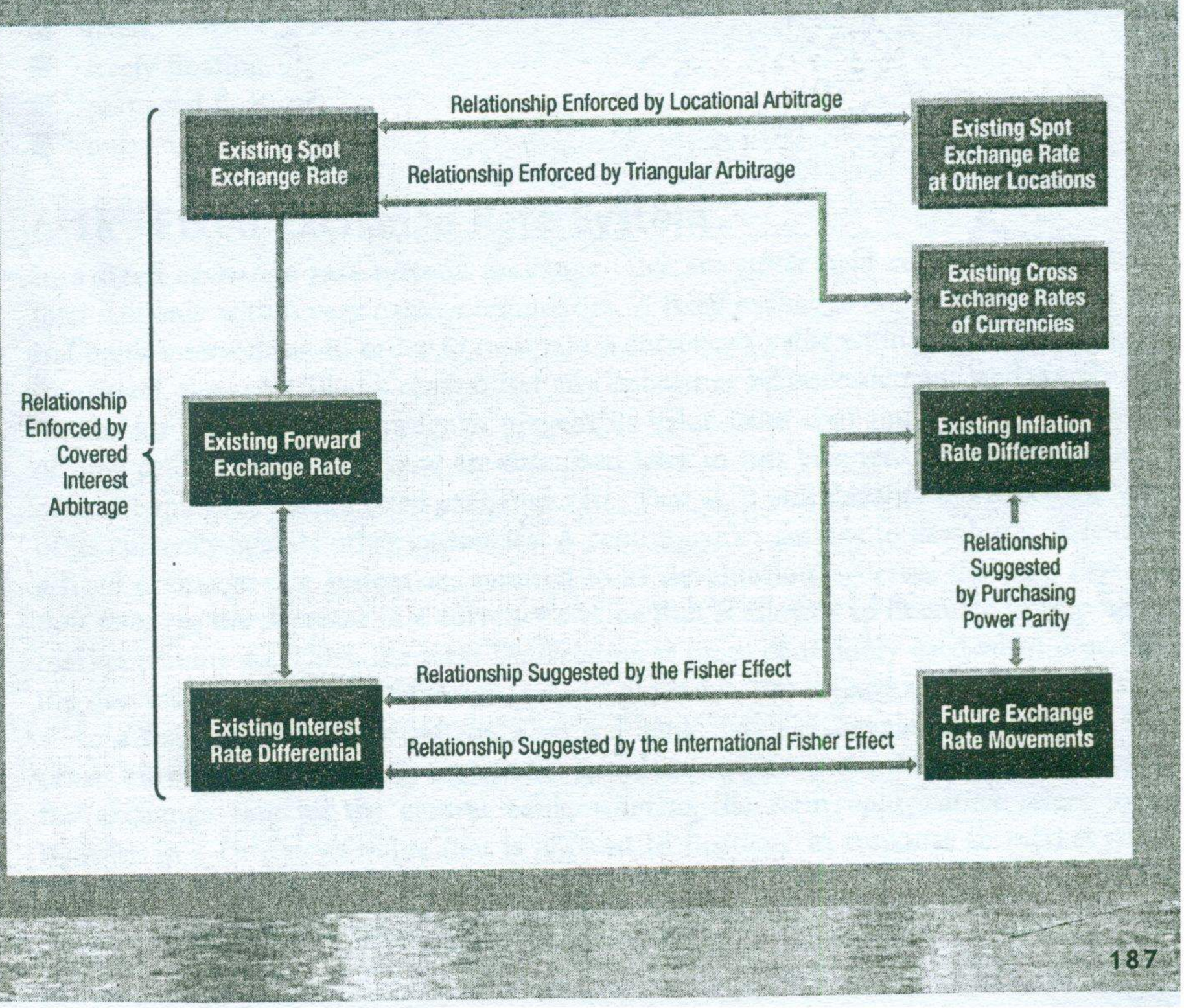
PART 2
Exchange Rate Behavior



Part 2 (consisting of Chapters 6 through 8) focuses on critical relationships pertaining to exchange rates. Chapter 6 explains how governments can influence exchange rate movements and how such movements can affect economic conditions. Chapter 7 explores the relationships among foreign currencies. It also explains how the forward exchange rate is influenced by the difference between the interest rates of any two countries. Chapter 8 discusses prominent theories regarding the impact of inflation on exchange rates and the impact of interest rate movements on exchange rates.



6
Government Influence on Exchange Rates

CHAPTER OBJECTIVES

The specific objectives of this chapter are to:

- describe the exchange rate systems used by various governments,
- describe the development and implications of a single European currency,
- explain how governments can use intervention to influence exchange rates, and
- explain how government intervention in the foreign exchange market can affect economic conditions.

As detailed in Chapter 4, government policies affect exchange rates. Some government policies are specifically intended to affect exchange rates, whereas other policies are intended to affect economic conditions but indirectly influence exchange rates. Because the performance of an MNC is affected by exchange rates, financial managers need to understand how the government influences exchange rates.

6-1 Exchange Rate Systems

Exchange rate systems can be classified in terms of the extent to which the exchange rates are government controlled. Exchange rate systems normally fall into one of the following categories, each of which will be discussed in turn:

- fixed,
- freely floating,
- managed float, or
- pegged.

6-1a Fixed Exchange Rate System

In a **fixed exchange rate system**, exchange rates are either held constant or allowed to fluctuate only within very narrow boundaries. A fixed exchange rate system requires central bank intervention in order to maintain a currency's value within narrow boundaries. In general, the central bank must offset any imbalance between demand and supply conditions for its currency in order to prevent its value from changing. The specific details of how central banks intervene are discussed later in this chapter. In some situations, a central bank may reset a fixed exchange rate. That is, it will **devalue** or reduce the value of its currency against other currencies. A central bank's actions to devalue a currency in a fixed exchange rate system are referred to as **devaluation**, whereas the term *depreciation* refers to the decrease in a currency's value that is allowed to fluctuate in response to market conditions. Thus, the term *depreciation* is more commonly used when describing the decrease in values of currencies that are not subject to a fixed exchange rate system.

In a fixed exchange rate system, a central bank may also **revalue** (increase the value of) its currency against other currencies. **Revaluation** refers to an upward adjustment of the exchange rate by the central bank, whereas the term *appreciation* refers to the increase in a currency's value that is allowed to fluctuate in response to market conditions. Like depreciation, appreciation is thus more commonly used when discussing currencies that are not subject to a fixed exchange rate system.

Bretton Woods Agreement, 1944–1971 From 1944 to 1971, most exchange rates were fixed according to a system planned at the Bretton Woods conference (held in Bretton Woods, New Hampshire, in 1944) by representatives from various countries. Because this arrangement, known as the **Bretton Woods Agreement**, lasted from 1944 to 1971, that period is sometimes referred to as the Bretton Woods era. Each currency was valued in terms of gold; for example, the U.S. dollar was valued as 1/35 ounce of gold. Since all currencies were valued in terms of gold, their values with respect to each other were fixed. Governments intervened in the foreign exchange markets to ensure that exchange rates drifted no more than 1 percent above or below the initially set rates.

Smithsonian Agreement, 1971–1973 During the Bretton Woods era, the United States often experienced balance-of-trade deficits. These deficits indicated that the dollar may have been overvalued, since the use of dollars for foreign purchases exceeded the demand by foreign countries for dollar-denominated goods. By 1971, it appeared that some currency values would need to be adjusted in order to restore a more balanced flow of payments between countries. In December 1971, a conference of representatives from various countries concluded with the **Smithsonian Agreement**, which called for a devaluation of the U.S. dollar by about 8 percent against other currencies. In addition, boundaries for the currency values were expanded to within 2.25 percent above or below the rates initially set by the agreement. Nevertheless, the imbalances in international payments continued and, as of February 1973, the dollar was again devalued. By March 1973, most governments of the major countries were no longer attempting to maintain their home currency values within the boundaries established by the Smithsonian Agreement.

Advantages of Fixed Exchange Rates A fixed exchange rate would be beneficial to a country for several reasons. First, exporters and importers could engage in international trade without concern about exchange rate movements of the currency to which their local currency is linked. Any firms that accept the foreign currency as payment would be insulated from the risk that the currency could depreciate over time. In addition, any firms that need to obtain that foreign currency in the future would be insulated from the risk of the currency appreciating over time. A second benefit is that firms could engage in direct foreign investment, without concern about exchange rate movements of that currency. They would be able to convert their foreign currency earnings into their home currency without concern that the foreign currency denominating their earnings might weaken over time. Thus, the management of an MNC would be much easier.

Third, investors would be able to invest funds in foreign countries without concern that the foreign currency denominating their investments might weaken over time. Funds are needed in any country to support economic growth. Countries that attract a large amount of capital flows normally have lower interest rates, which can stimulate their economies.

Disadvantages of Fixed Exchange Rates One disadvantage of a fixed exchange rate system is that there is still a risk of the government altering its currency's value. Although an MNC is not exposed to continual movements in an exchange rate, there is always the possibility that its home country's central bank will devalue or revalue its own currency.

A second disadvantage is that, from a macro viewpoint, a fixed exchange rate system may render each country (and its MNCs) more vulnerable to economic conditions in other countries.

EXAMPLE Assume that there are only two countries in the world: the United States and the United Kingdom. Also assume a fixed exchange rate system and that these two countries trade frequently with each other. If the United States experiences a much higher inflation rate than the United Kingdom, then

U.S. consumers should buy more goods from the United Kingdom and U.K. consumers should reduce their imports of U.S. goods (because of the high U.S. prices). This reaction would reduce U.S. production and increase U.S. unemployment; it could also cause higher inflation in the United Kingdom due to the excessive demand for British goods relative to the supply of British goods produced. In this way, high U.S. inflation could cause high inflation in the United Kingdom. In the mid- and late 1960s, the United States experienced relatively high inflation and was accused of "exporting" that inflation to some European countries.

A high U.S. unemployment rate will reduce U.S. income and lead to a decline in U.S. purchases of U.K. goods. Hence productivity in the United Kingdom may decrease and unemployment may rise there. In this scenario, the United States has "exported" unemployment to the United Kingdom. ●

6-1b Freely Floating Exchange Rate System

In a **freely floating exchange rate system**, exchange rate values are determined by market forces without intervention by governments. Whereas a fixed exchange rate system allows only limited exchange rate movements, a freely floating exchange rate system allows for complete flexibility. A freely floating exchange rate adjusts on a continual basis in response to the demand and supply conditions for that currency.

Advantages of a Freely Floating System One advantage of a freely floating exchange rate system is that a country is more insulated from the inflation of other countries.

EXAMPLE Continue with the previous example in which there are only two countries, but now assume a freely floating exchange rate system. If the United States experiences a high rate of inflation, then the resulting increased U.S. demand for U.K. goods will place upward pressure on the value of the British pound. As a second consequence of the high U.S. inflation, the reduced U.K. demand for U.S. goods will result in a reduced supply of British pounds for sale (exchanged for dollars), which will also place upward pressure on the pound's value. The pound will appreciate in response to these market forces (recall that appreciation is not allowed under the fixed rate system). This appreciation will make U.K. goods more expensive for U.S. consumers, even though U.K. producers have not raised their prices. The higher prices will simply be due to the pound's appreciation; that is, a greater number of U.S. dollars are now required to buy the same number of pounds.

In the United Kingdom, the actual price of the goods (as measured in British pounds) may be unchanged. Even though U.S. prices have increased, U.K. consumers will continue to purchase U.S. goods because they can exchange their pounds for more U.S. dollars (because of the British pound's appreciation against the U.S. dollar). ●

Another advantage of freely floating exchange rates is that a country is more insulated from unemployment problems in other countries.

EXAMPLE Under a floating rate system, the decline in U.S. purchases of U.K. goods will lead to reduced U.S. demand for British pounds. Such a demand shift could cause the pound to depreciate against the dollar (under the fixed rate system, the pound would not be allowed to depreciate). This depreciation will make British goods cheaper for U.S. consumers than before, offsetting the reduced demand for these goods that may follow a reduction in U.S. income. As was true with inflation, a sudden change in unemployment will have less effect on a foreign country under a floating rate system than under a fixed rate system. ●

These examples illustrate that, in a freely floating exchange rate system, the problems experienced in one country will not necessarily be contagious. Exchange rate adjustments serve as a form of protection against "exporting" economic problems to other countries.

An additional advantage of a freely floating exchange rate system is that a central bank is not required to constantly maintain exchange rates within specified boundaries. It is therefore never required, just for the sake of controlling exchange rates, to implement an

intervention policy that could have an unfavorable effect on the economy. Furthermore, each government is free to implement policies irrespective of their effect on the exchange rate. Finally, if exchange rates were not allowed to float, then investors would invest funds in whatever country had the highest interest rate. The likely result would be governments of countries with low interest rates seeking to restrict the exit of investor funds from the country. Hence there would be more restrictions on capital flows, and financial market efficiency would be reduced.

Disadvantages of a Freely Floating Exchange Rate System In the previous example, the United Kingdom is somewhat insulated from the problems experienced in the United States because of the freely floating exchange rate system. Although an advantage for the protected country (here, the United Kingdom), this insulation can be a disadvantage for the country that initially experienced the economic problems.

EXAMPLE If the United States experiences high inflation then the dollar may weaken, thereby insulating the United Kingdom from the inflation (as discussed previously). From the U.S. perspective, however, a weaker U.S. dollar causes import prices to be higher. This may increase the price of U.S. materials and supplies, which in turn would increase U.S. prices of finished goods. In addition, higher foreign prices (from the U.S. perspective) can force U.S. consumers to purchase domestic products. As U.S. producers recognize that their foreign competition has been reduced by the weak dollar, they can more easily raise their prices without losing customers to foreign competition. ●

In a similar manner, a freely floating exchange rate system can adversely affect a country that has high unemployment.

EXAMPLE If the U.S. unemployment rate is rising then U.S. demand for imports will decrease, putting upward pressure on the dollar's value. A stronger dollar will then cause U.S. consumers to purchase foreign rather than U.S. products because the foreign products can be purchased cheaply. However, that reaction can be detrimental to the United States during periods of high unemployment. ●

As these examples illustrate, a country's economic problems can sometimes be compounded by freely floating exchange rates. Under such a system, MNCs will need to devote substantial resources to measuring and managing exposure to exchange rate fluctuations.

6-1c Managed Float Exchange Rate System

The exchange rate system that exists today for most currencies lies somewhere between fixed and freely floating. It resembles the freely floating system in that exchange rates are allowed to fluctuate on a daily basis and there are no official boundaries. It is similar to the fixed rate system in that governments can and sometimes do intervene to prevent their currencies from moving too far in a certain direction. This type of system is known as a **managed float** or "dirty" float (as opposed to a "clean" float where rates float freely without any government intervention). The various forms of intervention used by governments to manage exchange rate movements are discussed later in this chapter.

The central banks of various countries (including Brazil, China, Denmark, Russia, and South Korea) have, at times, imposed boundaries that restrict the movement of their currency to within so-called bands. However, it is not unusual for these boundaries to be changed or removed entirely if central banks are unable to maintain their currency's value within the bands.

Countries with Floating Exchange Rates Most large developed countries allow their currencies to float, although they may be periodically managed by their respective central banks. Exhibit 6.1 lists some countries that allow their currencies to float.

Exhibit 6.1 Countries with Floating Exchange Rates and Their Currencies

COUNTRY	CURRENCY	COUNTRY	CURRENCY
Afghanistan	new afghani	Mexico	peso
Argentina	peso	Norway	bone
Australia	dollar	Paraguay	guarani
Bolivia	boliviano	Peru	new sol
Brazil	real	Poland	zloty
Canada	dollar	Romania	leu
Chile	peso	Russia	ruble
Denmark	krone	Singapore	dollar
Euro participants	euro	South Africa	rand
Hungary	forint	South Korea	won
India	rupee	Sweden	krona
Indonesia	rupiah	Switzerland	franc
Israel	new shekel	Taiwan	new dollar
Jamaica	dollar	Thailand	baht
Japan	yen	United Kingdom	pound

Criticisms of the Managed Float System Critics argue that the managed float system allows a government to manipulate exchange rates in order to benefit its own country at the expense of others. A government may attempt to weaken its currency to stimulate a stagnant economy. The increased aggregate demand for products that results from such a policy may cause a decreased aggregate demand for products in other countries, since the weakened currency attracts foreign demand. This is a valid criticism but could apply as well to the fixed exchange rate system, where governments have the power to devalue their currencies.

6-1d Pegged Exchange Rate System

Some countries use a **pegged exchange rate** in which their home currency's value is pegged to one foreign currency or to an index of currencies. Although the home currency's value is fixed in terms of the foreign currency to which it is pegged, it moves in line with that currency against other currencies.

A government may peg its currency's value to that of a stable currency, such as the dollar, because doing so stabilizes the value of its own currency. First, this forces the pegged currency's exchange rate with the dollar to be fixed. Second, that currency will move against non-dollar currencies to the same extent as does the dollar. Because the dollar is more stable than most currencies, it will make the pegged currency more stable than most currencies.

Limitations of a Pegged Exchange Rate Although countries with a pegged exchange rate may attract foreign investment because the exchange rate is expected to remain stable, weak economic or political conditions can cause firms and investors to question whether the peg will hold. A country that suffers a sudden recession may experience capital outflows as some firms and investors withdraw funds because they believe other countries offer better investment opportunities. These transactions result in an exchange of the local currency for dollars and other currencies, which puts downward

pressure on the local currency's value. The central bank would need to offset this pressure by intervening in the foreign exchange market (as explained shortly), but it might not be able to maintain the peg. If the peg is broken and if the exchange rate is dictated by market forces, then the local currency's value could immediately decline by 20 percent or more.

If foreign investors fear that a peg may be broken, they will quickly sell their investments in that country and convert the proceeds into their home currency. These transactions place more downward pressure on the local currency of that country. Even its own residents may consider selling their local investments and converting their funds into dollars (or some other currency) if they fear that the peg may be broken. They can exchange their currency for dollars to invest in the United States before the peg breaks, and they can leave that investment there until after the peg breaks and their local currency's value is reduced. Then these residents can sell their U.S. investments and convert the dollar proceeds into their home currency at a more favorable exchange rate. Their initial actions of converting their home currency into dollars also put downward pressure on that local currency.

For the reasons just explained, it is difficult for a country to maintain a pegged exchange rate while experiencing major political or economic problems. Even though a country whose pegged exchange rate is stable can attract foreign investment, investors will move funds to another country if they are concerned that the peg will break. Thus, a pegged exchange rate system could ultimately create more instability in a country's economy. Examples of pegged exchange rate systems are given next.

WEB

http://europa.eu/index_en.htm

Access to information about the European Union and on all related political and economic issues.

Europe's Snake Arrangement, 1972–1979 Several European countries established a pegged exchange rate arrangement in April 1972. Their goal was to maintain their currencies within established limits of each other. This arrangement became known as the **snake**. The snake was difficult to maintain, however, and market pressure caused some currencies to move outside their established limits. Consequently, some members withdrew from the snake arrangement and some currencies were realigned.

European Monetary System (EMS), 1979–1992 In response to continued problems with the snake arrangement, the European Monetary System (EMS) was pushed into operation in March 1979. Under the EMS, exchange rates of member countries were held together within specified limits and were also tied to the European Currency Unit (ECU), a weighted average of exchange rates of the member countries. Each weight was determined by a member's relative gross national product and activity in intra-European trade. The currencies of most of these member countries were allowed to fluctuate by no more than 2.25 percent (6 percent for some currencies) from the initially established values.

The method of linking European currency values with the ECU was known as the **exchange rate mechanism** (**ERM**). The participating governments intervened in the foreign exchange markets to maintain the exchange rates within boundaries established by the ERM.

The European Monetary System forced participating countries to have comparable interest rates, since the currencies were not allowed to deviate much against each other and money would flow to the European country with the highest interest rate. In 1992, the German government increased its interest rates to prevent excessive spending and inflation. Other European governments were more concerned about stimulating their economies to lower their high unemployment levels, so they wanted to reduce interest rates. Yet these governments could not achieve their individual goals for a stronger economy as long as their interest rates were so strongly affected by German interest rates. As a result, some countries suspended their participation in the EMS. The governments of

European countries realized that a pegged system could work only if it were set permanently. This realization provided momentum for the single European currency (the euro), which was introduced in 1999 and is discussed later in this chapter.

Mexico's Pegged System, 1994 In 1994, Mexico's central bank used a special pegged exchange rate system that linked the peso to the U.S. dollar but allowed it to fluctuate against the dollar within a band. The Mexican central bank enforced the peso's value through frequent intervention. Mexico experienced a large balance-of-trade deficit in 1994, which may have reflected an overvalued peso that encouraged Mexican firms and consumers to buy an excessive amount of imports.

Many speculators based in Mexico recognized that the peso was being maintained at an artificially high level, and they speculated on its potential decline by investing their funds in the United States. They planned to liquidate their U.S. investments if and when the peso's value weakened so that they could convert the dollars from those investments into pesos at a favorable exchange rate.

By December 1994, there was substantial downward pressure on the peso. On December 20, 1994, Mexico's central bank devalued the peso by about 13 percent. Mexico's stock prices plummeted as many foreign investors sold their shares and withdrew their funds from Mexico in anticipation of further devaluation of the peso. On December 22, the central bank allowed the peso to float freely, and it declined by another 15 percent. This was the beginning of what became known as the Mexican peso crisis. In an attempt to discourage foreign investors from withdrawing their investments in Mexico's debt securities, the central bank increased interest rates. However, the higher rates increased the cost of borrowing for Mexican firms and consumers, thereby slowing economic growth.

Mexico's financial problems caused investors to lose confidence in their peso-denominated securities, so they liquidated those positions and transferred the funds to other countries. These actions put additional downward pressure on the peso.

In the four months after December 20, 1994, the value of the peso declined by more than 50 percent against the dollar. The Mexican crisis might not have occurred if the peso had been allowed to float throughout 1994, because in that case the peso could have gravitated toward its natural level. The crisis illustrates that central bank intervention may not be able to overcome market forces, which serves as an argument for letting a currency float freely.

China's Pegged Exchange Rate, 1996–2005 From 1996 until 2005, China's yuan was pegged to be worth about $.12 (8.28 yuan per U.S. dollar). During this period, the yuan's value would change daily against non-dollar currencies to the same extent that the dollar did. Because of the peg, the yuan's value remained at that level even as the United States experienced a trade deficit with China of more than $100 billion annually. Politicians in the United States argued that the yuan was being held at an artificially low level by the Chinese government. In response to the growing criticism, China revalued its yuan by 2.1 percent in July 2005. It also began allowing the yuan to float (subject to a .3 percent limit each day from the previous day's closing value) against a set of major currencies. In May 2007, China widened its band so that the yuan's value could float as much as .5 percent each day.

Even though the yuan is now allowed to float (within limits), the huge balance-of-trade deficit will not necessarily force appreciation of the yuan. Large net capital flows from China to the United States (due to purchases of U.S. securities) could offset the trade flows.

The yuan appreciated against the dollar by about 20 percent from 2005 until July 2008. However, from July 2008 until June 2010, China restricted the movements of the

yuan within very narrow boundaries. Although China did not publicly announce a change in its currency policy, the yuan was essentially pegged to the dollar over this period. In June 2010, China announced that it would allow the yuan to move more freely against the dollar in response to market forces, but it continued to impose limits on the extent of movement in the yuan's exchange rate. During the period 2010–2012, the yuan's volatility (as measured by the standard deviation of its monthly movements) was less than one-fifth of that exhibited by other widely traded currencies.

Venezuela's Pegged Exchange Rate, 2010 The government of Venezuela has historically pegged its currency (the bolivar) to the dollar, although there have been periodic devaluations. The most recent devaluation was on January 9, 2010, when Venezuela devalued the bolivar by 50 percent, from 2.15 per dollar (1 bolivar = $.465) to 4.3 per dollar (1 bolivar = $.232). It also set a different exchange rate for essential imports (such as medicine) of 2.6 bolivars (1 bolivar = $.38).

The new peg reduced the bolivar's value by half not only against the dollar but also against all other currencies as well.

EXAMPLE The euro was worth about $1.44 before January 9, 2010, which means that the euro was worth about 3.1 bolivars before the devaluation but was worth about 6.2 bolivars after the devaluation. Thus the devaluation caused the bolivar to be reduced by half of its previous value against all currencies as of January 9, 2010. Thereafter, consumers in Venezuela who buy nonessential imports had to pay twice as much for them. ●

This peg to the U.S. dollar maintains a constant exchange rate between the bolivar and the dollar, or at least until Venezuela changes the pegged exchange rate again. At the same time, however, the bolivar floats against all currencies that float against the dollar. So any non-dollar currency that appreciates against the dollar appreciates against the bolivar by the same degree.

Because a devalued bolivar makes foreign products more expensive for consumers in Venezuela, it should increase the consumption of locally produced products at the expense of foreign products. Furthermore, the extreme reduction in the bolivar's value should increase foreign demand for Venezuela's products. Note that two aims of the devaluation were to improve the country's economy and reduce its unemployment. Finally, since the Venezuelan government is a major exporter of oil and since those exports are denominated in dollars, each dollar of oil revenue yields double the amount of bolivars after the devaluation. This effect generates more revenue for the government of Venezuela.

However, a possible adverse effect of the devaluation is that the new exchange rate might eliminate foreign competition because foreign products become too expensive. That would allow local producers in Venezuela to increase their prices without much concern about losing customers to foreign firms, and that could increase inflation in Venezuela. The potential for higher inflation in Venezuela is a serious concern because it was 25 percent during 2009 (before the devaluation).

Currency Boards Used to Peg Currency Values A **currency board** is a system for pegging the value of the local currency to some other specified currency. The board must maintain currency reserves for all the currency that it has printed. This large amount of reserves may increase the ability of a country's central bank to maintain its pegged currency.

EXAMPLE Hong Kong has tied the value of its currency, the Hong Kong dollar, to the U.S. dollar (HK$7.80 = $1.00) since 1983. Every Hong Kong dollar in circulation is backed by a U.S. dollar in reserve. Economic conditions periodically cause an imbalance in the U.S. demand for Hong Kong dollars and the supply of Hong Kong dollars for sale in the foreign exchange market. Under these conditions,

the Hong Kong central bank must intervene by making transactions in the foreign exchange market that offset this imbalance. Because the central bank has successfully maintained the fixed exchange rate between the Hong Kong dollar and U.S. dollar, firms in both countries are more willing to do business with each other and are relatively unconcerned about exchange rate risk. ●

A currency board is effective only if investors believe that it will last. If investors expect that market forces will prevent a government from maintaining the local currency's exchange rate, then they will attempt to move their funds to countries in which the local currency is expected to be stronger. By withdrawing their funds from a country and convert the funds into a different currency, foreign investors put downward pressure on the local currency's exchange rate. If the supply of the currency for sale continues to exceed demand, the government will be forced to devalue its currency.

EXAMPLE In 1991, Argentina established a currency board that pegged the Argentine peso to the U.S. dollar. In 2002, Argentina was suffering from major economic problems, and its government was unable to repay its debt. Foreign investors and local investors began to transfer their funds to other countries because they feared that their investments would earn poor returns. These actions required the exchange of pesos into other currencies, such as the dollar, and caused an excessive supply of pesos for sale in the foreign exchange market. The government could not maintain the exchange rate of 1 peso = 1 dollar because the supply of pesos for sale exceeded the demand at that exchange rate. In March 2002, the government devalued the peso to 1 peso = $.71 (1.4 pesos per dollar). Even at this new exchange rate, the supply of pesos for sale exceeded the demand, so the Argentine government decided to let the peso's value float in response to market conditions rather than set the peso's value. A currency board that is expected to remain in place for a long period may reduce fears that the local currency will weaken, thereby encouraging investors to maintain their investments within the country. However, a currency board is effective only if the government can convince investors that the exchange rate will be maintained. ●

Interest Rates of Pegged Currencies A country that uses a currency board does not have complete control over its local interest rates because its rates must be aligned with the interest rates of the currency to which it is tied.

EXAMPLE Recall that the Hong Kong dollar is pegged to the U.S. dollar. If Hong Kong lowers its interest rates to stimulate its economy, then its interest rates will be lower than U.S. interest rates. Investors based in Hong Kong would thus be enticed to exchange Hong Kong dollars for U.S. dollars and invest in the United States, where interest rates are higher. Since the Hong Kong dollar is tied to the U.S. dollar, the investors could exchange the proceeds of their investment back into Hong Kong dollars at the end of the investment period without concern about exchange rate risk (since the exchange rate is fixed).

If the United States raises its interest rates, Hong Kong would be forced to raise its own interest rates (on securities with similar risk as those in the United States). Otherwise, investors in Hong Kong could invest their money in the United States and earn a higher rate. ●

Even though a country may not have control over its interest rate when it establishes a currency board, its interest rate may be more stable than if it did not have a currency board. A country's interest rate will move in tandem with the interest rate of the currency to which its own currency is tied. The interest rate may include a risk premium reflecting either default risk or the risk that the currency board will be discontinued.

Exchange Rate Risk of a Pegged Currency A currency that is pegged to another currency cannot be pegged against all other currencies. If a currency is pegged to the dollar, then it will move in tandem with the dollar against all other currencies.

EXAMPLE When the Argentine peso was pegged to the dollar (during the period 1991-2002), the dollar often strengthened against the Brazilian real and some other currencies in South America; therefore, the Argentine peso also strengthened against those currencies. Yet many exporting firms in Argentina were adversely affected by the strong Argentine peso because it made their products too expensive

for importers. Since Argentina's currency board has been eliminated, the Argentine peso is no longer forced to move in tandem with the dollar against other currencies. ●

Classification of Pegged Exchange Rates Exhibit 6.2 gives examples of countries that have pegged their country's exchange rate that of some other currency. Most of these currencies are pegged to the U.S. dollar or to the euro.

6-1e Dollarization

Dollarization is the replacement of a foreign currency with U.S. dollars. This process is a step beyond a currency board because it forces the local currency to be replaced by the U.S. dollar. Although dollarization and a currency board both attempt to peg the local currency's value, the currency board does not replace the local currency with dollars. The decision to use U.S. dollars as the local currency cannot be easily reversed because in that case the country no longer has a local currency.

EXAMPLE From 1990 to 2000, Ecuador's currency (the sucre) depreciated by about 97 percent against the U.S. dollar. The weakness of the currency caused unstable trade conditions, high inflation, and volatile interest rates. In an effort to stabilize trade and economic conditions, Ecuador replaced the sucre with the U.S. dollar as its currency in 2000. By November of that year, inflation had declined and economic growth had increased. Thus, it appeared that dollarization had favorable effects. ●

6-2 A Single European Currency

In 1992, the Maastricht Treaty called for the establishment of a single European currency. In January 1999, the euro replaced the national currencies of 11 European countries. Since then, six more countries converted their home currency to the euro. The countries that now use the euro as their home currency are Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain. The countries that participate in the euro make up a region that is referred to as the *eurozone*. These participating countries together produce more than 20 percent of the world's gross domestic product, which is more than that of the United States.

Exhibit 6.2 Countries with Pegged Exchange Rates and the Currencies to Which They Are Pegged

COUNTRY	NAME OF LOCAL CURRENCY	PEGGED TO
Bahamas	dollar	U.S. dollar
Barbados	dollar	U.S. dollar
Bermuda	dollar	U.S. dollar
Denmark	krone	euro
Hong Kong	dollar	U.S. dollar
Latvia	lat	euro
Lithuania	litas	euro
Saudi Arabia	riyal	U.S. dollar
Tunisia	dinar	Portfolio of currencies in which the euro represents about 67% of the weight
United Arab Emirates	dirham	U.S. dollar
Venezuela	bolivar	U.S. dollar

Denmark, Norway, Sweden, Switzerland, and the United Kingdom continue to use their own home currency. The ten countries in Eastern Europe (including the Czech Republic, Hungary, and Poland) that joined the European Union in 2004 are eligible to participate in the euro if they meet specific economic goals, including a maximum limit on their budget deficit.

Some Eastern European countries have not adopted the euro but have pegged their currency's value to the euro. This allows them to assess how their economy is affected while their currency's value moves in tandem with the euro against other currencies. However, they still have the flexibility to adjust their exchange rate system under this arrangement. If they ultimately adopt the euro as their currency, it would be more difficult for them to reverse that decision.

6-2a Monetary Policy in the Eurozone

The adoption of the euro subjects all participating countries to the same monetary policy. The **European Central Bank (ECB)** is based in Frankfurt and is responsible for setting monetary policy for all participating European countries. Its objective is to control inflation in the participating countries and to stabilize (within reasonable boundaries) the value of the euro with respect to other major currencies. Thus, the ECB's monetary goals of price stability and currency stability are similar to those of central banks in many other countries around the world, with the difference that these goals concern a group of countries rather than a single country. It could be argued that a set of countries with the same currency and monetary policy will achieve greater economic stability than if each of these countries had its own currency and monetary policy.

6-2b Impact on Firms in the Eurozone

As a result of a single currency in the eurozone, prices of products are now more comparable among European countries. Thus, firms can more easily determine where they can purchase products at the lowest cost. In addition, firms can engage in international trade within the eurozone without incurring foreign exchange transactions costs because they use the same currency. The use of a single currency also encourages more long-term international trade arrangements between firms within the eurozone because they no longer have to worry about exposure to future exchange rate movements.

Firms in the eurozone may face more pressure to perform well because they can be measured against all other firms in the same industry throughout the participating countries, not just within their own country. Therefore, these firms are typically more focused on meeting various performance goals.

WEB

www.ecb.int/home/html/index.en.html
Information on the euro and on monetary policy as conducted by the European Central Bank.

6-2c Impact on Financial Flows in the Eurozone

A single European currency forces the interest rate offered on government securities to be similar across the participating European countries. Any discrepancy in rates would encourage investors within these countries to invest in the currency with the highest rate, which would realign the interest rates among them. However, the rate may still vary between two government securities with the same maturity if they exhibit different levels of credit risk.

Bond investors who reside in the eurozone can now invest in bonds issued by governments and corporations in these countries without concern about exchange rate risk, provided the bonds are denominated in euros. The yields offered on bonds within the eurozone need not be similar, even though they are now denominated in the same currency, because the credit risk may still be higher for issuers in a particular country.

Stock prices are now more comparable among the European countries within the eurozone because they are denominated in the same currency. Investors in the participating European countries are now able to invest in stocks in these countries without concern about exchange rate risk. Thus, there is more cross-border investing than there was in the past.

Because stock market prices are influenced by expectations of economic conditions, the stock prices among European countries may become more highly correlated if the economies in these countries become more highly correlated. Investors from other countries who invest in Europe may achieve less diversification than in the past because of the integration and given that exchange rate effects will be the same for all markets whose stocks are denominated in euros.

6-2d Exposure of Countries within the Eurozone

It may be argued that a single currency and monetary policy among many countries can create more stable economic conditions because the system is larger and thus may be less susceptible to outside shocks. However, a single European monetary policy prevents any individual European country from solving local economic problems with its own unique policy. Any *monetary* policy used in the eurozone during a particular period may enhance conditions in some countries while adversely affecting conditions in other countries. For example, a policy intended to increase interest rates and reduce economic growth might be beneficial to a country with a strong economy that is most concerned about inflation but could adversely affect a country experiencing weak economic conditions. However, each participating country is still able to apply its own *fiscal* policy (i.e., decisions on taxing and government expenditures) to correct economic conditions.

6-2e Impact of Crises within the Eurozone

One argument for the adoption of the euro is that the economies of the participating countries will become more integrated, which means that favorable conditions in some eurozone countries will be transmitted to the other participating countries. However, the same rationale suggests that unfavorable conditions could likewise be transmitted. When a country within the eurozone experiences a crisis, it may affect the economic conditions of the other participating countries because they all rely on the same currency and same monetary policy.

EXAMPLE Greece is one of the European countries that uses the euro as its local currency. In the spring of 2010, it experienced weak economic conditions and a large increase in its government budget deficit. Its debt rating was lowered substantially by rating agencies, and at one point Greece was paying about 11 percent on its debt (versus 4 percent for other countries in the eurozone). As the government of Greece reduced spending to correct the deficit, its economy weakened.

Multinational corporations and investors feared that the euro might weaken and began to move their investments out of euros. They liquidated their investments and exchanged euros for other currencies so that they could invest outside of the eurozone while the Greece crisis continued. These actions resulted in a large supply of euros exchanged for other currencies in the foreign exchange market, which led to a substantial decline in the euro's value: by nearly 20 percent from December 2009 to June 2010. During this period, the volume of investing by MNCs and other investors in eurozone countries declined because of the weak euro, which was attributed to the Greek crisis. Many of these countries rely on such investments to stimulate their economies. The eurozone countries could therefore argue that, if they had not adopted the euro as their currency, they would have been less exposed to the Greece crisis. ●

WEB

www.bis.org/cbanks.htm
Links to the Web sites of central banks around the world; some of these sites are in English.

Lessons from Eurozone Crises Since the Greece crisis, Portugal and Spain have also experienced crises while Italy and Ireland have been the subject of much attention

concerning their exposure to potential crises. Although each country's banking crisis is unique, there are some general conceptual lessons from the eurozone crises; these lessons are summarized next.

First, the banking industry in the eurozone is integrated because many of the banks rely on each other for funding. Consequently, the financial problems of one bank can easily spread to affect other banks in the eurozone.

Second, banks in the eurozone frequently engage in loan participations, which causes many banks across the eurozone to be exposed whenever borrowers are unable to make timely loan repayments. Thus, if there are weak economic conditions in any eurozone country that reduce the ability of its companies to repay loans, then banks throughout the eurozone may be affected.

Third, given these potential contagion effects, news about adverse conditions in any single eurozone country can trigger concerns that the problems will spread to other member countries. These concerns tend to increase the risk of securities that are traded in the eurozone. In response, institutional investors around the world may well discontinue their investments (purchases of stocks, bonds, and other securities) in the eurozone if they anticipate that one European country's problems might spread throughout the eurozone. The result is a decline in prices of securities in the eurozone, which reinforces the fear within financial markets.

Fourth, eurozone country governments do not have their own monetary policy and so must rely on fiscal policy (e.g., spending more and lowering taxes) when they experience serious financial problems. Although this type of fiscal policy can stimulate a country's economy in the short run, it results in a larger government budget deficit and could lead to concerns that the government will be unable to repay its debt in the future. In this event, the large financial institutions that normally serve as creditors to the governments of eurozone countries may no longer be willing to provide credit.

Fifth, eurozone governments rely heavily on banks within the eurozone for credit, issuing bonds that are purchased by the banks. Because banks are major creditors to their government, their performance is highly dependent on whether that government repays its debt owed to bank creditors. When a government in the eurozone is unable to obtain sufficient credit to cover its budget deficit, it may need to rely on the European Central Bank for funds. The ECB may be willing to provide credit because it recognizes the possible financial damage to the country, and to the rest of the eurozone, if the country defaults on its existing debt.

ECB Role in Resolving Economic Crises Although the European Central Bank's role was originally conceived to be setting monetary policy, in recent years the bank's role has expanded to include providing credit for eurozone countries that are experiencing a financial crisis. However, the ECB faces a dilemma when providing credit. In freely providing credit to any country whose federal budget deficit is excessive, the bank may be signalling that countries can obtain favorable credit terms irrespective of their budgets. For this reason, when providing credit to a country the ECB imposes restrictions intended to help resolve the country's budget deficit problems over time. In particular, before lending any funds the ECB may require the receiving government to correct its budget deficit by implementing so-called austerity measures as higher tax rates and reduced government spending.

When the ECB can provide credit based on austerity conditions that are agreeable to the borrowing country, the result is usually a calming effect on financial markets throughout the eurozone. Such credit reduces the fear of a government default on its existing loans, and increases the likelihood that the government will resolve its economic problems. It also reduces the uncertainty surrounding the eurozone and thus encourages

institutional investors around the world to invest in that region. The euro's value rises in response to increased capital flows into the eurozone.

However, the austerity conditions could further damage the country's economy: less spending by the government normally weakens an economy, and raising taxes reduces disposable income. A government that is unwilling to accept the ECB austerity conditions will raise concerns that the government will default on all of its existing loans, which would induce contagion effects throughout the eurozone. There may also be concerns that the government will exit the eurozone and possibly lead other countries to exit as well. Consequently, financial market participants may anticipate more uncertainty in the eurozone and avoid euro-denominated investments.

Because of the trade-off faced by the ECB, any decision will likely lead to criticism. Some critics argue that the ECB should not impose austerity conditions so that countries experiencing financial problems can receive not only loans but also the proper stimulus they need. Other critics argue that the ECB's role should be limited to monetary policy and that the bank should not be providing credit. Most central banks face similar trade-offs, but the differences are more pronounced in the eurozone because it contains so many countries and their economic situations vary. Therefore, a particular policy decision may help some countries in the eurozone at the expense of others.

6-2f Impact on a Country That Abandons the Euro

If a country's government believes that it does not benefit from participation in the euro, it might seek to abandon using the euro as its home currency. The subject of abandoning the euro has been discussed most often with reference to Greece, but other countries could find it relevant in the future.

A eurozone country that is experiencing budget deficit problems does not have direct control of the currency's value, since there are many other countries that participate in the euro. If the country had its own currency then it might be able to set its exchange rate low enough that its currency (and hence its exports) become inexpensive to potential importers, which would help stimulate the economy. However, a weak home currency is not a perfect cure because it can cause higher inflation (as explained later in the chapter). In addition, if the country still planned to repay its debt, then it would now have to remit in a devalued home currency and so larger payments would be required to cover existing debt.

In addition to these economic implications, there would also be political implications if a country abandoned the eurozone. That country might be expelled from the European Union, and its international trade with some European countries would almost certainly be reduced. If the country also decided to default on its debt, then other restrictions might be imposed by the governments of countries in which major creditors are based—for example, restrictions on any new credit provided to the government that defaulted. At the very least, some creditors would refuse to fund any government that defaulted on its debt.

6-2g Impact of Abandoning the Euro on Eurozone Conditions

Greece accounts for only a small portion of eurozone production, so one might suppose that its abandoning the euro would have little impact on that currency's value. However, Greece's abandoning the euro might signal the possible abandonment by other countries. If MNCs and large institutional investors outside of the eurozone feared that many countries would eventually abandon the euro, then they may not be willing to invest any more funds in the eurozone because they might fear the collapse of the euro.

Moreover, they may be concerned that existing investments in the eurozone may perform poorly when the proceeds are converted into their home currency. This concern might encourage investors to sell their assets in the eurozone now, before the euro weakens. Thus, a fear of future declines in the value of euro-denominated assets could cause the euro to weaken now.

In general, countries can more easily attract foreign investment from MNCs and large institutional investors when their local currency is expected to be stable. When the euro was created, the large number of participants in the eurozone probably reduced concerns about currency instability and so attracted more foreign investment in eurozone countries than if each had their own local currency. Yet because there has been a substantial amount of foreign investment in the eurozone, any concerns about the euro can now cause a much greater flow of funds out of Europe in the event that MNCs and institutional investors decide to withdraw their investments.

Furthermore, the sale of assets in the eurozone could lead to their value being reduced (apart from the currency effect). The fear that such conditions could ensue might even lead MNCs and large institutional investors *based in the eurozone* to sell their holdings of euro-based assets and move their money to a country whose currency is expected to be more stable. Such actions would place downward pressure on the value of these assets in the eurozone.

However, some critics contend that the mere threat to abandon the euro creates more problems for the eurozone than would any actual abandonment. Countries that want additional credit under favorable terms might use the threat of abandonment to obtain more funding. Critics of ECB loans contend that the creditors are just throwing good money (new funding) after bad money (credit that has still not been repaid).

6-3 Government Intervention

Each country has a central bank that may intervene in the foreign exchange markets to control its currency's value. In the United States, for example, the central bank is the Federal Reserve System (the Fed). Central banks have other duties besides intervening in the foreign exchange market. In particular, they attempt to control the growth of the money supply in their respective countries in a way that will maintain economic growth and low inflation.

6-3a Reasons for Government Intervention

The degree to which the home currency is controlled, or "managed," varies among central banks. Central banks commonly manage exchange rates for three reasons:

- to smooth exchange rate movements,
- to establish implicit exchange rate boundaries, and
- to respond to temporary disturbances.

Smoothing Exchange Rate Movements If a central bank is concerned that its economy will be affected by abrupt movements in the home currency's value, then it may attempt to smooth (stabilize) those currency movements over time. These actions may render business cycles less volatile. Smoothing currency movements may also reduce fears in the financial markets as well as speculative activity that could cause a major decline in a currency's value. So in reducing exchange rate uncertainty, the central bank hopes to encourage international trade.

Establishing Implicit Exchange Rate Boundaries Some central banks attempt to maintain their home currency rates within some unofficial, or implicit, boundaries.

Analysts are often quoted as forecasting that a currency will not fall below (or rise above) some benchmark value because the central bank would intervene to prevent that from occurring. In fact, the Federal Reserve periodically intervenes to reverse the U.S. dollar's upward or downward momentum.

Responding to Temporary Disturbances In some cases, a central bank may intervene to insulate a currency's value from a temporary disturbance. Note that the stated objective of the Fed's intervention policy is to counter disorderly market conditions.

EXAMPLE News that oil prices might rise could cause expectations of a future decline in the value of the Japanese yen because Japan exchanges yen for U.S. dollars when it purchases oil from oil-exporting countries. Foreign exchange market speculators may exchange yen for dollars in anticipation of this decline. Central banks may therefore intervene to offset the immediate downward pressure on the yen caused by such market transactions. ●

Several studies have found that government intervention does not have a permanent effect on exchange rate movements. To the contrary, in many cases the intervention is overwhelmed by market forces. In the absence of intervention, however, currency movements would be even more volatile.

6-3b Direct Intervention

To force the dollar to depreciate, the Fed can intervene directly by exchanging dollars that it holds as reserves for other foreign currencies in the foreign exchange market. By "flooding the market with dollars" in this manner, the Fed puts downward pressure on the dollar. If the Fed wants to strengthen the dollar then it can exchange foreign currencies for dollars in the foreign exchange market, thereby putting upward pressure on the dollar.

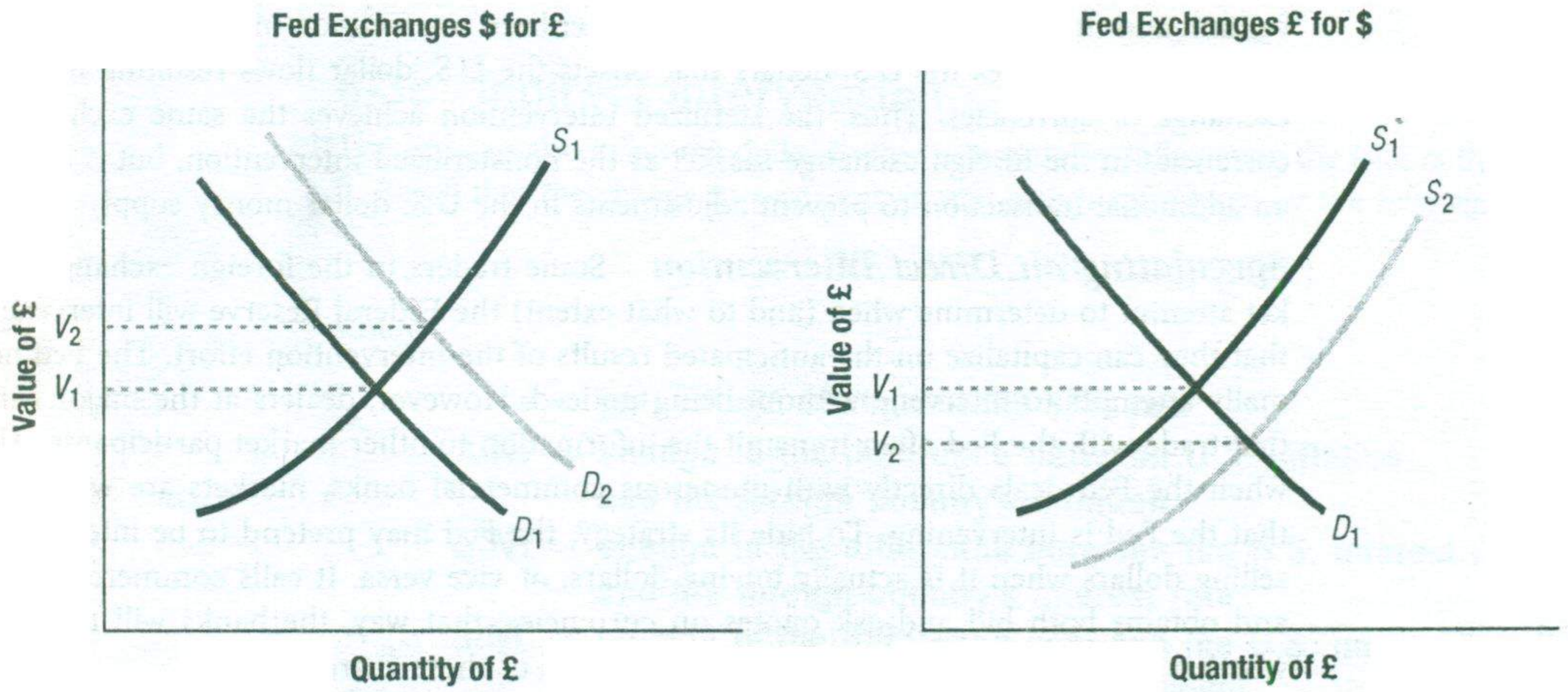
WEB
www.ny.frb.org/markets/foreignex.html
Information on the recent direct intervention in the foreign exchange market by the Federal Reserve Bank of NewYork.

The effects of direct intervention on the value of the British pound are illustrated in Exhibit 6.3. To strengthen the pound's value (or to weaken the dollar), the Fed exchanges dollars for pounds; this causes an outward shift in the demand for pounds in the foreign exchange market (as shown in the left-hand graph). Conversely, to weaken the pound's value (or to strengthen the dollar), the Fed exchanges pounds for dollars; this causes an outward shift in the supply of pounds for sale in the foreign exchange market (as shown in the right-hand graph).

Reliance on Reserves The potential effectiveness of a central bank's direct intervention is influenced by the amount of reserves it can use. For example, the central bank of China has a substantial amount of reserves that it can use to intervene in the foreign exchange market. Thus, it can more effectively use direct intervention than many other Asian countries. If the central bank has a low level of reserves, it may not be able to exert much pressure on the currency's value; in that case, market forces would likely overwhelm its actions.

In the first six months of 2012, the Indian rupee declined against the dollar by about 20 percent. The Reserve Bank of India (the central bank) responded during this period by exchanging billions of dollars in exchange for rupees. However, the central bank's efforts were ineffective because market forces overwhelmed the direct intervention. The central bank of India holds a much smaller amount of reserves than China's central bank, and investors with funds invested in India seemed to anticipate that the direct intervention would not prevent the rupee from depreciating. Hence they liquidated their investments and fled the currency by exchanging rupees in exchange for dollars, which more than offset the actions of the Reserve Bank of India.

Exhibit 6.3 Effects of Direct Central Bank Intervention in the Foreign Exchange Market



Frequency of Intervention As foreign exchange activity has grown, central bank intervention has become less effective. The volume of foreign exchange transactions on a single day now exceeds the combined values of reserves at all central banks. Consequently, the number of direct interventions has declined. In 1989, for example, the Fed intervened on 97 different days. Since then, the Fed has not intervened on more than 20 days in any year.

Coordinated Intervention Direct intervention is more likely to be effective when it is coordinated by several central banks. For example, if central banks agree that the euro's market value in dollars is too high, then they can engage in coordinated intervention in which they all use euros from their reserves to purchase dollars in the foreign exchange market. However, coordinated intervention requires the central banks to agree that a particular currency's value needs to be adjusted. Suppose a few central banks thought the euro's value was too high but that the ECB did not agree; in that case, the central banks would have to work out their differences before considering direct intervention in the foreign exchange market.

Nonsterilized versus Sterilized Intervention When the Fed intervenes in the foreign exchange market without adjusting for the change in the money supply, it is engaging in a **nonsterilized intervention**. For example, if the Fed exchanges dollars for foreign currencies in the foreign exchange markets in an attempt to strengthen foreign currencies (weaken the dollar), the dollar money supply increases.

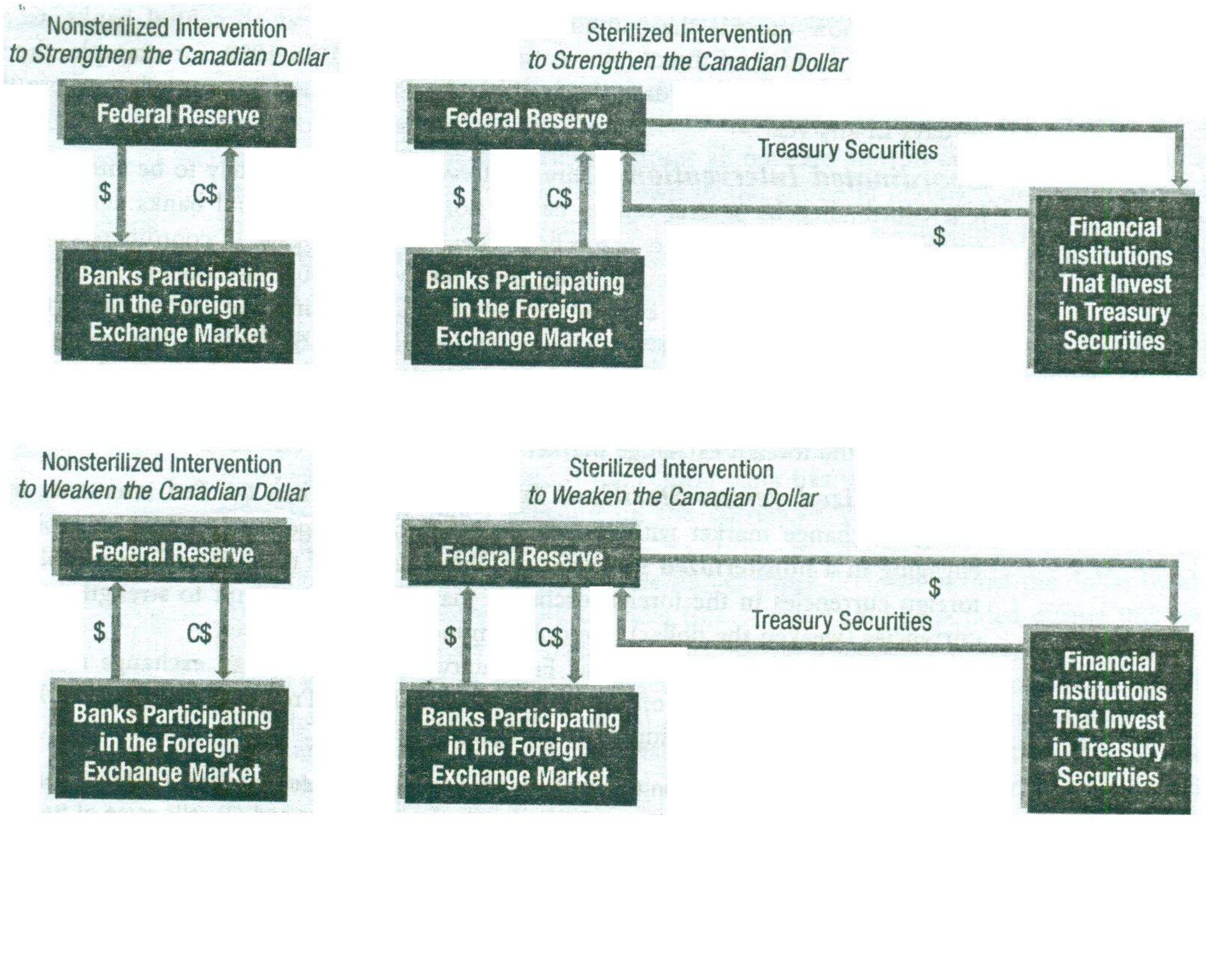
In a **sterilized intervention**, the Fed intervenes in the foreign exchange market and simultaneously engages in offsetting transactions in the Treasury securities markets. As a result, the dollar money supply is unchanged.

EXAMPLE If the Fed desires to strengthen foreign currencies (weaken the dollar) without affecting the dollar money supply, then it (1) exchanges dollars for foreign currencies and (2) sells some of its holdings of Treasury securities for dollars. The net effect is an increase in investors' holdings of Treasury securities and a decrease in bank foreign currency balances. ●

The difference between nonsterilized and sterilized intervention is illustrated in Exhibit 6.4. In the upper portion of the exhibit, the Federal Reserve attempts to strengthen the Canadian dollar; in the lower portion, the Federal Reserve attempts to weaken the Canadian dollar. For each scenario, the diagram on the left shows the nonsterilized intervention and the diagram on the right shows a sterilized intervention involving an exchange of Treasury securities for U.S. dollars that offsets the U.S. dollar flows resulting from the exchange of currencies. Thus, the sterilized intervention achieves the same exchange of currencies in the foreign exchange market as the nonsterilized intervention, but it involves an additional transaction to prevent adjustments in the U.S. dollar money supply.

Speculating on Direct Intervention Some traders in the foreign exchange market attempt to determine when (and to what extent) the Federal Reserve will intervene so that they can capitalize on the anticipated results of the intervention effort. The Fed normally attempts to intervene without being noticed. However, dealers at the major banks that trade with the Fed often transmit the information to other market participants. Also, when the Fed deals directly with numerous commercial banks, markets are well aware that the Fed is intervening. To hide its strategy, the Fed may pretend to be interested in selling dollars when it is actually buying dollars, or vice versa. It calls commercial banks and obtains both bid and ask quotes on currencies; that way, the banks will not know whether the Fed is considering purchases or sales of these currencies.

Exhibit 6.4 Forms of Central Bank Intervention in the Foreign Exchange Market



Intervention strategies vary among central banks. Some arrange for one large order when they intervene; others use several smaller orders equivalent to $5 million or $10 million each. Even if traders determine the extent of central bank intervention, they still cannot know with certainty what impact it will have on exchange rates.

6-3c Indirect Intervention

The Fed can also affect the dollar's value indirectly by influencing the factors that determine it. Recall that the 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 difference between U.S. inflation and the foreign country's inflation
ΔINT = change in the difference between the U.S. interest rate and the foreign country's interest rate
ΔINC = change in the difference 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

The central bank can influence all of these variables, which in turn can affect the exchange rate. Because these variables will probably have a more lasting impact on a spot rate than would direct intervention, a central bank may prefer to intervene indirectly by influencing these variables. Although the central bank can affect all of the variables, it is likely to focus on interest rates or government controls when using indirect intervention.

Government Control of Interest Rates When central banks of countries increase or reduce interest rates, this may have an indirect effect on the values of their currencies.

EXAMPLE When the Federal Reserve reduces U.S. interest rates, U.S. investors may transfer funds to other countries to capitalize on higher interest rates. This action reflects an increase in demand for other currencies and places upward pressure on these currencies against the dollar.

Conversely, if the Fed raises U.S. interest rates then foreign investors may transfer funds to the United States to capitalize on higher U.S. interest rates (especially if expected inflation in the United States is relatively low). This action reflects an increase in the supply of foreign currencies to be exchanged for dollars in the foreign exchange market, and it places downward pressure on those currencies against the dollar. ●

If the country experiences a currency crisis, then its central bank may raise interest rates in order to prevent a major flow of funds out of the country.

EXAMPLE Russia attracts a large amount of foreign funds from investors who want to capitalize on Russia's growth. However, when the Russian economy weakens, foreign investors flood the foreign exchange market with Russian rubles for other currencies so that they can transfer their money to other countries. The Russian central bank may raise interest rates so that foreign investors would earn a higher yield on securities if they left their funds in Russia. However, if investors still anticipate a major withdrawal of funds from the country, they will rush to sell their rubles before the value of its currency falls. These actions by investors cause the ruble's value to decline substantially. ●

The preceding example reflects the situation of many countries that experienced a currency crisis in the past, including Russia, many Southeast Asian countries, and many

countries in Latin American. In most cases, the central bank's indirect intervention failed to prevent the withdrawals of funds and also increased the financing rate faced by the country's firms. This can cause the economy to weaken further.

Government Use of Foreign Exchange Controls Some governments attempt to use foreign exchange controls (such as restrictions on the exchange of the currency) as a form of indirect intervention to maintain the exchange rate of their currency. China has historically used foreign exchange restrictions to control the yuan's exchange rate, but has partially removed these restrictions in recent years.

Intervention Warnings A central bank may announce that it is strongly considering intervention. Such announcements may be intended to warn speculators who are taking positions in a currency that benefit from appreciation in its value. An intervention warning could discourage additional speculation and might even encourage some speculators to unwind (liquidate) their existing positions in the currency. In this case there would be a large supply of that currency for sale in the foreign exchange market, which would tend to reduce its value. Thus, the central bank might more effectively achieve its goal (to reduce the local currency's value) with an intervention warning than with actual intervention.

6-4 Intervention as a Policy Tool

The government of any country may consider influencing the value of its home currency in order to improve its economy. It may attempt to weaken its currency under some conditions and strengthen it under others. In essence, the exchange rate becomes a tool, like tax laws and the money supply that the government can use to achieve its desired economic objectives.

6-4a Influence of a Weak Home Currency

A weak home currency can stimulate foreign demand for products. A weak dollar, for example, can substantially boost U.S. exports and U.S. jobs; in addition, it may also reduce U.S. imports. Exhibit 6.5 shows how the Federal Reserve can use either direct or indirect intervention to affect the value of the dollar in order to stimulate the U.S. economy. When the Fed reduces interest rates as a form of indirect intervention, it may stimulate the U.S. economy by reducing not only the dollar's value but also the financing costs of firms and individuals in the United States.

Although a weak currency can reduce unemployment at home, it can lead to higher inflation. A weak dollar makes U.S. imports more expensive, thereby creating a competitive advantage for U.S. firms that sell their products in the United States. Some U.S. firms may increase their prices when the competition from foreign firms is reduced, which results in higher U.S. inflation.

6-4b Influence of a Strong Home Currency

A strong home currency can encourage consumers and corporations of that country to buy goods from other countries. This situation intensifies foreign competition and forces domestic producers to refrain from increasing prices. Therefore, the country's overall inflation rate should be lower if its currency is stronger, other things being equal.

Exhibit 6.6 shows how the Federal Reserve can use either direct or indirect intervention to affect the dollar's value and thus reduce U.S. inflation. When the Fed increases interest rates as a form of indirect intervention, it may reduce U.S. inflation by increasing not only the dollar's value but also the cost of financing. Higher U.S. interest rates result

Exhibit 6.5 How Central Bank Intervention Can Stimulate the U.S. Economy

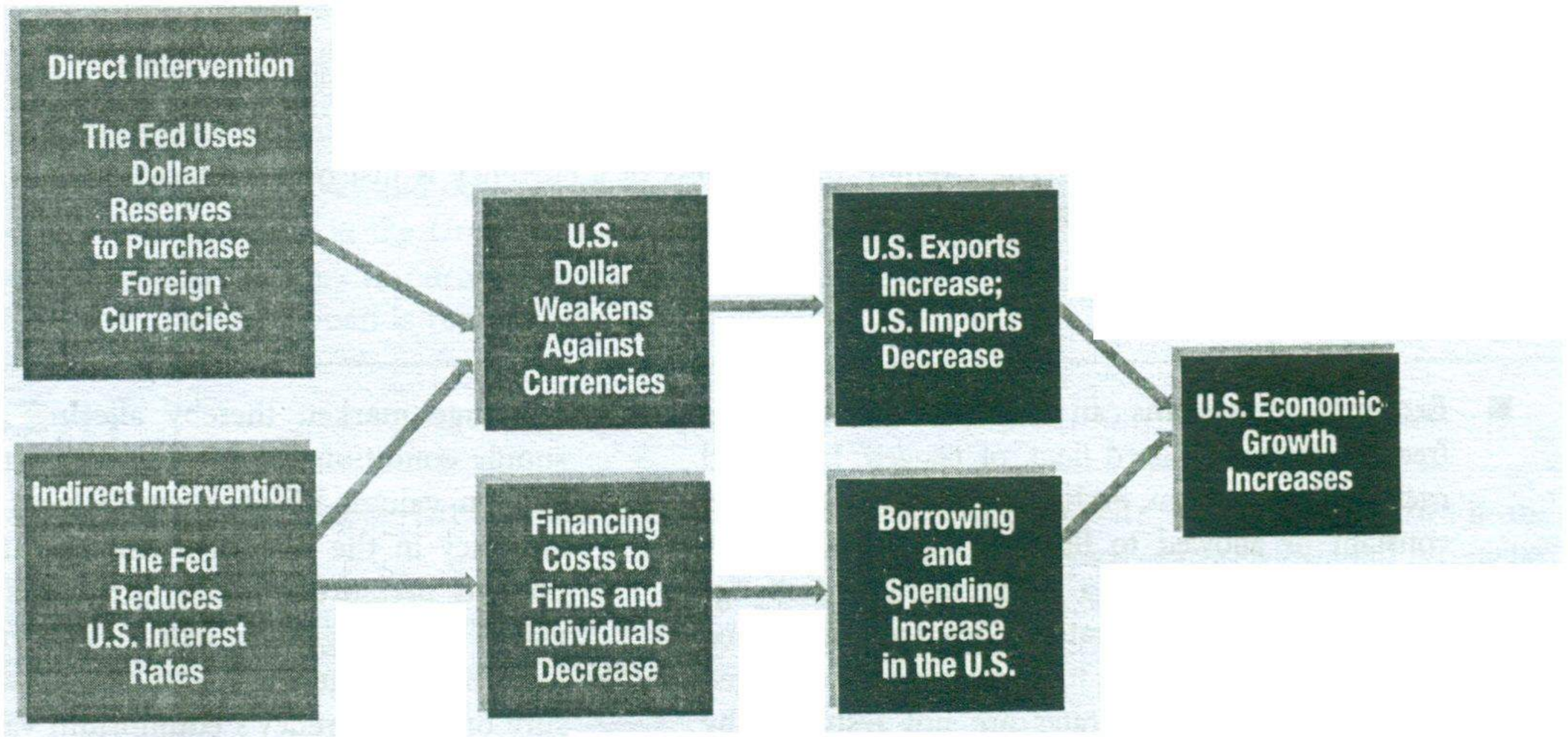
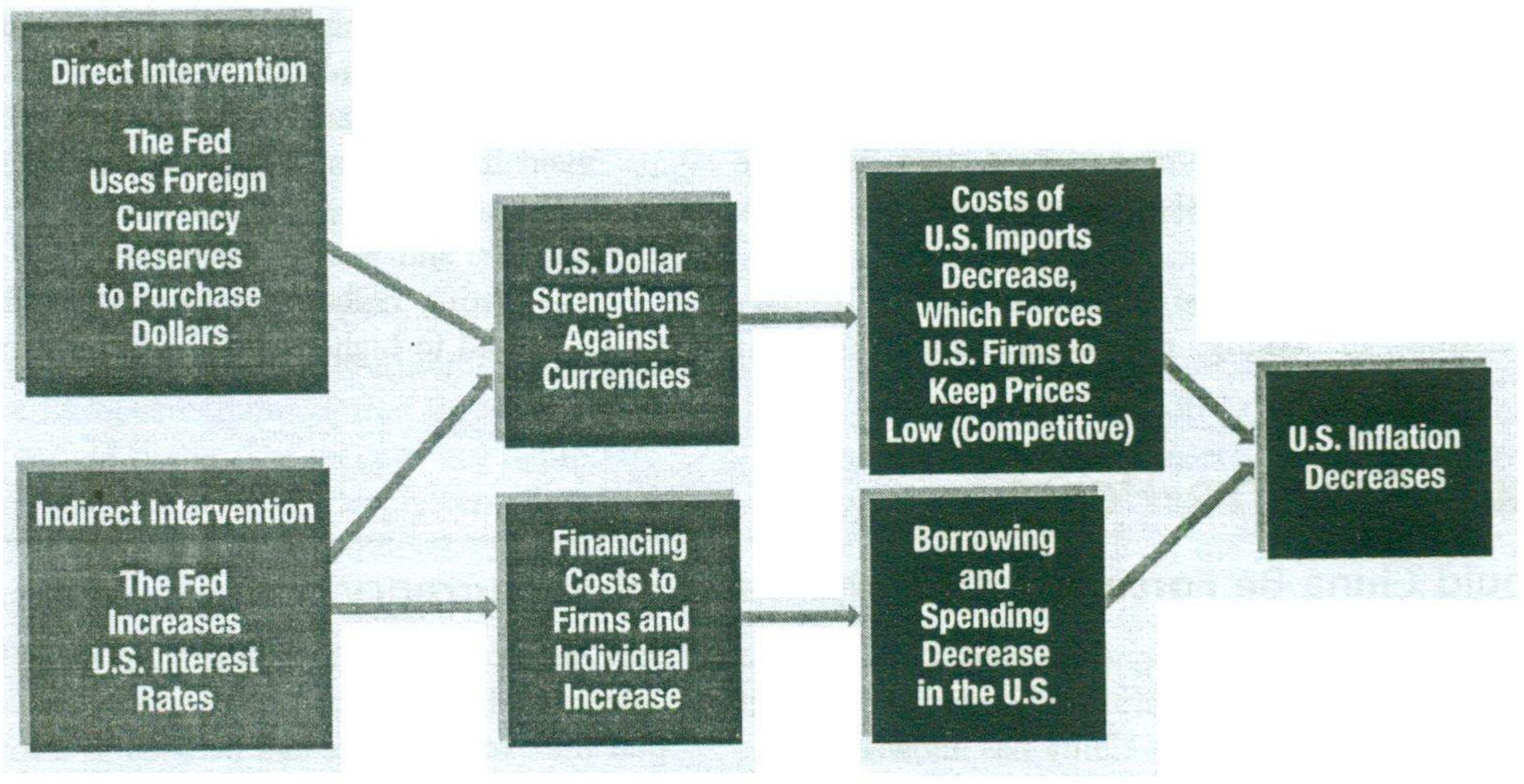


Exhibit 6.6 How Central Bank Intervention Can Reduce Inflation



in higher financing costs to firms and individuals in the United States, which tends to reduce the amount of borrowing and spending there. Because inflation is sometimes caused by excessive economic growth (excessive demand for products and services), the Fed may be able to reduce inflation indirectly when its policies reduce economic growth.

Although a strong currency may cure high inflation, it may also increase home unemployment because foreign products become less expensive. A currency's ideal value depends on the perspective of the country and the officials who must make such decisions. The strength or weakness of a currency is just one of many factors that influence a country's economic conditions.

SUMMARY

- Exchange rate systems can be classified as fixed rate, freely floating, managed float, or pegged. In a fixed exchange rate system, exchange rates are either held constant or allowed to fluctuate only within very narrow boundaries. In a freely floating exchange rate system, exchange rate values are determined by market forces without intervention. In a managed float system, exchange rates are not restricted by boundaries but are subject to government intervention. In a pegged exchange rate system, a currency's value is pegged to a foreign currency (or unit of account) and moves in line with that currency (or unit) against other currencies.
- Numerous European countries use the euro as their home currency. The single currency allows international trade among firms in the eurozone without foreign exchange expenses and without concerns about future exchange rate movements. However, countries that participate in the euro do not have complete control of their monetary policy because a single policy is applied to all countries in the eurozone. In addition, being part of the eurozone may render some countries more susceptible to a crisis occurring in some other eurozone country.
- Governments can use direct intervention by purchasing or selling currencies in the foreign exchange market, thereby altering demand and supply conditions and hence the currencies' equilibrium values. When a government purchases a currency in the foreign exchange market, it puts upward pressure on that currency's equilibrium value. When a government sells a currency in the foreign exchange market, it puts downward pressure on the currency's equilibrium value.

  Governments can use indirect intervention by influencing the economic factors that affect equilibrium exchange rates. A common form of indirect intervention is to increase interest rates in order to attract more international capital flows, which may cause the local currency to appreciate. However, indirect intervention is not always effective.
- When the Fed intervenes to weaken the U.S. dollar, the weaker dollar stimulates the U.S. economy by reducing U.S. demand for imports and increasing foreign demand for U.S. exports. Thus, the weak dollar tends to increase U.S. employment but can also increase U.S. inflation. When government intervention strengthens the U.S. dollar, the stronger dollar increases the U.S. demand for imports and so intensifies foreign competition. The strong dollar can reduce U.S. inflation but may lead to higher levels of U.S. unemployment.

POINT COUNTER-POINT

Should China Be Forced to Alter the Value of Its Currency?

Point U.S. politicians frequently suggest that China needs to increase the value of the Chinese yuan against the U.S. dollar, even though China has allowed the yuan to float (within boundaries). The U.S. politicians claim that the yuan is the cause of the large U.S. trade deficit with China. This issue is periodically raised not only with currencies tied to the dollar but also with currencies that have a floating rate. Some critics argue that the exchange rate can be used as a form of trade protectionism. That is, a country can discourage or prevent imports and encourage exports by keeping the value of its currency artificially low.

Counter-Point China might counter that its large balance-of-trade surplus with the United States has been due to the difference in prices between the two countries and that it should not be blamed for the high U.S. prices. It might argue that the U.S. trade deficit can be partiallyattributed to the very high prices in the United States, which are necessary to cover the excessive compensation for executives and other employees at U.S. firms. The high prices in the United States encourage firms and consumers to purchase goods from China. Even if China's yuan is revalued upward, this does not necessarily mean that U.S. firms and consumers will purchase U.S. products. They may shift their purchases from China to Indonesia or other low-wage countries rather than buy more U.S. products. Thus, the underlying dilemma is not China but any country that has lower costs of production than the United States.

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. Explain why it would be virtually impossible to set an exchange rate between the Japanese yen and the U.S. dollar and to maintain a fixed exchange rate.

2. Assume the Federal Reserve believes that the dollar should be weakened against the Mexican peso. Explain how the Fed could use direct and indirect intervention to weaken the dollar's value with respect to the peso. Assume that future inflation in the United States is expected to be low, regardless of the Fed's actions.

3. Briefly explain why the Federal Reserve may attempt to weaken the dollar.

4. Assume the country of Sluban ties its currency (the slu) to the dollar and the exchange rate will remain fixed. Sluban has frequent trade with countries in the eurozone and the United States. All traded products can easily be produced by all the countries, and the demand for these products in any country is very sensitive to the price because consumers can shift to wherever the products are relatively cheap. Assume that the euro depreciates substantially against the dollar during the next year.

a. What is the likely effect (if any) of the euro's exchange rate movement on the volume of Sluban's exports to the eurozone? Explain.

b. What is the likely effect (if any) of the euro's exchange rate movement on the volume of Sluban's exports to the United States? Explain.

QUESTIONS AND APPLICATIONS

1. Exchange Rate Systems Compare and contrast the fixed, freely floating, and managed float exchange rate systems. What are some advantages and disadvantages of a freely floating exchange rate system versus a fixed exchange rate system?

2. Intervention with Euros Assume that Belgium, one of the European countries that uses the euro as its currency, would prefer that its currency depreciate against the U.S. dollar. Can it apply central bank intervention to achieve this objective? Explain.

3. Direct Intervention How can a central bank use direct intervention to change the value of a currency? Explain why a central bank may desire to smooth exchange rate movements of its currency.

4. Indirect Intervention How can a central bank use indirect intervention to change the value of a currency?

5. Intervention Effects Assume there is concern that the United States may experience a recession. How should the Federal Reserve influence the dollar to prevent a recession? How might U.S. exporters react to this policy (favorably or unfavorably)? What about U.S. importing firms?

6. Currency Effects on Economy What is the impact of a weak home currency on the home economy, other things being equal? What is the impact of a strong home currency on the home economy, other things being equal?

7. Feedback Effects Explain the potential feedback effects of a currency's changing value on inflation.

8. Indirect Intervention Why would the Fed's indirect intervention have a stronger impact on some currencies than others? Why would a central bank's

indirect intervention have a stronger impact than its direct intervention?

9. Effects on Currencies Tied to the Dollar The Hong Kong dollar's value is tied to the U.S. dollar. Explain how the following trade patterns would be affected by the appreciation of the Japanese yen against the dollar: (a) Hong Kong exports to Japan and (b) Hong Kong exports to the United States.

10. Intervention Effects on Bond Prices U.S. bond prices are normally inversely related to U.S. inflation. If the Fed planned to use intervention to weaken the dollar, how might bond prices be affected?

11. Direct Intervention in Europe If most countries in Europe experience a recession, how might the European Central Bank use direct intervention to stimulate economic growth?

12. Sterilized Intervention Explain the difference between sterilized and nonsterilized intervention.

13. Effects of Indirect Intervention Suppose that the government of Chile reduces one of its key interest rates. The values of several other Latin American currencies are expected to change substantially against the Chilean peso in response to the news.

a. Explain why other Latin American currencies could be affected by a cut in Chile's interest rates.

b. How would the central banks of other Latin American countries be likely to adjust their interest rates? How would the currencies of these countries respond to the central bank intervention?

c. How would a U.S. firm that exports products to Latin American countries be affected by the central bank intervention? (Assume the exports are denominated in the corresponding Latin American currency for each country.)

14. Freely Floating Exchange Rates Should the governments of Asian countries allow their currencies to float freely? What would be the advantages of letting their currencies float freely? What would be the disadvantages?

15. Indirect Intervention During the Asian crisis (see Appendix 6 at the end of this chapter), some Asian central banks raised their interest rates to prevent their currencies from weakening. Yet, the currencies weakened anyway. Offer your opinion as to why the central banks' efforts at indirect intervention did not work.

Advanced Questions

16. Monitoring the Fed's Interventions Why do foreign market participants monitor the Fed's direct intervention efforts? How does the Fed attempt to hide its intervention actions? The media frequently report that "the dollar's value strengthened against many currencies in response to the Federal Reserve's plan to increase interest rates." Explain why the dollar's value may change even before the Federal Reserve affects interest rates.

17. Effects of September 11 Within a few days after the September 11, 2001, terrorist attack on the United States, the Federal Reserve reduced short-term interest rates to stimulate the U.S. economy. How might this action have affected the foreign flow of funds into the United States and affected the value of the dollar? How could such an effect on the dollar have increased the probability that the U.S. economy would strengthen?

18. Intervention Effects on Corporate Performance Assume you have a subsidiary in Australia. The subsidiary sells mobile homes to local consumers in Australia, who buy the homes using mostly borrowed funds from local banks. Your subsidiary purchases all of its materials from Hong Kong. The Hong Kong dollar is tied to the U.S. dollar. Your subsidiary borrowed funds from the U.S. parent, and must pay the parent $100,000 in interest each month. Australia has just raised its interest rate in order to boost the value of its currency (Australian dollar, A$). The Australian dollar appreciates against the U.S. dollar as a result. Explain whether these actions would increase, reduce, or have no effect on:

a. The volume of your subsidiary's sales in Australia (measured in A$).

b. The cost to your subsidiary of purchasing materials (measured in A$).

c. The cost to your subsidiary of making the interest payments to the U.S. parent (measured in A$). Briefly explain each answer.

19. Pegged Currencies Why do you think a country suddenly decides to peg its currency to the dollar or some other currency? When a currency is unable to maintain the peg, what do you think are the typical forces that break the peg?

20. Impact of Intervention on Currency Option Premiums Assume that the central bank of the country Zakow periodically intervenes in the foreign

exchange market to prevent large upward or downward fluctuations in its currency (the zak) against the U.S. dollar. Today, the central bank announced that it would no longer intervene in the foreign exchange market. The spot rate of the zak against the dollar was not affected by this news. Will the news affect the premium on currency call options that are traded on the zak? Will the news affect the premium on currency put options that are traded on the zak? Explain.

21. Impact of Information on Currency Option Premiums As of 10:00 a. m., the premium on a specific 1-year call option on British pounds is $.04. Assume that the Bank of England had not been intervening in the foreign exchange markets in the last several months. However, it announces at 10:01 a.m. that it will begin to frequently intervene in the foreign exchange market in order to reduce fluctuations in the pound's value against the U.S. dollar over the next year, but it will not attempt to push the pound's value higher or lower than what is dictated by market forces. Also, the Bank of England has no plans to affect economic conditions with this intervention. Most participants who trade currency options did not anticipate this announcement. When they heard the announcement, they expected that the intervention would be successful in achieving its goal. Will this announcement cause the premium on the 1-year call option on British pounds to increase, decrease, or be unaffected? Explain.

22. Speculating Based on Intervention Assume that you expect that the European Central Bank (ECB) plans to engage in central bank intervention in which it plans to use euros to purchase a substantial amount of U.S. dollars in the foreign exchange market over the next month. Assume that this direct intervention is expected to be successful at influencing the exchange rate.

a. Would you purchase or sell call options on euros today?

b. Would you purchase or sell futures on euros today?

23. Pegged Currency and International Trade Assume the Hong Kong dollar (HK$) value is tied to the U.S. dollar and will remain tied to the U.S. dollar. Last month, a HK$ = 0.25 Singapore dollars. Today, a HK$ = 0.30 Singapore dollars. Assume that there is much trade in the computer industry among Singapore, Hong Kong, and the United States and that all products are viewed as substitutes for each other and are of about the same quality. Assume that the firms invoice their products in their local currency and do not change their prices.

a. Will the computer exports from the United States to Hong Kong increase, decrease, or remain the same? Briefly explain.

b. Will the computer exports from Singapore to the United States increase, decrease, or remain the same? Briefly explain.

24. Implications of a Revised Peg The country of Zapakar has much international trade with the United States and other countries as it has no significant barriers on trade or capital flows. Many firms in Zapakar export common products (denominated in zaps) that serve as substitutes for products produced in the United States and many other countries. Zapakar's currency (called the zap) has been pegged at 8 zaps = $1 for the last several years. Yesterday, the government of Zapakar reset the zap's currency value so that it is now pegged at 7 zaps = $1.

a. How should this adjustment in the pegged rate against the dollar affect the volume of exports by Zapakar firms to the United States?

b. Will this adjustment in the pegged rate against the dollar affect the volume of exports by Zapakar firms to non-U.S. countries? If so, explain.

c. Assume that the Federal Reserve significantly raises U.S. interest rates today. Do you think Zapakar's interest rate would increase, decrease, or remain the same?

25. Pegged Currency and International Trade Assume that Canada decides to peg its currency (the Canadian dollar) to the U.S. dollar and that the exchange rate will remain fixed. Assume that Canada commonly obtains its imports from the United States and Mexico. The United States commonly obtains its imports from Canada and Mexico. Mexico commonly obtains its imports from the United States and Canada. The traded products are always invoiced in the exporting country's currency. Assume that the Mexican peso appreciates substantially against the U.S. dollar during the next year.

a. What is the likely effect (if any) of the peso's exchange rate movement on the volume of Canada's exports to Mexico? Explain.

b. What is the likely effect (if any) of the peso's exchange rate movement on the volume of Canada's exports to the United States? Explain.

26. Impact of Devaluation The inflation rate in Yinland was 14 percent last year. The government of Yinland just devalued its currency (the yin) by

40 percent against the dollar. Even though it produces products similar to those of the United States, it has much trade with the United States and very little trade with other countries. It presently has trade restrictions imposed on all non-U.S. countries. Will the devaluation of the yin increase or reduce inflation in Yinland? Briefly explain.

27. Intervention and Pegged Exchange Rates Interest rate parity exists and will continue to exist. The 1-year interest rates in the United States and in the eurozone is 6 percent and will continue to be 6 percent. Assume that the country of Latvia's currency (called the Lat) is presently pegged to the euro and will remain pegged to the euro in the future. Assume that you expect that the European central bank (ECB) to engage in central bank intervention in which it plans to use euros to purchase a substantial amount of U.S. dollars in the foreign exchange market over the next month. Assume that this direct intervention is expected to be successful at influencing the exchange rate.

a. Will the spot rate of the Lat against the dollar increase, decrease, or remain the same as a result of central bank intervention?

b. Will the forward rate of the euro against the dollar increase, decrease, or remain the same as a result of central bank intervention?

c. Would the ECB's intervention be intended to reduce unemployment or reduce inflation in the eurozone?

d. *If the ECB decided to use indirect intervention* instead of direct intervention to achieve its objective of influencing the exchange rate, would it increase or reduce the interest rate in the eurozone?

e. Based on your answer to part (d), will the interest rate of Latvia increase, decrease, or remain the same as a result of the ECB's indirect intervention?

28. Pegged Exchange Rates The United States, Argentina, and Canada commonly engage in international trade with each other. All the products traded can easily be produced in all three countries. The traded products are always invoiced in the exporting country's currency. Assume that Argentina decides to peg its currency (called the peso) to the U.S. dollar and the exchange rate will remain fixed. Assume that the Canadian dollar appreciates substantially against the U.S. dollar during the next year.

a. What is the likely effect (if any) of the Canadian dollar's exchange rate movement over the year on the volume of Argentina's exports to Canada? Briefly explain.

b. What is the likely effect (if any) of the Canadian dollar's exchange rate movement on the volume of Argentina's exports to the United States? Briefly explain.

29. Central Bank Control Over Its Currency's Value Assume that France wants to change the prevailing spot rate of its currency (euro) in order to improve its economy, while Switzerland wants to change the prevailing value of its currency (Swiss franc) in order to improve its economy. Which of these two countries is more likely to have more control over its currency? Briefly explain.

30. Coordinated Central Bank Intervention Assume that the U.S. has a weak economy and that the Fed wants to correct this problem by adjusting the value of the dollar. The Fed is not worried about inflation. Assume that the eurozone has a somewhat similar economic situation as the U.S. and the European Central Bank (ECB) wants to correct this problem by adjusting the value of the euro. The ECB is not worried about inflation. Do you think the European Central Bank and the Fed should engage in coordinated intervention in order to achieve their objectives? Briefly explain.

31. Effects of Central Bank Intervention

a. Assume that the Federal Reserve engages in intervention by exchanging a very large amount of Canadian dollars for U.S. dollars in the foreign exchange market. Should this increase, reduce, or have no effect on Canadian inflation? Briefly explain.

b. Ignore the actions of the Federal Reserve in the question above and assume that the Canadian central bank raises its interest rates. Should this increase, reduce, or have no effect on Canadian inflation? Briefly explain.

c. The Hong Kong dollar is tied to the U.S. dollar and will continue to be tied to the dollar. Given your answer in part (a), how will the intervention by the Federal Reserve affect the cross exchange rate between the Canadian dollar and the Hong Kong dollar?

32. Role of the ECB

a. Explain the dilemma that the European Central Bank (ECB) faces as it attempts to help countries with large budget deficits.

b. Describe the types of conditions that the ECB required when providing credit to countries that needed to resolve their budget deficit problems.

c. Why might these conditions have a temporary adverse effect on countries that receive credit from the ECB?

33. Impact of Abandoning the Euro

a. Explain why one country abandoning the euro could reduce the value of the euro, even if that country accounts for a very small proportion of the total production among all Euorzone participants.

b. Explain why one country abandoning the euro could affect the value of the assets in the eurozone, even if that country accounts for a very small proportion of the total production among all Euorzone participants.

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 *International Financial Management* text companion website. Go to www.cengagebrain.com (students) or www.cengage.com/login (instructors) and search using **ISBN 9781133947837.**

Blades, Inc. Case

Assessment of Government Influence on Exchange Rates

Recall that Blades, the U.S. manufacturer of roller blades, generates most of its revenue and incurs most of its expenses in the United States. However, the company has recently begun exporting roller blades to Thailand. The company has an agreement with Entertainment Products, Inc., a Thai importer, for a 3-year period. According to the terms of the agreement, Entertainment Products will purchase 180,000 pairs of "Speedos," Blades' primary product, annually at a fixed price of 4,594 Thai baht per pair. Due to quality and cost considerations, Blades is also importing certain rubber and plastic components from a Thai exporter. The cost of these components is approximately 2,871 Thai baht per pair of Speedos. No contractual agreement exists between Blades, Inc., and the Thai exporter. Consequently, the cost of the rubber and plastic components imported from Thailand is subject not only to exchange rate considerations but to economic conditions (such as inflation) in Thailand as well.

Shortly after Blades began exporting to and importing from Thailand, Asia experienced weak economic conditions. Consequently, foreign investors in Thailand feared the baht's potential weakness and withdrew their investments, resulting in an excess supply of Thai baht for sale. Because of the resulting downward pressure on the baht's value, the Thai government attempted to stabilize the baht's exchange rate. To maintain the baht's value, the Thai government intervened in the foreign exchange market. Specifically, it swapped its baht reserves for dollar reserves at other central banks and then used its dollar reserves to purchase the baht in the foreign exchange market. However, this agreement required Thailand to reverse this transaction by exchanging dollars for baht at a future date. Unfortunately, the Thai government's intervention was unsuccessful, as it was overwhelmed by market forces. Consequently, the Thai government ceased its intervention efforts, and the value of the Thai baht declined substantially against the dollar over a 3-month period.

When the Thai government stopped intervening in the foreign exchange market, Ben Holt, Blades' CFO, was concerned that the value of the Thai baht would continue to decline indefinitely. Since Blades generates net inflow in Thai baht, this would seriously affect the company's profit margin. Furthermore, one of the reasons Blades had expanded into Thailand was to appease the company's shareholders. At last year's annual shareholder meeting, they had demanded that senior management take action to improve the firm's low profit margins. Expanding into Thailand had been Holt's suggestion, and he is now afraid that his career might be at stake. For these reasons, Holt feels that the Asian crisis and its impact on Blades demand his serious attention. One of the factors Holt thinks he should consider is the issue of government intervention and how it could affect Blades in particular. Specifically, he wonders whether the decision to enter into a fixed agreement with Entertainment Products was a good idea under the circumstances. Another issue is how the future completion of the swap agreement initiated by the Thai government will affect Blades. To address these issues and to gain a little more understanding of the process of government intervention, Holt has prepared the following list of questions for you, Blades' financial analyst, since he knows that you understand international financial management.

1. Did the intervention effort by the Thai government constitute direct or indirect intervention? Explain.

2. Did the intervention by the Thai government constitute sterilized or nonsterilized intervention? What is the difference between the types of intervention? Which type do you think would be more effective in increasing the value of the baht? Why? (Hint: Think about the effect of nonsterilized intervention on U.S. interest rates.)
3. If the Thai baht is virtually fixed with respect to the dollar, how could this affect U.S. levels of inflation? Do you think these effects on the U. S. economy will be more pronounced for companies such as Blades that operate under trade arrangements involving commitments or for firms that do not? How are companies such as Blades affected by a fixed exchange rate?
4. What are some of the potential disadvantages for Thai levels of inflation associated with the floating exchange rate system that is now used in Thailand? Do you think Blades contributes to these disadvantages to a great extent? How are companies such as Blades affected by a freely floating exchange rate?
5. What do you think will happen to the Thai baht's value when the swap arrangement is completed? How will this affect Blades?

Small Business Dilemma

Assessment of Central Bank Intervention by the Sports Exports Company

Jim Logan, owner of the Sports Exports Company, is concerned about the value of the British pound over time because his firm receives pounds as payment for footballs exported to the United Kingdom. He recently read that the Bank of England (the central bank of the United Kingdom) is likely to intervene directly in the foreign exchange market by flooding the market with British pounds.

1. Forecast whether the British pound will weaken or strengthen based on the information provided.
2. How would the performance of the Sports Exports Company be affected by the Bank of England's policy of flooding the foreign exchange market with British pounds (assuming that it does not hedge its exchange rate risk)?

Internet/Excel Exercises

The website for Japan's central bank, the Bank of Japan, provides information about its mission and its policy actions. Its address is www.boj.or.jp/en.

1. Use this website to review the outline of the Bank of Japan's objectives. Summarize the mission of the Bank of Japan. How does this mission relate to intervening in the foreign exchange market?
2. Review the minutes of recent meetings by Bank of Japan officials. Summarize at least one recent meeting that was associated with possible or actual intervention to affect the yen's value.
3. Why might the foreign exchange intervention strategies of the Bank of Japan be relevant to the U.S. government and to U.S.-based MNCs?

Online Articles with Real-World Examples

Find a recent article online that describes an actual international finance application or a real world example about a specific MNC's actions that reinforces one or more concepts covered in this chapter.

If your class has an online component, your professor may ask you to post your summary there and provide the web link of the article so that other students can access it. If your class is live, your professor may ask you to summarize your application in class. Your professor may assign specific students to complete this assignment for this chapter, or may allow any students to do the assignment on a volunteer basis.

For recent online articles and real world examples applied to this chapter, consider using the following search terms and include the current year as a search term to ensure that the online articles are recent:

1. pegged exchange rate
2. Bank of China control of yuan
3. Federal Reserve intervention
4. European Central Bank intervention
5. central bank intervention
6. impact of the dollar
7. impact of the euro
8. central bank AND currency volatility
9. central bank AND weaken currency
10. central bank AND strengthen currency

APPENDIX 6

Government Intervention during the Asian Crisis

From 1990 to 1997, Asian countries achieved higher economic growth than any others. They were viewed as models for advances in technology and economic improvement. In the summer and fall of 1997, however, they experienced financial problems that led to what is known as the "Asian crisis" and resulted in the bailouts of several countries by the International Monetary Fund.

Much of the crisis is attributed to the substantial depreciation of Asian currencies, which caused severe financial problems for firms and governments throughout Asia and also in other regions. This crisis demonstrated how exchange rate movements could affect country conditions and thus affect the firms that operate in those countries.

The specific objectives of this appendix are to describe the conditions in the foreign exchange market that contributed to the Asian crisis, explain how governments intervened in an attempt to control their exchange rates, and describe the consequences of those intervention efforts. The Asian crisis offers useful lessons to governments about controlling their currency's value.

Crisis in Thailand

Until July 1997, Thailand was one of the world's fastest-growing economies. Its high level of spending and low level of saving put upward pressure on prices of real estate and products and also on the local interest rate. Normally, countries with high inflation tend to have weak currencies due to the force of purchasing power parity. Prior to July 1997, however, Thailand's currency was linked to the U.S. dollar. Thailand was an attractive site for foreign investors, who could earn a high interest rate on invested funds while being protected (until the crisis) from a large depreciation in the baht.

Bank Lending Situation

A country normally desires a large inflow of funds, which can help support its growth. In Thailand's case, however, the inflow of funds provided Thai banks with more funds than they could use for making loans. Consequently, in attempting to use all the funds, the banks made a large number of extremely risky loans. Commercial developers borrowed heavily without having to prove that the expansion was feasible. Lenders offered to lend large sums of money based solely on a developer's previous success. These loans made sense only if the economy continued its high growth, but such levels of development could not last forever.

Flow-of-Funds Situation

Apart from the bank lending situation just described, the large inflow of funds increased Thailand's susceptibility to a massive *outflow* of funds if foreign investors ever lost confidence in the Thai economy. Given the large amount of risky loans and the potential for large outflows, Thailand was sometimes described as a "house of cards" waiting to collapse.

Although the large inflow of funds put downward pressure on interest rates, the supply was offset by a strong demand for funds as developers and corporations sought to capitalize on the growth economy by expanding. Thailand's government was also borrowing heavily to improve the country's infrastructure. The sheer volume of borrowing was enough to increase interest rates, which made the debt expensive to borrowers.

Export Competition

During the first half of 1997, the U.S. dollar strengthened against the Japanese yen and European currencies, which reduced the prices of Japanese and European imports. Although the dollar was linked to the baht over this period, Thailand's products were more expensive than those of other exporters to the United States.

Pressure on the Thai Baht

The baht experienced downward pressure in July 1997 as some foreign investors recognized its potential weakness. The baht's value relative to the dollar was depressed by the large sale of baht in exchange for dollars. On July 2, 1997, the baht was detached from the dollar, after which Thailand's central bank attempted to maintain the currency's value by intervention. Specifically, it swapped its baht reserves for dollar reserves at other central banks and then used its dollar reserves to purchase the baht in the foreign exchange market (this swap agreement required Thailand to reverse this exchange by exchanging dollars for baht at a future date). The intervention was intended to offset the sales of baht by foreign investors in the foreign exchange market, but market forces overwhelmed the intervention efforts. As the supply of baht to be exchanged for dollars exceeded the U.S. demand for baht in the foreign exchange market, the government eventually had to surrender its effort to defend the baht's value. In July 1997, the value of the baht plummeted. Over a five-week period, it declined by more than 20 percent against the dollar.

Damage to Thailand

Thailand's central bank used more than $20 billion to purchase baht in the foreign exchange market as part of its direct intervention efforts. Then, because of the currency's steep decline, Thailand needed still more baht to be exchanged for the dollars required to repay the other central banks.

Thailand's banks estimated the amount of their defaulted loans at over $30 billion. Meanwhile, some corporations in Thailand had borrowed funds in other currencies (including the dollar) because the interest rates in Thailand were relatively high. This strategy backfired because the baht's weakening forced these corporations to exchange larger amounts of baht for the currencies needed to pay off the loans. Hence the corporations incurred a much higher effective financing rate (which explains the need to account for exchange rate effects when determining a loan's true cost) than if they had borrowed funds locally in Thailand. This higher borrowing cost was an additional strain on these corporations.

Rescue Package for Thailand

On August 5, 1997, the IMF and several countries agreed to provide Thailand with a $16 billion rescue package; Japan and the IMF provided $4 billion each. At the time,

this was the second-largest bailout plan ever put together for a single country (Mexico had received a $50 billion bailout in 1994). In return for this monetary support, Thailand agreed to reduce its budget deficit, prevent inflation from rising above 9 percent, raise its value-added tax from 7 to 10 percent, and clean up its local banks' financial statements, which had many undisclosed bad loans.

The rescue package took time to finalize because Thailand's government was unwilling to shut down all the banks experiencing financial problems that stemmed from their overly generous lending policies. Many critics have questioned the rescue package's efficacy, since some of the funding was misallocated because of corruption in Thailand.

Spread of the Crisis throughout Southeast Asia

The crisis in Thailand was contagious to other countries in Southeast Asia. The Southeast Asian economies are fairly integrated because of the trade between countries. The crisis was expected to weaken Thailand's economy, which would reduce its demand for imports from the other countries of Southeast Asia. As the demand for those countries' products declined, so would their national income and their demand for products from other Southeast Asian countries. In this way, the effects of the crisis could spread across the region. Like Thailand, the other Southeast Asian countries had experienced high growth in recent years, leading to overly optimistic assessments of future economic conditions and thus to excessive loans being extended for projects that had a high risk of default.

These countries were also similar to Thailand in that they had relatively high interest rates and their governments tended to stabilize their currencies. As a result, these other Southeast Asian countries had attracted a large amount of foreign investment as well. Thailand's crisis made foreign investors realize that a similar crisis could befall the region's other countries. Consequently, they began to withdraw funds from these countries.

Effects on Other Asian Currencies

In July and August of 1997, the values of the Malaysian ringgit, Singapore dollar, Philippine peso, Taiwan dollar, and Indonesian rupiah declined. The Philippine peso was devalued in July. Malaysia initially attempted to maintain the ringgit's value within a narrow band, but in the end it surrendered and let the ringgit float to a level determined by market forces.

In August 1997, Bank Indonesia (the central bank) used more than $500 million in direct intervention to purchase rupiah in the foreign exchange market in an attempt to boost that currency's value. By mid-August, however, it gave up this effort and let the rupiah float to its natural level, a decision that may have been influenced by the failure of Thailand's costly efforts to maintain the baht. The market forces were simply too strong to be offset by direct intervention. On October 30, 1997, a rescue package for Indonesia was announced, but the IMF and Indonesia's government did not agree on the $43 billion package's terms until the spring of 1998. One of the main points of contention was that President Suharto wanted to peg the rupiah's exchange rate; the IMF believed that Bank Indonesia would not be able to maintain the rupiah's exchange rate at a fixed level and so the currency would come under renewed speculative attack.

Investors and firms had no confidence that the fundamental factors causing weakness in these currencies were being corrected. Therefore, the flow of funds out of the Asian countries continued. This outflow led to even more sales of Asian currencies in exchange for other currencies, which put additional downward pressure on the values of the Asian currencies.

Impact of the Asian Crisis on Hong Kong

On October 23, 1997, prices in the Hong Kong stock market declined by 10.2 percent on average; considering the three trading days before that, the cumulative four-day effect

was a decline of 23.3 percent. This decline was primarily attributed to speculation that Hong Kong's currency might be devalued and that Hong Kong could experience financial problems similar to those evident in Southeast Asian countries. That Hong Kong companies could lose nearly a quarter of their market value in less than a week demonstrated the perceived exposure of Hong Kong to the crisis.

During this period, Hong Kong maintained its pegged exchange rate system (with the Hong Kong dollar tied to the U.S. dollar). However, it had to increase interest rates in order to discourage investors from transferring their funds out of the country.

Impact of the Asian Crisis on Russia

The Asian crisis caused investors to reconsider other countries where similar effects might occur. In particular, they focused on Russia. As investors lost confidence in the Russian currency (the ruble), they began to transfer funds out of Russia. In response to the downward pressure that this outflow of funds placed on the ruble, the central bank of Russia engaged in direct intervention by using dollars to purchase rubles in the foreign exchange market. It also used indirect intervention by raising interest rates to make Russia more attractive to investors, thereby discouraging additional outflows.

In July 1998, the IMF (with some help from Japan and the World Bank) organized a loan package worth $22.6 billion for Russia. The package required that Russia boost its tax revenues, reduce its budget deficit, and create a more capitalist environment for its businesses.

During August 1998, Russia's central bank intervened frequently to prevent substantial declines in the ruble. On August 26, however, it gave up its fight to defend the ruble's value, and market forces caused the ruble to decline by more than 50 percent against most currencies on that day. This led to fears of a new crisis and on the next day, "Bloody Thursday," paranoia swept stock markets around the world. Some stock markets (including the U.S. stock market) experienced declines of more than 4 percent.

Impact of the Asian Crisis on South Korea

By November 1997, seven of South Korea's conglomerates (called *chaebols)* had collapsed, and the banks that financed the operations of the chaebols were stuck with the equivalent of $52 billion in bad debt. Like banks in the Southeast Asian countries, South Korea's banks had been too willing to provide loans to corporations (especially the chaebols) without conducting a thorough credit analysis. In November, South Korea's currency (the won) declined substantially; the central bank tried using its reserves in an unsuccessful attempt to prevent a free fall in the won.

On December 3, 1997, the IMF agreed to a $55 billion rescue package for South Korea. The World Bank and the Asian Development Bank joined with the IMF to provide a standby credit line of $35 billion. In exchange for this funding, South Korea agreed to reduce its economic growth and to restrict the excessive borrowing of its conglomerates. This restriction resulted in some bankruptcies and unemployment, since the banks could now provide loans to conglomerates only if the funding was economically justified.

Impact of the Asian Crisis on Japan

Japan was also affected by the Asian crisis not only because it exports products to the affected countries but also because many of its corporations have subsidiaries located there, which means that the business performance of Japanese firms is affected by foreign economic conditions. Japan had also been experiencing its own problems. Its financial industry had been struggling, primarily because of defaulted loans. In April 1998, the Bank of Japan used more than $20 billion to purchase yen in the foreign exchange market.

This effort to boost the yen's value was unsuccessful. Prime Minister Hashimoto resigned in July 1998, causing more uncertainty about the outlook for Japan.

Impact of the Asian Crisis on China

Because China had grown less rapidly than the Southeast Asian countries, it did suffer any adverse economic effects from the Asian crisis. The Chinese government also had more influence on its economic conditions: it still owned most of the real estate and still controlled most of the banks that provided credit to support growth. As a result, China saw few bankruptcies resulting from the Asian crisis in China. China's government was also able to maintain the value of the yuan against the dollar, which limited speculative flows of funds out of China. Although interest rates increased during the crisis, they remained relatively low; hence Chinese firms could obtain funding at a reasonable cost and could continue to meet their interest payments.

Impact of the Asian Crisis on Latin American Countries

The Asian crisis also affected Latin American countries. Chile, Mexico, and Venezuela were all adversely affected because they export products to Asia, and the weakened Asian economies resulted in a lower demand for Latin American exports. In addition, the Latin American countries lost some business to other countries that switched to Asian products because the Asian currencies depreciated substantially, which made their products cheaper than those of Latin America.

These adverse effects on Latin American countries put pressure on Latin American currency values, since there was concern that speculative outflows of funds would weaken these currencies in the same way that Asian currencies had weakened. In particular, there was pressure on Brazil's currency (the real) in late October 1997.

The central bank of Brazil used about $7 billion of reserves in a direct intervention to buy the real in the foreign exchange market and protect the real from depreciation. It also used indirect intervention by raising short-term interest rates in Brazil. However, this intervention reduced economic growth because it increased the cost of borrowing for households, corporations, and government agencies in Brazil.

Impact of the Asian Crisis on Europe

Like firms in Latin America, some firms in Europe experienced a reduced demand for their exports to Asia during the crisis. In addition, they lost some exporting business to Asian exporters as a result of the weakened Asian currencies that reduced Asian prices from an importer's perspective. European banks were especially affected by the Asian crisis because they had provided large loans to numerous Asian firms that defaulted.

Impact of the Asian Crisis on the United States

The effects of the Asian crisis were felt even in the United States. Stock values of U.S. firms, such as 3M Co., Motorola, Hewlett-Packard, and Nike, that conducted much business in Asia declined. Many U.S. engineering and construction firms were adversely affected as Asian countries reduced their plans to improve infrastructure. Stock values of U.S. exporters to those countries fell because of the decline in spending by consumers and corporations in Asian countries and also because of the weakened Asian currencies, which made U.S. products more expensive. Some large U.S. commercial banks experienced significant stock price declines because of their exposure (primarily loans and bond holdings) to Asian countries.

Lessons about Exchange Rates and Intervention

The Asian crisis demonstrated the degree to which currencies could depreciate in response to a lack of confidence by investors and firms in a central bank's ability to stabilize its local currency. If investors and firms had believed the central banks could prevent the free fall in currency values, then they would not have transferred their funds to other countries and Southeast Asian currency values would not have experienced such downward pressure.

Exhibit 6A.1 shows how the exchange rates of some Asian currencies changed against the U.S. dollar during one year of the crisis (from June 1997 to June 1998). The currencies of Indonesia, Malaysia, South Korea, and Thailand all declined substantially.

The Asian crisis also demonstrated how interest rates could be affected by flows of funds out of countries. Exhibit 6A.2 illustrates how interest rates changed from June 1997 (just before the crisis) to June 1998 for various Asian countries. The increase in interest rates can be attributed to the indirect interventions (intended to prevent the local currencies from depreciating further) or to the massive outflows of funds or to both of these conditions. In particular, the interest rates of Indonesia, Malaysia, and Thailand increased substantially from their pre-crisis levels. Those countries whose local currencies experienced more depreciation had higher upward adjustments. Since the substantial increase in interest rates (which tends to reduce economic growth) may have been caused by the outflow of funds, it could have resulted indirectly from the lack of confidence by investors and firms in the ability of the Asian central banks to stabilize their respective local currencies.

Finally, the Asian crisis demonstrated how integrated country economies actually are—especially during a crisis. Just as the United States and European economies can affect emerging markets, they are susceptible to conditions in emerging markets. Even if a central bank can withstand the pressure on its currency caused by conditions in other

Exhibit 6A.1 How Exchange Rates Changed during the Asian Crisis (June 1997–June 1998)

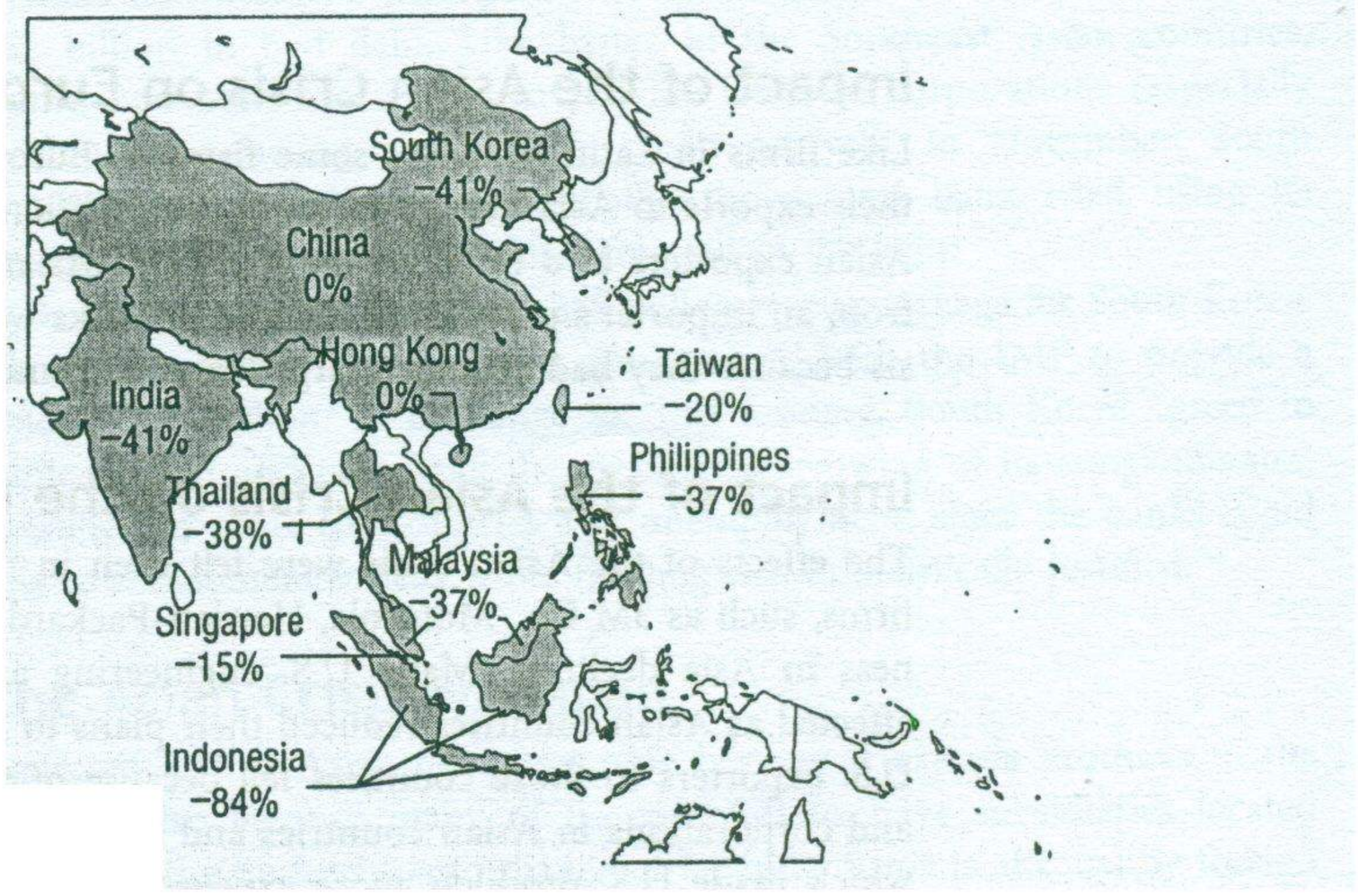
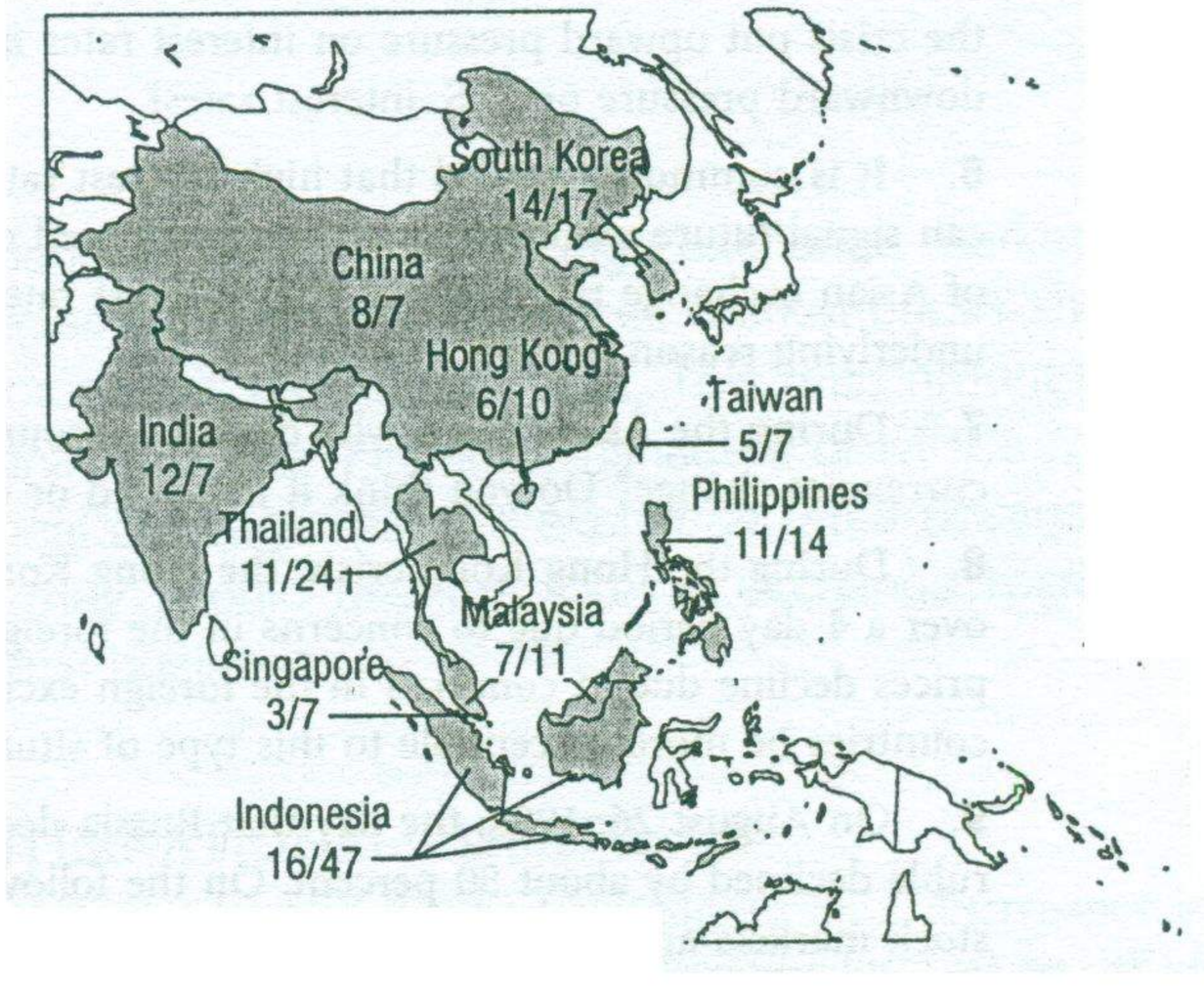


Exhibit 6A.2 How Interest Rates Changed during the Asian Crisis (Number before slash represents annualized interest rate as of June 1997; number after slash represents annualized interest rate as of June 1998)



countries, it may not be able to insulate its economy from other countries that are experiencing financial problems.

Discussion Questions

The following discussion questions related to the Asian crisis illustrate how the foreign exchange market conditions are integrated with the other financial markets around the world. Thus, participants in any of these markets must understand the dynamics of the foreign exchange market. These discussion questions can be used in several ways. They may serve as an assignment on a day that the professor is unable to attend class. They are especially useful for group exercises. The class could be segmented into small groups; each group is asked to assess all of the issues and determine a solution. Each group should have a spokesperson. For each issue, one of the groups will be randomly selected and asked to present its solution, and then other students not in that group may suggest alternative answers if they feel that the answer can be improved. Some of the issues have no perfect solution, which allows for different points of view to be presented by students.

1. Was the depreciation of the Asian currencies during the Asian crisis due to trade flows or capital flows? Why do you think the degree of movement over a short period may depend on whether the reason is trade flows or capital flows?

2. Why do you think the Indonesian rupiah was more exposed to an abrupt decline in value than the Japanese yen during the Asian crisis (even if their economies experienced the same degree of weakness)?

3. During the Asian crisis, direct intervention did not prevent depreciation of currencies. Offer your explanation for why the interventions did not work.

4. During the Asian crisis, some local firms in Asia borrowed U.S. dollars rather than local currency to support local operations. Why would they borrow dollars when they really needed their local currency to support operations? Why did this strategy backfire?

5. The Asian crisis showed that a currency crisis could affect interest rates. Why did the crisis put upward pressure on interest rates in Asian countries? Why did it put downward pressure on U.S. interest rates?

6. It is commonly argued that high interest rates reflect high expected inflation and can signal future weakness in a currency. Based on this theory, how would expectations of Asian exchange rates change after interest rates in Asia increased? Why? Is the underlying reason logical?

7. During the Asian crisis, why did the discount of the forward rate of Asian currencies change? Do you think it increased or decreased? Why?

8. During the Hong Kong crisis, the Hong Kong stock market declined substantially over a 4-day period due to concerns in the foreign exchange market. Why would stock prices decline due to concerns in the foreign exchange market? Why would some countries be more susceptible to this type of situation than others?

9. On August 26, 1998, the day that Russia decided to let the ruble float freely, the ruble declined by about 50 percent. On the following day, called "Bloody Thursday," stock markets around the world (including the United States) declined by more than 4 percent. Why do you think the decline in the ruble had such a global impact on stock prices? Was the markets' reaction rational? Would the effect have been different if the ruble's plunge had occurred in an earlier time period, such as 4 years earlier? Why?

10. Normally, a weak local currency is expected to stimulate the local economy. Yet, it appeared that the weak currencies of Asia adversely affected their economies. Why do you think the weakening of the currencies did not initially improve their economies during the Asian crisis?

11. During the Asian crisis, Hong Kong and China successfully intervened (by raising their interest rates) to protect their local currencies from depreciating. Nevertheless, these countries were also adversely affected by the Asian crisis. Why do you think the actions to protect the values of their currencies affected these countries' economies? Why do you think the weakness of other Asian currencies against the dollar and the stability of the Chinese and Hong Kong currencies against the dollar adversely affected their economies?

12. Why do you think the values of bonds issued by Asian governments declined during the Asian crisis? Why do you think the values of Latin American bonds declined in response to the Asian crisis?

13. Why do you think the depreciation of the Asian currencies adversely affected U.S. firms? (There are at least three reasons, each related to a different type of exposure of some U.S. firms to exchange rate risk.)

14. During the Asian crisis, the currencies of many Asian countries declined even though their governments attempted to intervene with direct intervention or by raising interest rates. Given that the abrupt depreciation of the currencies was attributed to an abrupt outflow of funds in the financial markets, what alternative Asian government action might have been more successful in preventing a substantial decline in the currencies' values? Are there any possible adverse effects of your proposed solution?

7
International Arbitrage and Interest Rate Parity

CHAPTER OBJECTIVES

The specific objectives of this chapter are to:

- explain the conditions that will result in various forms of international arbitrage and the realignments that will occur in response,
- explain the concept of interest rate parity, and
- explain the variation in forward rate premiums across maturities and over time.

If discrepancies occur in the foreign exchange market, with quoted prices of currencies varying from what their market prices should be, then certain market forces will realign the rates. This realignment occurs as a result of international arbitrage. Financial managers of MNCs must understand how international arbitrage realigns exchange rates because it has implications for how they should use the foreign exchange market to facilitate their international business.

7-1 International Arbitrage

Arbitrage can be loosely defined as capitalizing on a discrepancy in quoted prices by making a riskless profit. In many cases, the strategy involves no risk and does not require that funds be tied up.

The type of arbitrage discussed in this chapter is primarily international in scope; it is applied to foreign exchange and international money markets and takes three common forms:

- locational arbitrage,
- triangular arbitrage, and
- covered interest arbitrage

Each form will be discussed in turn.

7-1a Locational Arbitrage

Commercial banks providing foreign exchange services normally quote about the same rates on currencies, so shopping around may not lead to a more favorable rate. If the demand and supply conditions for a particular currency vary among banks then a given currency may be priced at different rates, in which case market forces will lead to realignment.

When quoted exchange rates vary among locations, participants in the foreign exchange market can capitalize on the discrepancy. Specifically, they can use **locational arbitrage**, which is the process of buying a currency at a location where it is priced cheap and then immediately selling it at some other location where it is priced higher.

EXAMPLE Akron Bank and Zyn Bank serve the foreign exchange market by buying and selling currencies. Assume that there is no bid/ask spread. The exchange rate quoted at Akron Bank for a British pound is $1.60 while the exchange rate quoted at Zyn Bank is $1.61. You could conduct locational arbitrage by purchasing pounds at Akron Bank for $1.60 per pound and then selling them at Zyn Bank for $1.61 per pound. If there is no bid/ ask spread and if there are no other costs of

Exhibit 7.1 Currency Quotes for Locational Arbitrage Example

	AKRON BANK			ZYN BANK	
	BID	ASK		BID	ASK
British pound	$1.60	$1.61	British pound	$1.61	$1.62

conducting this arbitrage strategy, then your gain would be $.01 per pound. The gain is risk free in that you knew, when you purchased the pounds, how much you could sell them for. Also, you did not have to tie your funds up for any length of time. ●

Locational arbitrage is normally conducted by banks or other foreign exchange dealers whose computers can continuously monitor the quotes provided by other banks. If other banks observed a discrepancy between the prices quoted by Akron Bank and Zyn Bank, then these other banks would quickly engage in locational arbitrage to earn an immediate risk-free profit. Because banks do, in fact, have a bid/ask spread on currencies, the following example accounts for that spread.

EXAMPLE In Exhibit 7.1, the information given previously on British pounds at both banks is revised to include the bid/ask spread. Based on these quotes, you can no longer profit from locational arbitrage. If you buy pounds at $1.61 (Akron Bank's ask price) and then sell them at $1.61 (Zyn Bank's bid price), you just break even. As this example demonstrates, locational arbitrage will not always be possible. To achieve profits from this strategy, the bid price of one bank must be higher than the ask price of another bank. ●

Gains from Locational Arbitrage Your gain from locational arbitrage is based on two factors: the amount of money that you use to capitalize on the exchange rate discrepancy; and the size of that discrepancy.

EXAMPLE The quotations for the New Zealand dollar (NZ$) at two banks are shown in Exhibit 7.2. You can obtain New Zealand dollars from North Bank at the ask price of $.640 and then sell them to South Bank at the bid price of $.645. This is considered to be one *round-trip* transaction in locational arbitrage. *If you start with $10,000 and conduct one round-trip transaction, how many U.S. dollars will you end up with?* The $10,000 is initially exchanged for NZ$15,625 ($10,000/$.640 per New Zealand dollar) at North Bank. Then the NZ$15,625 are sold for $.645 each to yield a total of $10,078. Thus, your gain from locational arbitrage is $78. ●

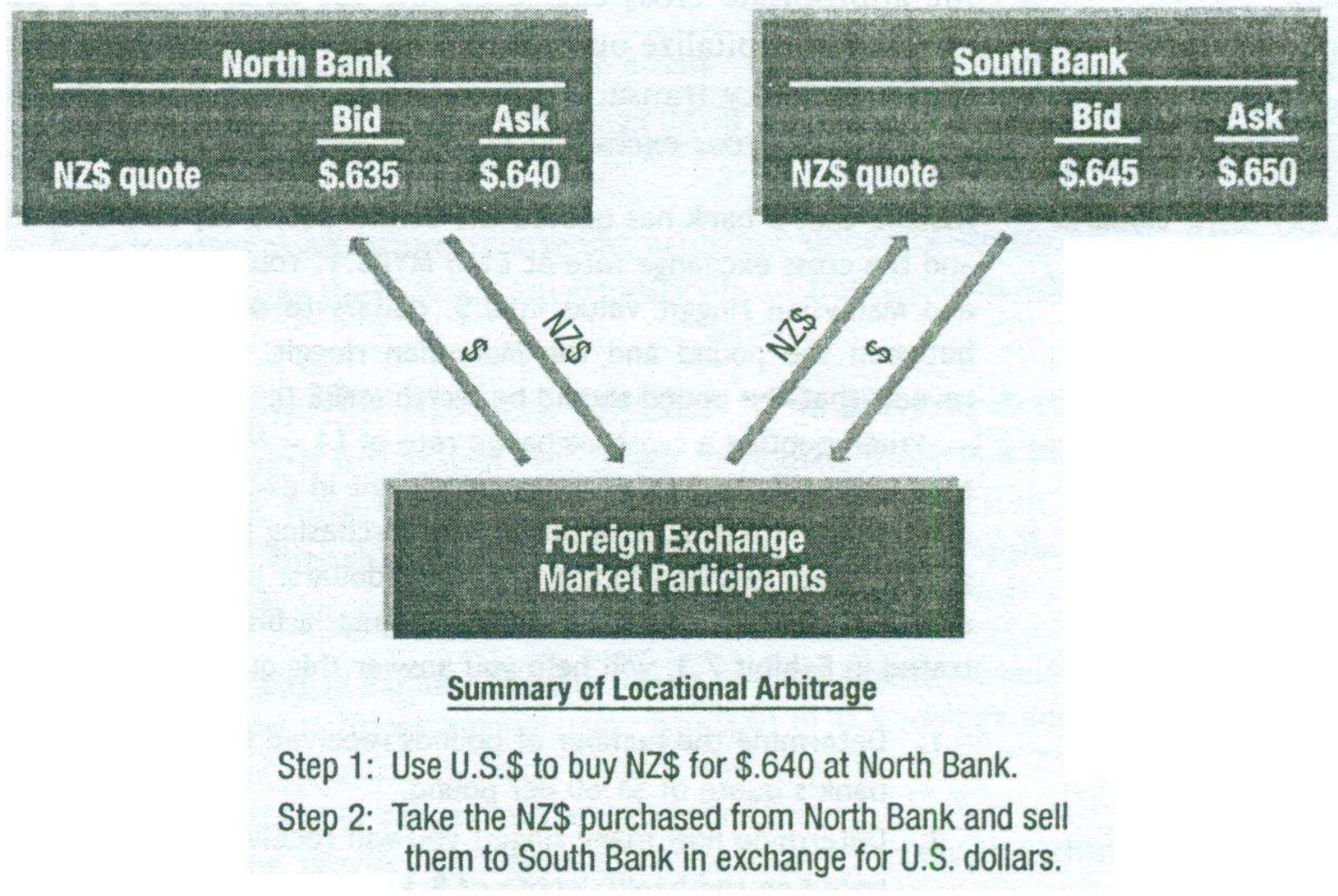
Your gain may appear to be small relative to your investment of $10,000. However, consider that you did not have to tie up any of your funds. Your round-trip transaction could take place over a telecommunications network within a matter of seconds. Also, if you could use a larger sum of money for the transaction then your gains would be larger. Finally, you could continue to repeat this round-trip transaction until North Bank's ask price is no longer less than South Bank's bid price.

This example is not intended to suggest that you can finance your education with part-time locational arbitrage. As mentioned before, all foreign exchange dealers compare quotes from banks on computer terminals, which immediately signal any opportunity to employ locational arbitrage.

Realignment Due to Locational Arbitrage Quoted prices will react to the locational arbitrage strategy used by you and other foreign exchange market participants.

EXAMPLE In the previous example, the high demand for New Zealand dollars at North Bank (resulting from arbitrage activity) will cause a shortage of New Zealand dollars there. As a result of this shortage, North Bank will raise its ask price for New Zealand dollars. The excess supply of New Zealand dollars at South Bank (resulting from sales of New Zealand dollars to South Bank in exchange for U.S. dollars) will force South Bank to lower its bid price. As the currency prices are adjusted, gains from locational arbitrage will be reduced. Once the ask price of North Bank is not any lower than

Exhibit 7.2 Locational Arbitrage



the bid price of South Bank, locational arbitrage will no longer occur. Prices may adjust in a matter of seconds or minutes from the time when locational arbitrage occurs. ●

WEB

finance.yahoo.com/currency?u
Currency converter for over 100 currencies with frequent daily foreign exchange rate updates.

The concept of locational arbitrage is relevant because it explains why exchange rate quotations among banks at different locations will seldom differ by a significant amount. This generalization applies not only to banks on the same street or within the same city but to banks across the world. Technology allows all banks to be electronically and continuously connected to foreign exchange quotations. As a result, banks can ensure that their quotes are in line with those of other banks. They can also detect any discrepancies among quotations in real time and capitalize on those discrepancies. Thus, technology enables more consistent prices among banks and reduces the likelihood of significant discrepancies in foreign exchange quotations among locations.

7-1b Triangular Arbitrage

Cross exchange rates express the relation between two currencies that each differ from one's base currency. In the United States, the term *cross exchange rate* refers to the relationship between two non-dollar currencies.

EXAMPLE If the British pound (£) is worth $1.60 and if the Canadian dollar (C$) is worth $.80, then the value of the British pound with respect to the Canadian dollar is calculated as follows:

$$\text{Value of £ in units of C\$} = \$1.60/\$.80 = 2.0$$

The value of the Canadian dollar in units of pounds can also be determined from the cross exchange rate formula:

$$\text{Value of C\$ in units of £} = \$.80/\$1.60 = .50$$

Note that the value of a Canadian dollar in units of pounds is simply the reciprocal of the value of a pound in units of Canadian dollars. ●

Gains from Triangular Arbitrage If a quoted cross exchange rate differs from the appropriate cross exchange rate (as determined by the preceding formula), you can attempt to capitalize on the discrepancy. Specifically, you can use **triangular arbitrage** in which currency transactions are conducted in the spot market to capitalize on a discrepancy in the cross exchange rate between two currencies.

EXAMPLE Assume that a bank has quoted the British pound (£) at $1.60, the Malaysian ringgit (MYR) at $.20, and the cross exchange rate at £1 = MYR8.1. Your first task is to use the pound value in U.S. dollars and Malaysian ringgit value in U.S. dollars to develop the cross exchange rate that should exist between the pound and the Malaysian ringgit. The cross rate formula in the previous example reveals that the pound should be worth MYR8.0.

When quoting a cross exchange rate of £1 = MYR8.1, the bank is exchanging too many ringgit for a pound and is asking for too many ringgit in exchange for a pound. Based on this information, you can engage in triangular arbitrage by purchasing pounds with dollars, converting the pounds to ringgit, and then exchanging the ringgit for dollars. If you have $10,000, then how many dollars will you end up with if you implement this triangular arbitrage strategy? The following steps, which are illustrated in Exhibit 7.3, will help you answer this question.

1. Determine the number of pounds received for your dollars: $10,000 = £6,250, based on the bank's quote of $1.60 per pound.
2. Determine how many ringgit you will receive in exchange for pounds: £6,250 = MYR50,625, based on the bank's quote of 8.1 ringgit per pound.
3. Determine how many U.S. dollars you will receive in exchange for the ringgit: MYR50,625 = $10,125 based on the bank's quote of $.20 per ringgit (5 ringgit to the dollar). The triangular arbitrage strategy generates $10,125, which is $125 more than you started with. ●

Exhibit 7.3 Example of Triangular Arbitrage

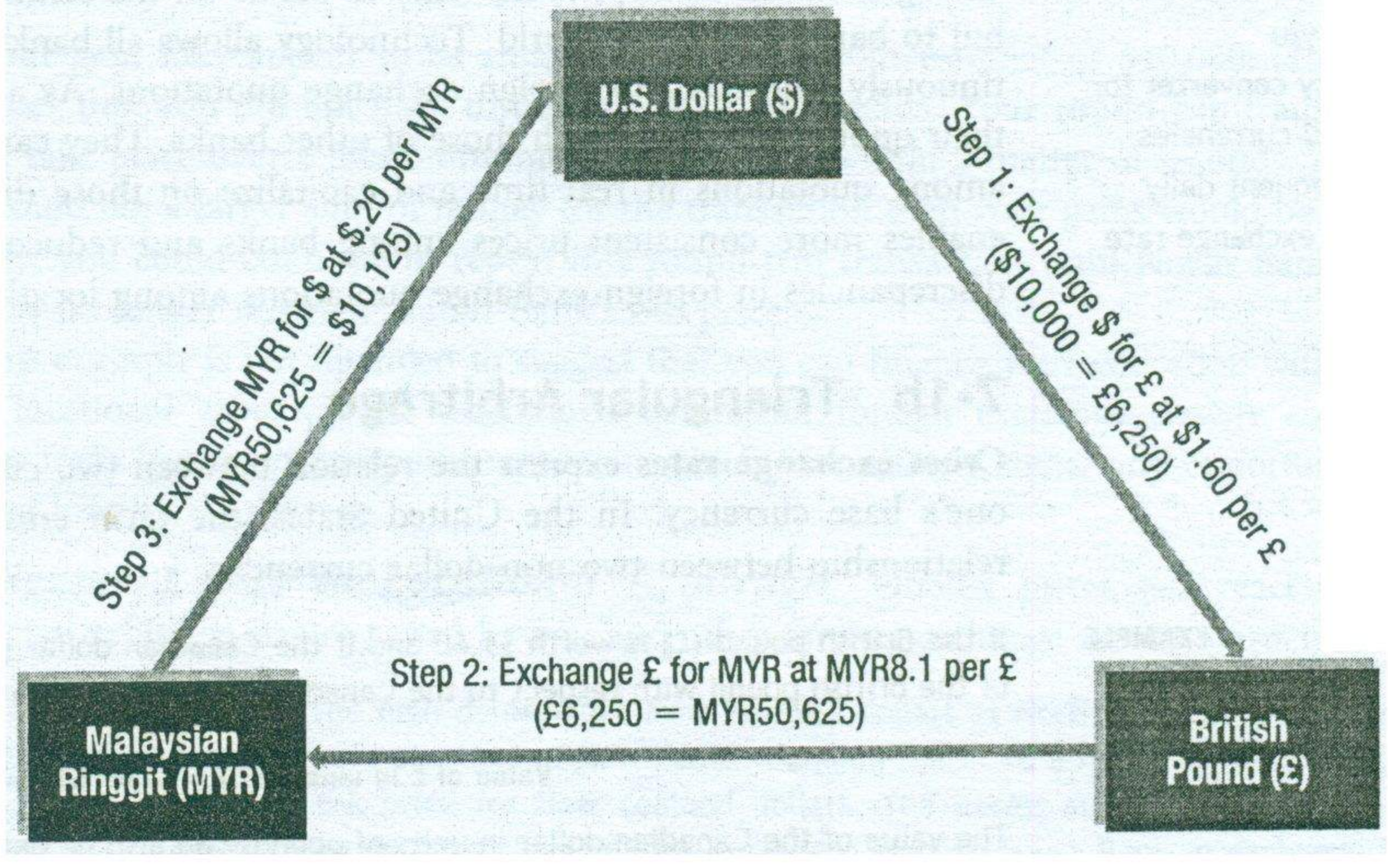


Exhibit 7.4 Currency Quotes for Triangular Arbitrage Example with Transaction Costs

	QUOTED BID PRICE	QUOTED ASK PRICE
Value of a British pound in U.S. dollars	$1.60	$1.61
Value of a Malaysian ringgit (MYR) in U.S. dollars	$.200	$.201
Value of a British pound in Malaysian ringgit (MYR)	MYR8.10	MYR8.20

Like locational arbitrage, triangular arbitrage does not tie up funds. Also, the strategy is risk free because there is no uncertainty about the prices at which you will buy and sell the currencies.

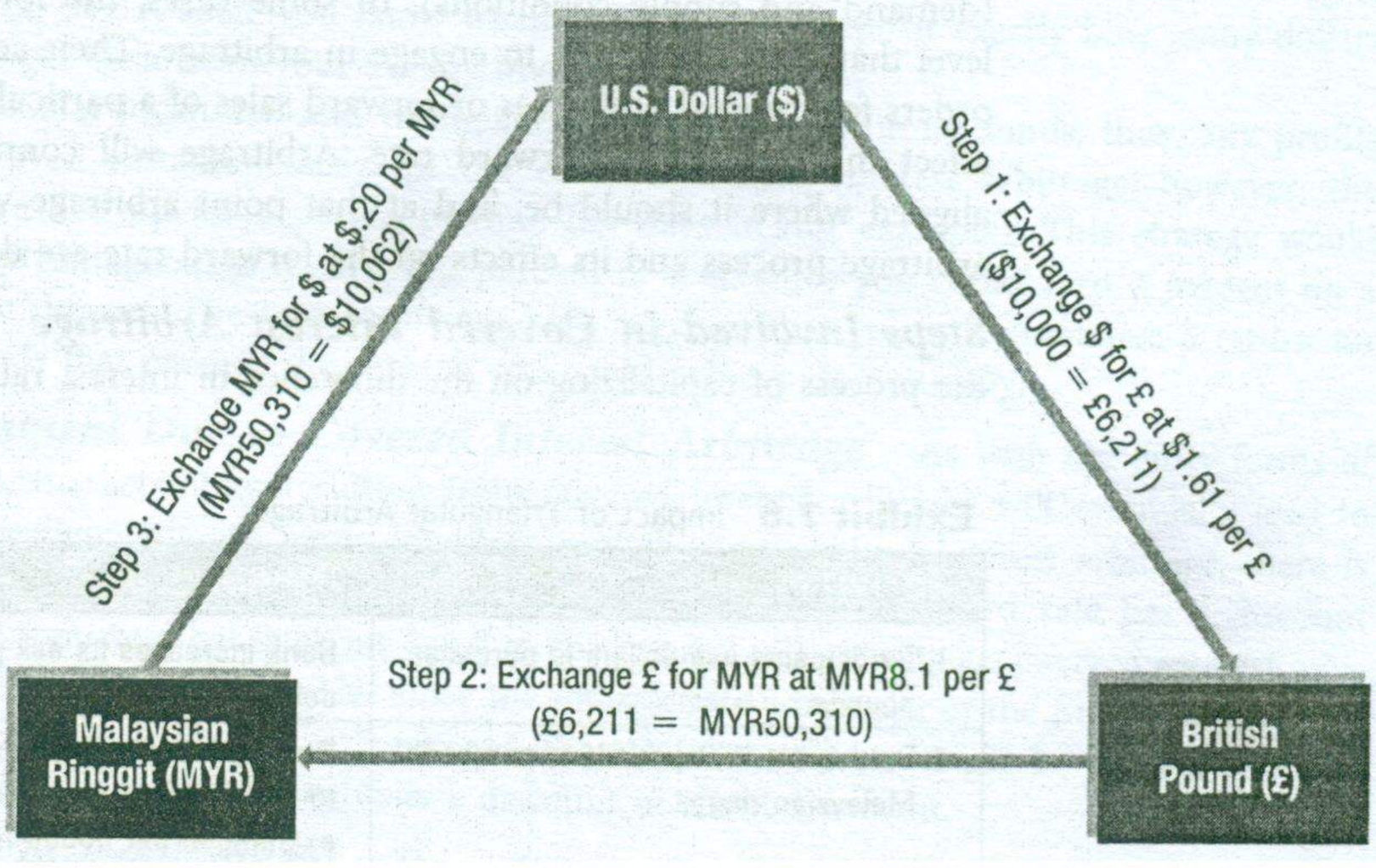
Accounting for the Bid/Ask Spread The previous example is simplified in that it does not account for transaction costs. In reality, there is a bid and ask quote for each currency, which means that the arbitrageur incurs transaction costs that can reduce or even eliminate the gains from triangular arbitrage. The following example illustrates how bid and ask prices can affect arbitrage profits.

EXAMPLE Using the quotations in Exhibit 7.4, you can determine whether triangular arbitrage is possible by starting with some fictitious amount (say, $10,000) of U.S. dollars and estimating the number of dollars you would generate by implementing the strategy. Exhibit 7.4 differs from the previous example only in that bid/ask spreads are now considered.

Recall that the previous triangular arbitrage strategy involved exchanging dollars for pounds, pounds for ringgit, and then ringgit for dollars. Apply this strategy to the bid and ask quotations in Exhibit 7.4. The steps are summarized in Exhibit 7.5.

Step 1. Your initial $10,000 will be converted into approximately £6,211 (based on the bank's ask price of $1.61 per pound).

Exhibit 7.5 Example of Triangular Arbitrage Accounting for Bid/Ask Spreads



Step 2. Then the £6,211 are converted into MYR50,310 (based on the bank's bid price of MYR8.1 per pound, £6,211 × 8.1 = MYR50,310).

Step 3. The MYR50,310 are converted to $10,062 (based on the bank's bid price of $.200).

The profit is $10,062 − $10,000 = $62. The profit is lower here than in the previous example because bid and ask quotations are used. If the bid/ask spread were slightly larger in this example, then triangular arbitrage would not have been profitable. ●

Realignment Due to Triangular Arbitrage The realignment that results from triangular arbitrage activity is summarized in the second column of Exhibit 7.6. The realignment will probably occur quickly to prevent continued benefits from triangular arbitrage. The discrepancies assumed here would seldom at a single bank; it is much more likely that triangular arbitrage would require three transactions at three separate banks.

If any two of these three exchange rates are known, then the exchange rate of the third pair can be determined. Whenever the actual cross exchange rate differs from the appropriate cross exchange rate, the exchange rates of the currencies are not in equilibrium. Triangular arbitrage would force the exchange rates back into equilibrium.

Like locational arbitrage, triangular arbitrage is a strategy that few of us can ever exploit because the computer technology available to foreign exchange dealers can almost instantaneously detect misalignments in cross exchange rates. The point of this discussion is that triangular arbitrage will ensure that cross exchange rates are usually aligned correctly. If cross exchange rates are not properly aligned, then triangular arbitrage will take place until the rates are aligned correctly.

7-1c Covered Interest Arbitrage

The forward rate of a currency for a specified future date is determined by the interaction of demand for the contract (forward purchases) versus the supply (forward sales). Forward rates are quoted for some widely traded currencies (just below the respective spot rate quotation) in the *Wall Street Journal.* Financial institutions that offer foreign exchange services set the forward rates, but these rates are driven by market forces (demand and supply conditions). In some cases, the forward rate may be priced at a level that allows investors to engage in arbitrage. Their actions will affect the volume of orders for forward purchases or forward sales of a particular currency, which in turn will affect the equilibrium forward rate. Arbitrage will continue until the forward rate is aligned where it should be, and at that point arbitrage will no longer be feasible. This arbitrage process and its effects on the forward rate are described next.

Steps Involved in Covered Interest Arbitrage **Covered interest arbitrage** is the process of capitalizing on the difference in interest rates between two countries while

Exhibit 7.6 Impact of Triangular Arbitrage

ACTIVITY	IMPACT
1. Participants use dollars to purchase pounds.	Bank increases its ask price of pounds with respect to the dollar.
2. Participants use pounds to purchase Malaysian ringgit.	Bank reduces its bid price of the British pound with respect to the ringgit; that is, it reduces the number of ringgit to be exchanged per pound received.
3. Participants use Malaysian ringgit to purchase U.S. dollars.	Bank reduces its bid price of ringgit with respect to the dollar.

covering your exchange rate risk with a forward contract. The logic of the term *covered interest arbitrage* becomes clear when it is broken into two parts: "interest arbitrage" refers to the process of capitalizing on the difference between interest rates between two countries; "covered" refers to hedging your position against exchange rate risk.

Covered interest arbitrage is sometimes interpreted to mean that the funds to be invested are borrowed locally. In this case, the investors are not tying up any of their own funds. In another interpretation, however, investors use their own funds. In this case, the term *arbitrage* is applied more loosely because there is a positive dollar amount invested over a period of time. The following discussion is based on this latter meaning of covered interest arbitrage; under either interpretation, however, arbitrage should have a similar impact on currency values.

EXAMPLE You desire to capitalize on relatively high rates of interest in the United Kingdom and have funds available for 90 days. The interest rate is certain; only the future exchange rate at which you will exchange pounds back to U.S. dollars is uncertain. You can use a forward sale of pounds to guarantee the rate at which you can exchange pounds for dollars at some future time.

Assume the following information.

- You have $800,000 to invest.
- The current spot rate of the pound is $1.60.
- The 90-day forward rate of the pound is $1.60.
- The 90-day interest rate in the United States is 2 percent.
- The 90-day interest rate in the United Kingdom is 4 percent.

Based on this information, you should proceed as follows:

1. On day 1, convert the $800,000 to £500,000 and deposit the £500,000 in a British bank.
2. On day 1, sell £520,000 90 days forward. By the time the deposit matures, you will have £520,000 (including interest).
3. In 90 days when the deposit matures, you can fulfill your forward contract obligation by converting your £520,000 into $832,000 (based on the forward contract rate of $1.60 per pound). ●

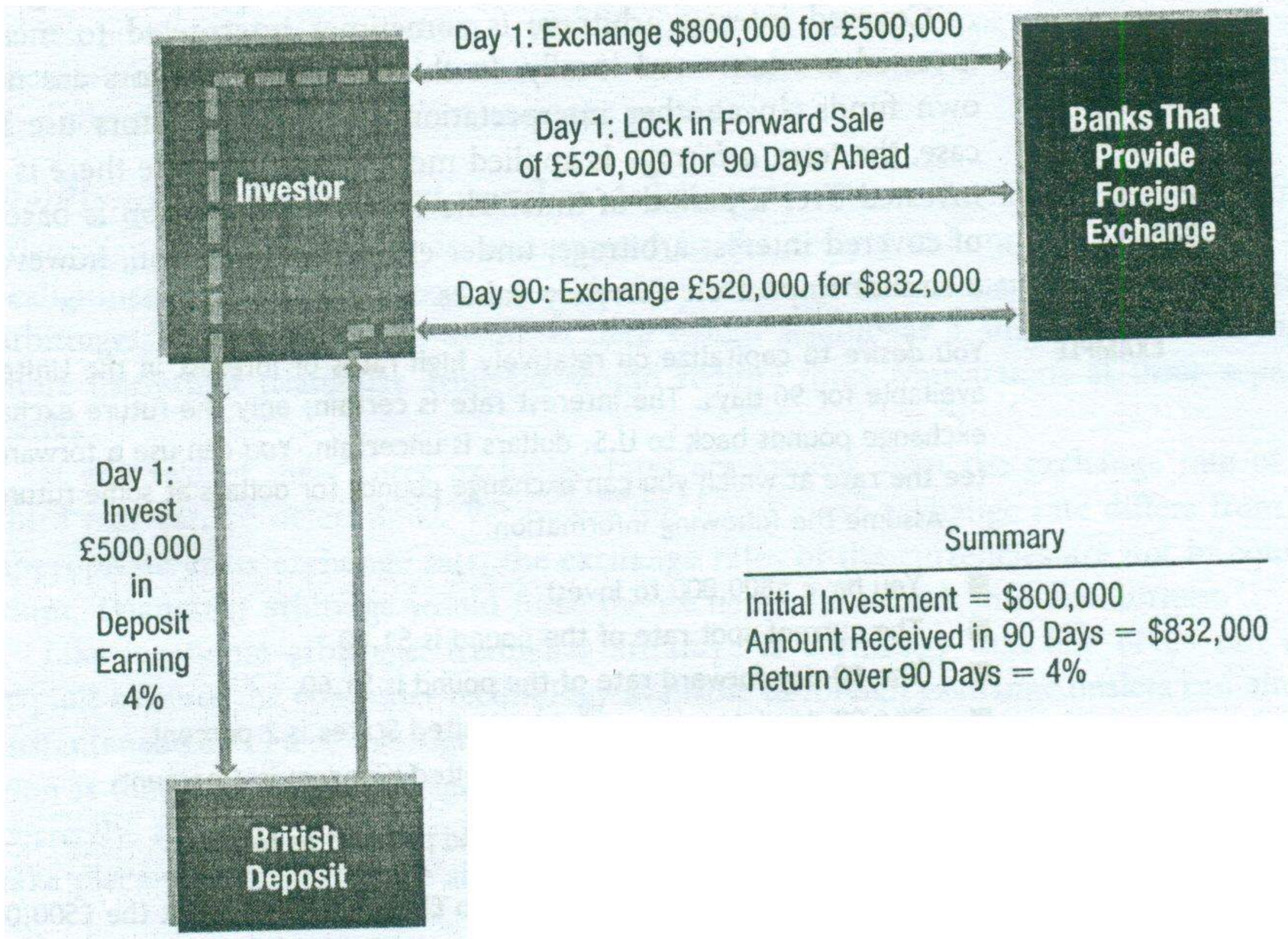
The steps involved in covered interest arbitrage are illustrated in Exhibit 7.7. In this example the strategy results in a 4 percent return over the three-month period, which is 2 percent above the return on a U.S. deposit. In addition, the return on this strategy is known on day 1, since you know when you make the deposit exactly how many dollars you will get back from your 90-day investment.

Recall that locational and triangular arbitrage do not tie up funds; thus, any profits are achieved instantaneously. In the case of covered interest arbitrage, however, the funds are tied up for a period of time (90 days in our example). This strategy would not be advantageous if it earned 2 percent or less, since you could earn 2 percent on a domestic deposit. The term *arbitrage* here suggests that you can guarantee a return on your funds that exceeds the returns you could achieve domestically.

Realignment Due to Covered Interest Arbitrage As with the other forms of arbitrage, market forces resulting from covered interest arbitrage will eventually lead to market realignment. As many investors capitalize on covered interest arbitrage, there is downward pressure on the 90-day forward rate. Once the forward rate has a discount from the spot rate that is about equal to the interest rate advantage, covered interest arbitrage will no longer be feasible. Since the interest rate advantage of the British interest rate over the U.S. interest rate is 2 percent, the arbitrage will no longer be feasible once the forward rate of the pound exhibits a discount of about 2 percent.

Timing of Realignment The realignment of the forward rate might not be completed until several transactions occur. The realignment does not erase the gains to those

Exhibit 7.7 Example of Covered Interest Arbitrage



U.S. investors who initially engaged in covered interest arbitrage. Recall that they locked in their gain by obtaining a forward contract on the day that they made their investment. But their actions to sell pounds forward placed downward pressure on the forward rate. Perhaps their actions initially would have caused a small discount in the forward rate, such as 1 percent. Under these conditions, U.S. investors would still benefit from covered interest arbitrage, because the 1 percent discount only partially offsets the 2 percent interest rate advantage. Even though the benefits are not as great as they were initially, covered interest arbitrage should continue until the forward rate exhibits a discount of about 2 percent (i.e., enough to offset the 2 percent interest rate advantage). Even though complete realignment may require several arbitrage transactions, this usually occurs quickly (e.g., within a few minutes).

Realignment Is Focused on the Forward Rate In the previous example, only the forward rate was affected by the forces of covered interest arbitrage. It is possible that also the spot rate could experience upward pressure due to the increased demand. If the spot rate appreciates, then the forward rate would not have to decline by as much in order to achieve the 2 percent forward discount that would offset the 2 percent interest rate differential. Yet because the forward market is less liquid, the forward rate is more sensitive to shifts in demand (or supply) conditions caused by covered interest arbitrage; therefore, the forward rate is likely to experience most if not all of the adjustment needed to achieve realignment.

EXAMPLE Assume that, as a result of covered interest arbitrage, the 90-day forward rate of the pound declined to $1.5692. Consider the results from using $800,000 (as in the previous example) to engage in covered interest arbitrage after the forward rate has adjusted.

1. Convert $800,000 to pounds:

$$\$800{,}000/\$1.60 = £500{,}000$$

2. Calculate accumulated pounds over 90 days at 4 percent:

$$£500{,}000 \times 1.04 = £520{,}000$$

3. Reconvert pounds to dollars (at the forward rate of $1.5692) after 90 days:

$$£520{,}000 \times \$1.5692 = \$815{,}984$$

4. Determine the yield earned from covered interest arbitrage:

$$(\$815{,}984 - \$800{,}000)/\$800{,}000 = .02, \text{ or } 2\%$$

As this example shows, the forward rate has declined to a level such that future attempts to engage in covered interest arbitrage are no longer feasible. Now the return from covered interest arbitrage is no better than what the investor can earn domestically. ●

Accounting for Spreads The following example illustrates the effects of the spread between the bid and ask quotes and of the spread between deposit and loan rates.

EXAMPLE Suppose you are given the following exchange rates and one-year interest rates.

	BID QUOTE	ASK QUOTE
Euro spot	$1.12	$1.13
Euro 1-year forward	$1.12	$1.13
	DEPOSIT RATE	LOAN RATE
Interest rate on dollars	6.0%	9.0%
Interest rate on euros	6.5%	9.5%

You have $100,000 to invest for one year. Would you benefit from engaging in covered interest arbitrage?

Observe that the quotes of the euro spot and forward rates are exactly the same whereas the deposit rate on euros is .5 percent higher than the deposit rate on dollars. It may therefore seem that covered interest arbitrage is feasible. However, U.S. investors would be subjected to the ask quote when buying euros (€) in the spot market versus the bid quote when selling those euros via a one-year forward contract.

1. Convert $100,000 to euros (ask quote):

$$\$100{,}000/\$1.13 = £88{,}496$$

2. Calculate accumulated euros over one year at 6.5 percent:

$$£88{,}496 \times 1.065 = £94{,}248$$

3. Sell euros for dollars at the forward rate (bid quote):

$$£94{,}248 \times \$1.12 = \$105{,}558$$

4. Determine the yield earned from covered interest arbitrage:

$$(\$105{,}558 - \$100{,}000)/\$100{,}000 = 05558, \text{ or } 5.558\%$$

The yield is less than if you had invested the funds in the United States. Thus, covered interest arbitrage is not feasible. ●

Covered Interest Arbitrage by Non-U.S. Investors In the examples so far, covered interest arbitrage was conducted as if the United States were the home country for investors. The examples could easily be adapted to make any country the home country for investors.

EXAMPLE Assume that the one-year U.S. interest rate is 5 percent while the one-year Japanese interest rate is 4 percent. Suppose the spot rate of the Japanese yen is $.01 and that the one-year forward rate of the yen is $.01. Investors based in Japan could benefit from covered interest arbitrage by converting Japanese yen to dollars at the prevailing spot rate, investing the dollars at 5 percent, and simultaneously selling dollars (buying yen) forward. Since they are buying and selling dollars at the same price, they would earn 5 percent on this strategy, which is better than they could earn from investing in Japan.

As Japanese investors engage in covered interest arbitrage, the high Japanese demand to buy yen forward will place upward pressure on the one-year forward rate of the yen. Once the one-year forward rate of the Japanese yen exhibits a premium of about 1 percent, new attempts to pursue covered interest arbitrage would not be feasible for Japanese investors because the 1 percent premium paid to buy yen forward would offset the 1 percent interest rate advantage in the United States. ●

The concept of covered interest arbitrage applies to any two countries for which there is a spot rate and a forward rate between their currencies as well as risk-free interest rates quoted for both currencies. If investors from Japan wanted to pursue covered interest arbitrage over a 90-day period in France, they would convert Japanese yen to euros in the spot market, invest in a 90-day risk-free security in France, and simultaneously lock in the sale of euros (in exchange for Japanese yen) 90 days forward with a 90-day forward contract.

7-1d Comparison of Arbitrage Effects

Exhibit 7.8 compares the three types of arbitrage. The threat of locational arbitrage ensures that quoted exchange rates are similar across banks at different locations; the threat of triangular arbitrage ensures that cross exchange rates are properly set; and the threat of covered interest arbitrage ensures that forward exchange rates are properly set. Any discrepancy will trigger arbitrage, which should eliminate the discrepancy. Thus, arbitrage tends to ensure a more orderly foreign exchange market.

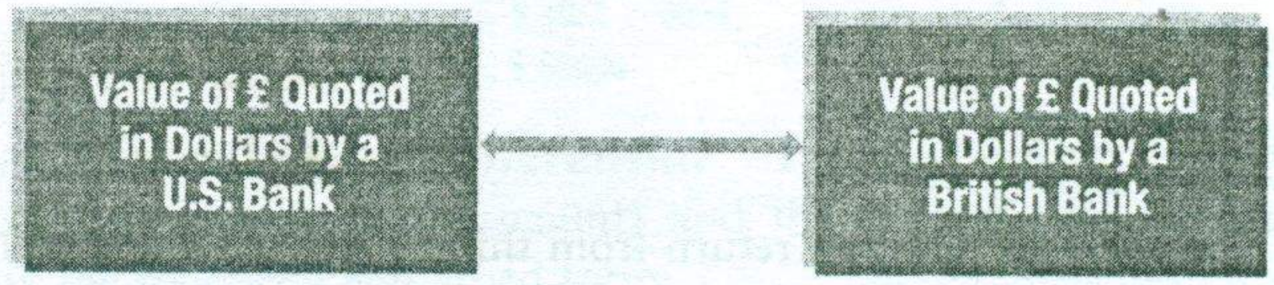
How Arbitrage Reduces Transaction Costs Many MNCs engage in transactions amounting to more than $100 million per year. Because the foreign exchange market is over the counter, there is no single consistently transparent set of exchange quotations. Hence managers of an MNC could incur large transaction costs if they consistently paid too much for the currencies they needed. However, the arbitrage process limits the degree of difference in quotations among currencies. Locational arbitrage limits the differences in a spot exchange rate quotation across locations, while covered interest arbitrage ensures that the forward rate is properly priced. Thus, an MNC's managers should be able to avoid excessive transaction costs.

7-2 Interest Rate Parity (IRP)

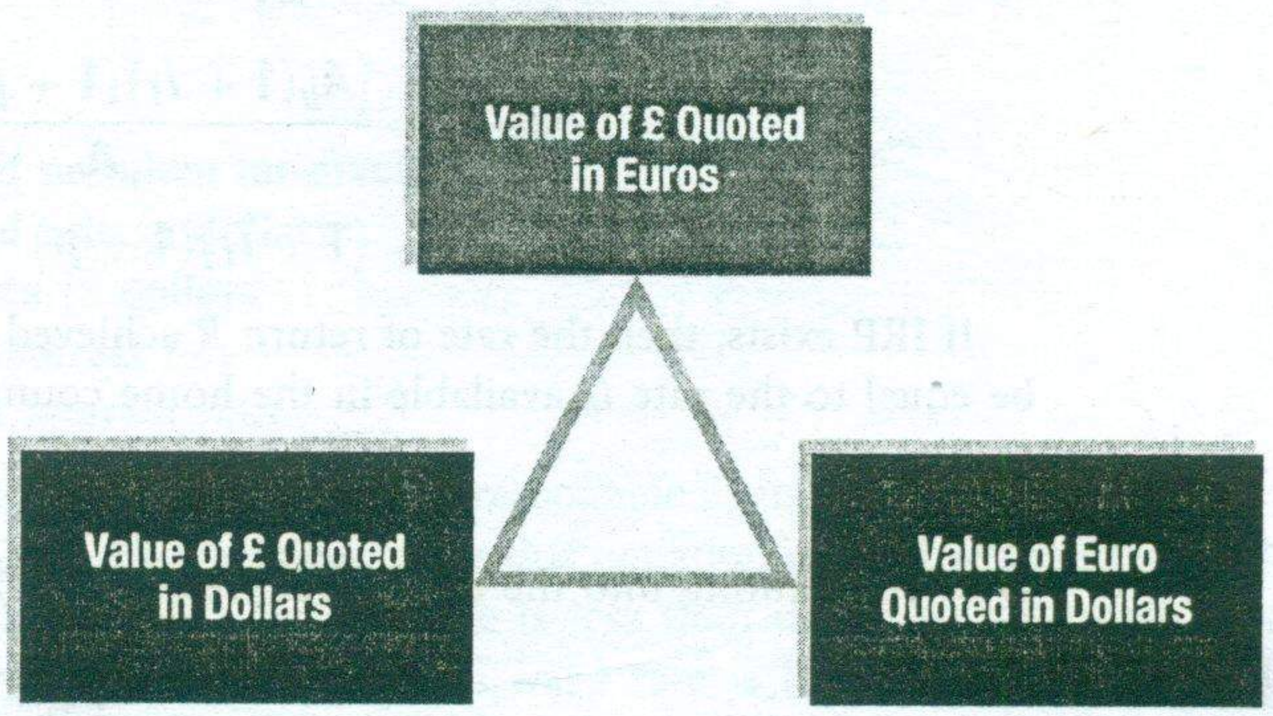
When market forces cause interest rates and exchange rates to adjust such that covered interest arbitrage is no longer feasible, the result is an equilibrium state known as **interest rate parity (IRP)**. In equilibrium, the forward rate differs from the spot rate by a sufficient amount to offset the interest rate differential between two currencies. In the previous example, the U.S. investor receives a higher interest rate from the foreign investment; yet there is an offsetting effect because the investor must pay more per unit of foreign currency (at the spot rate) than is received per unit when the currency is sold forward (at the forward rate). Recall that when the forward rate is less than the spot rate, this implies that the forward rate exhibits a discount.

Exhibit 7.8 Comparing Arbitrage Strategies

Locational Arbitrage: Capitalizes on discrepancies in exchange rates across locations.



Triangular Arbitrage: Capitalizes on discrepancies in cross exchange rates.



Covered Interest Arbitrage: Capitalizes on discrepancies between the forward rate and the interest rate differential.



7-2a Derivation of Interest Rate Parity

The relationship between a forward premium (or discount) of a foreign currency and the interest rates representing these currencies according to IRP can be determined as follows. Consider a U.S. investor who attempts covered interest arbitrage. The investor's return from using this strategy can be calculated from the following information:

- the amount of the home currency (U.S. dollars, in our example) that is initially invested (A_h),
- the spot rate (S) in dollars when the foreign currency is purchased,
- the interest rate on the foreign deposit (i_f), and
- the forward rate (F) in dollars at which the foreign currency will be converted back to U.S. dollars.

With this strategy, the amount of home currency received at the end of the deposit period is

$$A_n = (A_h/S)(1 + i_f)F$$

Since F is simply S multiplied by 1 plus the forward premium p, we can rewrite this equation as

$$\begin{aligned} A_n &= (A_h/S)(1 + i_f)[S(1 + p)] \\ &= A_h(1 + i_f)(1 + p) \end{aligned}$$

The rate of return from this investment (called R) is given as follows:

$$\begin{aligned} R &= \frac{A_n - A_h}{A_h} \\ &= \frac{[A_h(1 + i_f)(1 + p)] - A_h}{A_h} \\ &= (1 + i_f)(1 + p) - 1 \end{aligned}$$

If IRP exists, then the rate of return R achieved from covered interest arbitrage should be equal to the rate i_h available in the home country; we therefore set

$$R = i_h$$

Now substituting into the original expression for R, we obtain

$$(1 + i_f)(1 + p) - 1 = i_h$$

After rearranging terms, we can determine what the forward premium of the foreign currency should be under IRP:

$$\begin{aligned} (1 + i_f)(1 + p) - 1 &= i_h \\ (1 + i_f)(1 + p) &= 1 + i_h \\ 1 + p &= \frac{1 + i_h}{1 + i_f} \\ p &= \frac{1 + i_h}{1 + i_f} - 1 \end{aligned}$$

Thus, given the two interest rates of concern, the forward rate under conditions of IRP can be derived. If the actual forward rate is different from this derived forward rate, then there may be potential for covered interest arbitrage.

7-2b Determining the Forward Premium

Using the information just presented, the forward premium can be measured based on the interest rate difference under conditions of IRP.

EXAMPLE Assume that the Mexican peso exhibits a six-month interest rate of 6 percent and that the U.S. dollar exhibits a six-month interest rate of 5 percent. From a U.S. investor's perspective, the U.S. dollar is the home currency. According to IRP, the forward rate premium of the peso with respect to the U.S. dollar should be

$$\begin{aligned} p &= \frac{1 + .05}{1 + .06} - 1 \\ &= -.0094, \text{ or } -.94\% \text{ (not annualized)} \end{aligned}$$

Thus, the six-month forward contract on the peso should exhibit a discount of about .94 percent. This means that U.S. investors would receive .94 percent less when selling pesos six months from now (based on a forward sale) than the price they pay for pesos today at the spot rate. Such a discount would offset the peso's interest rate advantage. If the peso's spot rate is $.10, then a forward discount of .94 percent results in the following calculation of the six-month forward rate:

$$\begin{aligned} F &= S(1 + p) \\ &= \$.10(1 - 0094) \\ &= \$.09906 \end{aligned}$$

Effect of the Interest Rate Differential The relationship predicted by IRP between the forward premium (or discount) and the interest rate differential can be approximated by the following simplified form:

$$p = \frac{F - S}{S} \approx i_h - i_f$$

where

p = forward premium (or discount)
F = forward rate in dollars
S = spot rate in dollars
i_h = home interest rate
i_f = foreign interest rate

This approximate form provides a reasonable estimate when the interest rate differential is small. Note that the variables in this equation are not annualized. In our previous example, the U.S. (home) interest rate is less than the foreign interest rate, so the forward rate contains a discount (the forward rate is less than the spot rate). The larger the degree by which the foreign interest rate exceeds the home interest rate, the larger will be the forward discount of the foreign currency specified by the IRP formula.

If the foreign interest rate is less than the home interest rate, then IRP suggests that the forward rate should exhibit a premium.

Implications If the forward premium is equal to the interest rate differential as just described, then covered interest arbitrage will not be feasible.

EXAMPLE Use the information on the spot rate, the six-month forward rate of the peso, and Mexico's interest rate from the preceding example to determine a U.S. investor's return from using covered interest arbitrage. Assume the investor begins with $1,000,000 to invest.

Step 1. On the first day, the U.S. investor converts $1,000,000 into Mexican pesos (MXP) at $.10 per peso:

$$\$1{,}000{,}000/\$.10 \text{ per peso} = \text{MXP}10{,}000{,}000$$

Step 2. On the first day, this investor also sells pesos six months forward. The number of pesos to be sold forward is the anticipated accumulation of pesos over the six-month period, which is estimated as

$$\text{MXP}10{,}000{,}000 \times (1 + .06) = \text{MXP}10{,}600{,}000$$

Step 3. After six months, the U.S. investor withdraws the initial deposit of pesos along with the accumulated interest, amounting to a total of 10,600,000 pesos. The investor converts the pesos into dollars in accordance with the forward contract agreed upon six months earlier. The forward rate was $.09906, so the number of U.S. dollars received from the conversion is

$$\text{MXP}10{,}600{,}000 \times (\$.09906 \text{ per peso}) = \$1{,}050{,}036$$

In this case, the investor's covered interest arbitrage achieves a return of about 5 percent. Rounding the forward discount to .94 percent causes the slight deviation from the 5 percent return. Thus, using covered interest arbitrage under these circumstances generates a return that is about

what the investor would receive by investing the funds domestically. This result confirms that covered interest arbitrage is not worthwhile if IRP holds. ●

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7-2c Graphic Analysis of Interest Rate Parity

A graph can be used to compare the interest rate differential with the forward premium (or discount). The diagonal line in Exhibit 7.9 plots all points that satisfy interest rate parity.

Points Representing a Discount For all situations in which the foreign interest rate is *higher* than the home interest rate, the forward rate should exhibit a discount approximately equal to that difference. When the foreign interest rate (i_f) exceeds the home interest rate (i_h) by 1 percent ($i_h - i_f = -1\%$), the forward rate should exhibit a discount of 1 percent. This is represented by point A on the graph. If the foreign interest rate exceeds the home rate by 2 percent then the forward rate should exhibit a discount of 2 percent (as represented by point B), and so forth.

Points Representing a Premium For all situations in which the foreign interest rate is *lower* than the home interest rate, the forward rate should exhibit a premium approximately equal to that difference. For example, when the home interest rate exceeds the foreign rate by 1 percent ($i_h - i_f = 1\%$), the forward premium should be 1 percent; this is represented by point C in Exhibit 7.9. If the home interest rate exceeds the foreign rate by 2 percent ($i_h - i_f = 2\%$) then the forward premium should be 2 percent, as represented by point D, and so forth.

Exhibit 7.9 Illustration of Interest Rate Parity

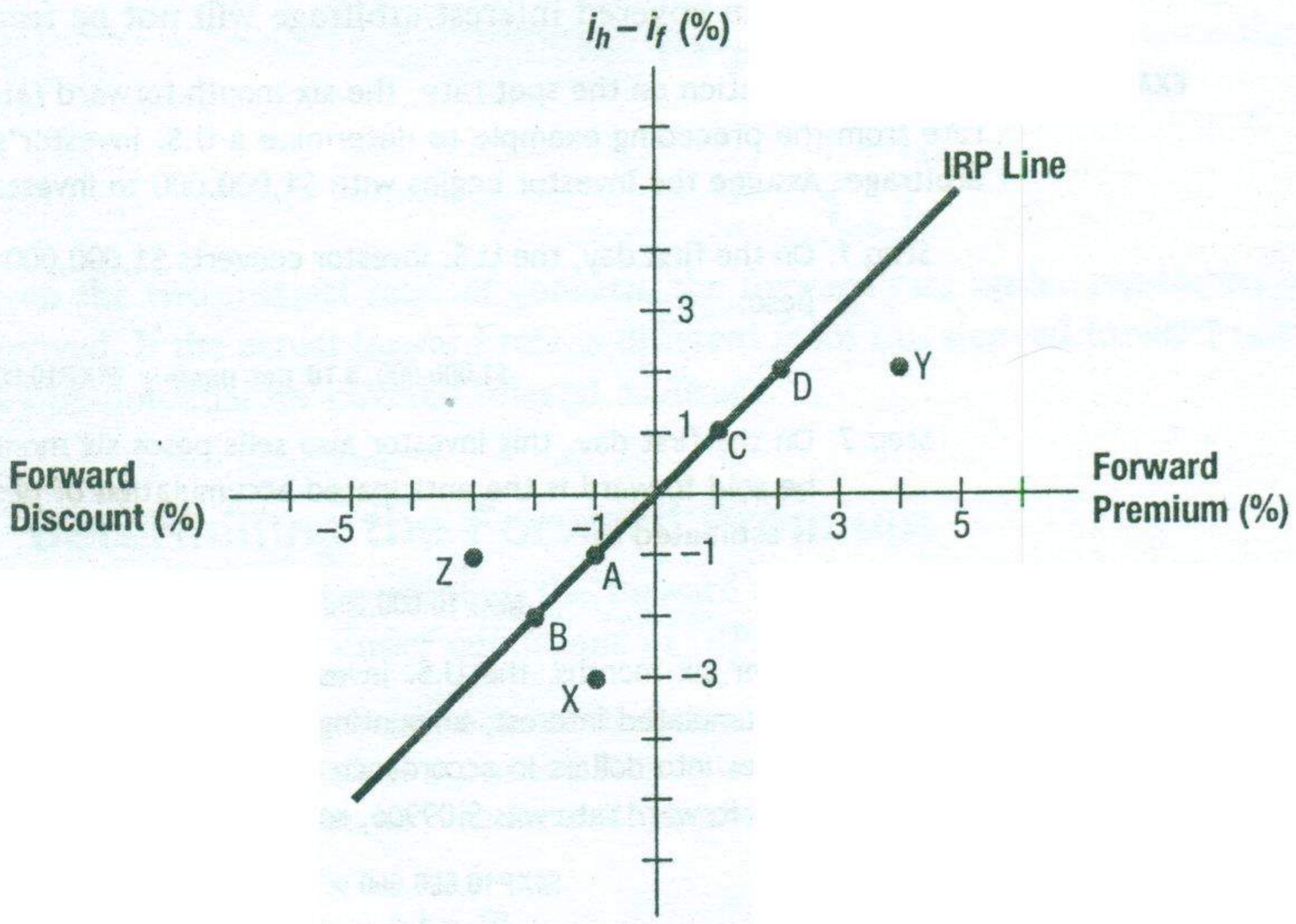


Exhibit 7.9 can be used whether or not you annualize the rates as long as you are consistent. That is, if you annualize the interest rates to determine the interest rate differential, then you should also annualize the forward premium or discount.

Points Representing IRP Any points lying on the diagonal line that intersects the graph's origin represent IRP. For this reason, that diagonal line is referred to as the **interest rate parity (IRP) line**. Covered interest arbitrage is not possible under conditions represented by points along the IRP line.

At any time, an individual or corporation can examine any currency to compare its forward rate premium (or discounts) to the interest rate differential with the United States. From a U.S. perspective, interest rates in Japan are usually lower than the home interest rate. Consequently, the forward rate of the Japanese yen usually exhibits a premium and may be represented by points such as C or D (or even by points above D) along the diagonal line in Exhibit 7.9. Conversely, the United Kingdom often has higher interest rates than the United States, so the pound's forward rate often exhibits a discount, which could be represented by point A or B on the graph.

A currency represented by point B has an interest rate that is 2 percent above the prevailing home interest rate. If the home country is the United States, then this means that investors who live in the foreign country and invest their funds in local risk-free securities earn 2 percent more than investors in the United States who invest in risk-free U.S. securities. Under IRP, a U.S. investor who attempted covered interest arbitrage (by investing in that foreign currency with the higher interest rate) would fail to earn any more than could be earned in the United States because the forward rate of that currency would exhibit a 2 percent discount.

A currency represented by point D has an interest rate that is 2 percent below the prevailing interest rate. If the home country is the United States, then investors who live in the foreign country and invest their funds in local risk-free securities earn 2 percent less than U.S. investors who invest in risk-free U.S. securities. Under IRP, even if those foreign investors attempt to use covered interest arbitrage by investing in the United States, they will still earn only what they could in the United States; the reason is that they would have to pay a forward premium of 2 percent when exchanging dollars for their home currency.

Points below the IRP Line Suppose a three-month deposit denominated in a foreign currency offers an annualized interest rate of 10 percent versus an annualized interest rate of 7 percent in the home country; this scenario is represented on the graph by $i_h - i_f = -3\%$. Assume that the foreign currency exhibits an annualized forward discount of 1 percent. The combined interest rate differential and forward discount information can be represented by point X on the Exhibit 7.9 graph. Since point X is not on the IRP line, we should expect that covered interest arbitrage will be beneficial for some investors. The investor attains an additional 3 percentage points for the foreign deposit, and this advantage is only partially offset by the 1 percent forward discount.

Now suppose that the annualized interest rate for the foreign currency is 5 percent versus 7 percent in the home country; this differential is expressed on the graph as $i_h - i_f = 2\%$. Assume, however, that the forward premium of the foreign currency is 4 percent (point Y in the graph). The high forward premium more than compensates for what the investor loses on the lower interest rate from the foreign investment.

If the current interest rate and forward rate situation is represented by point X or Y, then home country investors can engage in covered interest arbitrage. By investing in a foreign currency, they will earn a higher return (after considering the foreign interest rate and forward premium or discount) than the home interest rate. This type of activity will place upward pressure on the spot rate of the foreign currency, as well as downward pressure on the forward rate of the foreign currency, until covered interest arbitrage is no longer feasible.

Points above the IRP Line Now shift to the left side of the IRP line and take point Z, for example. This point represents a foreign interest rate that exceeds the home interest rate by 1 percent while the forward rate exhibits a 3 percent discount. This point, like all points to the left of the IRP line, signifies that U.S. investors would receive a lower return on a foreign than a domestic investment. The lower return normally occurs either because (1) the advantage of the foreign interest rate relative to the U.S. interest rate is more than offset by the forward rate discount (reflected by point Z), or (2) the extent by which the home interest rate exceeds the foreign rate more than offsets the forward rate premium.

For points such as these, covered interest arbitrage is feasible from the perspective of foreign investors. Consider British investors in the United Kingdom, whose interest rate is 1 percent higher than the U.S. interest rate and whose currency's forward rate (with respect to the dollar) contains a 3 percent discount (as represented by point Z). British investors will sell their foreign currency in exchange for dollars, invest in dollar-denominated securities, and engage in a forward contract to purchase pounds forward. Though they earn 1 percent less on the U. S. investment, they are able to purchase their home currency forward for 3 percent less than what they initially sold it forward in the spot market. This type of activity will place downward pressure on the spot rate of the pound, and upward pressure on the pound's forward rate, until covered interest arbitrage is no longer feasible.

7-2d How to Test Whether Interest Rate Parity Holds

An investor or firm can plot all realistic points for various currencies on a graph such as that in Exhibit 7.9 to determine whether gains from covered interest arbitrage can be achieved. The location of the points provides an indication of whether covered interest arbitrage is worthwhile. For points to the right of the IRP line, investors in the home country should consider using covered interest arbitrage, since a return higher than the home interest rate (i_h) is achievable. Of course, as investors and firms take advantage of such opportunities, the point will tend to move toward the IRP line. Covered interest arbitrage should continue until interest rate parity holds.

7-2e Interpretation of Interest Rate Parity

Interest rate parity does not imply that investors from different countries will earn the same returns. Rather, parity reflects a comparison between foreign versus domestic investment in risk-free interest-bearing securities by a particular investor.

EXAMPLE Assume that the United States has a 10 percent interest rate while the United Kingdom has a 14 percent interest rate. Then U.S. investors can either earn 10 percent domestically or attempt to use covered interest arbitrage. If they attempt covered interest arbitrage and if IRP holds then they will earn a 10 percent return, the same as they invested in the United States. Analogously, if U.K. investors attempt covered interest arbitrage and IRP holds, then they will be the same (14 percent) as what they could earn in the United Kingdom. Thus, U.S. and U.K. investors do not achieve the same nominal return even though IRP exists. In short: if IRP holds then investors cannot use covered interest arbitrage to earn higher returns than they could earn in their respective home countries. ●

7-2f Does Interest Rate Parity Hold?

In order to determine conclusively whether or not interest rate parity holds, compare the forward rate (or discount) with interest rate quotations occurring at the same time. If the forward rate and interest rate quotations are not simultaneous, then results could be somewhat distorted. However, limitations in access to data make it difficult to obtain quotations that reflect the same moment of time.

At different points in time, the position of a country may change. For example, if Brazil's interest rate increased while other countries' interest rates stayed the same, then Brazil's position would move downward along the *y*-axis in Exhibit 7.9. Yet also its forward discount would likely be more pronounced (more leftward along the *x*-axis), for otherwise covered interest arbitrage would occur. Therefore, Brazil's new location would be farther to the left but still along the 45-degree line.

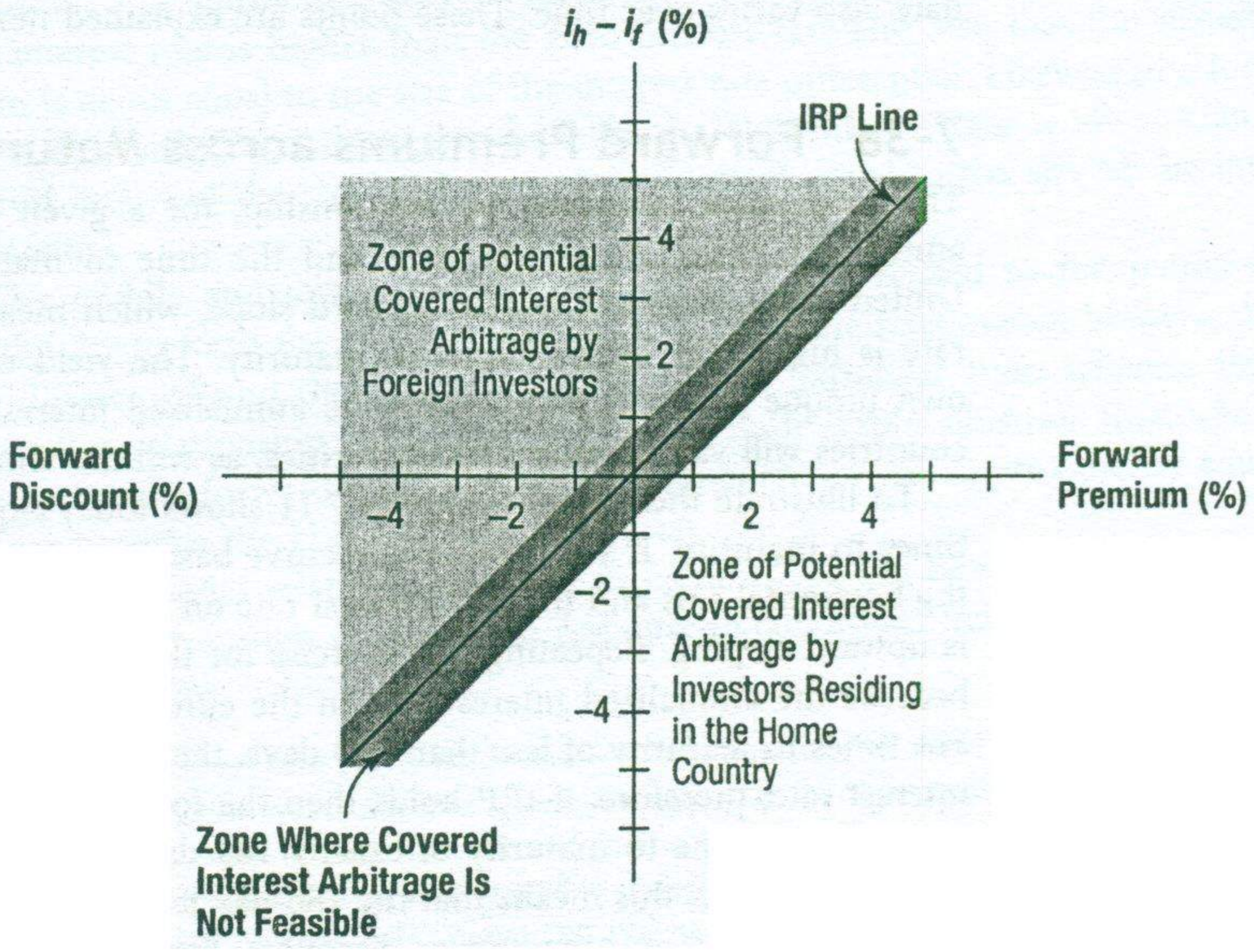
Numerous academic studies have examined IRP empirically in several periods. The actual relationship between the forward rate premium and interest rate differentials generally supports IRP. Although deviations from interest rate parity do occur, they are usually too slight to make covered interest arbitrage worthwhile, as we now discuss in more detail.

7-2g Considerations When Assessing Interest Rate Parity

If interest rate parity does not hold, then financial managers should contemplate covered interest arbitrage. Even without IRP, however, covered interest arbitrage may still prove not to be worthwhile after accounting for such characteristics of foreign investments as transaction costs, political risk, and differential tax laws.

Transaction Costs If an investor accounts for transaction costs, the point that indicates the actual interest rate differential and forward rate premium must then be farther from the IRP line to make covered interest arbitrage worthwhile. Exhibit 7.10 identifies the areas with potential for covered interest arbitrage *after* accounting for transaction costs: the dark shaded band surrounding the 45-degree IRP line. For points off the IRP

Exhibit 7.10 Potential for Covered Interest Arbitrage When Considering Transaction Costs



line but still within this band, covered interest arbitrage is not worthwhile (because the excess return is offset by costs). For points to the right of (or below) the band, investors residing in the home country could gain through covered interest arbitrage; tor points to the left of (or above) the band, foreign investors could gain through such arbitrage.

Political Risk Even if covered interest arbitrage appears feasible after accounting for transaction costs, investing funds overseas is subject to political risk. Although the forward contract locks in the rate at which the foreign funds should be reconverted, there is no guarantee that the foreign government will allow the funds to be reconverted. A crisis in the foreign country could cause its government to restrict any exchange of the local currency for other currencies. In this case, the investor would be unable to use these funds until the foreign government eliminated the restriction.

Investors may also perceive a slight default risk on foreign investments, such as foreign Treasury bills, because they cannot be certain that the foreign government will guarantee full repayment of interest and principal upon default. So because of concern that the foreign Treasury bills may default, these investors may accept a lower interest rate on their domestic Treasury bills rather than engage in covered interest arbitrage in an effort to obtain a slightly higher expected return.

Differential Tax Laws Because tax laws vary among countries, investors and firms that set up deposits in other countries must be aware of the prevailing tax laws. It may be that covered interest arbitrage is feasible in terms of before-tax but not after-tax returns. This scenario may arise when tax rates in the investor's country differ from those in the country of investment.

7-3 Variation in Forward Premiums

At any time, the forward premium varies among maturities for any particular currency. In addition, the forward premium of a particular currency with a particular maturity date also varies over time. These points are explained next.

7-3a Forward Premiums across Maturities

The *yield curve* describes the relationship, for a given moment in time, between the annualized yield of risk-free debt and the time to maturity. The yield curve for the United States normally has an upward slope, which means that the annualized interest rate is higher for longer terms to maturity. The yield curve for every country has its own unique shape. Consequently, the annualized interest rate differential between two countries will vary among debt maturities, as will the annualized forward premiums.

To illustrate these points, Exhibit 7.11 shows today's quoted interest rates for various times to maturity. If you plot a yield curve based on this data, with time to maturity on the horizontal axis and the U.S. interest rate on the vertical axis, then the U.S. yield curve is upward sloping. Repeating this exercise for the euro, however, yields a flat yield curve because the annualized interest rate in the eurozone is the same regardless of maturity. For times to maturity of less than 180 days, the euro interest rate is higher than the U.S. interest rate; therefore, if IRP holds then the forward rate of the euro will exhibit a discount. For a time to maturity of exactly 180 days, the euro interest rate is equal to the U.S. interest rate; this means that the 180-day forward rate of the euro should be equal to its spot rate (i.e., no premium or discount). For times to maturity beyond 180 days, the euro interest rate is lower than the U.S. interest rate and so the euro's forward rate should exhibit a premium (if IRP holds).

Exhibit 7.11 Quoted Interest Rates for Various Times to Maturity

TIME TO MATURITY	U.S. INTEREST (ANNUALIZED) QUOTED TODAY	EURO INTEREST (ANNUALIZED) QUOTED TODAY	INTEREST RATE DIFFERENTIAL (ANNUALIZED) BASED ON TODAY'S QUOTES	APPROXIMATE FORWARD RATE PREMIUM (ANNUALIZED) OF EURO AS OF TODAY IF IRP HOLDS
30 days	4.0%	5.0%	−1.0%	−1.0%
90 days	4.5	5.0	−.5	−.5
180 days	5.0	5.0	.0	.0
1 year	5.5	5.0	+.5	+.5
2 years	6.0	5.0	+1.0	+1.0

Now consider the implications for U.S. firms that hedge future euro payments. A firm hedging euro outflows for a date that is less than 180 days from now will lock in a euro forward rate below the existing spot rate; conversely, a firm hedging euro outflows for a date that is beyond 180 days from now will lock in a euro forward rate above the existing spot rate. Thus, the amount of dollars needed by an MNC to hedge a future payment in euros will vary with the maturity date of the forward contract.

7-3b Changes in Forward Premiums over Time

Exhibit 7.12 illustrates the relationship between interest rate differentials and the forward premium over time when interest rate parity holds. Under IRP, the forward premium must adjust to existing interest rate conditions. In January, the U.S. interest rate is 2 percent above the euro interest rate, so the euro's forward premium must be 2 percent. By February, the U.S. and euro interest rates are the same, so the forward rate must be equal to the spot rate (and thus have no premium or discount). In March, the U.S. interest rate is 1 percent below the euro interest rate, so the euro must have a forward discount of 1 percent.

Exhibit 7.12 shows that the forward rate of the euro exhibits a premium whenever the U.S. interest rate is higher than the euro interest rate and also that the size of the premium is about equal to the size of the interest rate differential. Likewise, the forward rate of the euro exhibits a discount whenever the U.S. interest rate is lower than the euro interest rate, and the size of the premium is about equal to the size of the interest rate differential.

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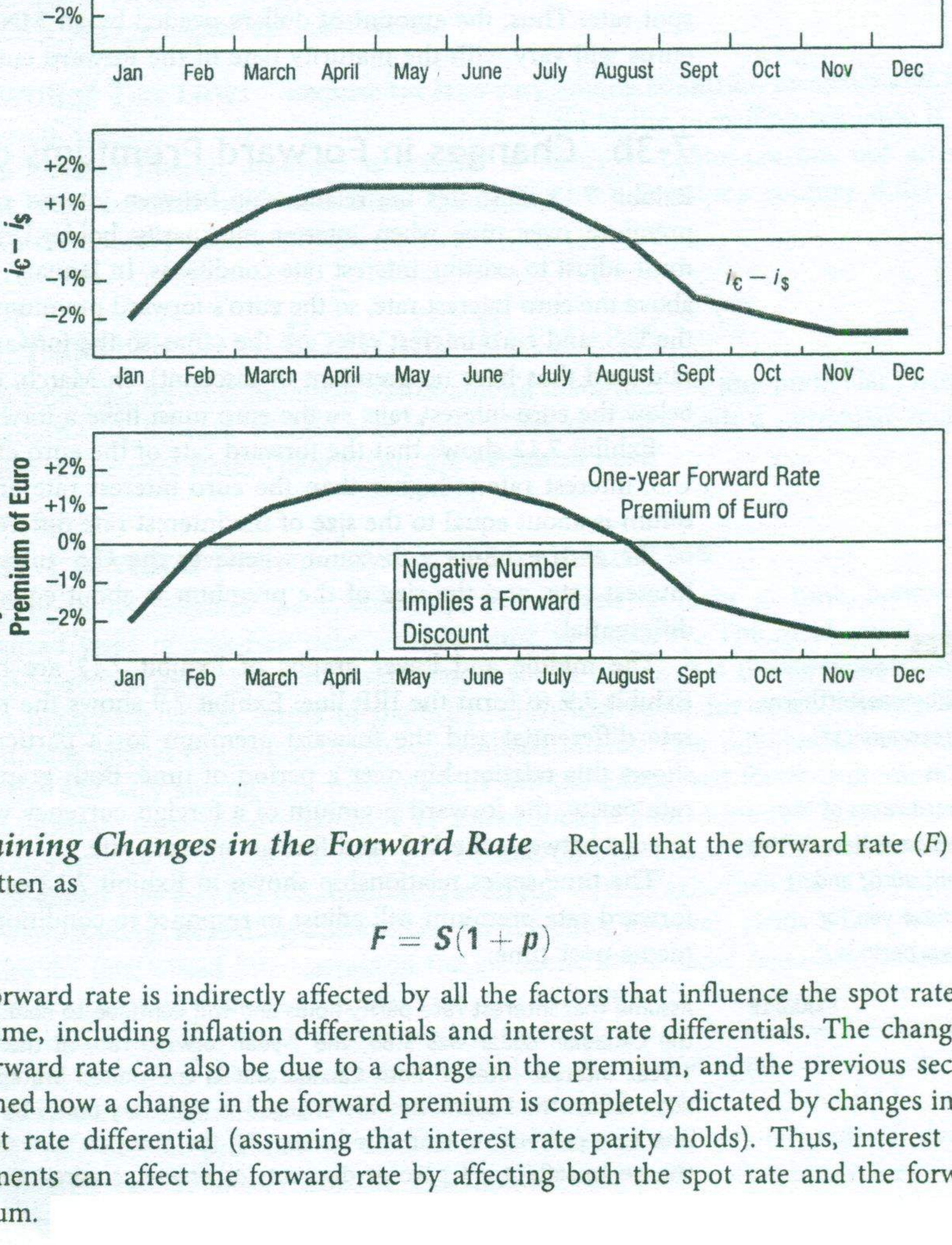
Forward rates of the Canadian dollar, British pound, euro, and Japanese yen for various periods.

The middle and lower graphs of Exhibit 7.12 are related to the points plotted in Exhibit 7.9 to form the IRP line. Exhibit 7.9 shows the relationship between the interest rate differential and the forward premium for a particular time, whereas Exhibit 7.12 shows this relationship over a period of time. Both graphs illustrate that, under interest rate parity, the forward premium of a foreign currency will approximately equal the difference between the U.S. and foreign interest rate.

The time-series relationship shown in Exhibit 7.12 can be used to determine how the forward rate premium will adjust in response to conditions that affect interest rate movements over time.

EXAMPLE Assume that interest rate parity holds and will continue to hold. As of this morning, the spot rate of the Canadian dollar was $.80, the 1-year forward rate of the Canadian dollar was $.80, and the 1-year interest rates in both Canada and in the United States were 5 percent. Suppose that, at noon today, the Federal Reserve engaged in monetary policy by reducing the one-year U.S. interest rate to 4 percent. In that case, under IRP the one-year forward rate of the Canadian dollar must change to reflect a 1 percent discount; otherwise, covered interest arbitrage will occur until the forward rate does exhibit a 1 percent discount. ●

Exhibit 7.12 Relationship over Time between the Interest Rate Differential and the Forward Premium



Explaining Changes in the Forward Rate Recall that the forward rate (F) can be written as

$$F = S(1 + p)$$

The forward rate is indirectly affected by all the factors that influence the spot rate (S) over time, including inflation differentials and interest rate differentials. The change in the forward rate can also be due to a change in the premium, and the previous section explained how a change in the forward premium is completely dictated by changes in the interest rate differential (assuming that interest rate parity holds). Thus, interest rate movements can affect the forward rate by affecting both the spot rate and the forward premium.

EXAMPLE Assume that, as of yesterday, the United States and Canada each had an annual interest rate of 5 percent. Under these conditions, interest rate parity should force the Canadian dollar to have a forward premium of zero. Suppose that the annual interest rate in the United States increased to 6 percent today while the Canadian interest rate remained at 5 percent. To maintain interest rate parity, commercial banks that serve the foreign exchange market will quote a forward rate with a premium of about 1 percent today, reflecting today's 1 percent interest rate differential between U.S. and Canadian interest rates. Thus, the forward rate will be 1 percent above today's spot rate. As long as the interest rate differential remains at 1 percent, any future movement in the spot rate will result in a similar movement in the forward rate to retain that 1 percent forward premium. ●

SUMMARY

- Locational arbitrage may occur if foreign exchange quotations differ among banks. The act of locational arbitrage should force the foreign exchange quotations of banks to become realigned, after which locational arbitrage will no longer be possible.
- Triangular arbitrage is related to cross exchange rates. A cross exchange rate between two currencies is determined by the values of these two currencies with respect to a third currency. If the actual cross exchange rate of these two currencies differs from the rate that should exist, triangular arbitrage is possible. The act of triangular arbitrage should force cross exchange rates to become realigned, at which time triangular arbitrage will no longer be possible.
- Covered interest arbitrage is based on the relationship between the forward rate premium and the interest rate differential. The size of the premium or discount exhibited by the forward rate of a currency should be about the same as the differential between the interest rates of the two countries of concern. In general terms, the forward rate of the foreign currency will contain a discount if its interest rate is higher than the U.S. interest rate.
- If the forward premium deviates substantially from the interest rate differential, then covered interest arbitrage is possible. In this type of arbitrage, a short-term investment in some foreign currency is covered by a forward sale of that foreign currency in the future. In this manner, the investor is not exposed to fluctuation in the foreign currency's value.
- According to the theory of interest rate parity (IRP), the size of the forward premium (or discount) should be equal to the interest rate differential between the two countries of concern. If IRP holds then covered interest arbitrage is not feasible, because any interest rate advantage in the foreign country will be offset by the discount on the forward rate. Thus, covered interest arbitrage would not generate higher returns than would be generated by a domestic investment.
- Since the forward premium of a currency (from a U.S. perspective) is influenced both by the interest rate of that currency and by the U.S. interest rate, and since those interest rates change over time, it follows that the forward premium changes over time. Thus a forward premium that is large and positive in one period, when the interest rate of that currency is relatively low, could become negative (reflecting a discount) if its interest rate rises above the U.S. level.

POINT COUNTER-POINT

Does Arbitrage Destabilize Foreign Exchange Markets?

Point Yes. Large financial institutions have the technology to recognize when one participant in the foreign exchange market is trying to sell a currency for a higher price than another participant. They also recognize when the forward rate does not properly reflect the interest rate differential. They use arbitrage to capitalize on these situations, which results in large foreign exchange transactions. In some cases, their arbitrage involves taking large positions in a currency and then reversing their positions a few minutes later. This jumping in and out of currencies can cause abrupt price adjustments of currencies and may create more volatility in the foreign exchange market. Regulations should be created that would force financial institutions to maintain their currency positions for at least 1 month. This would result in a more stable foreign exchange market.

Counter-Point No. When financial institutions engage in arbitrage, they create pressure on the price of a currency that will remove any pricing discrepancy. If arbitrage did not occur, pricing discrepancies would become more pronounced. Consequently, firms and individuals who use the foreign exchange market would have to spend more time searching for the best exchange rate when trading a currency. The market would become fragmented, and prices could differ substantially among banks in a region, or among regions. If the discrepancies became large enough, firms and individuals might even attempt to conduct arbitrage themselves. The arbitrage conducted by banks allows for a more integrated foreign exchange market, which ensures that foreign exchange prices quoted by any institution are in line with the market.

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. Assume that the following spot exchange rates exist today:

£1 = $1.50
C$ = $.75
£1 = C$2

Assume no transaction costs. Based on these exchange rates, can triangular arbitrage be used to earn a profit? Explain.

2. Assume the following information:

Spot rate of £ = $1.60
180-day forward rate of £ = $1.56
180-day British interest rate = 4%
180-day U.S interest rate = 3%

Based on this information, is covered interest arbitrage by U.S. investors feasible (assuming that U.S. investors use their own funds)? Explain.

3. Using the information in the previous question, does interest rate parity exist? Explain.

4. Explain in general terms how various forms of arbitrage can remove any discrepancies in the pricing of currencies.

5. Assume that the British pound's 1-year forward rate exhibits a discount. Assume that interest rate parity continually exists. Explain how the discount on the British pound's 1-year forward discount would change if British 1-year interest rates rose by 3 percentage points while U.S. 1-year interest rates rose by 2 percentage points.

QUESTIONS AND APPLICATIONS

1. **Locational Arbitrage** Explain the concept of locational arbitrage and the scenario necessary for it to be plausible.

2. **Locational Arbitrage** Assume the following information:

	BEAL BANK	YARDLEY BANK
Bid price of New Zealand dollar	$.401	$.398
Ask price of New Zealand dollar	$.404	$.400

Given this information, is locational arbitrage possible? If so, explain the steps involved in locational arbitrage, and compute the profit from this arbitrage if you had $1 million to use. What market forces would occur to eliminate any further possibilities of locational arbitrage?

3. **Triangular Arbitrage** Explain the concept of triangular arbitrage and the scenario necessary for it to be plausible.

4. **Triangular Arbitrage** Assume the following information:

	QUOTED PRICE
Value of Canadian dollar in U.S. dollars	$.90
Value of New Zealand dollar in U.S. dollars	$.30
Value of Canadian dollar in New Zealand dollars	NZ$3.02

Given this information, is triangular arbitrage possible? If so, explain the steps that would reflect triangular arbitrage, and compute the profit from this strategy if you had $1 million to use. What market forces would occur to eliminate any further possibilities of triangular arbitrage?

5. Covered Interest Arbitrage Explain the concept of covered interest arbitrage and the scenario necessary for it to be plausible.

6. Covered Interest Arbitrage Assume the following information:

Spot rate of Canadian dollar	$.80
90-day forward rate of Canadian dollar	$.79
90-day Canadian interest rate	4%
90-day U.S. interest rate	2.5%

Given this information, what would be the yield (percentage return) to a U.S. investor who used covered interest arbitrage? (Assume the investor invests $1 million.) What market forces would occur to eliminate any further possibilities of covered interest arbitrage?

7. Covered Interest Arbitrage Assume the following information:

Spot rate of Mexican peso	$.100
180-day forward rate of Mexican peso	$.098
180-day Mexican interest rate	6%
180-day U.S. interest rate	5%

Given this information, is covered interest arbitrage worthwhile for Mexican investors who have pesos to invest? Explain your answer.

8. Effects of September 11 The terrorist attack on the United States on September 11, 2001, caused expectations of a weaker U.S. economy. Explain how such expectations could have affected U.S. interest rates and therefore have affected the forward rate premium (or discount) on various foreign currencies.

9. Interest Rate Parity Explain the concept of interest rate parity. Provide the rationale for its possible existence.

10. Inflation Effects on the Forward Rate Why do you think currencies of countries with high inflation rates tend to have forward discounts?

11. Covered Interest Arbitrage in Both Directions Assume that the existing U.S. 1-year interest rate is 10 percent and the Canadian 1-year interest rate is 11 percent. Also assume that interest rate parity exists. Should the forward rate of the Canadian dollar exhibit a discount or a premium? If U.S. investors attempt covered interest arbitrage, what will be their return? If Canadian investors attempt covered interest arbitrage, what will be their return?

12. Interest Rate Parity Why would U.S. investors consider covered interest arbitrage in France when the interest rate on euros in France is lower than the U.S. interest rate?

13. Interest Rate Parity Consider investors who invest in either U.S. or British 1-year Treasury bills. Assume zero transaction costs and no taxes.

a. If interest rate parity exists, then the return for U.S. investors who use covered interest arbitrage will be the same as the return for U.S. investors who invest in U.S. Treasury bills. Is this statement true or false? If false, correct the statement.

b. If interest rate parity exists, then the return for British investors who use covered interest arbitrage will be the same as the return for British investors who invest in British Treasury bills. Is this statement true or false? If false, correct the statement.

14. Changes in Forward Premiums Assume that the Japanese yen's forward rate currently exhibits a premium of 6 percent and that interest rate parity exists. If U.S. interest rates decrease, how must this premium change to maintain interest rate parity? Why might we expect the premium to change?

15. Changes in Forward Premiums Assume that the forward rate premium of the euro was higher last month than it is today. What does this imply about interest rate differentials between the United States and Europe today compared to those last month?

16. Interest Rate Parity If the relationship that is specified by interest rate parity does not exist at any period but does exist on average, then covered interest arbitrage should not be considered by U.S. firms. Do you agree or disagree with this statement? Explain.

17. Covered Interest Arbitrage in Both Directions The 1-year interest rate in New Zealand is 6 percent. The 1-year U.S. interest rate is 10 percent. The spot rate of the New Zealand dollar (NZ$) is $.50. The forward rate of the New Zealand dollar is $.54. Is covered interest arbitrage feasible for U.S. investors? Is it feasible for New Zealand investors? In each case, explain why covered interest arbitrage is or is not feasible.

18. Limitations of Covered Interest Arbitrage Assume that the 1-year U.S. interest rate is 11 percent, while the 1-year interest rate in Malaysia is 40 percent. Assume that a U.S. bank is willing to purchase the currency of that country from you 1 year from now at a discount of 13 percent. Would covered interest arbitrage be worth considering? Is there any reason why you should not attempt covered interest arbitrage in this situation? (Ignore tax effects.)

19. Covered Interest Arbitrage in Both Directions Assume that the annual U.S. interest rate is currently 8 percent and Germany's annual interest rate is currently 9 percent. The euro's 1-year forward rate currently exhibits a discount of 2 percent.

a. Does interest rate parity exist?

b. Can a U.S. firm benefit from investing funds in Germany using covered interest arbitrage?

c. Can a German subsidiary of a U.S. firm benefit by investing funds in the United States through covered interest arbitrage?

20. Covered Interest Arbitrage The South African rand has a 1-year forward premium of 2 percent. One-year interest rates in the United States are 3 percentage points higher than in South Africa. Based on this information, is covered interest arbitrage possible for a U.S. investor if interest rate parity holds?

21. Deriving the Forward Rate Assume that annual interest rates in the United States are 4 percent, while interest rates in France are 6 percent.

a. According to IRP, what should the forward rate premium or discount of the euro be?

b. If the euro's spot rate is $1.10, what should the 1-year forward rate of the euro be?

22. Covered Interest Arbitrage in Both Directions The following information is available:

- You have $500,000 to invest.
- The current spot rate of the Moroccan dirham is $.110.
- The 60-day forward rate of the Moroccan dirham is $.108.
- The 60-day interest rate in the United States is 1 percent.
- The 60-day interest rate in Morocco is 2 percent.

a. What is the yield to a U.S. investor who conducts covered interest arbitrage? Did covered interest arbitrage work for the investor in this case?

b. Would covered interest arbitrage be possible for a Moroccan investor in this case?

Advanced Questions

23. Economic Effects on the Forward Rate Assume that Mexico's economy has expanded significantly, causing a high demand for loanable funds there by local firms. How might these conditions affect the forward discount of the Mexican peso?

24. Differences among Forward Rates Assume that the 30-day forward premium of the euro is 1 percent, while the 90-day forward premium of the euro is 2 percent. Explain the likely interest rate conditions that would cause these premiums. Does this ensure that covered interest arbitrage is worthwhile?

25. Testing Interest Rate Parity Describe a method for testing whether interest rate parity exists. Why are transaction costs, currency restrictions, and differential tax laws important when evaluating whether covered interest arbitrage can be beneficial?

26. Deriving the Forward Rate Before the Asian crisis began, Asian central banks were maintaining a somewhat stable value for their respective currencies. Nevertheless, the forward rate of Southeast Asian currencies exhibited a discount. Explain.

27. Interpreting Changes in the Forward Premium Assume that interest rate parity holds. At the beginning of the month, the spot rate of the Canadian dollar is $.70, while the 1-year forward rate is $.68. Assume that U.S. interest rates increase steadily over the month. At the end of the month, the 1-year forward rate is higher than it was at the beginning of the month. Yet, the 1-year forward discount is larger (the 1-year premium is more negative) at the end of the month than it was at the beginning of the month. Explain how the relationship between the U.S. interest rate and the Canadian interest rate changed from the beginning of the month until the end of the month.

28. Interpreting a Large Forward Discount The interest rate in Indonesia is commonly higher than the interest rate in the United States, which reflects a high expected rate of inflation there. Why should Nike consider hedging its future remittances from Indonesia to the U.S. parent even when the forward discount on the currency (rupiah) is so large?

29. Change in the Forward Premium At the end of this month, you (owner of a U.S. firm) are meeting with a Japanese firm to which you will try to sell supplies. If you receive an order from that firm, you will obtain a forward contract to hedge the future receivables in yen. As of this morning, the forward rate of the

yen and spot rate are the same. You believe that interest rate parity holds.

This afternoon, news occurs that makes you believe that the U.S. interest rates will increase substantially by the end of this month, and that the Japanese interest rate will not change. However, your expectations of the spot rate of the Japanese yen are not affected at all in the future. How will your expected dollar amount of receivables from the Japanese transaction be affected (if at all) by the news that occurred this afternoon? Explain.

30. Testing IRP The 1-year interest rate in Singapore is 11 percent. The 1-year interest rate in the United States is 6 percent. The spot rate of the Singapore dollar (S$) is $.50 and the forward rate of the S$ is $.46. Assume zero transaction costs.

a. Does interest rate parity exist?

b. Can a U.S. firm benefit from investing funds in Singapore using covered interest arbitrage?

31. Implications of IRP Assume that interest rate parity exists. You expect that the 1-year nominal interest rate in the United States is 7 percent, while the 1-year nominal interest rate in Australia is 11 percent. The spot rate of the Australian dollar is $.60. You will need 10 million Australian dollars in 1 year. Today, you purchase a 1-year forward contract in Australian dollars. How many U.S. dollars will you need in 1 year to fulfill your forward contract?

32. Triangular Arbitrage You go to a bank and are given these quotes:

You can buy a euro for 14 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.

33. Triangular Arbitrage You are given these quotes by the bank:

You can sell Canadian dollars (C$) to the bank for $.70

You can buy Canadian dollars from the bank for $.73.

The bank is willing to buy dollars for 0.9 euros per dollar.

The bank is willing to sell dollars for 0.94 euros per dollar.

The bank is willing to buy Canadian dollars for 0.64 euros per C$.

The bank is willing to sell Canadian dollars for 0.68 euros per C$.

You have $100,000. Estimate your profit or loss if you would attempt triangular arbitrage by converting your dollars to euros, and then convert euros to Canadian dollars and then convert Canadian dollars to U.S. dollars.

34. Movement in Cross Exchange Rates Assume that cross exchange rates are always proper, such that triangular arbitrage is not feasible. While at the Miami airport today, you notice that a U.S. dollar can be exchanged for 125 Japanese yen or 4 Argentine pesos at the foreign exchange booth. Last year, the Japanese yen was valued at $0.01, and the Argentine peso was valued at $.30. Based on this information, the Argentine peso has changed by what percent against the Japanese yen over the last year?

35. Impact of Arbitrage on the Forward Rate Assume that the annual U.S. interest rate is currently 6 percent and Germany's annual interest rate is currently 8 percent. The spot rate of the euro is $1.10 and the 1-year forward rate of the euro is $1.10. Assume that as covered interest arbitrage occurs, the interest rates are not affected, and the spot rate is not affected. Explain how the 1-year forward rate of the euro will change in order to restore interest rate parity, and why it will change. Your explanation should specify which type of investor (German or U.S.) would be engaging in covered interest arbitrage, whether they are buying or selling euros forward, and how that affects the forward rate of the euro.

36. IRP and Changes in the Forward Rate Assume that interest rate parity exists. As of this morning, the 1-month interest rate in Canada was lower than the 1-month interest rate in the United States. Assume that as a result of the Fed's monetary policy this afternoon, the 1-month interest rate in the United States declined this afternoon, but was still higher than the Canadian 1-month interest rate. The 1-month interest rate in Canada remained unchanged. Based on the information, the forward rate of the Canadian dollar exhibited a ___ [discount or premium] this morning that ___ [increased or decreased] this afternoon. Explain.

37. Deriving the Forward Rate Premium Assume that the spot rate of the Brazilian real is $.30 today. Assume that interest rate parity exists. Obtain the

interest rate data you need from Bloomberg.com to derive the 1-year forward rate premium (or discount), and then determine the 1-year forward rate of the Brazilian real.

38. Change in the Forward Premium over Time Assume that interest rate parity exists and will continue to exist. As of today, the 1-year interest rate of Singapore is 4 percent versus 7 percent in the United States. The Singapore central bank is expected to decrease interest rates in the future so that as of December 1, you expect that the 1-year interest rate in Singapore will be 2 percent. The U.S. interest rate is not expected to change over time. Based on the information, explain how the forward premium (or discount) is expected to change by December 1.

39. Forward Rates for Different Time Horizons Assume that interest rate parity (IRP) exists. Assume this information provided by today's Wall Street Journal:

Spot rate of British pound = $1.80

6-month forward rate of pound = $1.82

12-month forward rate of pound = $1.78

a. Is the annualized 6-month U.S. risk-free interest rate above, below, or equal to the British risk-free interest rate?

b. Is the 12-month U.S. risk-free interest rate above, below, or equal to the British risk-free interest rate?

40. Interpreting Forward Rate Information Assume that interest rate parity exists. The 6-month forward rate of the Swiss franc has a premium while the 12-month forward rate of the Swiss franc has a discount. What does this tell you about the relative level of Swiss interest rates versus U.S. interest rates?

41. IRP and Speculation in Currency Futures Assume that interest rate parity exists. The spot rate of the Argentine peso is $.40. The 1-year interest rate in the United States is 7 percent versus 12 percent in Argentina. Assume the futures price is equal to the forward rate. An investor purchased futures contracts on Argentine pesos, representing a total of 1,000,000 pesos. Determine the total dollar amount of profit or loss from this futures contract based on the expectation that the Argentine peso will be worth $.42 in 1 year.

42. Profit from Covered Interest Arbitrage Today, the 1-year U.S. interest rate is 4 percent, while the 1-year interest rate in Argentina is 17 percent. The spot rate of the Argentine peso (AP) is $.44. The 1-year forward rate of the AP exhibits a 14 percent discount. Determine the yield (percentage return on investment) to an investor from Argentina who engages in covered interest arbitrage.

43. Assessing Whether IRP Exists Assume zero transaction costs. As of now, the Japanese 1-year interest rate is 3 percent, and the U.S. 1-year interest rate is 9 percent. The spot rate of the Japanese yen is $.0090 and the 1-year forward rate of the Japanese yen is $.0097.

a. Determine whether interest rate parity exists, or whether the quoted forward rate is too high or too low.

b. Based on the information provided in (a), is covered interest arbitrage feasible for U.S. investors, for Japanese investors, for both types of investors, or for neither type of investor?

44. Change in Forward Rate Due to Arbitrage Earlier this morning, the annual U.S. interest rate was 6 percent and Mexico's annual interest rate was 8 percent. The spot rate of the Mexican peso was $.16. The 1-year forward rate of the peso was $.15. Assume that as covered interest arbitrage occurred this morning, the interest rates were not affected, and the spot rate was not affected, but the forward rate was affected, and consequently interest rate parity now exists. Explain which type of investor (Mexican or U.S.) engaged in covered interest arbitrage, whether they were buying or selling pesos forward, and how that affected the forward rate of the peso.

45. IRP Relationship Assume that interest rate parity (IRP) exists. Assume this information provided by today's *Wall Street Journal*:

Spot rate of Swiss franc = $.80

6-month forward rate of Swiss franc = $.78

12-month forward rate of Swiss franc = $.81

Assume that the annualized U.S. interest rate is 7 percent for a 6-month maturity and a 12-month maturity. Do you think the Swiss interest rate for a 6-month maturity is greater than, equal to, or less than the U.S. interest rate for a 6-month maturity? Explain.

46. Impact of Arbitrage on the Forward Rate Assume that the annual U.S. interest rate is currently 8 percent and Japan's annual interest rate is currently 7 percent. The spot rate of the Japanese yen is $.01. The 1-year forward rate of the Japanese yen is $.01. Assume that as covered interest arbitrage occurs the interest rates are not affected and the spot rate is not affected. Explain how the 1-year forward rate of the yen will change in order to restore interest rate parity, and why it will change. [Your explanation should specify which

type of investor (Japanese or U.S.) would be engaging in covered interest arbitrage and whether these investors are buying or selling yen forward, and how that affects the forward rate of the yen.]

47. Profit from Triangular Arbitrage The bank is willing to buy dollars for 0.9 euros per dollar. It is willing to sell dollars for 0.91 euros per dollar.

You can sell Australian dollars (A$) to the bank for $.72.

You can buy Australian dollars from the bank for $.74.

The bank is willing to buy Australian dollars (A$) for 0.68 euros per A$.

The bank is willing to sell Australian dollars (A$) for 0.70 euros per A$.

You have $100,000. Estimate your profit or loss if you were to attempt triangular arbitrage by converting your dollars to Australian dollars, then converting Australian dollars to euros, and then converting euros to U.S. dollars.

48. Profit from Triangular Arbitrage Alabama Bank is willing to buy or sell British pounds for $1.98. The bank is willing to buy or sell Mexican pesos at an exchange rate of 10 pesos per dollar. The bank is willing to purchase British pounds at an exchange rate of 1 peso = .05 British pounds. Show how you can make a profit from triangular arbitrage and what your profit would be if you had $100,000.

49. Cross Rate and Forward Rate Biscayne Co. will be receiving Mexican pesos today and will need to convert them into Australian dollars. Today, a U.S. dollar can be exchanged for 10 Mexican pesos. An Australian dollar is worth one-half of a U.S. dollar.

a. What is the spot rate of a Mexican peso in Australian dollars?

b. Assume that interest rate parity exists and that the annual risk-free interest rate in the United States, Australia, and Mexico is 7 percent. What is the 1-year forward rate of a Mexican peso in Australian dollars?

50. Changes in the Forward Rate Assume that interest rate parity exists and will continue to exist. As of this morning, the 1-month interest rate in the United States was higher than the 1-month interest rate in the eurozone. Assume that as a result of the European Central Bank's monetary policy this afternoon, the 1-month interest rate of the euro increased and is now higher than the U.S. 1-month interest rate. The 1-month interest rate in the United States remained unchanged.

a. Based on the information, do you think the 1-month forward rate of the euro exhibited a discount or premium this morning?

b. How did the forward premium change this afternoon?

51. Forces of Triangular Arbitrage You obtain the following quotes from different banks. One bank is willing to buy or sell Japanese yen at an exchange rate of 110 yen per dollar. A second bank is willing to buy or sell the Argentine peso at an exchange rate of $.37 per peso. A third bank is willing to exchange Japanese yen at an exchange rate of 1 Argentine peso = 40 yen.

a. Show how you can make a profit from triangular arbitrage and what your profit would be if you had $1,000,000.

b. As investors engage in triangular arbitrage, explain the effect on each of the exchange rates until triangular arbitrage would no longer be possible.

52. Return Due to Covered Interest Arbitrage Interest rate parity exists between the United States and Poland (its currency is the zloty). The 1-year risk-free CD (deposit) rate in the United States is 7 percent. The 1-year risk-free CD rate in Poland is 5 percent and denominated in zloty. Assume that there is zero probability of any financial or political problem such as a bank default or government restrictions on bank deposits or currencies in either country. Myron is from Poland and plans to invest in the United States. What is Myron's return if he invests in the United States and covers the risk of his investment with a forward contract?

53. Forces of Covered Interest Arbitrage As of now, the nominal interest rate is 6 percent in the United States and 6 percent in Australia. The spot rate of the Australian dollar is $.58, while the 1-year forward rate of the Australian dollar exhibits a discount of 2 percent. Assume that as covered interest arbitrage occurred this morning, the interest rates were not affected, the spot rate of the Australian dollar was not affected, but the forward rate of the Australian dollar was affected. Consequently interest rate parity now exists. Explain the forces that caused the forward rate of the Australian dollar to change by completing this sentence: The ___ [Australian or U.S.?] investors could benefit from engaging in covered interest arbitrage; their arbitrage would involve ___ [buying or selling?] Australian dollars forward, which would cause the forward rate of the Australian dollar to ___ [increase or decrease?].

54. Change in Forward Premium Over Time Assume that the one-year interest rate in the U.K. is 9 percent, while the one-year interest in the U.S is 4%. The spot rate of the pound is $1.50. Assume that interest rate parity exists. The quoted one-year interest in the U.K. is expected to rise consistently over the next month. Meanwhile, the quoted one-year interest rate in the U.S. is expected to decline consistently over the next month. Assume that the spot rate does not change over the month. Based on this information, how will the quoted one-year forward rate change over the next month?

55. Forward Rate Premiums Among Maturities Today, the annualized interest rate in the U.S. is 4% for any debt maturity. The annualized interest rate in Australia is 4% for debt maturities of 3 months or less, is 5% for debt maturities between 3 months and 6 months, and is 6% for debt maturities more than 6 months. Assume that interest rate parity exists. Does the forward rate quoted today for the Australian dollar exhibit a premium, or a discount, or does your answer vary with specific conditions? Briefly explain.

56. Explaining Movements in Forward Premiums Assume that interest rate parity holds and will continue to hold in the future. At the beginning of the month, the spot rate of the British pound is $1.60, while the one-year forward rate is $1.50. Assume that U.S. annual interest rate remains steady over the month. At the end of the month, the one-year forward rate of the British pound exhibits a discount of 1 percent. Explain how the British annual interest rate changed over the month, and whether it is higher, lower, or equal to the U.S. rate at the end of the month.

57. Forces of Covered Interest Arbitrage Assume that the one-year interest rate in Canada is 4 percent. The one-year U.S. interest rate is 8 percent. The spot rate of the Canadian dollar (C$) is $.94. The forward rate of the Canadian dollar is $.98.

a. Is covered interest arbitrage feasible for U.S. investors? Show the results if a U.S. firm engages in covered interest arbitrage to support your answer.

b. Assume that the spot rate and interest rates remain unchanged as coverage interest arbitrage is attempted by U.S. investors. Do you think the forward rate of the Canadian dollar will be affected? If so, state whether it will increase or decrease, and explain why.

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 International Financial Management* text companion website. Go to www.cengagebrain.com (students) or www.cengage.com/login (instructors) and search using **ISBN 9781133947837.**

Blades, Inc. Case

Assessment of Potential Arbitrage Opportunities

Recall that Blades, a U.S. manufacturer of roller blades, has chosen Thailand as its primary export target for Speedos, Blades' primary product. Moreover, Blades' primary customer in Thailand, Entertainment Products, has committed itself to purchase 180,000 Speedos annually for the next 3 years at a fixed price denominated in baht, Thailand's currency. Because of quality and cost considerations, Blades also imports some of the rubber and plastic components needed to manufacture Speedos from Thailand.

Lately, Thailand has experienced weak economic growth and political uncertainty. As investors lost confidence in the Thai baht as a result of the political uncertainty, they withdrew their funds from the country. This resulted in an excess supply of baht for sale over the demand for baht in the foreign exchange market, which put downward pressure on the baht's value. As foreign investors continued to withdraw their funds from Thailand, the baht's value continued to deteriorate. Since Blades has net cash flows in baht resulting from its exports to Thailand, a deterioration in the baht's value will affect the company negatively.

Ben Holt, Blades' CFO, would like to ensure that the spot and forward rates Blades' bank has quoted are reasonable. If the exchange rate quotes are reasonable, then arbitrage will not be possible. If the quotations are not appropriate, however, arbitrage may be possible. Under these conditions, Holt would like Blades to use some form of arbitrage to take advantage of possible mispricing in the foreign exchange market. Although Blades is not an arbitrageur, Holt believes that arbitrage opportunities could offset the negative impact resulting from the baht's depreciation, which would otherwise seriously affect Blades' profit margins.

Holt has identified three arbitrage opportunities as profitable and would like to know which one of them is the most profitable. Thus, he has asked you, Blades' financial analyst, to prepare an analysis of the arbitrage opportunities he has identified. This would allow Holt to assess the profitability of arbitrage opportunities very quickly.

1. The first arbitrage opportunity relates to locational arbitrage. Holt has obtained spot rate quotations from two banks in Thailand: Minzu Bank and Sobat Bank, both located in Bangkok. The bid and ask prices of Thai baht for each bank are displayed in the table below:

	MINZU BANK	SOBAT BANK
Bid	$.0224	$.0228
Ask	$.0227	$.0229

Determine whether the foreign exchange quotations are appropriate. If they are not appropriate, determine the profit you could generate by withdrawing $100,000 from Blades' checking account and engaging in arbitrage before the rates are adjusted.

2. Besides the bid and ask quotes for the Thai baht provided in the previous question, Minzu Bank has provided the following quotations for the U.S. dollar and the Japanese yen:

	QUOTED BID PRICE	QUOTED ASK PRICE
Value of a Japanese yen in U.S. dollars	$.0085	$.0086
Value of a Thai baht in Japanese yen	¥2.69	¥2.70

Determine whether the cross exchange rate between the Thai baht and Japanese yen is appropriate. If it is not appropriate, determine the profit you could generate for Blades by withdrawing $100,000 from Blades' checking account and engaging in triangular arbitrage before the rates are adjusted.

3. Ben Holt has obtained several forward contract quotations for the Thai baht to determine whether covered interest arbitrage may be possible. He was quoted a forward rate of $.0225 per Thai baht for a 90-day forward contract. The current spot rate is $.0227. Ninety-day interest rates available to Blades in the United States are 2 percent, while 90-day interest rates in Thailand are 3.75 percent (these rates are not annualized). Holt is aware that covered interest arbitrage, unlike locational and triangular arbitrage, requires an investment of funds. Thus, he would like to be able to estimate the dollar profit resulting from arbitrage over and above the dollar amount available on a 90-day U.S. deposit.

Determine whether the forward rate is priced appropriately. If it is not priced appropriately, determine the profit you could generate for Blades by withdrawing $100,000 from Blades' checking account and engaging in covered interest arbitrage. Measure the profit as the excess amount above what you could generate by investing in the U.S. money market.

4. Why are arbitrage opportunities likely to disappear soon after they have been discovered? To illustrate your answer, assume that covered interest arbitrage involving the immediate purchase and forward sale of baht is possible. Discuss how the baht's spot and forward rates would adjust until covered interest arbitrage is no longer possible. What is the resulting equilibrium state called?

Small Business Dilemma

Assessment of Prevailing Spot and Forward Rates by the Sports Exports Company

As the Sports Exports Company exports footballs to the United Kingdom, it receives British pounds. The check (denominated in pounds) for last month's exports just arrived. Jim Logan (owner of the Sports Exports Company) normally deposits the check with his local bank and requests that the bank convert the check to dollars at the prevailing spot rate (assuming that he did not use a forward contract to hedge this payment). Logan's local bank provides foreign exchange services for many of its business customers who need to buy or sell widely traded currencies. Today, however, Logan decided to check the quotations of the spot rate at other banks before converting the payment into dollars.

1. Do you think Logan will be able to find a bank that provides him with a more favorable spot rate than his local bank? Explain.
2. Do you think that Logan's bank is likely to provide more reasonable quotations for the spot rate of the British pound if it is the only bank in town that provides foreign exchange services? Explain.

3. Logan is considering using a forward contract to hedge the anticipated receivables in pounds next month. His local bank quoted him a spot rate of $1.65 and a 1-month forward rate of $1.6435. Before he decides to sell pounds 1 month forward, he wants to be sure that the forward rate is reasonable, given the prevailing spot rate. A 1-month Treasury security in the United States currently offers a yield (not annualized) of 1 percent, while a 1-month Treasury security in the United Kingdom offers a yield of 1.4 percent. Do you believe that the 1-month forward rate is reasonable given the spot rate of $1.65?

INTERNET/EXCEL EXERCISE

The Bloomberg website provides quotations in foreign exchange markets. Its address is www.bloomberg.com.

Use this web page to determine the cross exchange rate between the Canadian dollar and the Japanese yen.

Notice that the value of the pound (in dollars) and the value of the yen (in dollars) are also disclosed. Based on these values, is the cross rate between the Canadian dollar and the yen what you expected it to be? Explain.

ONLINE ARTICLES WITH REAL-WORLD EXAMPLES

Find a recent article online that describes an actual international finance application or a real world example about a specific MNC's actions that reinforces one or more concepts covered in this chapter.

If your class has an online component, your professor may ask you to post your summary there and provide the web link of the article so that other students can access it. If your class is live, your professor may ask you to summarize your application in class. Your professor may assign specific students to complete this assignment for this chapter, or may allow any students to do the assignment on a volunteer basis.

For recent online articles and real world examples applied to this chapter, consider using the following search terms and include the current year as a search term to ensure that the online articles are recent:

1. foreign exchange AND arbitrage
2. foreign exchange AND bid/ask spread
3. covered interest arbitrage
4. currency arbitrage
5. interest rate parity
6. forward contract AND arbitrage
7. market imperfections AND interest rate parity
8. transaction costs AND interest rate parity
9. forward contract AND interest rate parity
10. forward premium AND transaction costs

8
Relationships among Inflation, Interest Rates, and Exchange Rates

CHAPTER OBJECTIVES

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.

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.

8-1 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 (because of their 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 relationship between inflation and the exchange rate. This theory supports the notion developed in Chapter 4 about how relatively high inflation places downward pressure on a currency's value, but PPP is more specific about the degree by which a currency will weaken in response to high inflation.

8-1a Interpretations of Purchasing Power Parity

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

Absolute Form of PPP The **absolute form of PPP** is based on the idea that, in the absence of international barriers, consumers will shift their demand to wherever prices are lowest. The implication is that prices of the same basket of goods in two different countries should be equal when measured in a common currency. If there is a discrepancy in the prices as measured by such a common currency, then demand should shift so that these prices converge.

EXAMPLE If the same basket of goods is produced by the United States and the United Kingdom and if the price in the United Kingdom is lower when measured in a common currency, then the demand for that basket should increase in the United Kingdom and decline in the United States. Both forces would eventually cause the prices of the baskets to match when measured in a common currency. ●

The existence of transportation costs, tariffs, and quotas render the absolute form of PPP unrealistic. If transportation costs were high in the preceding example, then demand for the baskets of goods might not shift as suggested. In that case, the discrepancy in prices would continue.

Relative Form of PPP The **relative form of PPP** accounts for such market imperfections as transportation costs, tariffs, and quotas. This version acknowledges that these imperfections make it unlikely for prices of the same basket of goods in different countries to be the same when measured in a common currency. However, this form of PPP suggests that the *rate of change* in the prices of the those baskets should be comparable when measured in a common currency (assuming that transportation costs and trade barriers are unchanged).

EXAMPLE Assume that the United States and the United Kingdom trade extensively with each other and initially have zero inflation. Now suppose 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 difference between their inflation rates). Given British inflation of 5 percent and the pound's appreciation of 4 percent, U.S. consumers will have to pay about 9 percent more for British goods than they paid in the initial equilibrium state. That value is equal to the 9 percent increase in prices of U.S. goods due to U.S. inflation. The exchange rate should adjust to offset the differential in the two countries' inflation rates, in which case the prices of goods in the two countries should appear similar to consumers. ●

8-1b Rationale behind Relative PPP Theory

The relative PPP theory is based on the notion that exchange rate adjustment is necessary for the relative purchasing power to be the same whether buying products locally or from another country. If that purchasing power is not equal, then consumers will shift purchases to wherever products are cheaper until purchasing power equalizes.

EXAMPLE Reconsider the previous example but now suppose that 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. We should therefore expect U.S. consumers to continue shifting their consumption to British goods. Purchasing power parity suggests that this increased U.S. consumption of British goods by U.S. consumers would persist until the pound appreciated by about 4 percent. Thus, from the U.S. consumer's viewpoint, any level of appreciation lower than this would result in lower British prices than U.S. prices.

From the British consumer's viewpoint, the price of U.S. goods would have initially increased by 4 percent more than British goods. Hence British consumers would continue to reduce their imports from the United States until the pound appreciated enough to make U.S. goods no more expensive than British goods. The net effect of the pound appreciating by 4 percent 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). ●

8-1c 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. Because of this 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 in response to inflation in that country:

$$P_f(1 + I_f)$$

If $I_h > I_f$ and if the exchange rate between the two countries' currencies does not change, then the consumer's purchasing power is greater for foreign than for home goods. In this case, PPP does not hold. If $I_h < I_f$ and again the exchange rate remains unchanged, then the consumer's purchasing power is greater for home than for foreign goods. So in this case, too, PPP does not hold.

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, then 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 be such that parity is maintained between 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:

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

Solving for e_f then yields

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

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

Since P_h is equal to P_f (because price indexes were assumed to be equal in both countries) the two terms cancel, which leaves

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

This equality expresses the relationship (according to PPP) between relative inflation rates and the exchange rate. Observe that if $I_h > I_f$ then e_f should be positive, which 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.

8-1d 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 different inflation rates in two countries.

EXAMPLE Assume that the exchange rate is initially in equilibrium. 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:

$$\begin{aligned} e_f &= \frac{1 + I_h}{1 + I_f} - 1 \\ &= \frac{1 + .05}{1 + .03} - 1 \\ &= .0194, \text{ or } 1.94\% \end{aligned}$$

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 that exchange rate change does occur, then 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 its currency pushes the its price index upward from the perspective of home country consumers. 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.

EXAMPLE This example examines the case where foreign inflation exceeds home inflation. Suppose that the exchange rate is initially in equilibrium but that 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:

$$e_f = \frac{1 + I_h}{1 + I_f} - 1$$
$$= \frac{1 + .04}{1 + .07} - 1$$
$$= -.028, \text{ or } -2.8\%$$

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

The theory of purchasing power parity is summarized in Exhibit 8.1. Notice that international trade is the mechanism by which the inflation differential is theorized to affect the exchange rate. This means that PPP is more applicable when the two countries of concern engage in extensive international trade with each other. If there is not much trade between the countries, then the inflation differential will have little effect on that trade and so the exchange rate should not be expected to change.

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

$$e_f \approx I_h - I_f$$

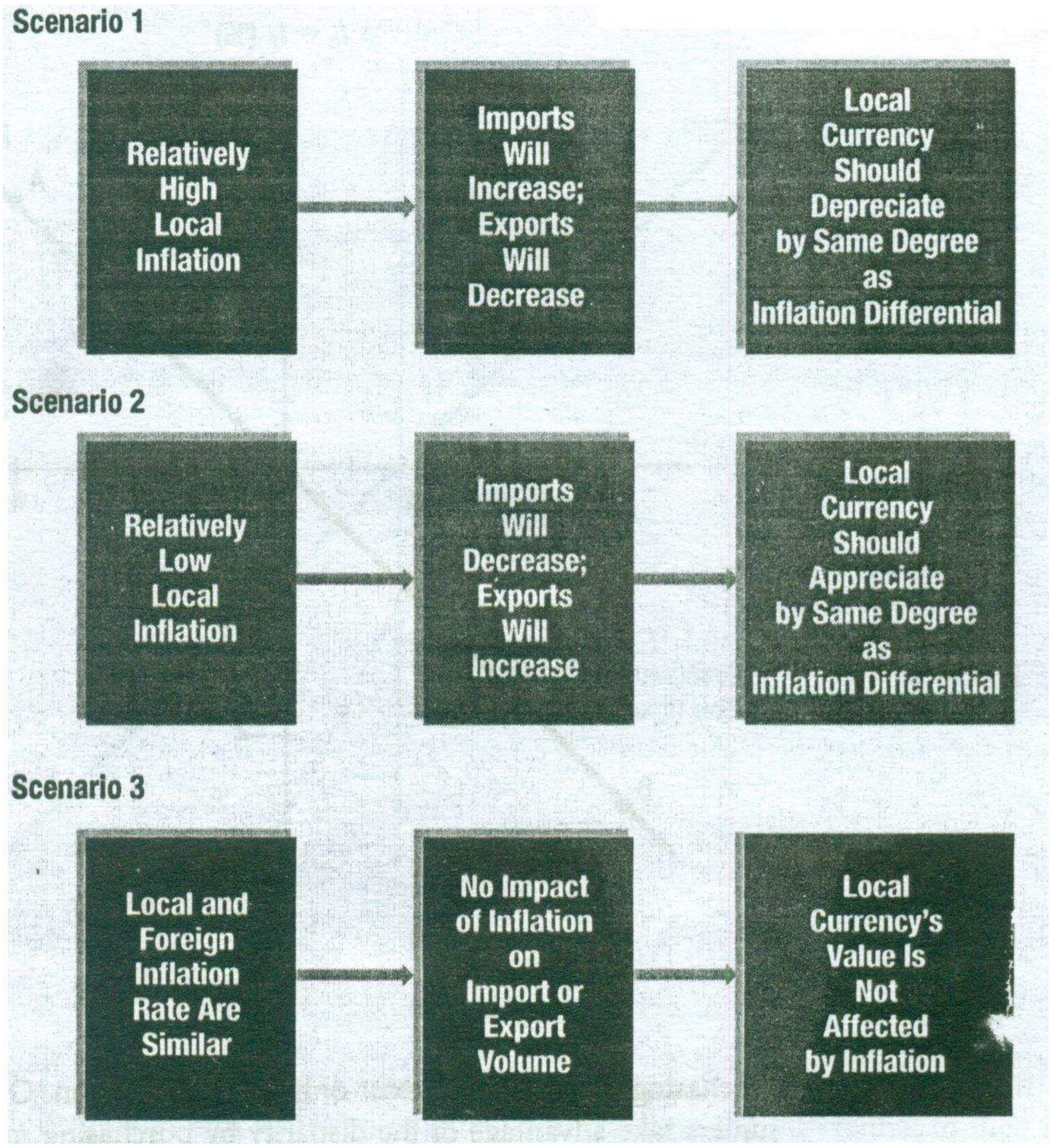
That is, the percentage change in the exchange rate should be approximately equal to the difference in inflation rates between the two countries. This simplified formula is appropriate only when the inflation differential is small or when the value of I_f is close to zero.

8-1e Graphic Analysis of Purchasing Power Parity

Using PPP theory, we should be able to assess the possible impact of inflation on exchange rates. Exhibit 8.2 is a graphic representation of PPP theory. The points on the graph indicate that, if there is an inflation differential of X percent between the home and the foreign country, then the foreign currency should adjust by X percent in response 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 in Exhibit 8.2 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 these conditions led

Exhibit 8.1 Summary of Purchasing Power Parity

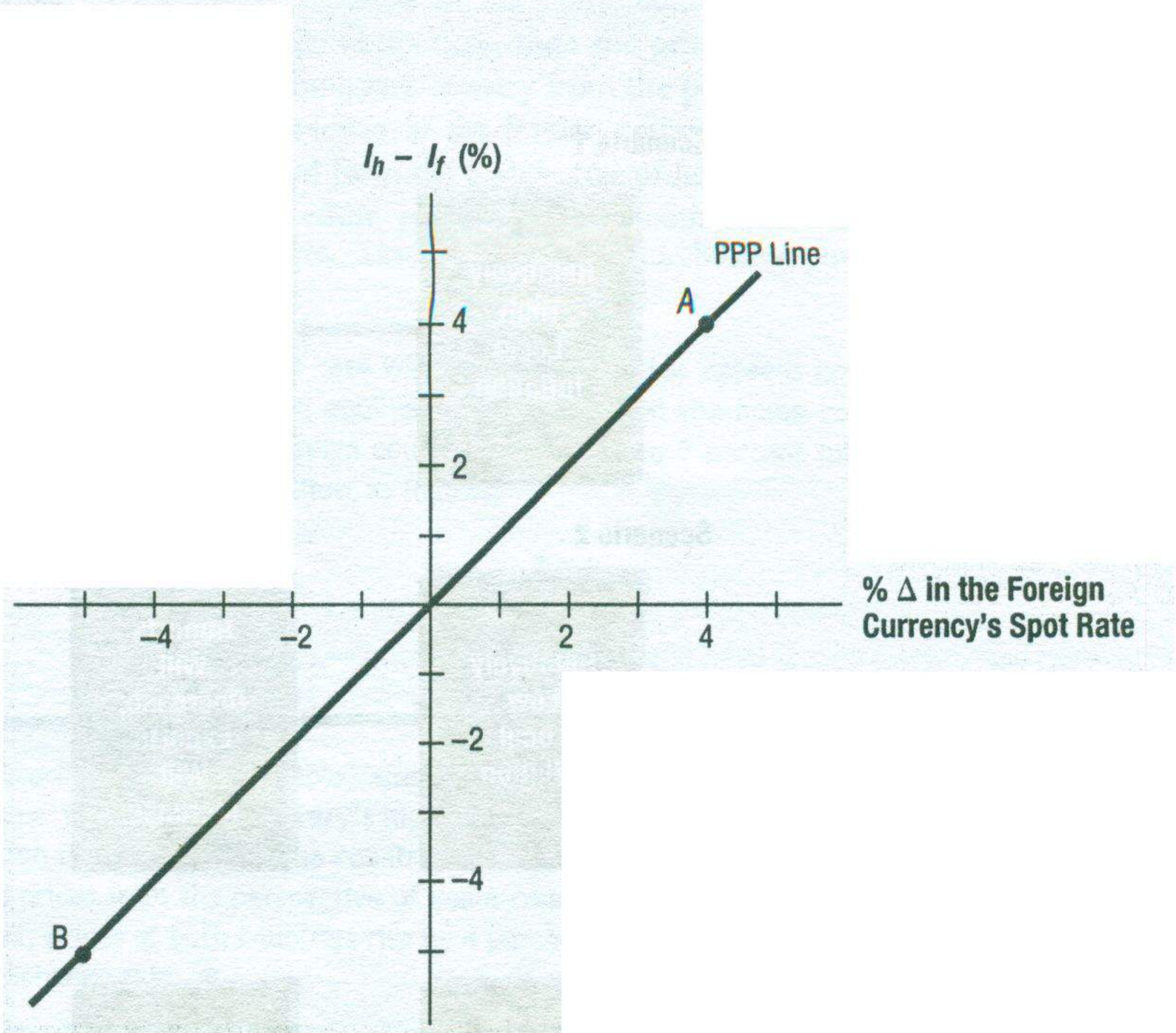


to the anticipated appreciation in the British pound of 4 percent, as illustrated by point A. Point B reflects the scenario in which the U.K. inflation rate exceeds the U.S. inflation rate by 5 percent, so that $I_h - I_f = -5\%$. This leads the British pound to depreciate by 5 percent (point B). If the exchange rate does in fact respond to inflation differentials, as PPP theory suggests, then the actual points should lie on or close to the PPP line.

Purchasing Power Disparity Exhibit 8.3 identifies areas of purchasing power disparity. Any points that are *off* of the PPP line represent purchasing power disparity. Suppose an equilibrium is followed by a change in the inflation rates of two countries. If the exchange rate does not move as PPP theory suggests, then there is a disparity in the purchasing power of consumers in those two countries.

Point C in Exhibit 8.3 represents a case where home inflation I_h exceeds foreign inflation I_f by 4 percent. Yet because the foreign currency appreciated by only 1 percent in response to this inflation differential, there is purchasing power disparity. That is, home country consumers' purchasing power for foreign goods has increased relative to their purchasing power for the home country's goods. The PPP theory suggests that such a disparity in

Exhibit 8.2 Illustration of Purchasing Power Parity



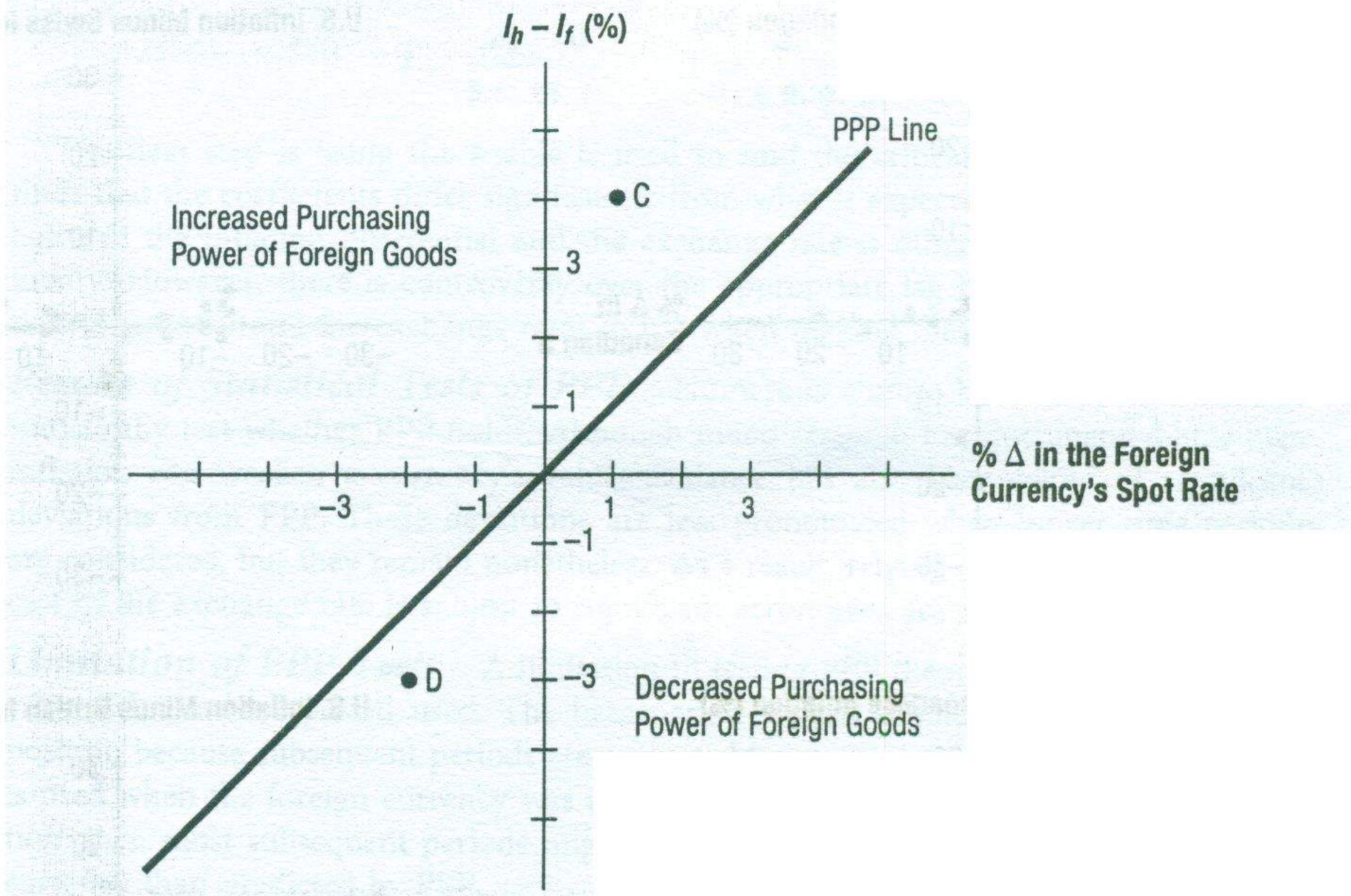
purchasing power should exist only in the short run. Over time, as the home country consumers take advantage of the disparity by purchasing more foreign goods, upward pressure on the foreign currency's value will cause point C to move toward the PPP line. All points to the left of (or above) the PPP line represent more favorable purchasing power for foreign goods than for home goods.

Point D in Exhibit 8.3 represents a case where home inflation is 3 percent below foreign inflation but the foreign currency has depreciated by only 2 percent. Once again, there is purchasing power disparity: now the currency's purchasing power for foreign goods has decreased relative to its 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 in order to fully offset the 3 percent inflation differential. Since the foreign currency did not weaken to this extent, home country consumers may cease to purchase foreign goods. Such behavior would cause the foreign currency to weaken to the extent anticipated by PPP theory, so point D would move toward the PPP line. All points to the right of (or below) the PPP line represent greater purchasing power for home country goods than for foreign goods.

8-1f Testing the Purchasing Power Parity Theory

The PPP theory provides an explanation of how relative inflation rates between two countries can influence an exchange rate, and it also provides information that can be used to forecast exchange rates.

Exhibit 8.3 Identifying Disparity in Purchasing Power

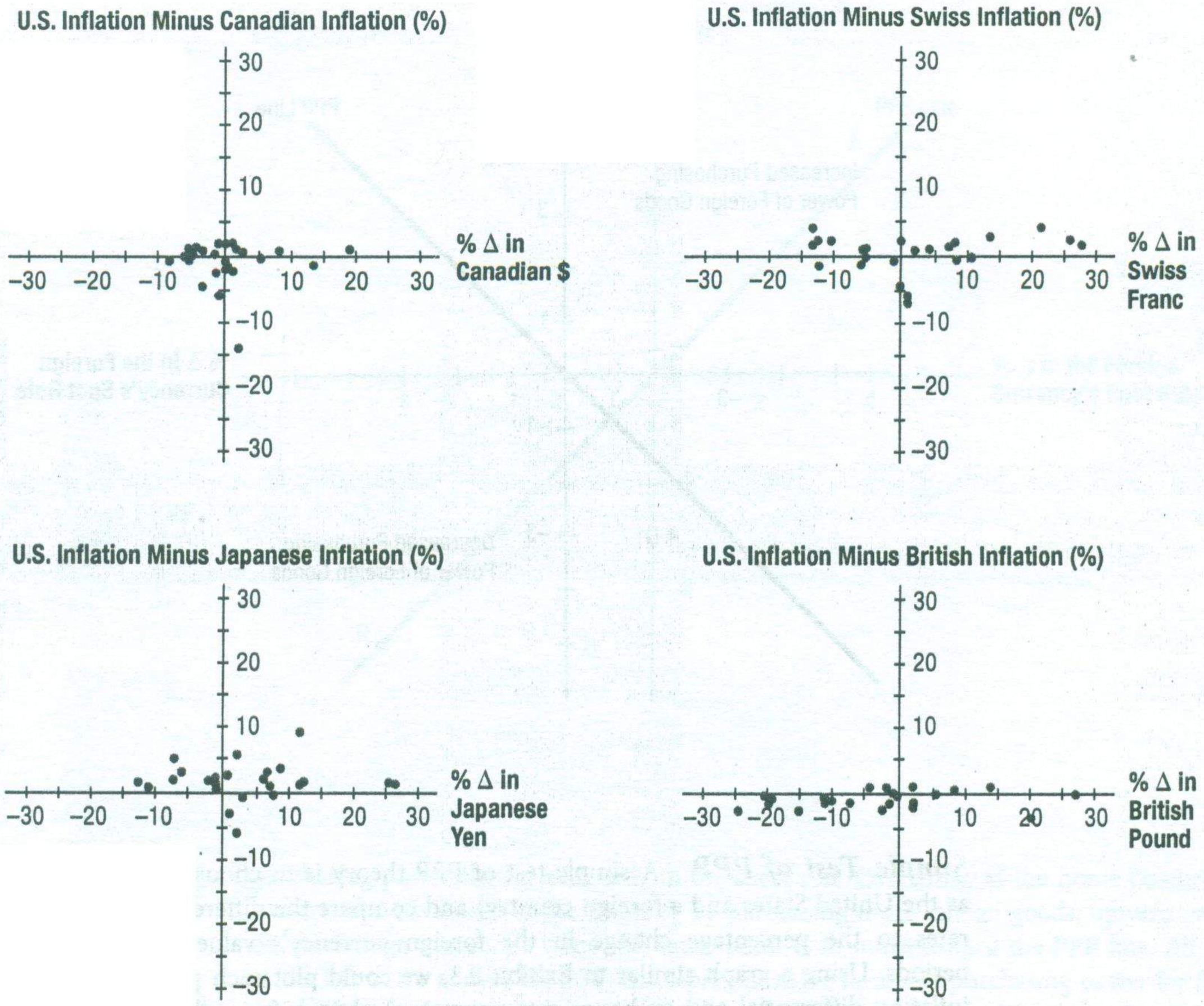


Simple Test of PPP A simple test of PPP theory is to choose two countries (such as the United States and a foreign country) and compare the differential in their inflation rates to the percentage change in the foreign currency's value during several time periods. Using a graph similar to Exhibit 8.3, 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 8.3. If the points deviate significantly from the PPP line, then the percentage change in the foreign currency is not being affected by the inflation differential in the manner that PPP theory suggests.

This simple test of PPP is applied to four different currencies from a U.S. perspective in Exhibit 8.4 (each graph represents a particular currency). The annual difference in inflation between the United States and each foreign country is represented on the vertical axis, while the annual percentage change in the exchange rate of each foreign currency (relative to the U.S. dollar) is represented on the horizontal axis. Each point on a graph represents one year during the period 1982–2009.

Although each graph shows different results, some general comments apply to all four of them. The percentage changes in exchange rates are typically much more pronounced than the inflation differentials. Thus, it seems that exchange rates change to a greater extent than PPP theory would predict. In some years, the currency actually appreciated when its inflation was higher than U.S. inflation. Overall, the results in Exhibit 8.4 indicate that, over the period assessed, the actual relationship between inflation differentials and exchange rate movements is not consistent with PPP theory.

Exhibit 8.4 Comparison of Annual Inflation Differentials and Exchange Rate Movements for Four Major Countries



Statistical Test of PPP A 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 follows:

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

Here 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, respectively. These coefficients imply that, on average, for a given inflation differential there is an equal (offsetting) percentage

change in the exchange rate. 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:

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

The next step is using 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, then the relationship between the inflation differential and the exchange rate is other than as stated by PPP theory. However, there is controversy over the appropriate lag time (between the inflation differential and the exchange rate) to use when making these calculations.

Results of Statistical Tests of PPP Numerous studies have been conducted to statistically test whether PPP holds. Although much research has documented how high inflation can weaken a currency's value, evidence has also been found of significant deviations from PPP. These deviations are less pronounced when longer time periods are considered, but they remain nonetheless. As a result, relying on PPP to derive a forecast of the exchange rate is subject to significant error, even for long-term forecasts.

Limitation of PPP Tests A limitation in testing PPP theory is that the results will vary with the base period used. The base period chosen should reflect an equilibrium position because subsequent periods are evaluated in comparison with it. If a base period is used when the foreign currency was relatively weak for reasons other than high inflation, then most subsequent periods might erroneously show higher appreciation of that currency than predicted by PPP.

8-1g Why Purchasing Power Parity Does Not Hold

Purchasing power parity does not normally hold because of confounding effects and because there are no 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. Recall from Chapter 4, however, that a currency's spot rate is affected by several 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 exchange rate movements are not driven solely by ΔINF, the relationship between the inflation differential and exchange rate movement cannot be as simple as the PPP theory suggests.

EXAMPLE Assume that Switzerland's inflation rate is 3 percent above the U.S. inflation rate. From this information, PPP theory would suggest that the Swiss franc should depreciate by about 3 percent against the U.S. dollar. Yet, if the government of Switzerland imposes trade barriers against some U.S. exports, Switzerland'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 purchasing power parity. ●

No Substitutes for Traded Goods The idea behind PPP theory is that, as soon as prices become relatively higher in one country, consumers in the other country will stop buying imported goods and instead purchase domestic goods. This shift, in turn, affects the exchange rate. However, if substitute goods are not available domestically then consumers will probably not desist from buying imported goods.

EXAMPLE Reconsider the previous example in which Switzerland's inflation is 3 percent higher than the U.S. inflation rate. The U.S. consumers who do not find suitable substitute goods at home may continue to buy the highly priced goods from Switzerland, in which case the Swiss franc may not depreciate as PPP theory would predict. ●

8-2 International Fisher Effect (IFE)

Along with PPP theory, another major theory in international finance is the **international Fisher effect (IFE) theory**. It uses the difference in interest (rather than inflation) rates to explain why exchange rates shift over time. Recall from Chapter 4 that a high interest rate can attract a strong demand for a local currency and so may put upward pressure on that currency's value. However, the international Fisher effect theory offers a counterargument about how interest rates affect exchange rates, and it uses PPP to support that argument.

8-2a Fisher Effect

The first step in understanding the international Fisher effect is to recognize how a country's nominal (quoted) interest rate and inflation rate are related. This relation is commonly referred to as the Fisher effect, named after the economist Irving Fisher. The Fisher effect presumes that the nominal interest rate consists of two components: the expected inflation rate and the real rate of interest. The real rate of interest is defined as the return on the investment to savers after accounting for expected inflation, and it is measured as the nominal interest rate minus the expected inflation rate. If the real rate of interest in a country is constant over time, then the nominal rate of interest there must adjust to changes in the expected rate of inflation.

EXAMPLE Suppose that inhabitants of the United States are willing to save money only if they can earn a real interest rate of 2 percent. This means that their savings must grow by 2 percent *more* than the general price level of products that savers might purchase in the future with their savings. If the expected U.S. annual rate of inflation is 1 percent, then the one-year interest rate on a savings deposit should be 3 percent in order to allow for a real interest rate of 2 percent.

As expected inflation in the United States changes over time, the nominal interest rate would have to change as well in order to provide savers with a real interest rate of 2 percent. Suppose economic conditions have led U.S. savers to believe that the expected annual rate of inflation is now 4 percent instead of 1 percent. At the nominal interest rate of 3 percent, saving would be a losing proposition because the prices of products for which consumers are saving increase more rapidly than their savings. If the nominal interest rate on deposits remained lower than expected inflation, then the real interest rate would be negative; in this case, savers may be better off spending their money now (and even borrowing, if necessary) in order to purchase products before prices

increase. Thus savers are willing to save money only if the nominal interest rate on savings deposits is 5 percent, which would allow for a 2 percent real rate of interest (after accounting for the expected annual inflation of 3 percent). This means that financial institutions must increase their deposit rate to 5 percent in order to attract savers.

Now assume that economic conditions change again, causing savers to expect that annual inflation will be 6 percent over the next year. If the prevailing nominal interest rate of 5 percent did not change, then savers would be unwilling to save money because prices are increasing faster than the rates paid on savings deposit. Under these conditions, savers would be willing to save only if the nominal one-year interest rate on deposits rises to 8 percent; that would allow for a real rate of interest of 2 percent after accounting for the expected annual inflation of 6 percent. ●

We cannot directly observe the expected inflation rate in a country. However, we can use the Fisher effect to infer the expected inflation at any time once given both the existing nominal interest rate and the assumed real rate of interest at that time:

IF THE U.S. NOMINAL INTEREST RATE IS	AND IF THE REAL INTEREST RATE IS	THEN THE EXPECTED INFLATION RATE IS
3%	2%	1%
5%	2%	3%

Because nominal one-year interest rates are publicly available for some countries, the expected inflation rate of these countries can be derived using the Fisher effect and assuming a real rate of interest.

8-2b Using the IFE to Predict Exchange Rate Movements

Two steps are required when using the international Fisher effect to predict exchange rate movements between two countries. First, apply the Fisher effect to estimate the expected inflation for each country. Second, rely on purchasing power parity theory to estimate how the difference in expected inflation will affect the exchange rate.

Apply the Fisher Effect to Derive Expected Inflation per Country The first step is to derive the expected inflation rates of the two countries based on the Fisher effect's claim that the nominal interest rate in two countries differs because of the difference in their expected inflation. By assuming that the real interest rate is the same in the two countries, the difference between them in terms of the nominal interest rate is completely attributed to the difference in their expected inflation rates. Thus the difference in expected inflation is equal to the difference in nominal interest rates between the two countries, which means that expected inflation is higher in the country whose interest rate is higher.

EXAMPLE Assume that the real rate of interest is 2 percent in both Canada and the United States, and assume that the one-year nominal interest rate is 13 percent in Canada versus 8 percent in the United States. According to the Fisher effect, the expected inflation rate over the next year in each country is equal to the nominal interest rate minus the real rate of interest. For Canada, the expected inflation rate is 13% − 2% = 11%; for the United States, it is 8% − 2% = 6%. Hence the difference in expected inflation between the two countries is 11% − 6% = 5%. Note that this difference in expected inflation between the countries is equal to the difference in nominal interest rates (13% − 8% = 5%) between them. ●

Rely on PPP to Estimate the Exchange Rate Movement The second step when using the international Fisher effect to predict movements in the exchange rate is to determine via PPP how the exchange rate would change in response to the two countries' expected inflation rates as calculated in the first step. As discussed previously, the

theory of purchasing power parity argues that international trade flows adjust in response to differential inflation rates; in particular, the country with the higher inflation increases its demand for imports and experiences a reduced demand for its exports. This shift in trade flows causes the currency with the higher inflation to depreciate, and the shift in trade continues until a new equilibrium is reached in which the level of depreciation offsets the inflation differential (i.e., the point at which a consumer's purchasing power is the same for products in either country).

EXAMPLE Recall from the preceding example that Canada has an expected inflation of 11 percent versus 6 percent in the United States. Since the expected inflation is 5 percent higher in Canada, PPP suggests that the Canadian dollar should depreciate against the U.S. dollar by about 5 percent.

Observe that this level of depreciation would offset the interest rate advantage in Canada, so that U.S. investors would not benefit from investing there. They would earn about 8 percent on a savings deposit in Canada if the Canadian dollar weakened by 5 percent over the year, which is similar to what they would have earned in the United States. ●

8-2c Implications of the International Fisher Effect

The discussion so far indicates that currencies with high interest rates will exhibit high expected inflation (because of the IFE) and that this relatively high inflation will cause those currencies to depreciate (because of PPP). This explains why MNCs and investors based in the United States may refrain from investments in the interest-bearing securities of those countries; the exchange rate effect could offset the interest rate advantage. The offset would not be exact in every (or even any) period, and the difference could be more pronounced in either direction. Yet IFE advocates insist that, overall, neither MNCs nor investors benefit from investing in foreign securities with higher interest rates because the the expected return from the strategy (after accounting for the exchange rate effect) in any period would not exceed what they could earn domestically.

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.

EXAMPLE Suppose the nominal interest rate is 8 percent in the United States and 5 percent in Japan, and suppose the real rate of interest 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, then 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. Although the U.S. interest rate is 3 percent higher than the Japanese interest rate, the Japanese investors will repurchase their yen at the end of the investment period for 3 percent more than the price at which they initially exchanged yen for dollars. Therefore, their return from investing in the United States is no better than what they would have earned domestically. ●

Implications of the IFE for Two Non-U.S. Currencies The international Fisher effect applies also to exchange rates that involve two non-U.S. currencies.

EXAMPLE Suppose the nominal interest rate is 13 percent in Canada and 5 percent in Japan, and suppose the expected real rate of interest is 2 percent in each country. The expected inflation differential between Canada and Japan is 8 percent. According to PPP theory, this inflation differential means 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 about 5 percent by investing in Canada, which is the same as what they would earn on an investment in Japan. ●

WEB

www.newyorkfed.org/index.html
Exchange rate and interest rate data for various countries.

These possible investment opportunities, along with some others, are summarized in Exhibit 8.5. According to the IFE, the expected return (after considering the exchange rate effect) is the same irrespective of where the investors of a given country invest their funds. Therefore, U.S. investors who believe in the IFE will not invest in foreign countries to achieve a higher interest rate. The higher the interest rate in a foreign country, the higher is the expected inflation in that country and the greater will be the expected level of depreciation in its currency.

8-2d Derivation of the International Fisher Effect

According to the IFE, the precise relationship between the interest rate differential of two countries and the expected exchange rate change can be derived as follows. Note that 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. However, the actual return to investors who invest in a foreign money market security depends not only on the foreign interest rate (i_f) but also the percentage change in the value of the foreign currency (e_f) denominating that security. The formula for the actual or "effective" (exchange rate–adjusted) return on a foreign bank deposit, or any other money market security, is

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

The IFE theory states that 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. Hence we can determine the degree by which the foreign currency must

Exhibit 8.5 The International Fisher Effect from Various Investor Perspectives

INVESTORS RESIDING IN	SEEK 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

change in order to make investments in both countries generate similar returns. Take the previous formula defining r and set it equal to i_h as follows:

$$r = i_h,$$

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

Now solve for

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

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

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

As verified here, the IFE theory contends that if $i_h > i_f$ then 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, if $i_f > i_h$ then 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 Derivation of the IFE Given two interest rates, the value of e_f can be determined from the formula just derived and then used to forecast the exchange rate.

EXAMPLE Assume that the interest rate on a one-year insured home country bank deposit is 11 percent, and the interest rate on a 1-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:

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

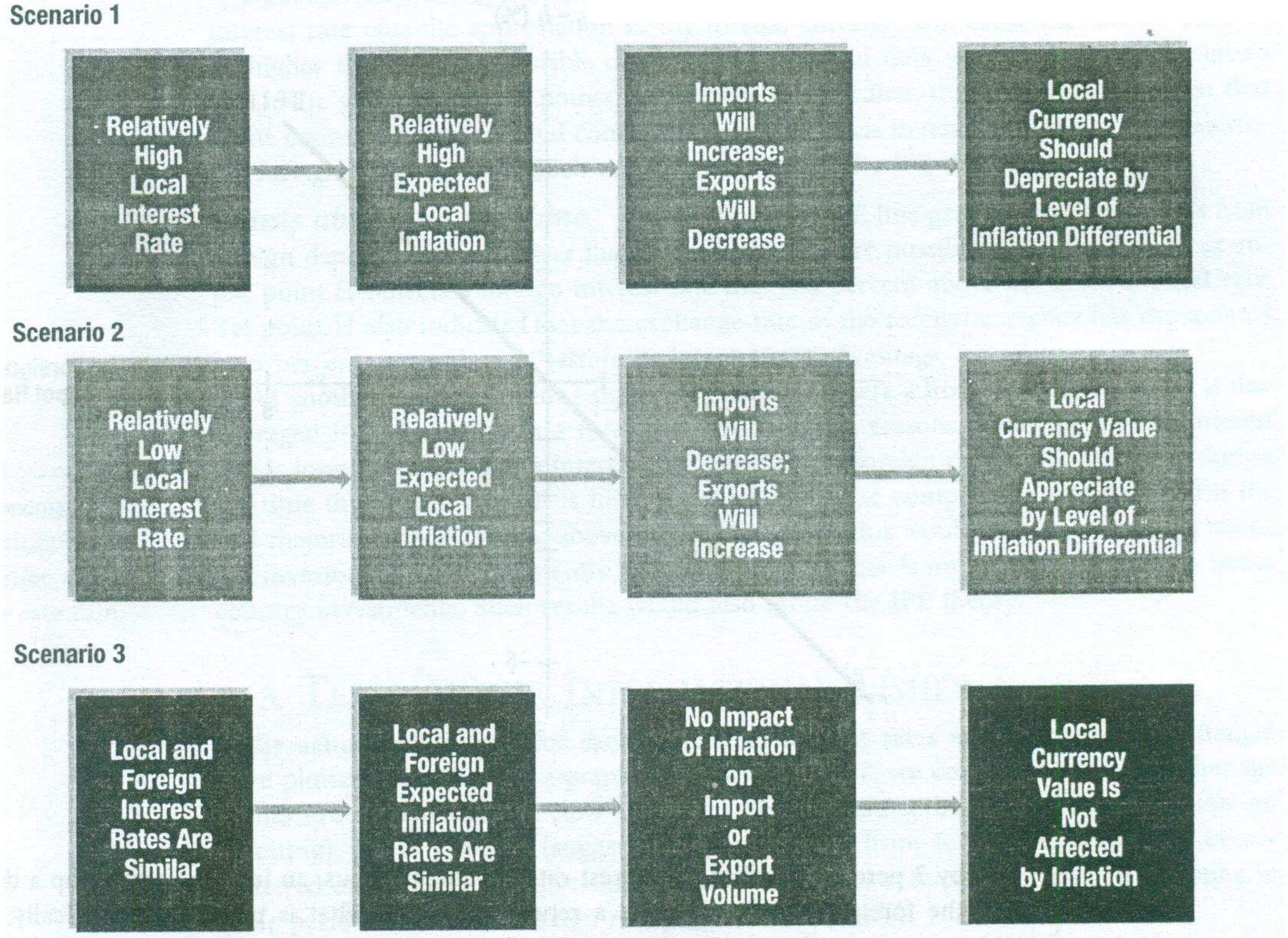
$$= \frac{1 + .11}{1 + .12} - 1$$

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

In other words, 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. That amount of depreciation would make the return on the foreign investment equal to the return on a domestic investment. ●

The theory of the international Fisher effect is summarized in Exhibit 8.6. Notice that this exhibit is similar to the summary of PPP in Exhibit 8.1. In particular, international trade is the mechanism by which the nominal interest rate differential affects the exchange rate (according to IFE theory). This means that the IFE is more applicable when the two countries of concern engage in considerable international trade with each other. If there is not much trade between the two countries then their inflation differential should not have a major impact on that trade, and there is no reason for expecting that the exchange rate will change in response to the interest rate differential. So in this case, even a large interest rate differential (which signals a large differential in expected

Exhibit 8.6 Summary of International Fisher Effect



inflation) would have a negligible effect on trade between the countries. Investors might then be more willing to invest in a foreign country with a high interest rate, although the currency of that country could still weaken for other reasons.

Simplified Relationship A simplified (but less precise) relationship specified by the IFE is

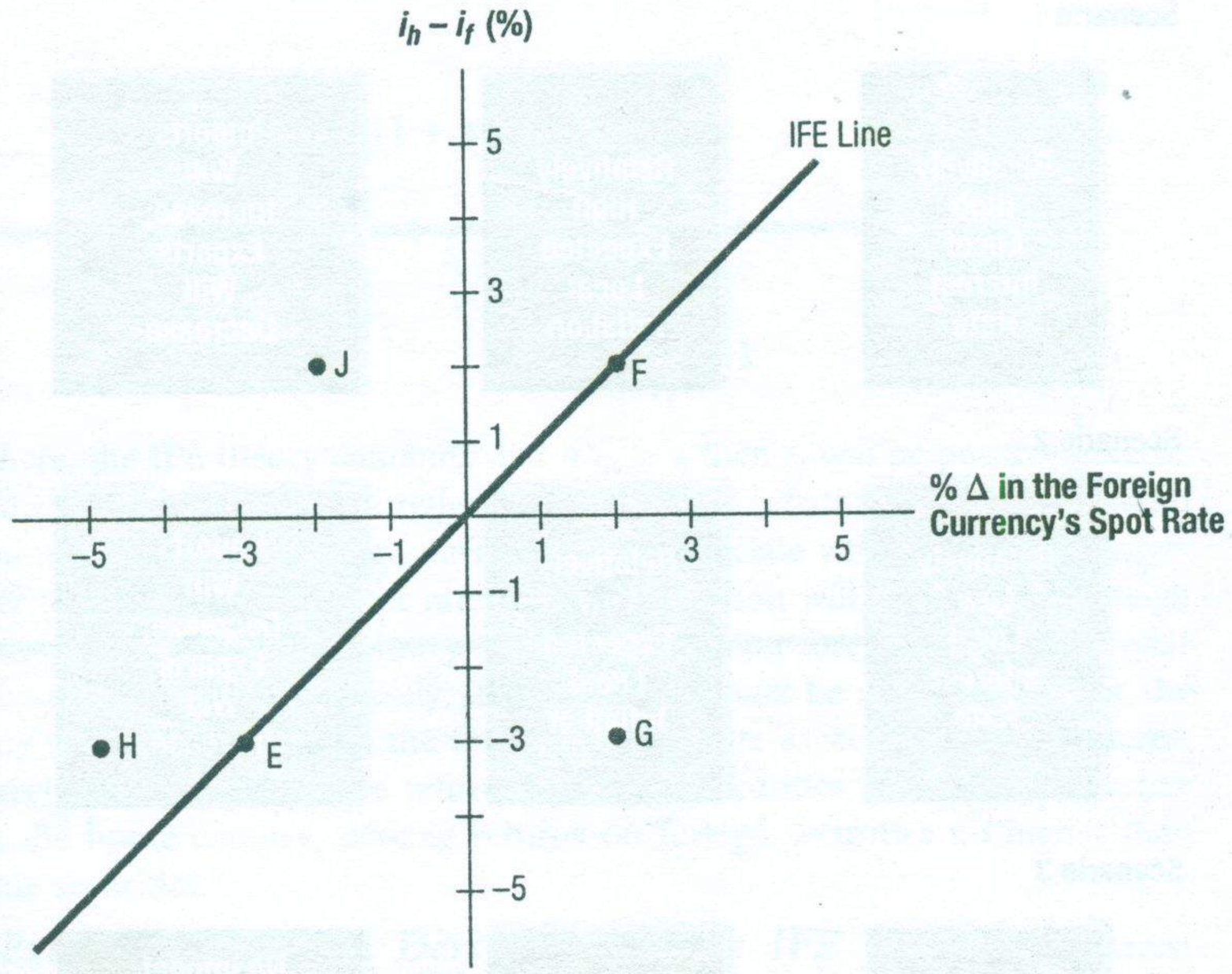
$$e_f \approx i_h - i_f$$

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.

8-2e Graphical Analysis of the International Fisher Effect

Exhibit 8.7 displays the set of points that conform to the argument behind IFE theory. For example, point E reflects a case where the foreign interest rate exceeds the home interest rate by 3 percentage points; observe that the foreign currency has depreciated

Exhibit 8.7 Illustration of IFE Line (When Exchange Rate Changes Perfectly Offset Interest Rate Differentials)



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 that is 2 percent above the foreign interest rate. In this case, investors from the home country who establish a foreign deposit must accept a lower interest rate; however, IFE theory suggests that the currency should appreciate by 2 percent to offset that interest rate disadvantage.

Point F in Exhibit 8.7 also illustrates the IFE from a foreign investor's perspective, for whom the home interest rate will appear attractive. However, IFE theory suggests that the foreign currency will appreciate by 2 percent; from the foreign investor's perspective, this 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 **international Fisher effect (IFE) line** in Exhibit 8.7 reflect exchange rate adjustments to offset the differential in interest rates. This means that 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, by periodically making foreign investments to take advantage of higher foreign interest rates, the firm will achieve a yield that is sometimes above and sometimes below the domestic yield. Thus such periodic investments will, on average, achieve a yield similar to that if the firm simply makes 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 8.7 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 if the vast majority of points were below the IFE line, then this would suggest that home country investors 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 that are 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 the case where a home country investor is discouraged from investing in a foreign deposit for two reasons. 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 if the vast majority of points were above the IFE line, then this would suggest that home country investors would consistently receive lower returns from foreign than from home country investments. Such results would also refute the IFE theory.

WEB

www.economagic.com/fedstl.htm
U.S. inflation and exchange rate data.

8-3 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 8.7, 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).

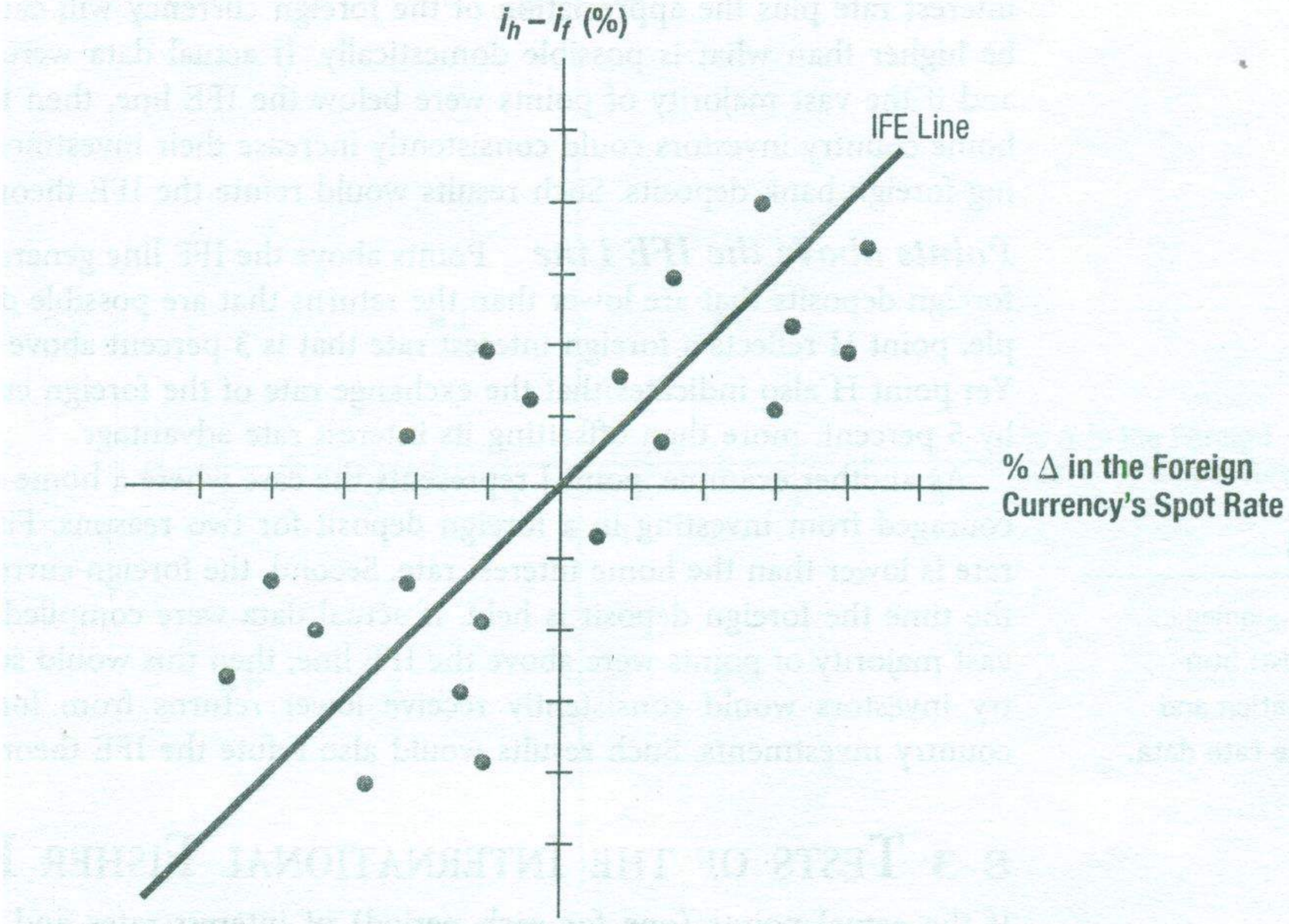
Exhibit 8.8 displays a set of points that tend to support the IFE theory. It implies that returns from short-term foreign investments are, on average, about equal to the returns that are possible domestically. Each point reflects a shift in the exchange rate that does not *exactly* offset the interest rate differential. In some cases, the exchange rate change does not fully offset the interest rate differential; in other cases, the former more than offsets the latter. The results balance out such that the interest rate differentials are, overall, 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, then a U.S. firm would probably prefer 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 of fluctuations in the spot exchange rate. 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.

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

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

Exhibit 8.8 Illustration of IFE Concept (Exchange Rate Changes Offsetting Interest Rate Differentials on Average)



Here a_0 is a constant, a_1 is the coefficient's slope, and μ is an error term. Regression analysis would determine the regression coefficients. It is hypothesized that $a_0 = 0$ and $a_1 = 1$.

Just as in the case of testing the PPP, here 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.

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

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, then the IFE is refuted.

8-3a Limitations of the IFE

The IFE theory is subject to some limitations that explain why it does not consistently hold. Recall that the IFE relies on two components to forecast the exchange rate movement, the Fisher effect and the application of PPP. There are limitations to the use of both components.

Limitation of the Fisher Effect The expected inflation rate derived by subtracting the each country's real interest rate from its nominal interest rate (in accordance with

the Fisher effect) is subject to error. You can verify this by comparing annual nominal interest rates to the corresponding annual inflation rates for any particular country. You will see that the difference between the nominal interest rate and actual inflation rate (which is supposed to reflect the real interest rate) is not consistent and is even negative in some periods. Thus, although the Fisher effect can use nominal interest rates to estimate the market's expected inflation over a particular period, the market may be wrong. Actual inflation for each country might be much higher or lower than what was anticipated over the period, in which case the wrong input has been used to forecast the exchange rate movement.

Limitation of PPP Because the IFE relies on the PPP, it has similar limitations to those cited for the PPP theory. In particular, there are other country characteristics besides inflation (such as income levels and government controls) that can affect exchange rate movements. Thus, even if the expected inflation derived from the Fisher effect properly reflects the actual inflation rate over the period, relying solely on inflation to forecast the future exchange rate is subject to error.

8-3b IFE Theory versus Reality

The IFE theory contradicts the arguments in Chapter 4 about how a country with a high interest rate can attract more capital flows and therefore cause the local currency's value to strengthen. The IFE theory also contradicts the arguments in Chapter 6 about how a central bank may purposely try to raise interest rates in order to attract funds and strengthen the value of its local currency. In reality, a currency with a high interest rate strengthens in some situations, which is consistent with the points made in Chapters 4 and 6 yet contrary to the IFE. Many MNCs frequently invest in money market securities in developed foreign countries where they can earn a slightly higher interest rate. They may believe that the higher interest rate advantage of the foreign money market securities is due to factors other than higher expected inflation or that any impact of inflation will not offset the interest rate advantage over the investment horizon.

Whether the IFE actually holds depends on the countries involved and also on the period assessed. From a U.S. perspective, investing in foreign money market securities of developed countries has resulted in higher returns than what could have been achieved domestically in some periods, which refutes the IFE. In other periods, however investing in those money market securities would have resulted in either lower returns or about the same returns that could have been achieved domestically.

The IFE theory may be especially meaningful in cases where MNCs and large investors consider investing in countries where prevailing interest rates are extremely high. These countries tend to be less developed and to have higher inflation, and their currencies tend to weaken substantially over time. The depreciation in the currencies of these countries could more than offset the interest rate advantage and might even cause U.S. investors to experience a loss on their money market investments. Investors could also experience a loss on money market investments in developed countries, but the likelihood of inflation causing a substantial depreciation of their currencies is much lower.

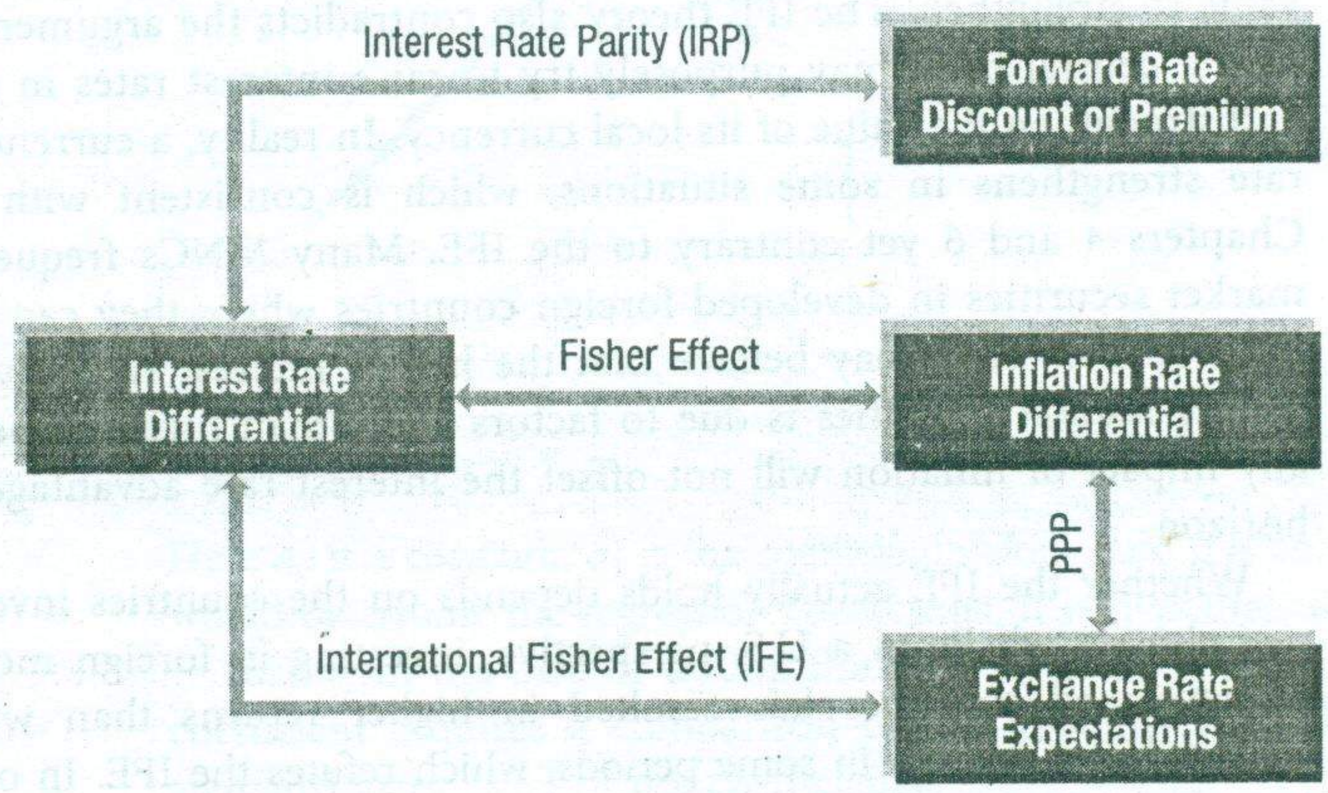
Overall, MNCs and investors who attempt to anticipate exchange rate movements should consider not only the IFE but also the factors identified in Chapter 4. Yet even when considering the same set of factors, MNCs or investors will have varied opinions about how an exchange rate will change because they have varied opinions about the expected impact of each factor on the exchange rate. This issue is discussed in more detail in the following chapter.

8-4 Comparison of the IRP, PPP, and IFE

At this point, it may be helpful to compare three related theories of international finance: interest rate parity (IRP), discussed in Chapter 7; purchasing power parity (PPP); and the international Fisher effect (IFE). Exhibit 8.9 summarizes the main themes of each theory. Even though all three of these 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 how much the difference should be at a specific point in time. In contrast, the PPP theory and IFE theory both 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, IFE theory suggests that it will change in accordance with interest rate differentials. Nonetheless, 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).

Exhibit 8.9 Comparison of the IRP, PPP, and IFE Theories



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.

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).

Financial managers who believe in PPP recognize that the exchange rate movement in any particular period will not always move according to the inflation differential between the two countries of concern. Even so, these managers may still rely on the inflation differential in order to derive their best guess of the expected exchange rate movement. Financial managers who believe in IFE recognize that the exchange rate movement in any particular period will not always move according to the interest rate differential between the two countries of concern; yet they may still rely on the interest rate differential in order to derive their best guess of the expected exchange rate movement.

SUMMARY

- Purchasing power parity (PPP) theory specifies a precise relationship between the relative inflation rates of two countries and their exchange rate. PPP theory suggests that the equilibrium exchange rate will adjust by about the same magnitude as the difference between the two countries' inflation rates. Although PPP continues to be a valuable concept, there is evidence of sizable real-world deviations from the theory.
- 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 interest-bearing foreign 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 interest rate advantage achieved by foreign investments. Yet there is evidence that the IFE does not hold during all periods, which means that investment in foreign short-term securities may achieve a higher return than what is possible domestically. However, a firm that attempts to achieve this higher return also incurs the risk that the currency denominating the foreign security depreciates against the investor's home currency during the investment period. In that 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. These theories explain how exchange rates move over time, while interest rate parity (IRP) theory covered in the previous chapter focuses on the relationship between the interest rate differential and the forward rate premium (or discount) at a given point in time.

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. 1-year interest rates are initially 6 percent. Then assume that the Australian 1-year interest rate increases by 5 percentage points, while the U.S. 1-year interest rate remains unchanged. Using this information and the international Fisher effect (IFE) theory, forecast the spot rate for 1 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 1-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 1-year interest rate is 11 percent in the United States and 7 percent in Singapore. What will the spot rate be in 1 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 1-year interest rates in Europe are 5 percent, while 1-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 1 year be?

b. If the spot rate of the euro in 1 year is $1.00, what is Beth's percentage return from her strategy?

c. If the spot rate of the euro in 1 year is $1.08, what is Beth's percentage return from her strategy?

d. What must the spot rate of the euro be in 1 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 1 year?

c. According to the IFE, what is the expected spot rate of the euro in 1 year?

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

26. IRP The 1-year risk-free interest rate in Mexico is 10 percent. The 1- 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 1-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 1 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 1-year interest rate that is higher than the U.S. 1-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 1 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 1 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 1 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 1-year inflation rate is 7 percent in the United Kingdom, 5 percent in Switzerland, and 1 percent in the United States. The 1-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 1 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 1 year. You could hedge the receivables with the 1-year forward contract. Or, you could decide to not hedge. Is your expected U.S. dollar amount of the receivables in 1 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 Speculation 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 1 year. Determine the expected amount of dollars to be paid by the Wake Forest Co. for the pesos in 1 year.

36. Investment Implications of IRP and IFE The Argentine 1-year CD (deposit) rate is 13 percent, while the Mexican 1-year CD rate is 11 percent and the U.S. 1-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 1-year CD in Argentina.

Ann (based in the United States) invests in a 1-year CD in Mexico.

Ken (based in the United States) invests in a 1-year CD in Argentina and sells Argentine pesos 1 year forward to cover his position.

Juan (who lives in Argentina) invests in a 1-year CD in the United States.

Maria (who lives in Mexico) invests in a 1-year CD in the United States.

Nina (who lives in Mexico) invests in a 1-year CD in Argentina.

Carmen (who lives in Argentina) invests in a 1-year CD in Mexico and sells Mexican pesos 1 year forward to cover her position.

Corio (who lives in Mexico) invests in a 1-year CD in Argentina and sells Argentine pesos 1 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 1-year CD (deposit) rate in New Zealand is 7 percent, and the 1-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 1-year CD rate in Switzerland is 5 percent. The spot rate of the Swiss franc is the same as the 1-year forward rate.

Karen (based in the United States) invests in a 1-year CD in New Zealand and sells New Zealand dollars 1 year forward to cover her position.

James (based in the United States) invests in a 1-year CD in New Zealand and does not cover his position.

Brian (based in the United States) invests in a 1-year CD in Switzerland and sells Swiss francs 1 year forward to cover his position.

Eric (who lives in Switzerland) invests in a 1-year CD in Switzerland.

Tonya (who lives in New Zealand) invests in a 1-year CD in the United States and sells U.S. dollars 1 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 1-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?

39. PPP and Real Interest Rates The nominal (quoted) U.S. 1-year interest rate is 6 percent, while the nominal 1-year interest rate in Canada is 5 percent. Assume you believe in purchasing power parity. You believe the real 1-year interest rate is 2 percent in the United States, and that the real 1-year interest rate is 3 percent in Canada. Today the Canadian dollar spot rate is $.90. What do you think the spot rate of the Canadian dollar will be in 1 year?

40. IFE, Cross Exchange Rates, and Cash Flows Assume the Hong Kong dollar (HK$) value is tied to the U.S. dollar and will remain tied to the U.S. dollar. Assume that interest rate parity exists. Today, an Australian dollar (A$) is worth $.50 and HK$3.9. The 1-year interest rate on the Australian dollar is 11 percent, while the 1-year interest rate on the U.S. dollar is 7 percent. You believe in the international Fisher effect. You will receive A$1 million in 1 year from selling products to Australia, and will convert these proceeds into Hong Kong dollars in the spot market at that time to purchase imports from Hong Kong. Forecast the amount of Hong Kong dollars that you will be able to purchase in the spot market 1 year from now with A$1 million. Show your work.

41. PPP and Cash Flows Boston Co. will receive 1 million euros in 1 year from selling exports. It did not hedge this future transaction. Boston believes that the future value of the euro will be determined by purchasing power parity (PPP). It expects that inflation in countries using the euro will be 12 percent next year, while inflation in the United States will be 7 percent next year. Today the spot rate of the euro is $1.46, and the 1-year forward rate is $1.50.

a. Estimate the amount of U.S. dollars that Boston will receive in 1 year when converting its euro receivables into U.S. dollars.

b. Today, the spot rate of the Hong Kong dollar is pegged at $.13. Boston believes that the Hong Kong dollar will remain pegged to the dollar for the next year. If Boston Co. decides to convert its 1 million euros into Hong Kong dollars instead of U.S. dollars at the end of 1 year, estimate the amount of Hong Kong dollars that Boston will receive in 1 year when converting its euro receivables into Hong Kong dollars.

42. PPP and Currency Futures Assume that you believe purchasing power parity (PPP) exists. You expect that inflation in Canada during the next year will be 3 percent and inflation in the United States will be 8 percent. Today the spot rate of the Canadian dollar is $.90 and the 1-year futures contract of the Canadian dollar is priced at $.88. Estimate the expected profit or loss if an investor sold a 1-year futures contract today on 1 million Canadian dollars and settled this contract on the settlement date.

43. PPP and Changes in the Real Interest Rate Assume that you believe exchange rate movements are mostly driven by purchasing power parity. The U.S. and Canada presently have the same nominal (quoted) interest rate. The central bank of Canada just made an announcement that causes you to revise your estimate of Canada's real interest rate downward. Nominal interest rates were not affected by the announcement. Do you expect that the Canadian dollar to appreciate, depreciate, or remain the same against the dollar in response to the announcement? Briefly explain your answer.

44. IFE and Forward Rate The one-year Treasury (risk-free) interest rate in the U.S. is presently 6%, while the one-year Treasury interest rate in Switzerland is 13%. The spot rate of the Swiss franc is $.80. Assume that you believe in the international Fisher effect. You will receive 1 million Swiss francs in one year.

a. What is the estimated amount of dollars you will receive when converting the francs to U.S. dollars in one year at the spot rate at that time?

b. Assume that interest rate parity exists. If you hedged your future receivables with a one-year forward contract, how many dollars will you receive when converting the francs to U.S. dollars in one year?

45. PPP You believe that the future value of the Australian dollar will be determined by purchasing power parity (PPP). You expect that inflation in Australia will be 6% next year, while inflation in the U.S. will be 2% next year. Today the spot rate of the Australian dollar is $.81, and the one-year forward rate is $.77. What is the expected spot rate of the Australian dollar in one year?

46. Logic Behind IFE Investors based in the U.S. can earn 11% interest on a one-year bank deposit in Argentina (with no default risk) or 2% on a one-year U.S. bank deposit in the U.S. (with no default risk). Assess the following statement: "According to the international Fisher effect (IFE), if U.S. investors invest 1000 Argentine pesos in an Argentine bank deposit, they are expected to receive only 20 pesos (2% × 1,000 pesos) as interest." Is this statement a correct explanation of why the international Fisher effect would discourage U.S. investors from investing in Argentina? If not, provide a more accurate explanation for why investors who believe in IFE would not pursue the Argentine investment in this example.

47. Influence of PPP The U.S. has expected inflation of 2%, while Country A, Country B, and Country C have expected inflation of 7%. Country A engages in much international trade with the U.S. The products that are traded between Country A and the U.S. can easily be produced by either country. Country B engages in much international trade with the U.S. The products that are traded between Country B and the U.S. are important health products, and there are not substitutes for these products that are exported from the U.S. to Country B or from Country B to the U.S. Country C engages in much international financial flows with the U.S. but very little trade. If you were to use purchasing power parity to predict the future exchange rate over the next year for the local currency of each country against the dollar, do you think PPP would provide the most accurate forecast for the currency of Country A, Country B, or Country C? Briefly explain.

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 *International Financial Management* text companion website. Go to www.cengagebrain.com (students) or www.cengage.com/login (instructors) and search using **ISBN 9781133947837**.

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.

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, he 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, 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. Because the forward premium reflects that same interest rate differential, the results from hedging should equal the results from not hedging on average.

1. Is Logan's interpretation of the IFE theory correct?
2. If you were in Logan'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 Web site (www.bloomberg.com) provides interest rate quotations for numerous currencies.

1. Review the section of the website that provide interest rates for various countries. 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 three countries that is implied by the nominal interest rate (according to the IFE).
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?

ONLINE ARTICLES WITH REAL-WORLD EXAMPLES

Find a recent article online that describes an actual international finance application or a real world example about a specific MNC's actions that reinforces one or more concepts covered in this chapter. If your class has an online component, your professor may ask you to post your summary there and provide the web link of the article so that other students can access it. If your class is live, your professor may ask you to summarize your application in class. Your professor may assign specific students to complete this assignment for this chapter, or may allow any students to do the assignment on a volunteer basis. For recent online articles and real world examples applied to this chapter, consider using the following search terms and include the current year as a search term to ensure that the online articles are recent:

1. purchasing power parity
2. U.S. AND purchasing power parity
3. euro AND purchasing power parity
4. inflation AND exchange rate
5. inflation AND currency effects
6. inflationary pressure AND exchange rate
7. international Fisher effect
8. interest rate differential AND currency effects
9. interest rate differential AND exchange rate
10. international interest rate AND expected inflation

PART 2 INTEGRATIVE PROBLEM

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%

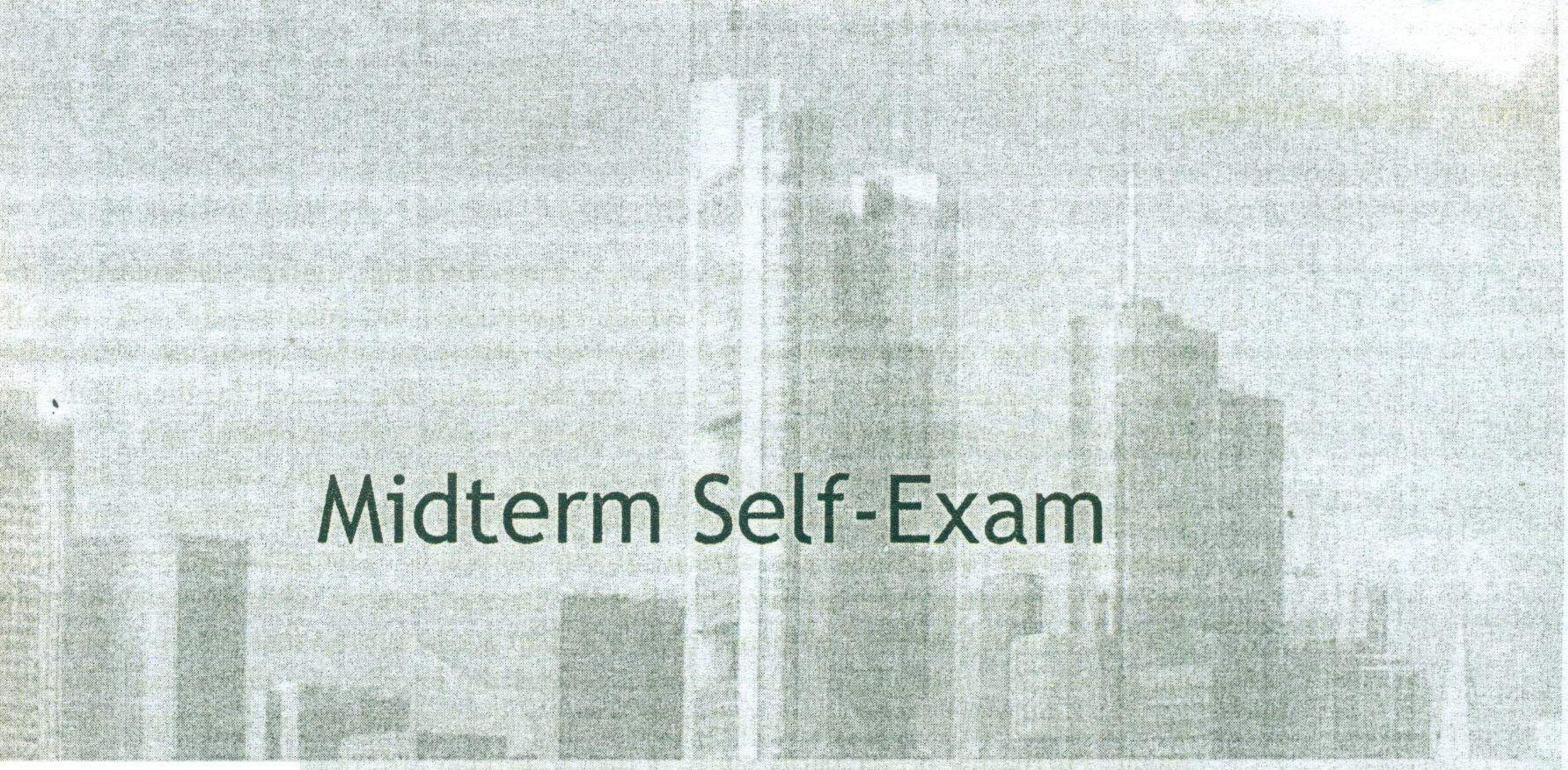
   Determine whether triangular arbitrage is feasible and, if so, how it should be conducted to make a profit.

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 Self-Exam

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 on the 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 1-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 1-year forward rate is used to predict the value of the Australian dollar in 1 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 1 year. You received a premium on the put option of $.05 per unit. The exercise price was $1.22. Assume that 1 year ago, the spot rate of the euro was $1.20. One year ago, the 1-year forward rate of the euro exhibited a discount of 2 percent, and the 1-year futures price of the euro was the same as the 1-year forward rate of the euro. From 1 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 1 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 1-year nominal interest rate in the United States is 7 percent, while the 1-year nominal interest rate in Australia is 11 percent. The spot rate of the Australian dollar is $.60. Today, you purchase a 1-year forward contract on 10 million Australian dollars. How many U.S. dollars will you need in 1 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 1 year. Determine the expected amount of dollars to be paid by the Carolina Co. for the pesos in 1 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 1-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 1 year.

Karen (based in the United States) invests in a 1-year CD in New Zealand and sells New Zealand dollars 1 year forward to cover her position.

Marcia (who lives in New Zealand) invests in a 1-year CD in the United States and sells U.S. dollars 1 year forward to cover her position.

William (who lives in Canada) invests in a 1-year CD in the United States and does not cover his position.

James (based in the United States) invests in a 1-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 people 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 1 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 1-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 9,090.9 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 the exercise price is the same as the 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 that she could earn locally.

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

William earns 8.6 percent. If he converts, C\$ = \$.625 today. After 1 year, C\$ = \$.61. So if William invests C \$1,000, it converts to \$625. At the end of 1 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 that in 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 the forward rate. The 1-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 1 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.