Ben Holt has asked you to provide him with answers to the following questions:

1. What is the relationship between the exchange rates and relative inflation levels of the two countries? How will this relationship affect Blades' Thai revenue and costs given that the baht is freely floating? What is the net effect of this relationship on Blades?

2. What are some of the factors that prevent PPP from occurring in the short run? Would you expect PPP to hold better if countries negotiate trade arrangements under which they commit themselves to the purchase or sale of a fixed number of goods over a specified time period? Why or why not?

3. How do you reconcile the high level of interest rates in Thailand with the expected change of the baht-dollar exchange rate according to PPP?

4. Given Blades' future plans in Thailand, should the company be concerned with PPP? Why or why not?

5. PPP may hold better for some countries than for others. The Thai baht has been freely floating for more than a decade. How do you think Blades can gain insight into whether PPP holds for Thailand? Offer some logic to explain why the PPP relationship may not hold here.

SMALL BUSINESS DILEMMA

Assessment of the IFE by the Sports Exports Company

Every month, the Sports Exports Company receives a payment denominated in British pounds for the footballs it exports to the United Kingdom. Jim Logan, owner of the Sports Exports Company, decides each month whether to hedge the payment with a forward contract for the following month. Now, however, he is questioning whether this process is worth the trouble. He suggests that if the international Fisher effect (IFE) holds, the pound's value should change (on average) by an amount that reflects the differential between the interest rates of the two countries of concern. Since the forward premium reflects that same interest rate differential, the results from hedging should equal the results from not hedging on average.

1. Is Jim's interpretation of the IFE theory correct?
2. If you were in Jim's position, would you spend time trying to decide whether to hedge the receivables each month, or do you believe that the results would be the same (on average) whether you hedged or not?

INTERNET/EXCEL EXERCISES

The "Market" section of the Bloomberg website provides interest rate quotations for numerous currencies. Its address is **http://www.bloomberg.com**.

1. Go to the "Rates and Bonds" section and then click on each foreign country to review its interest rate. Determine the prevailing one-year interest rate of the Australian dollar, the Japanese yen, and the British pound. Assuming a 2 percent real rate of interest for savers in any country, determine the expected rate of inflation over the next year in each of these countries that is implied by the nominal interest rate (according to the Fisher effect).

2. What is the approximate expected percentage change in the value of each of these currencies against the dollar over the next year when applying PPP to the inflation level of each of these currencies versus the dollar?

Exchange Rate Behavior

Questions

1 As an employee of the foreign exchange department for a large company, you have been given the following information:

Beginning of Year

Spot rate of £ = $1.596

Spot rate of Australian dollar (A$) = $.70

Cross exchange rate: £1 = A$2.28

One-year forward rate of A$ = $.71

**One-year forward rate of £ = $1.58004**

One-year U.S. interest rate = 8.00%

One-year British interest rate = 9.09%

One-year Australian interest rate = 7.00%

Determine whether triangular arbitrage is feasible and, if so, how it should be conducted to make a profit.

2 Using the information in question 1, determine whether covered interest arbitrage is feasible and, if so, how it should be conducted to make a profit.

3 Based on the information in question 1 for the beginning of the year, use the international Fisher effect (IFE) theory to forecast the annual percentage change in the British pound's value over the year.

4 Assume that at the beginning of the year, the pound's value is in equilibrium. Assume that over the year the British inflation rate is 6 percent, while the U.S. inflation rate is 4 percent. Assume that any change in the pound's value due to the inflation differential has occurred by the end of the year. Using this information and the information provided in question 1, determine how the pound's value changed over the year.

5 Assume that the pound's depreciation over the year was attributed directly to central bank intervention. Explain the type of direct intervention that would place downward pressure on the value of the pound.
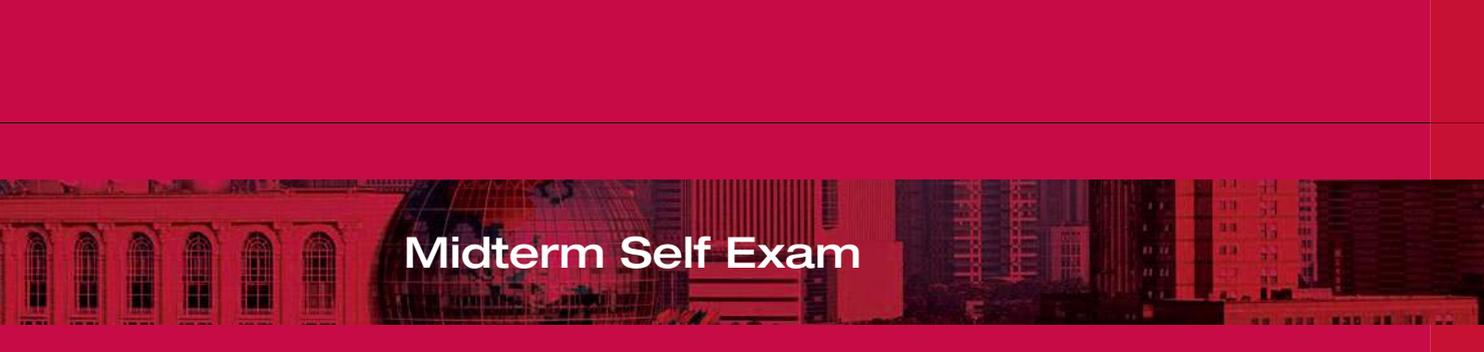
Midterm Review

You have just completed all the chapters focused on the macro- and market-related concepts. Here is a brief summary of some of the key points in those chapters. Chapter 1 explains the role of financial managers to focus on maximizing the value of the MNC and how that goal can be distorted by agency problems. MNCs use various incentives to ensure that managers serve shareholders rather than themselves. Chapter 1 explains that an MNC's value is the present value of its future cash flows and how a U.S.-based MNC's value is influenced by its foreign cash flows. Its dollar cash flows (and therefore its value) are enhanced when the foreign currencies received appreciate against the dollar, or when foreign currencies of outflows depreciate. The MNC's value is also influenced by its cost of capital, which is influenced by its capital structure and the risk of the projects that it pursues. The valuation is dependent on the environment in which MNCs operate along with their managerial decisions.

Chapter 2 focuses on international transactions in a global context, with emphasis on international trade and capital flows. International trade flows are sensitive to relative prices of products between countries, while international capital flows are influenced by the potential return on funds invested. They can have a major impact on the economic conditions of each country and the MNCs that operate there. Net trade flows to a country may create more jobs there, while net capital flows to a country can increase the amount of funds that can be channeled to finance projects by firms or government agencies.

Chapter 3 introduces the international money, bond, and stock markets and explains how they facilitate the operations of MNCs. It also explains how the foreign exchange market facilitates international transactions. Chapter 4 explains how a currency's direct exchange rate (value measured in dollars) may rise when its country has relatively low inflation and relatively high interest rates (if expected inflation is low) compared with the United States. Chapter 5 introduces currency derivatives and explains how they can be used by MNCs or individuals to capitalize on expected movements in exchange rates.

Chapter 6 describes the role of central banks in the foreign exchange market and how they can use direct intervention to affect exchange rate movements. They can attempt to raise the value of their home currency by using dollars or another currency in their reserves to purchase their home currency in the foreign exchange market. The central banks can also attempt to reduce the value of their home currency by using their home currency reserves to purchase dollars in the foreign exchange market. Alternatively, they could use indirect intervention by affecting interest rates in a manner that will affect the appeal of their local money market securities relative to other

countries. This action affects the supply of their home currency for sale and/or the demand for their home currency in the foreign exchange market and therefore affects the exchange rate.

Chapter 7 explains how the forces of arbitrage allow for parity conditions and more orderly foreign exchange market quotations. Specifically, locational arbitrage ensures that exchange rate quotations are similar among locations. Triangular arbitrage ensures that cross exchange rates are properly aligned. Covered interest arbitrage tends to ensure that the spot and forward exchange rates maintain a relationship that reflects interest rate parity, whereby the forward rate premium reflects the interest rate differential. Chapter 8 gives special attention to the impact of inflation and interest rates on exchange rate movements. Purchasing power parity suggests that a currency will depreciate to offset its country's inflation differential above the United States (or will appreciate if its country's inflation is lower than in the United States). The international Fisher effect suggests that if nominal interest rate differentials reflect the expected inflation differentials (the real interest rate is the same in each country), the exchange rate will move in accordance with purchasing power parity as applied to expected inflation. That is, a currency will depreciate to offset its country's expected inflation differential above the United States (or will appreciate if its country's expected inflation is lower than in the United States).

Midterm Self Exam

This self exam allows you to test your understanding of some of the key concepts covered up to this point. Chapters 1 to 8 are macro- and market-oriented, while Chapters 9 to 21 are micro-oriented. This is a good opportunity to assess your understanding of the macro and market concepts, before moving on to the micro concepts in Chapters 9 to 21.

This exam does not replace all the end-of-chapter self tests, nor does it test all the concepts that have been covered up to this point. It is simply intended to let you test yourself on a general overview of key concepts. Try to simulate taking an exam by answering all questions without using your book and your notes. The answers to this exam are provided just after the exam so that you can grade your exam. If you have any wrong answers, you should reread the related material and then redo any exam questions that you had wrong.

This exam may not necessarily match the level of rigor in your course. Your instructor may offer you specific information about how this Midterm Self Exam relates to the coverage and rigor of the midterm exam in your course.

1. An MNC's cash flows and therefore its valuation can be affected by expected exchange rate movements (as explained in Chapter 1). Sanoma Co. is a U.S.-based MNC that wants to assess how its valuation is affected by expected exchange rate movements. Given Sanoma's business transactions and its expectations of exchange rates, fill out the table at the top of next page.

2. The United States has a larger balance-of-trade deficit each year (as explained in Chapter 2). Do you think a weaker dollar would reduce the balance-of-trade deficit? Offer a convincing argument for your answer.

3. Is outsourcing by U.S. firms to foreign countries beneficial to the U.S. economy? Weigh the pros and cons, and offer your conclusions.

4. **a.** The dollar is presently worth .8 euros. What is the direct exchange rate of the euro?

   b. The direct exchange rate of the euro is presently valued higher than it was last month. What does this imply about the movement of the indirect exchange rate of the euro over the last month?

Each Quarter during the Year, Sanoma's Main Business Transactions Will Be to:	Currency Used in Transaction	Expected Movement in Currency's Value against the U.S. Dollar during This Year	How the Expected Currency Movement Will Affect Sanoma's Net Cash Flows (and Therefore Value) This Year
a. Import materials from Canada	Canadian dollar	Depreciate	
b. Export products to Germany	Euro	Appreciate	
c. Receive remitted earnings from its foreign subsidiary in Argentina	Argentine peso	Appreciate	
d. Receive interest from its Australian cash account	Australian dollar	Depreciate	
e. Make loan payments on a loan provided by a Japanese bank	Japanese yen	Depreciate	

    c. The *Wall Street Journal* quotes the Australian dollar to be worth $.50, while the one-year forward rate of the Australian dollar is $.51. What is the forward rate premium? What is the expected rate of appreciation (or depreciation) if the one-year forward rate is used to predict the value of the Australian dollar in one year?

5. Assume that the Polish currency (called zloty) is worth $.32. The U.S. dollar is worth .7 euros. A U.S. dollar can be exchanged for 8 Mexican pesos.
    Last year a dollar was valued at 2.9 Polish zloty, and the peso was valued at $.10.

    a. Would U.S. exporters to Mexico that accept pesos as payment be favorably or unfavorably affected by the change in the Mexican peso's value over the last year?

    b. Would U.S. importers from Poland that pay for imports in zloty be favorably or unfavorably affected by the change in the zloty's value over the last year?

    c. What is the percentage change in the cross exchange rate of the peso in zloty over the last year? How would firms in Mexico that sell products to Poland denominated in zloty be affected by the change in the cross exchange rate?

6. Explain how each of the following conditions would be expected to affect the value of the Mexican peso.

Situation	Expected Impact on the Exchange Rate of the Peso
a. Mexico suddenly experiences a high rate of inflation.	
b. Mexico's interest rates rise, while its inflation is expected to remain low.	
c. Mexico's central bank intervenes in the foreign exchange market by purchasing dollars with pesos.	
d. Mexico imposes quotas on products imported from the United States.	

7. One year ago, you sold a put option on 100,000 euros with an expiration date of one year. You received a premium on the put option of $.05 per unit. The exercise price was $1.22. Assume that one year ago, the spot rate of the euro was $1.20. One year ago, the one-year forward rate of the euro exhibited a discount of 2 percent, and the one-year futures price of the euro was the same as the one-year forward rate of the euro. From one year ago to today, the euro depreciated against the dollar by 4 percent. Today the put option will be exercised (if it is feasible for the buyer to do so).

    a. Determine the total dollar amount of your profit or loss from your position in the put option.

b. One year ago, Rita sold a futures contract on 100,000 euros with a settlement date of one year. Determine the total dollar amount of her profit or loss.

8. Assume that the Federal Reserve wants to reduce the value of the euro with respect to the dollar. How could it attempt to use indirect intervention to achieve its goal? What is a possible adverse effect from this type of intervention?

9. Assume that interest rate parity exists. The one-year nominal interest rate in the United States is 7 percent, while the one-year nominal interest rate in Australia is 11 percent. The spot rate of the Australian dollar is $.60. Today, you purchase a one-year forward contract on 10 million Australian dollars. How many U.S. dollars will you need in one year to fulfill your forward contract?

10. You go to a bank and are given these quotes:

  You can buy a euro for 14 Mexican pesos.
  The bank will pay you 13 pesos for a euro.

  You can buy a U.S. dollar for .9 euros.
  The bank will pay you .8 euros for a U.S. dollar.

  You can buy a U.S. dollar for 10 pesos.
  The bank will pay you 9 pesos for a U.S. dollar.

You have $1,000. Can you use triangular arbitrage to generate a profit? If so, explain the order of the transactions that you would execute and the profit that you would earn. If you cannot earn a profit from triangular arbitrage, explain why.

11. Today's spot rate of the Mexican peso is $.10. Assume that purchasing power parity holds. The U.S. inflation rate over this year is expected to be 7 percent, while the Mexican inflation over this year is expected to be 3 percent. Carolina Co. plans to import from Mexico and will need 20 million Mexican pesos in one year. Determine the expected amount of dollars to be paid by the Carolina Co. for the pesos in one year.

12. Tennessee Co. purchases imports that have a price of 400,000 Singapore dollars, and it has to pay for the imports in 90 days. It will use a 90-day forward contract to cover its payables. Assume that interest rate parity exists and will continue to exist. This morning, the spot rate of the Singapore dollar was $.50. At noon, the Federal Reserve reduced U.S. interest rates. There was no change in the Singapore interest rates. The Singapore dollar's spot rate remained at $.50 throughout the day. But the Fed's actions immediately increased the degree of uncertainty surrounding the future value of the Singapore dollar over the next 3 months.

a. If Tennessee Co. locked in a 90-day forward contract this afternoon, would its total U.S. dollar cash outflows be *more than, less than,* or *the same as* the total U.S. dollar cash outflows if it had locked in a 90-day forward contract this morning? Briefly explain.

b. Assume that Tennessee uses a currency options contract to hedge rather than a forward contract. If Tennessee Co. purchased a currency call option contract at the money on Singapore dollars this afternoon, would its total U.S. dollar cash outflows be *more than, less than,* or *the same as* the total U.S. dollar cash outflows if it had purchased a currency call option contract at the money this morning? Briefly explain.

c. Assume that the U.S. and Singapore interest rates were the same as of this morning. Also assume that the international Fisher effect holds. If Tennessee Co. purchased a currency call option contract at the money this morning to hedge its exposure, would you expect that its total U.S. dollar cash outflows would be *more than, less than,* or *the same as* the total U.S. dollar cash outflows if it had negotiated a forward contract this morning? Briefly explain.

13. Today, a U.S. dollar can be exchanged for 3 New Zealand dollars or for 1.6 Canadian dollars. The one-year CD (deposit) rate is 7 percent in New Zealand, is 6 percent in the United States, and is 5 percent in Canada. Interest rate parity exists

between the United States and New Zealand and between the United States and Canada. The international Fisher effect exists between the United States and New Zealand. You expect that the Canadian dollar will be worth $.61 at the end of one year.

Karen (based in the United States) invests in a one-year CD in New Zealand and sells New Zealand dollars one year forward to cover her position.

Marcia (who lives in New Zealand) invests in a one-year CD in the United States and sells U.S. dollars one year forward to cover her position.

William (who lives in Canada) invests in a one-year CD in the United States and does not cover his position.

James (based in the United States) invests in a one-year CD in New Zealand and does not cover his position.

Based on this information, which person will be expected to earn the highest return on the funds invested? If you believe that multiple persons will tie for the highest expected return, name each of them. Briefly explain.

14. Assume that the United Kingdom has an interest rate of 8 percent, versus an interest rate of 5 percent in the United States.

    a. Explain what the implications are for the future value of the British pound according to the theory in Chapter 4 that a country with high interest rates may attract capital flows versus the theory of the international Fisher effect (IFE) in Chapter 8.

    b. Compare the implications of the IFE from Chapter 8 versus interest rate parity (IRP) as related to the information provided here.

Answers to Midterm Self Exam

1. **a.** Increase
   b. Increase
   c. Increase
   d. Decrease
   e. Increase

2. One argument is that a weak dollar will make U.S. products imported by foreign countries cheaper, which will increase the demand for U.S. exports. In addition, a weaker dollar may discourage U.S. firms from importing foreign products because the cost will be higher. Both factors result in a smaller balance-of-trade deficit.

   However, a weak dollar might not improve the balance-of-trade deficit because it is unlikely to weaken against all countries simultaneously. Foreign firms may compare the price they would pay for U.S. products to the price paid for similar products in other countries. Even if the dollar weakens, products produced in China or some other countries where there is cheap labor may still be cheaper for customers based in the United States or other countries.

3. Outsourcing can be beneficial to the U.S. economy because it may allow U.S. firms to produce their products at a lower cost and increase their profits (which increases income earned by the U.S. owners of those firms). It also allows U.S. customers to purchase products and services at a lower cost.

   However, outsourcing eliminates some jobs in the United States, which reduces or eliminates income for people whose job was outsourced. The overall effect on the U.S. economy is based on a comparison of these two forces. It is possible to make arguments for either side. Also, the effects will vary depending on the location. For example, outsourcing may be more likely in a high-wage city in the United States where firms provide services that can be handled by phone or by electronic interaction. These jobs are easier to outsource than some other jobs.

4. **a.** A euro = $1.25.

   b. The indirect value of the euro must have declined over the last month.

   c. The forward premium is 2 percent. If the forward rate is used to forecast, the expected degree of appreciation over the next year is ($.51 − $.50)/$.50 = 2%, which is the same as the forward rate premium.

5. **a.** The peso is valued at $.125 today. Since the peso appreciated, the U.S. exporters are favorably affected.

   b. The zloty was worth about $.345 last year. Since the zloty depreciated, the U.S. importers were favorably affected.

   c. Last year, the cross rate of the peso in zloty = $.10/$.345 = .2898. Today, the cross rate of the peso in zloty = $.125/$.32 = .391. The percentage change is (.391 − .2898)/.2898 = 34.92%.

6. **a.** Depreciate

   b. Appreciate

   c. Depreciate

   d. Appreciate

7. **a.** The spot rate depreciated from $1.20 to $1.152. You receive $.05 per unit. The buyer of the put option exercises the option, and you buy the euros for $1.22 and sell them in the spot market for $1.152. Your gain on the put option per unit is ($1.152 − $1.22) + $.05 = −$.018. Total gain = −$.018 × 100,000 = −$1,800.

   b. The futures rate one year ago was equal to:

   $1.20 × (1 − .02) = $1.176. So the futures rate is $1.176. The gain per unit is $1.176 − $1.152 = $.024 and the total gain is $.024 × 100,000 = $2,400.

8. The Fed could use indirect intervention by raising U.S. interest rates so that the United States would attract more capital flows, which would place upward pressure on the dollar. However, the higher interest rates could make borrowing too expensive for some firms, and would possibly reduce economic growth.

9. [(1.07)/(1.11)] − 1 = −3.60%. So the one-year forward rate is $.60 × [1 + (−.036)] = $.5784. You will need 10,000,000 × $.5784 = $5,784,000.

10. Yes, you can generate a profit by converting dollars to euros, and then euros to pesos, and then pesos to dollars. First convert the information to direct quotes:

	Bid	Ask
Euro in $	1.11	1.25
Pesos in $	$.10	$.11
Euro in pesos	13	14

Use $1,000 to purchase euros: $1,000/1.25 = 800 euros.

Convert 800 euros to buy pesos: 800 euros × 13 = 10,400 pesos.

Convert the 10,400 pesos to U.S. dollars: 10,400 × $.10 = $1,040.

There is profit of $40 on a $1,000 investment.

The alternative strategy that you could attempt is to first buy pesos:

Use $1,000 to purchase pesos: $1,000/$.11 = 9,090.9 pesos.

Convert 9,090 pesos to euros: 9,090.9/14 = 649.35 euros.

Convert 649.35 euros to dollars: 649.35 euros × 1.11 = $720.78.

This strategy results in a loss.

11. $[(1.07)/(1.03)] - 1 = 3.8835\%$. So the expected future spot rate is \$.1038835. Carolina will need to pay \$.1038835 × 20 million pesos = \$2,077,670.

12. **a.** Less than because the discount would be more pronounced or the forward premium would be reduced.

    b. More than because the option premium increased due to more uncertainty.

    c. More than because there is an option premium on the option and the forward rate has no premium in this example, and the expectation is that the future spot rate will be no higher than today's forward rate. The option is at the money so exercise price is same as expected spot rate but you have to pay the option premium.

13. The expected returns of each person are as follows:

    Karen earns 6 percent due to interest rate parity, and earns the same return as what she could earn locally.

    Marcia earns 7 percent due to interest rate parity, and earns the same return as what she could earn locally.

    William earns 8.6 percent. If he converts, C\$ = \$.625 today. After one year, C\$ = \$.61. So if William invests C\$1,000, it converts to \$625. At the end of one year, he has \$662.50. He converts to C\$ and has C\$1,086.

    James is expected to earn 6 percent, since the international Fisher effect (IFE) suggests that on average, the exchange rate movement will offset the interest rate differential.

14. **a.** The IFE disagrees with the theory from Chapter 4 that a currency will appreciate if it has a high interest rate (holding other factors such as inflation constant). The IFE says that capital flows will not go to where the interest rate is higher because the higher interest rate reflects a higher expectation of inflation, which means the currency will weaken over time.

    If you believe the higher interest rate reflects higher expected inflation, then the IFE makes sense. However, in many cases (such as this case), a higher interest rate may be caused by reasons other than inflation (perhaps the U.K. economy is strong and many firms are borrowing money right now) and if so, then there is no reason to think the currency will depreciate in the future. Therefore, the IFE would not make sense.

    The key is that you can see the two different arguments, so that you can understand why a high interest rate may lead to local currency depreciation in some cases and appreciation in other cases.

    b. If U.S. investors attempt to capitalize on the higher rate without covering, they do not know what their return will be. However, if they believe in the IFE, then this means that the United Kingdom's higher interest rate of 3 percent above the United States reflects a higher expected inflation rate in the United Kingdom of about 3 percent. This implies that the best guess of the change in the pound will be −3 percent for the pound (since the IFE relies on PPP), which means that the best guess of the U.S. investor return is about 5 percent, the same as is possible domestically. It may be better, it may be worse, but on average, it is not expected to be any better than what investors can get locally.

    The IFE is focused on situations in which you are trying to anticipate the movement in a currency and you know the interest rate differentials.

    Interest rate parity uses interest rate differentials to derive forward rate. The one-year forward rate would be exactly equal to the expected future spot rate if you use the IFE to derive a best guess of the future spot rate in one year. But if you invest and cover with the forward rate, you know exactly what your outcome will be. If you invest and do not cover, the IFE gives you a prediction of what the outcome will be, but it is just a guess. The result could be 20 percent above or below that guess or even farther away from the guess.