PART 5

International Finance and Monetary Policy

Crisis and Response: Foreign Exchange Market Turmoil and the IMF

From 2002 until 2008, the U.S. dollar steadily declined in value relative to other currencies. Indeed, a major concern of policymakers was that the dollar might crash, with adverse effects on both economic activity and inflation. With the credit markets seizing up in September and October 2008, after the failure of Lehman Brothers, an amazing thing happened. Instead of continuing its decline, the dollar appreciated sharply. The same "flight to quality" that led investors to step up their purchases of U.S. Treasury securities also led them to want to hold more U.S. dollars, thereby bidding up the dollar's value.

The dollar's higher value made imported goods—ranging from flat-screen televisions to wines—cheaper to purchase and traveling abroad more affordable. But this good news for the U.S. dollar was often bad news for other currencies. Many countries in Latin America and Eastern Europe now found their currencies in free fall. The International Monetary Fund (IMF) stepped in and set up a new lending facility to make loans to distressed countries with fewer strings attached than were attached to the IMF's previous lending programs. The IMF started making loans to the tune of billions of dollars. The IMF, which had looked as though it was on the sidelines as the global financial crisis spread worldwide, now was moving to front and center.

The global financial crisis demonstrated that financial events that start in the United States can have worldwide ramifications and that international financial institutions like the IMF have an important role in responding to such events, to make sure that the international financial system continues to work well. Chapter 18 outlines how the foreign exchange market functions and how exchange rates between different countries' currencies are determined. In Chapter 19, we examine how the international financial system operates and how it affects monetary policy.

18 The Foreign Exchange Market

Learning Objectives

- Explain how the foreign exchange market works and why exchange rates are important.
- Identify the main factors that affect exchange rates in the long run.
- Draw the demand and supply curves for the foreign exchange market and interpret the equilibrium in the market for foreign exchange.
- List and illustrate the factors that affect the exchange rate in the short run.

Preview

In the mid-1980s, American businesses became less competitive with their foreign counterparts; subsequently, in the 1990s and 2000s, their competitiveness increased. Did this swing in competitiveness occur primarily because American management fell down on the job in the 1980s and then got its act together afterwards? Not really. American businesses became less competitive in the 1980s because American dollars became worth more in terms of foreign currencies, making American goods more expensive relative to foreign goods. By the 1990s and 2000s, the value of the U.S. dollar had fallen appreciably from its highs in the mid-1980s, making American goods cheaper and American businesses more competitive.

The price of one currency in terms of another is called the **exchange rate**. As you can see in Figure 1, exchange rates are highly volatile. The exchange rate affects the economy and our daily lives, because when the U.S. dollar becomes more valuable relative to foreign currencies, foreign goods become cheaper for Americans, and American goods become more expensive for foreigners. When the U.S. dollar falls in value, foreign goods become more expensive for Americans, and American goods become cheaper for foreigners.

Fluctuations in the exchange rate also affect both inflation and output, and are an important concern to monetary policymakers. When the U.S. dollar falls in value, the higher prices of imported goods feed directly into a higher price level and inflation. At the same time, a declining U.S. dollar, which makes U.S. goods cheaper for foreigners, increases the demand for U.S. goods and leads to higher production and output.

We begin our study of international finance by examining the **foreign exchange market**, the financial market in which exchange rates are determined.

FOREIGN EXCHANGE MARKET

Most countries of the world have their own currencies: The United States has its dollar; the European Monetary Union, its euro; Brazil, its real; and China, its yuan. Trade between countries involves the mutual exchange of different currencies (or, more typically, bank deposits denominated in different currencies). When an American firm buys foreign goods, services, or financial assets, for example, U.S. dollars (typically, bank deposits denominated in U.S. dollars) must be exchanged for foreign currency (bank deposits denominated in the foreign currency).

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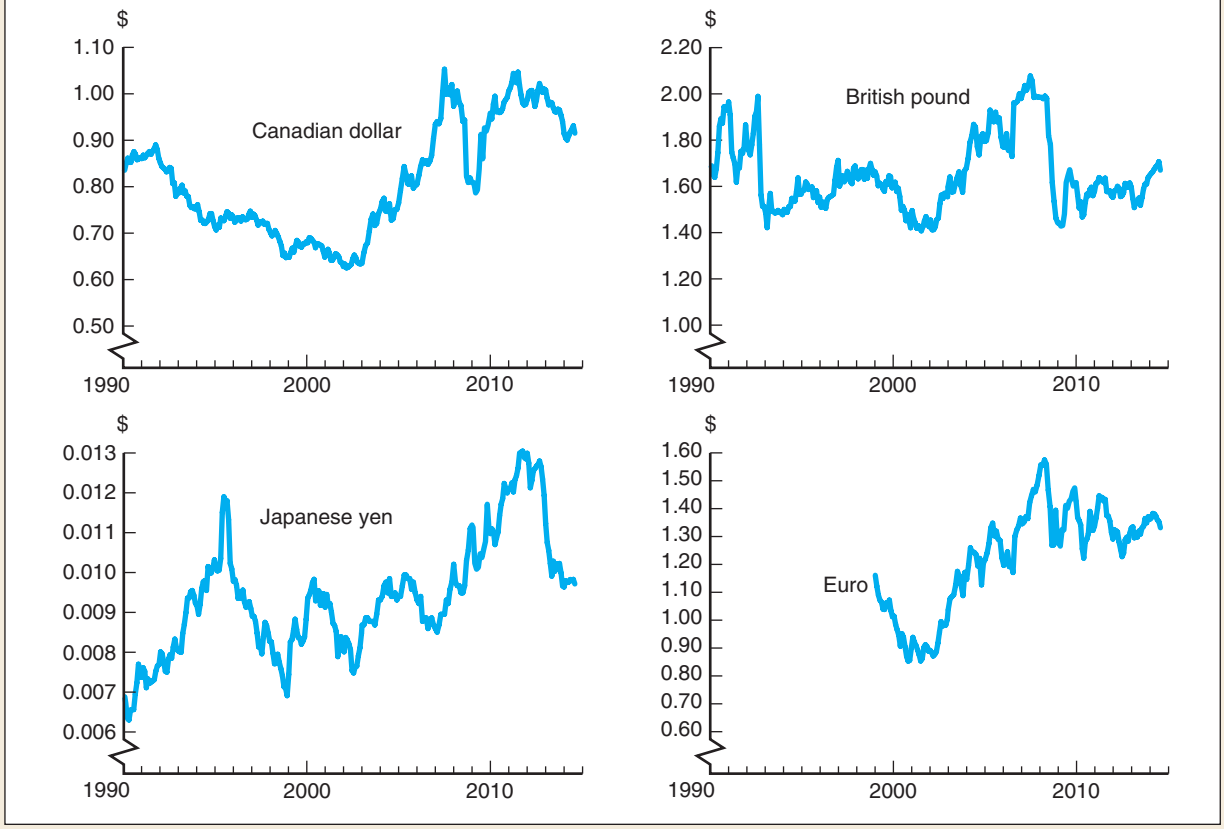

FIGURE 1 **Exchange Rates, 1990–2014**

Exchange rates are highly volatile. Note that exchange rates are quoted as $ per unit of foreign currency, so that a rise in these plots indicates a strengthening of the foreign currency (weakening of the dollar).

Source: Federal Reserve Bank of St. Louis, FRED database: http://research.stlouisfed.org/fred2/.

The trading of currencies and bank deposits denominated in particular currencies takes place in the foreign exchange market. Transactions conducted in the foreign exchange market determine the rates at which currencies are exchanged, which in turn determine the cost of purchasing foreign goods and financial assets.

What Are Foreign Exchange Rates?

There are two kinds of exchange rate transactions. The predominant ones, called **spot transactions**, involve the immediate (two-day) exchange of bank deposits. **Forward transactions** involve the exchange of bank deposits at some specified future date. The **spot exchange rate** is the exchange rate for the spot transaction, and the **forward exchange rate** is the exchange rate for the forward transaction.

Following the Financial News Foreign Exchange Rates

Foreign exchange rates are published daily in newspapers and on Internet sites such as http://www.finance.yahoo.com. Exchange rates for a currency such as the euro are quoted in two ways: in U.S. dollars per unit of domestic currency and in domestic currency per U.S. dollar. For example, on May 13, 2014, the euro exchange rate was quoted as $1.37 per euro and 0.73 euro per dollar. Americans generally would regard the exchange rate with the euro as $1.37 per euro, while Europeans would think of it as 0.73 euro per dollar.

Exchange rates typically are quoted for the spot transaction (the spot exchange rate) and for forward transactions (the forward exchange rates) that will take place one month, three months, and six months in the future.

When a currency increases in value, it experiences **appreciation**; when it falls in value and is worth fewer U.S. dollars, it undergoes **depreciation**. At the beginning of 1999, for example, the euro was valued at 1.18 dollars; on May 13, 2014, it was valued at 1.37 dollars, as indicated in the Following the Financial News box, "Foreign Exchange Rates." The euro *appreciated* by 16%: $(1.37 - 1.18/1.18) = 0.16 = 16\%$. Equivalently, we could say that the U.S. dollar, which went from a value of 0.85 euro per dollar at the beginning of 1999 to a value of 0.73 euro per dollar on May 13, 2014, *depreciated* by 14%: $(0.73 - 0.85)/0.85 = -0.14 = 14\%$.

Why Are Exchange Rates Important?

Exchange rates are important because they affect the relative prices of domestic and foreign goods. The dollar price of French goods to an American is determined by the interaction of two factors: the price of French goods in euros and the euro/dollar exchange rate.

Suppose that Wanda the Winetaster, an American, decides to buy a bottle of 1961 (a very good year) Château Lafite Rothschild to complete her wine cellar. If the price of the wine in France is 1,000 euros and the exchange rate is $1.37 to the euro, the wine will cost Wanda $1,370 (= 1,000 euros × $1.37/euro). Now suppose that Wanda delays her purchase by two months, at which time the euro has appreciated to $1.70 per euro. If the domestic price of the bottle of Lafite Rothschild remains 1,000 euros, its dollar cost will have risen from $1,370 to $1,700.

The same currency appreciation, however, makes the price of foreign goods in France less expensive. At an exchange rate of $1.37 per euro, a Dell computer priced at $2,000 costs Pierre the Programmer 1,460 euros; if the exchange rate increases to $1.70 per euro, the computer will cost only 1,176 euros.

A depreciation of the euro lowers the cost of French goods in America but raises the cost of American goods in France. If the euro drops in value to $1.00, Wanda's bottle of Lafite Rothschild will cost her only $1,000 instead of $1,370, and the Dell computer will cost Pierre 2,000 euros rather than 1,460 euros.

Such reasoning leads to the following conclusion: ***When a country's currency appreciates (rises in value relative to other currencies), the country's goods abroad become more expensive, and foreign goods in that country become cheaper (holding***

domestic prices constant in the two countries). Conversely, when a country's currency depreciates, its goods abroad become cheaper, and foreign goods in that country become more expensive.

Depreciation of a currency makes it easier for domestic manufacturers to sell their goods abroad and makes foreign goods less competitive in domestic markets. From 2002 to 2014, the depreciated dollar helped U.S. industries sell more goods, but it hurt American consumers because foreign goods were more expensive. The prices of French wine and cheese and the cost of vacationing abroad all rose as a result of the weak dollar.

How Is Foreign Exchange Traded?

You cannot go to a centralized location to watch exchange rates being determined; currencies are not traded on exchanges such as the New York Stock Exchange. Instead, the foreign exchange market is organized as an over-the-counter market in which several hundred dealers (mostly banks) stand ready to buy and sell deposits denominated in foreign currencies. Because these dealers are in constant telephone and computer contact, the market is very competitive; in effect, it functions no differently from a centralized market.

An important point to note is that although banks, companies, and governments talk about buying and selling currencies in foreign exchange markets, they do not take a fistful of dollar bills and sell them for British pound notes. Rather, most trades involve the buying and selling of bank deposits denominated in different currencies. So when we say that a bank is buying dollars in the foreign exchange market, what we actually mean is that the bank is buying *deposits denominated in dollars*. The volume in this market is colossal, exceeding $5 trillion per day.

Trades in the foreign exchange market consist of transactions in excess of $1 million. The market that determines the exchange rates given in the Following the Financial News box is not the market in which we would buy foreign currency for a trip abroad. Instead, we buy foreign currency in the retail market, from dealers such as American Express or from banks. Because retail prices are higher than wholesale prices, when we buy foreign exchange, we obtain fewer units of foreign currency per dollar—that is, we pay a higher price for foreign currency—than the exchange rates quoted in the newspaper.

EXCHANGE RATES IN THE LONG RUN

Like the price of any good or asset in a free market, exchange rates are determined by the interaction of supply and demand. To simplify our analysis of exchange rates in a free market, we divide it into two parts. First, we examine how exchange rates are determined in the long run; then we use our knowledge of the long-run determinants of exchange rates to help us understand how they are determined in the short run.

Law of One Price

The starting point for understanding how exchange rates are determined is a simple idea called the **law of one price**: If two countries produce an identical good, and transportation costs and trade barriers are very low, the price of the good should be the same

throughout the world, no matter which country produces it. Suppose that American steel costs $100 per ton and identical Japanese steel costs 10,000 yen per ton. For the law of one price to hold, the exchange rate between the yen and the dollar must be 100 yen per dollar ($0.01 per yen), so that one ton of American steel sells for 10,000 yen in Japan (the price of Japanese steel) and one ton of Japanese steel sells for $100 in the United States (the price of U.S. steel). If the exchange rate were 200 yen to the dollar, Japanese steel would sell for $50 per ton in the United States, or half the price of American steel, and American steel would sell for 20,000 yen per ton in Japan, twice the price of Japanese steel. Because American steel would be more expensive than Japanese steel in both countries and because American steel is identical to Japanese steel, the demand for American steel would go to zero. Given a fixed dollar price for American steel, the resulting excess supply of American steel would be eliminated only if the exchange rate fell to 100 yen per dollar, making the prices of American steel and Japanese steel the same in both countries.

Theory of Purchasing Power Parity

One of the most prominent theories of how exchange rates are determined is the **theory of purchasing power parity (PPP)**. It states that exchange rates between any two currencies will adjust to reflect changes in the price levels of the two countries. The theory of PPP is simply an application of the law of one price to national price levels rather than to individual prices. Suppose that the yen price of Japanese steel rises 10% (to 11,000 yen) relative to the dollar price of American steel (unchanged at $100). For the law of one price to hold, the exchange rate must rise to 110 yen to the dollar, a 10% appreciation of the dollar. By applying the law of one price to the price levels in the two countries, we get the theory of purchasing power parity, which maintains that if the Japanese price level rises 10% relative to the U.S. price level, the dollar will appreciate by 10%.

Another way of thinking about purchasing power parity is through a concept called the **real exchange rate**, the rate at which domestic goods can be exchanged for foreign goods. In effect, the real exchange rate is the price of domestic goods relative to the price of foreign goods denominated in the domestic currency. For example, if a basket of goods in New York costs $50 while the same basket of goods in Tokyo costs $75 (because the basket of goods costs 7500 yen and the exchange rate is 100 yen per dollar), then the real exchange rate is 0.66 (= $50/$75). In our example, the real exchange rate is below 1.0, indicating that it is cheaper to buy the basket of goods in the United States than in Japan. The real exchange rate for the U.S. dollar is currently low against many other currencies, and this is why New York is overwhelmed by so many foreign tourists going on shopping sprees. The real exchange rate indicates whether a currency is relatively cheap or not. The theory of PPP can also be described in terms of the real exchange rate. PPP predicts that the real exchange rate is always equal to 1.0, so that the purchasing power of the dollar is the same as that of other currencies, such as the yen or the euro.

As our U.S./Japanese example demonstrates, the theory of PPP suggests that if one country's price level rises relative to another's, its currency should depreciate (and the other country's currency should appreciate). As you can see in Figure 2, this prediction is borne out in the long run. From 1973 to 2014, the British price level rose 68% relative to the U.S. price level, and as the theory of PPP predicts, the dollar appreciated against the pound—although by 43%, an amount smaller than the 68% increase predicted by PPP.

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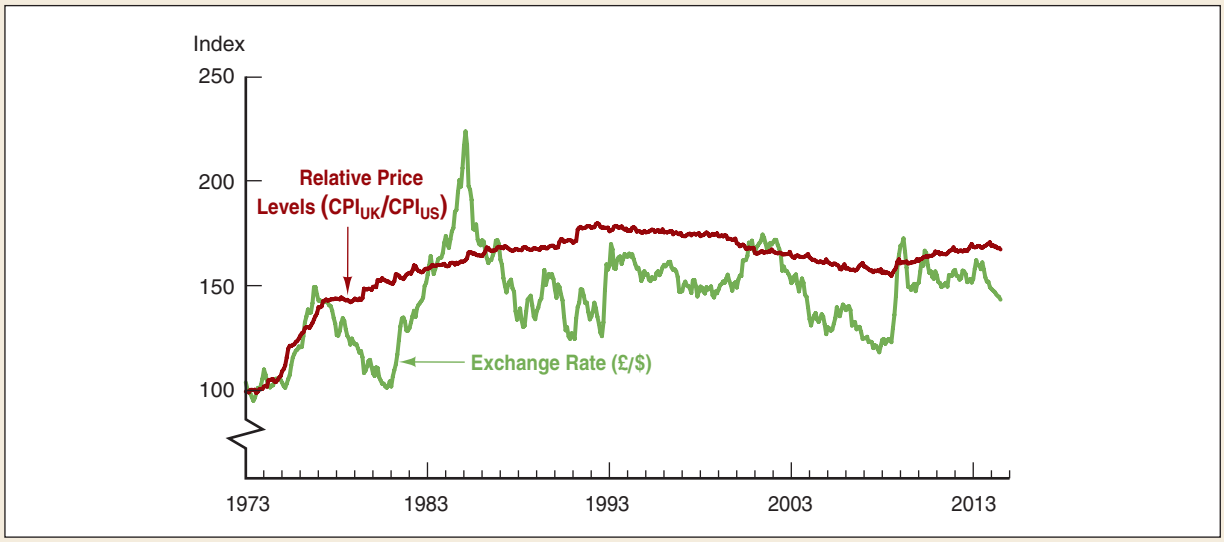

FIGURE 2 **Purchasing Power Parity, United States/United Kingdom, 1973–2014 (Index: March 1973 = 100.)**
Over the whole period shown, the rise in the British price level relative to the U.S. price level is associated with a rise in the value of the dollar, as predicted by PPP. However, the PPP relationship does not hold over shorter periods.
Source: Federal Reserve Bank of St. Louis, FRED database: http://research.stlouisfed.org/fred2/.

Yet, as the same figure indicates, PPP theory often has poor predictive power in the short run. From early 1985 to the end of 1987, for example, the British price level rose relative to that of the United States. Instead of appreciating, as predicted by PPP theory, the U.S. dollar actually depreciated by 40% against the pound. So even though PPP theory provides some guidance as to the long-run movement of exchange rates, it is not perfect and in the short run is a particularly poor predictor. What explains the PPP theory's failure to predict well in the short run?

Why the Theory of Purchasing Power Parity Cannot Fully Explain Exchange Rates

The PPP conclusion that exchange rates are determined solely by changes in relative price levels rests on the assumptions that all goods are identical in both countries and that transportation costs and trade barriers are very low. When these assumptions are true, the law of one price states that the relative prices of all these goods (that is, the relative price level between the two countries) will determine the exchange rate. The assumption that goods are identical may not be unreasonable for American and Japanese steel, but is it a reasonable assumption for American and Japanese cars? Is a Toyota the equivalent of a Chevrolet?

Because Toyotas and Chevys are obviously not identical, their prices do not have to be equal. Toyotas can be more expensive relative to Chevys, and both Americans and Japanese will still purchase Toyotas. Because the law of one price does not hold for all

goods, a rise in the price of Toyotas relative to Chevys will not necessarily mean that the yen must depreciate by the amount of the relative price increase of Toyotas over Chevys.

Furthermore, PPP theory does not take into account that many goods and services (whose prices are included in a measure of a country's price level) are not traded across borders. Housing, land, and services such as restaurant meals, haircuts, and golf lessons are not traded goods. So even though the prices of these items might rise, leading to a higher price level relative to another country's, the exchange rate would experience little direct effect.

Factors That Affect Exchange Rates in the Long Run

In the long run, four major factors affect the exchange rate: relative price levels, trade barriers, preferences for domestic versus foreign goods, and productivity. We examine how each of these factors affects the exchange rate while holding the other factors constant.

The basic reasoning proceeds along the following lines: Anything that increases the demand for domestically produced goods that are traded relative to foreign traded goods tends to appreciate the domestic currency, because domestic goods will continue to sell well even when the value of the domestic currency is higher. Similarly, anything that increases the demand for foreign goods relative to domestic goods tends to depreciate the domestic currency, because domestic goods will continue to sell well only if the value of the domestic currency is lower. In other words, ***if a factor increases the demand for domestic goods relative to foreign goods, the domestic currency will appreciate; if a factor decreases the relative demand for domestic goods, the domestic currency will depreciate.***

Relative Price Levels

In line with PPP theory, when prices of American goods rise (holding prices of foreign goods constant), the demand for American goods falls, and the dollar tends to depreciate so that American goods can still sell well. By contrast, if prices of Japanese goods rise, causing the relative prices of American goods to fall, the demand for American goods increases, and the dollar tends to appreciate because American goods will continue to sell well even with a higher value of the domestic currency. ***In the long run, a rise in a country's price level (relative to the foreign price level) causes its currency to depreciate, and a fall in the country's relative price level causes its currency to appreciate.***

Trade Barriers

Barriers to free trade such as **tariffs** (taxes on imported goods) and **quotas** (restrictions on the quantity of foreign goods that can be imported) can affect the exchange rate. Suppose the United States increases its tariff or puts a lower quota on Japanese steel. These increases in trade barriers increase the demand for American steel, and the dollar tends to appreciate because American steel will still sell well even with a higher value of the dollar. ***Increasing trade barriers causes a country's currency to appreciate in the long run.***

Preferences for Domestic Versus Foreign Goods

If the Japanese develop an appetite for American goods—say, for Florida oranges and American movies—the increased demand for American goods (exports) tends to appreciate the dollar, because the American goods will continue to sell well even at a higher value of the dollar. Likewise, if Americans decide that they prefer Japanese cars to American cars, the increased

SUMMARY TABLE 1

Factors That Affect Exchange Rates in the Long Run

Factor	Change in Factor	Response of the Exchange Rate, E^*
Domestic price level†	↑	↓
Trade barriers†	↑	↑
Import demand	↑	↓
Export demand	↑	↑
Productivity†	↑	↑

*Units of foreign currency per dollar: ↑ indicates domestic currency appreciation; ↓, depreciation.
†Relative to other countries.
Note: Only increases (↑) in the factors are shown; the effects of decreases in the variables on the exchange rate are the opposite of those indicated in the "Response" column.

demand for Japanese goods (imports) tends to depreciate the dollar. ***Increased demand for a country's exports causes its currency to appreciate in the long run; conversely, increased demand for imports causes the domestic currency to depreciate.***

Productivity When productivity in a country rises, it tends to rise in domestic sectors that produce traded goods rather than nontraded goods. Higher productivity, therefore, is associated with a decline in the price of domestically produced traded goods relative to foreign traded goods. As a result, the demand for domestic traded goods rises, and the domestic currency tends to appreciate. If, however, a country's productivity lags behind that of other countries, its traded goods become relatively more expensive, and the currency tends to depreciate. ***In the long run, as a country becomes more productive relative to other countries, its currency appreciates.***[1]

Our long-run theory of exchange rate behavior is summarized in Table 1. We use the convention that the exchange rate E is quoted such that an appreciation of the domestic currency corresponds to a rise in the exchange rate. In the case of the United States, this means that we are quoting the exchange rate as units of foreign currency, say, euros, per dollar.[2]

[1]A country might be so small that a change in productivity or the preferences for domestic or foreign goods will have no effect on the prices of these goods relative to foreign goods. In this case, changes in productivity or changes in preferences for domestic or foreign goods affect the country's income but do not necessarily affect the value of the currency. In our analysis, we are assuming that changes in productivity or preferences can affect relative prices and consequently the exchange rate.

[2]Exchange rates can be quoted either as units of foreign currency per domestic currency or as units of domestic currency per foreign currency. In professional writing, many economists quote exchange rates as units of domestic currency per foreign currency so that an appreciation of the domestic currency is portrayed as a fall in the exchange rate. The opposite convention is used in this text because it is more intuitive to think of an appreciation of the domestic currency as a rise in the exchange rate.

EXCHANGE RATES IN THE SHORT RUN: A SUPPLY AND DEMAND ANALYSIS

We have developed a theory of the long-run behavior of exchange rates. However, because factors driving long-run changes in exchange rates move slowly over time, if we are to understand why exchange rates exhibit such large changes (sometimes several percentage points) from day to day, we must develop a supply and demand analysis that explains how current exchange rates (spot exchange rates) are determined in the short run.

The key to understanding the short-run behavior of exchange rates is to recognize that an exchange rate is the price of domestic assets (bank deposits, bonds, equities, and so on, denominated in the domestic currency) in terms of foreign assets (similar assets denominated in the foreign currency). Because the exchange rate is the price of one asset in terms of another, the natural way to investigate the short-run determination of exchange rates is with a supply and demand analysis that uses an asset market approach, which relies heavily on the theory of portfolio choice developed in Chapter 5. As you will see, however, the long-run determinants of the exchange rate we have just outlined also play an important part in the short-run asset market approach.

In the past, supply and demand approaches to exchange rate determination emphasized the role of import and export demand. The more modern asset market approach used here emphasizes stocks of assets rather than the flows of exports and imports over short periods, because export and import transactions are small relative to the amounts of domestic and foreign assets held at any given time. For example, the total value of foreign exchange transactions in the United States each year is well over 25 times greater than the amount of U.S. exports and imports. Thus, over short periods, decisions to hold domestic or foreign assets have a much greater role in exchange rate determination than the demand for exports and imports does.

Supply Curve for Domestic Assets

We start by discussing the supply curve. In this analysis we treat the United States as the home country, so domestic assets are denominated in dollars. For simplicity, we use euros to stand for any foreign country's currency, so foreign assets are denominated in euros.

The quantity of dollar assets supplied is primarily the quantity of bank deposits, bonds, and equities in the United States, and for all practical purposes we can take this amount as fixed with respect to the exchange rate. The quantity supplied at any exchange rate is the same, so the supply curve, S, is vertical, as shown in Figure 3.

Demand Curve for Domestic Assets

The demand curve traces out the quantity demanded at each current exchange rate by holding everything else constant, particularly the expected future value of the exchange rate. We write the current exchange rate (the spot exchange rate) as E_t, and the expected exchange rate for the next period as E^e_{t+1}. As suggested by the theory of portfolio choice, the most important determinant of the quantity of domestic (dollar) assets demanded is the relative expected return on domestic assets. Let's see what happens as the current exchange rate E_t falls.

Suppose we start at point A in Figure 3, where the current exchange rate is at E_A. With the future expected value of the exchange rate held constant at E^e_{t+1}, a lower value of the exchange rate—say, at E^*—implies that the dollar is more likely to rise in value, that is, appreciate. The greater the expected rise (appreciation) of the dollar, the higher is

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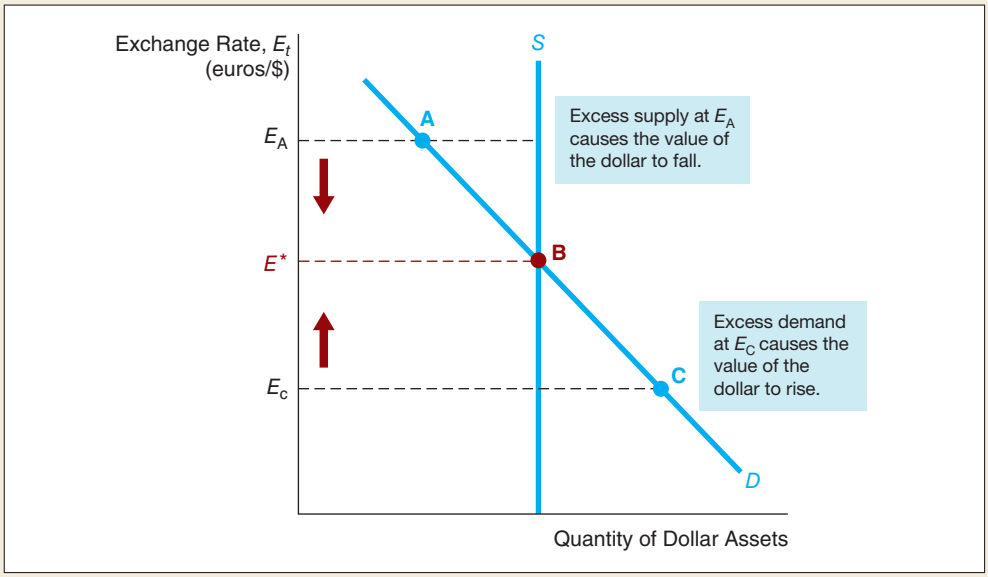

FIGURE 3
Equilibrium in the Foreign Exchange Market
Equilibrium in the foreign exchange market occurs at point *B*, the intersection of the demand curve *D* and the supply curve *S* at an exchange rate of E^*.

the relative expected return on dollar (domestic) assets. According to the theory of portfolio choice, because dollar assets are now more desirable to hold, the quantity of dollar assets demanded will rise, as shown by point *B* in Figure 3. If the current exchange rate falls even further to E_C, there will be an even higher expected appreciation of the dollar, a higher expected return, and therefore an even greater quantity of dollar assets demanded. This effect is shown at point *C* at Figure 3. The resulting demand curve *D*, which connects these points, is downward-sloping, indicating that at lower current values of the dollar (everything else being equal), the quantity demanded of dollar assets is higher.

Equilibrium in the Foreign Exchange Market

As in the usual supply and demand analysis, the market is in equilibrium when the quantity of dollar assets demanded equals the quantity supplied. In Figure 3, equilibrium occurs at point *B*, the intersection of the demand and supply curves. At point *B*, the exchange rate is E^*.

Suppose the exchange rate is at E_A, which is higher than the equilibrium exchange rate of E^*. As we can see in Figure 3, the quantity of dollar assets supplied is now greater than the quantity demanded, a condition of excess supply. Given that more people want to sell dollar assets than want to buy them, the value of the dollar will fall. As long as the exchange rate remains above the equilibrium exchange rate, an excess supply of dollar assets will continue to be available, and the dollar will fall in value until it reaches the equilibrium exchange rate of E^*.

Similarly, if the exchange rate is less than the equilibrium exchange rate at E_C, the quantity of dollar assets demanded will exceed the quantity supplied, a condition of excess demand. Given that more people want to buy dollar assets than want to sell them, the value of the dollar will rise until the excess demand disappears and the value of the dollar is again at the equilibrium exchange rate of E^*.

EXPLAINING CHANGES IN EXCHANGE RATES

The supply and demand analysis of the foreign exchange market illustrates how and why exchange rates change.[3] We have simplified this analysis by assuming that the amount of dollar assets is fixed: The supply curve is vertical at a given quantity and does not shift. Under this assumption, we need to look at only those factors that shift the demand curve for dollar assets to explain how exchange rates change over time.

Shifts in the Demand for Domestic Assets

As we have seen, the quantity of domestic (dollar) assets demanded depends on the relative expected return on dollar assets. To see how the demand curve shifts, we need to determine how the quantity demanded changes, holding the current exchange rate, E_t, constant, when other factors change.

For insight into the direction in which the demand curve will shift, suppose you are an investor who is considering putting funds into domestic (dollar) assets. When a factor changes, you must decide whether, at a given level of the current exchange rate and holding all other variables constant, you would earn a higher or lower expected return on dollar assets versus foreign assets. This decision will tell you whether you want to hold more or fewer dollar assets and thus whether the quantity demanded will increase or decrease at each level of the exchange rate. The direction of the change in the quantity demanded at each exchange rate indicates which way the demand curve will shift. In other words, if the relative expected return on dollar assets rises, holding the current exchange rate constant, the demand curve will shift to the right. If the relative expected return falls, the demand curve will shift to the left.

Domestic Interest Rate, i^D Suppose that dollar assets pay an interest rate of i^D. When the domestic interest rate on dollar assets i^D rises, holding the current exchange rate E_t and everything else constant, the return on dollar assets increases relative to the return on foreign assets, and so people will want to hold more dollar assets. The quantity of dollar assets demanded increases at every value of the exchange rate, as shown by the rightward shift of the demand curve from D_1 to D_2 in Figure 4. The new equilibrium is reached at point 2, the intersection of D_2 and S, and the equilibrium exchange rate rises from E_1 to E_2. ***An increase in the domestic interest rate i^D shifts the demand curve for domestic assets D to the right and causes the domestic currency to appreciate*** **($E\uparrow$).**

Conversely, if i^D falls, the relative expected return on dollar assets falls, the demand curve shifts to the left, and the exchange rate falls. ***A decrease in the domestic interest rate i^D shifts the demand curve for domestic assets D to the left and causes the domestic currency to depreciate*** **($E\downarrow$).**

[3]How and why exchange rates change can also be modeled using the *interest parity condition*, an important concept in international finance that shows the relationships among domestic interest rates, foreign interest rates, and the expected appreciation of domestic currency. The interest parity condition and how it explains the determination of exchange rates is discussed in an appendix to this chapter.

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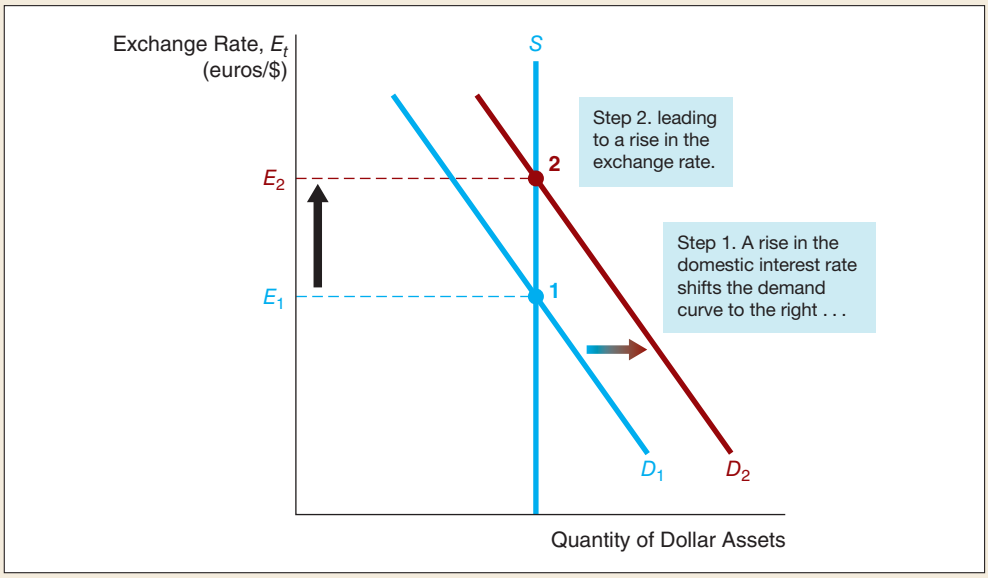
FIGURE 4
Response to an Increase in the Domestic Interest Rate, i^D

When the domestic interest rate i^D increases, the relative expected return on domestic (dollar) assets increases and the demand curve shifts to the right. The equilibrium exchange rate rises from E_1 to E_2.



Foreign Interest Rate, i^F Suppose foreign assets pay an interest rate of i^F. When the foreign interest rate i^F rises, holding the current exchange rate and everything else constant, the return on foreign assets rises relative to the return on dollar assets. Thus the relative expected return on dollar assets falls. Now people want to hold fewer dollar assets, and the quantity demanded decreases at every value of the exchange rate. This scenario is shown by the leftward shift of the demand curve from D_1 to D_2 in Figure 5. The new equilibrium is reached at point 2, when the value of the dollar has fallen. Conversely, a decrease in i^F raises the relative expected return on dollar assets, shifts the demand curve to the right, and raises the exchange rate. To summarize, ***an increase in the foreign interest rate i^F shifts the demand curve D to the left and causes the domestic currency to depreciate; a fall in the foreign interest rate i^F shifts the demand curve D to the right and causes the domestic currency to appreciate.***

Changes in the Expected Future Exchange Rate, E^e_{t+1} Expectations about the future value of the exchange rate play an important role in shifting the current demand curve because the demand for domestic assets, like that for any physical or financial asset, depends on the future resale price. Given the current exchange rate E_t, any factor that causes the expected future exchange rate E^e_{t+1} to rise increases the expected appreciation of the dollar. The result is a higher relative expected return on dollar assets, which increases the demand for dollar assets at every exchange rate, thereby shifting the demand curve to the right from D_1 to D_2 in Figure 6. The equilibrium exchange rate rises to point 2 at the intersection of the D_2 and S curves. ***A rise in the expected future exchange rate E^e_{t+1} shifts the demand curve to the right and causes an appreciation of the domestic currency.*** According to the same reasoning, ***a fall in the expected future exchange rate E^e_{t+1} shifts the demand curve to the left and causes a depreciation of the currency.***

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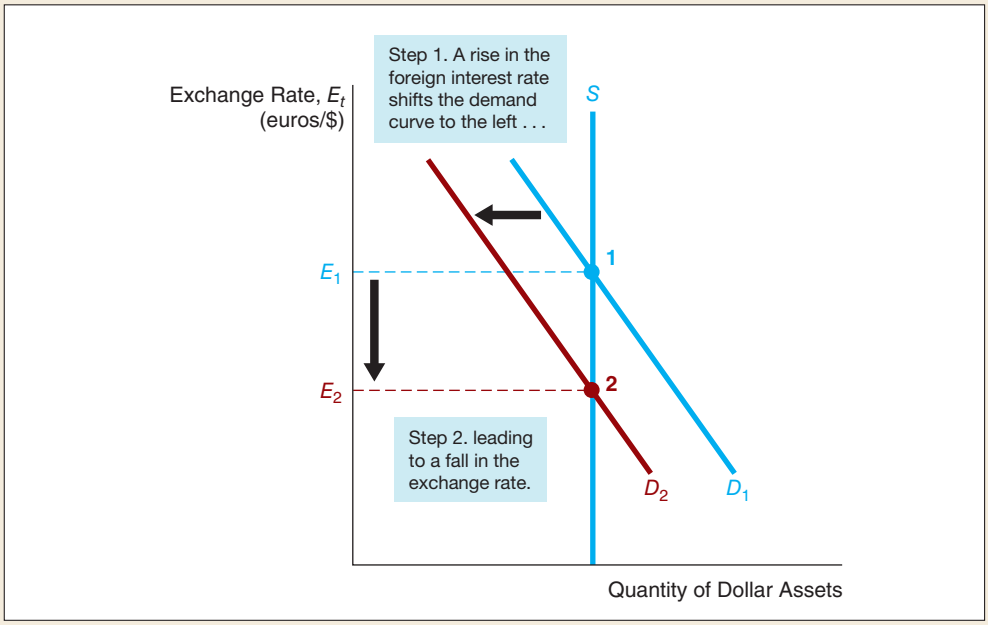
FIGURE 5
Response to an Increase in the Foreign Interest Rate, i^F

When the foreign interest rate i^F increases, the relative expected return on domestic (dollar) assets falls and the demand curve shifts to the left. The equilibrium exchange rate falls from E_1 to E_2.



Earlier in the chapter we discussed the determinants of the exchange rate in the long run: the relative price level, relative trade barriers, import and export demand, and relative productivity (refer to Summary Table 1). These four factors influence the expected future exchange rate. The theory of purchasing power parity suggests that if a

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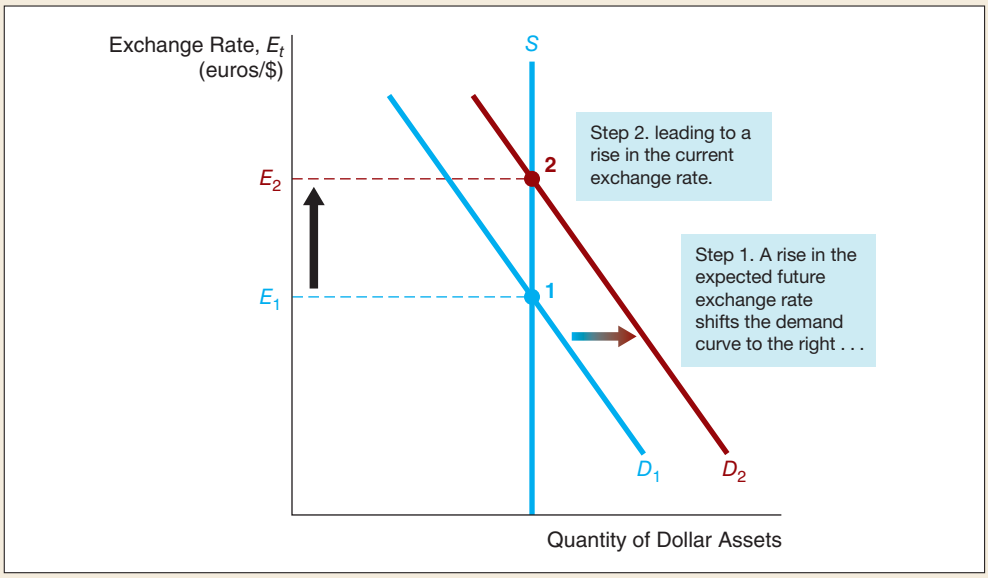
FIGURE 6
Response to an Increase in the Expected Future Exchange Rate, E^e_{t+1}

When the expected future exchange rate increases, the relative expected return on domestic (dollar) assets rises and the demand curve shifts to the right. The equilibrium exchange rate rises from E_1 to E_2.



higher American price level relative to the foreign price level is expected to persist, then the dollar will depreciate in the long run. A higher expected relative American price level should thus have a tendency to lower E^e_{t+1}, lower the relative expected return on dollar assets, shift the demand curve to the left, and lower the current exchange rate.

Similarly, the other long-run determinants of the exchange rate can influence the relative expected return on dollar assets and the current exchange rate. Briefly, the following changes, all of which increase the demand for domestic goods relative to foreign goods, will raise E^e_{t+1}: (1) expectations of a fall in the American price level relative to the foreign price level; (2) expectations of higher American trade barriers relative to foreign trade barriers; (3) expectations of lower American import demand; (4) expectations of higher foreign demand for American exports; and (5) expectations of higher American productivity relative to foreign productivity. By increasing E^e_{t+1}, all of these changes increase the relative expected return on dollar assets, shift the demand curve to the right, and cause an appreciation of the domestic currency, the dollar.

Recap: Factors That Change the Exchange Rate

Summary Table 2 outlines all of the factors that shift the demand curve for domestic assets and thereby cause the exchange rate to change. Shifts in the demand curve occur when one factor changes, holding everything else constant, including the current exchange rate. Again, the theory of portfolio choice asserts that changes in the relative expected return on dollar assets are the source of shifts in the demand curve.

Let's review what happens when each of the seven factors in Table 2 changes. Remember that to understand the direction in which the demand curve will shift, we must consider what happens to the relative expected return on dollar assets when the factor changes. If the relative expected return rises, holding the current exchange rate constant, the demand curve shifts to the right. If the relative expected return falls, the demand curve shifts to the left.

1. When the interest rates on domestic assets i^D rise, the expected return on dollar assets rises at each exchange rate and so the quantity demanded increases. The demand curve therefore shifts to the right, and the equilibrium exchange rate rises, as shown in the first row of Table 2.

2. When the foreign interest rate i^F rises, the return on foreign assets rises, and so the relative expected return on dollar assets falls. The quantity demanded of dollar assets then falls, the demand curve shifts to the left, and the exchange rate falls, as shown in the second row of Table 2.

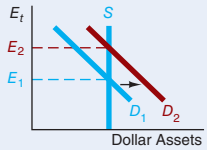
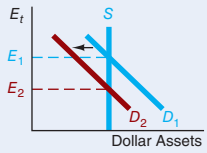
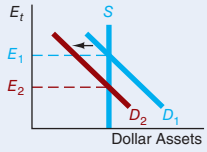
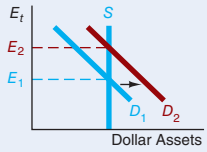
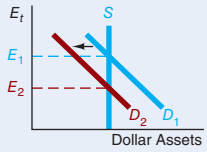
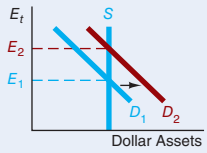
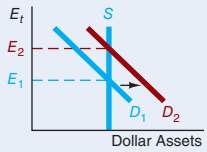
3. When the expected domestic price level rises relative to the foreign price level, our analysis of the long-run determinants of the exchange rate indicates that the value of the dollar will fall in the future. The expected return on dollar assets thus falls, the quantity demanded declines, the demand curve shifts to the left, and the exchange rate falls, as indicated in the third row of Table 2.

4. With higher expected trade barriers, the value of the dollar is higher in the long run and the expected return on dollar assets is higher. The quantity demanded of dollar assets thus rises, the demand curve shifts to the right, and the exchange rate rises, as shown in the fourth row of Table 2.

5. When the expected import demand rises, we expect the exchange rate to depreciate in the long run, so the expected return on dollar assets falls. The quantity demanded of dollar assets at each value of the current exchange rate therefore falls, the demand curve shifts to the left, and the exchange rate falls, as shown in the fifth row of Table 2.

SUMMARY TABLE 2

Factors That Shift the Demand Curve for Domestic Assets and Affect the Exchange Rate

Factor	Change in Factor	Change in Quantity Demanded of Domestic Assets at Each Exchange Rate	Response of Exchange Rate, E_t	
Domestic interest rate, i^D	↑	↑	↑	
Foreign interest rate, i^F	↑	↓	↓	
Expected domestic price level*	↑	↓	↓	
Expected trade barriers*	↑	↑	↑	
Expected import demand	↑	↓	↓	
Expected export demand	↑	↑	↑	
Expected productivity*	↑	↑	↑	

*Relative to other countries.

Note: Only increases (↑) in the factors are shown; the effects of decreases in the variables on the exchange rate are the opposite of those indicated in the "Response" column.

6. When the expected export demand rises, the exchange rate is expected to appreciate in the long run. Thus the expected return on dollar assets rises, the demand curve shifts to the right, and the exchange rate rises, as indicated in the sixth row of Table 2.

7. When expected domestic productivity rises, the exchange rate is expected to appreciate in the long run, so the expected return on domestic assets rises. The quantity demanded at each exchange rate therefore rises, the demand curve shifts to the right, and the exchange rate rises, as shown in the seventh row of Table 2.

APPLICATION Effects of Changes in Interest Rates on the Equilibrium Exchange Rate

Our analysis has revealed the factors that affect the value of the equilibrium exchange rate. Now we use this analysis to take a closer look at the response of the exchange rate to changes in interest rates and money growth.

Changes in domestic interest rates i^D are often cited as a major factor affecting exchange rates. For example, we see headlines in the financial press like this one: "Dollar Recovers as Interest Rates Edge Upward." But is the positive correlation suggested in this headline true in every case?

Not necessarily, because to analyze the effects of interest rate changes, we must carefully distinguish the sources of the changes. The Fisher equation (Chapter 4) states that a nominal interest rate such as i^D equals the *real* interest rate plus expected inflation: $i = i_r + \pi^e$. The Fisher equation thus indicates that the interest rate i^D can change for two reasons: Either the real interest rate i_r changes or the expected inflation rate π^e changes. The effect on the exchange rate is quite different, depending on which of these two factors is the source of the change in the nominal interest rate.

Suppose the domestic real interest rate increases, so that the nominal interest rate i^D rises while expected inflation remains unchanged. In this case, it is reasonable to assume that the expected appreciation of the dollar will be unchanged because expected inflation is unchanged. In this case, the increase in i^D increases the relative expected return on dollar assets, raises the quantity of dollar assets demanded at each level of the exchange rate, and shifts the demand curve to the right. We end up with the situation depicted in Figure 4, which analyzes an increase in i^D, holding everything else constant. Our model of the foreign exchange market produces the following result: ***When domestic real interest rates rise, the domestic currency appreciates.***

When the nominal interest rate rises because of an increase in expected inflation, we get a different result from the one shown in Figure 4. The rise in expected domestic inflation leads to a decline in the expected appreciation of the dollar, which is typically found to be larger than the increase in the domestic interest rate i^D. As a result, at any given exchange rate, the relative expected return on domestic (dollar) assets falls, the demand curve shifts to the left, and the exchange rate falls from E_1 to E_2, as shown in Figure 7. Our analysis leads to this conclusion: ***When domestic interest rates rise due to an expected increase in inflation, the domestic currency depreciates.***

Because this result is completely different from the result that is obtained when the rise in the domestic interest rate is associated with a higher real interest rate, we must always distinguish between *real* and *nominal* measures when analyzing the effects of interest rates on exchange rates.

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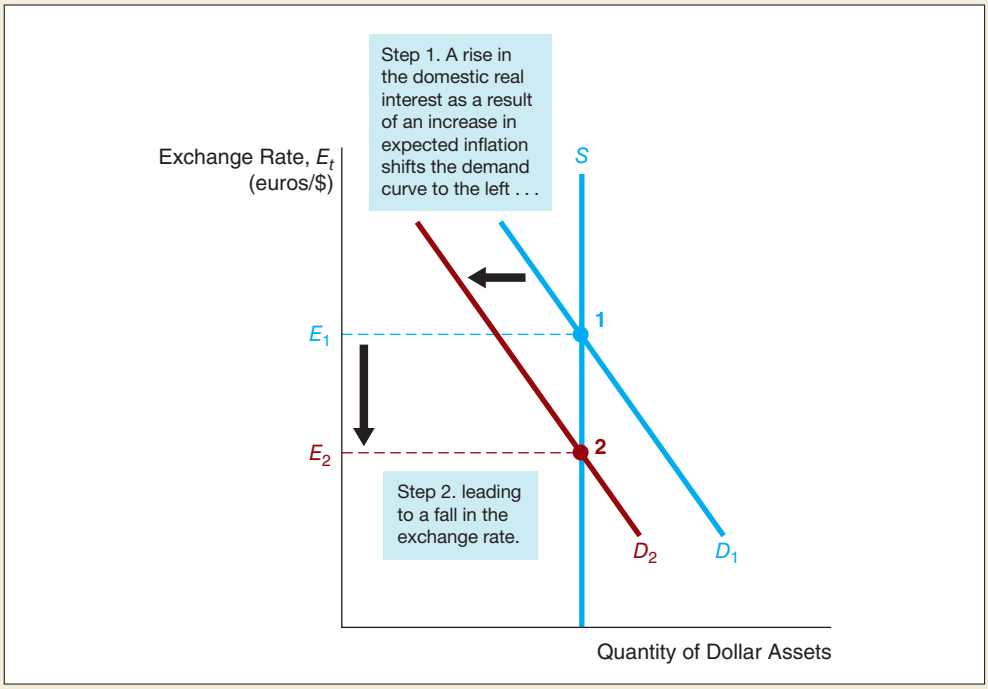

FIGURE 7
Effect of a Rise in the Domestic Interest Rate as a Result of an Increase in Expected Inflation

Because a rise in domestic expected inflation leads to a decline in expected dollar appreciation that is larger than the increase in the domestic interest rate, the relative expected return on domestic (dollar) assets falls. The demand curve shifts to the left, and the equilibrium exchange rate falls from E_1 to E_2.

APPLICATION Why Are Exchange Rates So Volatile?

The high volatility of foreign exchange rates has surprised many people. Thirty or so years ago, economists generally believed that allowing exchange rates to be determined in the free market would not lead to large fluctuations in their values. Recent experience has proved them wrong. If we return to Figure 1, we see that exchange rates over the 1990–2014 period have been very volatile.

The asset market approach to exchange rate determination that we have outlined in this chapter gives a straightforward explanation of the volatility of exchange rates. Because expected appreciation of the domestic currency affects the expected return on domestic assets, expectations about the price level, inflation, trade barriers, productivity, import demand, export demand, and the money supply play important roles in determining the exchange rate. When expectations about any of these variables change, as they do—and often, at that—our model indicates that the expected return on domestic assets, and therefore the exchange rate, will be immediately affected. Because expectations on all of these variables change with just about every bit of news that is reported, it is not surprising that the exchange rate is volatile. Because earlier models of exchange rate behavior focused on goods markets rather than asset markets, they did not emphasize changing expectations as a source of exchange rate movements, and so these earlier models did not predict substantial fluctuations in exchange rates. The failure of earlier models to explain volatility is one reason why they are no longer so popular. The more modern approach developed here emphasizes that the foreign exchange market is like any other asset market in

which expectations of the future matter. The foreign exchange market, like other asset markets such as the stock market, displays substantial price volatility, and foreign exchange rates are notoriously hard to forecast.

APPLICATION The Dollar and Interest Rates

In the chapter preview, we mentioned that the value of the dollar was weak in the late 1970s, rose substantially from 1980 to 1985, and declined thereafter. We can use our analysis of the foreign exchange market to understand exchange rate movements and help explain the dollar's rise in value in the early 1980s and its fall in value thereafter.

Some important information that will enable us to trace the dollar's changing value is presented in Figure 8, which plots measures of real and nominal interest rates and the value of the dollar in terms of a basket of foreign currencies (called an **effective exchange rate index**). We can see that the value of the dollar and the measure of real

MyEconLab Mini-lecture MyEconLab Real-time data

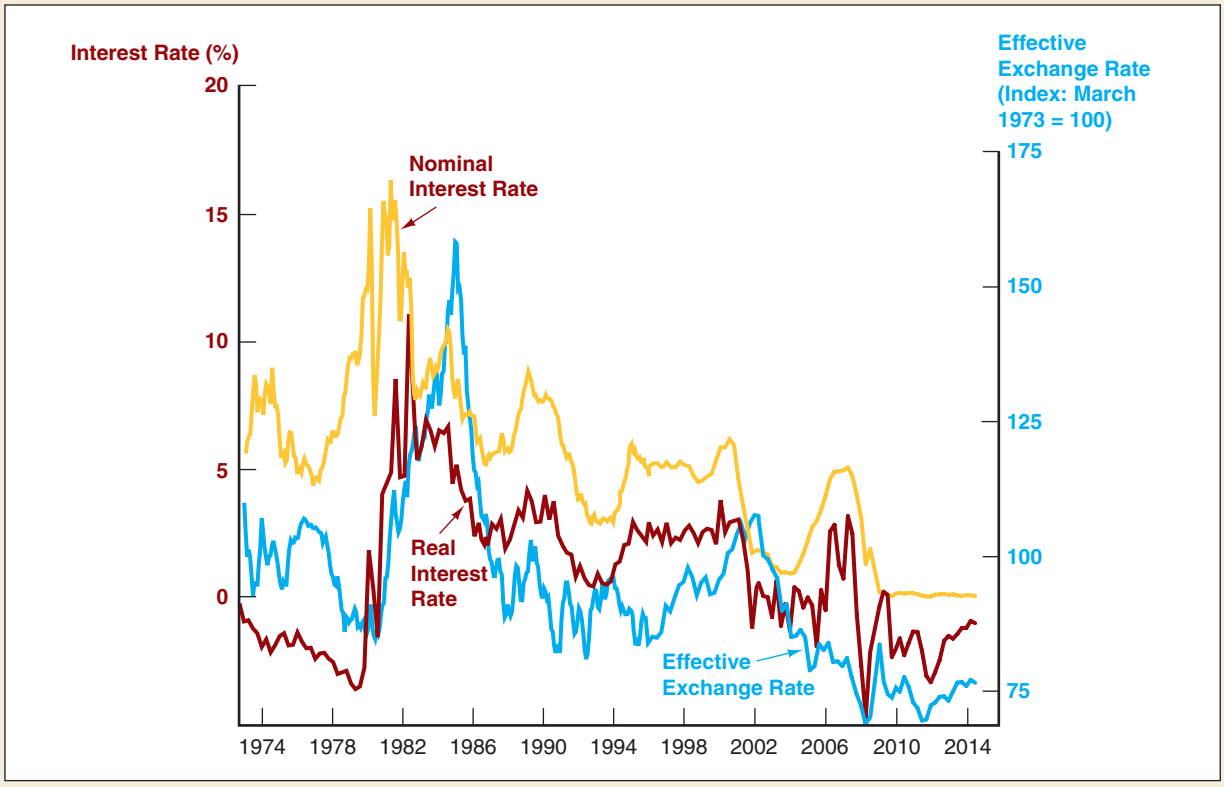

FIGURE 8 **Value of the Dollar and Interest Rates, 1973–2014**

The correspondence between nominal interest rates and exchange rate movements is not nearly as close as that between *real* interest rates and exchange rate movements.

Source: Federal Reserve Bank of St. Louis, FRED database: http://research.stlouisfed.org/fred2/.

interest rates tend to rise and fall together. In the late 1970s, real interest rates were at low levels, and so was the value of the dollar. Beginning in 1980, however, real interest rates in the United States began to climb sharply, and at the same time, so did the value of the dollar. After 1984, the real interest rate declined substantially, as did the value of the dollar.

Our model of exchange rate determination helps explain the rise in the value of the dollar in the early 1980s and its fall in value thereafter. As Figure 4 indicates, a rise in the U.S. real interest rate raises the relative expected return on dollar assets, which leads to purchases of dollar assets that raise the exchange rate. This is exactly what happened in the 1980–1984 period. The subsequent fall in U.S. real interest rates then reduced the relative expected return on dollar assets, which lowered the demand for them and thus lowered the exchange rate.

The plot of nominal interest rates in Figure 8 also demonstrates that the correspondence between nominal interest rates and exchange rate movements is not nearly as close as that between *real* interest rates and exchange rate movements. This is also exactly what our analysis predicts. The rise in nominal interest rates in the late 1970s was not reflected in a corresponding rise in the value of the dollar; indeed, the value of the dollar actually fell in the late 1970s. Figure 8 explains why the rise in nominal rates in the late 1970s did not produce a rise in the value of the dollar. As is indicated by a comparison of the real and nominal interest rates in the late 1970s, the rise in nominal interest rates reflected an increase in expected inflation, not an increase in real interest rates. As our analysis in Figure 7 demonstrates, a rise in nominal interest rates stemming from a rise in expected inflation should lead to a decline in the dollar's value, and that is exactly what happened.

If the story has a moral, it is that a failure to distinguish between real and nominal interest rates can lead to poor predictions of exchange rate movements. The weakness of the dollar in the late 1970s and the strength of the dollar in the early 1980s can be explained by movements in *real* interest rates, but not by movements in *nominal* interest rates.

APPLICATION The Global Financial Crisis and the Dollar

With the start of the global financial crisis in August 2007, the dollar began an accelerated decline in value, falling by 9% against the euro until mid-July of 2008 and by 6% against a wider basket of currencies. After hitting an all-time low against the euro on July 11, the value of the dollar suddenly shot upward, by over 20% against the euro by the end of October and by 15% against a wider basket of currencies. What is the relationship between the global financial crisis and these large swings in the value of the dollar?

During 2007, the negative effects of the financial crisis on economic activity were mostly confined to the United States. The Federal Reserve acted aggressively to lower interest rates to counter the contractionary effects, decreasing the federal funds rate target by 325 basis points from September 2007 to April 2008. In contrast, other central banks like the ECB did not see the need to lower interest rates, particularly because high energy prices had led to a surge in inflation. The relative expected return on dollar assets thus declined, shifting the demand curve for dollar assets to the left, as in Figure 5, and leading to a decline in the equilibrium exchange rate. Our analysis of the foreign exchange market thus explains why the early phase of the global financial crisis led to a decline in the value of the dollar.

We now turn to the rise in the value of the dollar. Starting in the summer of 2008, the effects of the global financial crisis on economic activity began to spread more widely throughout the world. Foreign central banks started to cut interest rates, with the expectation that further rate cuts would follow, as indeed did occur. The expected decline in foreign interest rates then increased the relative expected return on dollar assets, leading to a rightward shift in the demand curve and a rise in the value of the dollar, as shown in Figure 4. Another factor driving the dollar upward was the "flight to quality" that occurred when the global financial crisis reached a particularly virulent stage in September and October. Both Americans and foreigners now wanted to put their money into the safest assets possible: U.S. Treasury securities. The resulting increase in the demand for dollar assets provided an additional reason for the demand curve for dollar assets to shift out to the right, thereby helping to produce a sharp appreciation of the dollar. ◆

SUMMARY

1. Foreign exchange rates (the price of one country's currency in terms of another's) are important because they affect the price of domestically produced goods sold abroad and the cost of foreign goods bought domestically.
2. The theory of purchasing power parity suggests that long-run changes in the exchange rate between the currencies of two countries are determined by changes in the relative price levels in the two countries. Other factors that affect exchange rates in the long run are tariffs and quotas, import demand, export demand, and productivity.
3. In the short run, exchange rates are determined by changes in the relative expected return on domestic assets, which cause the demand curve to shift. Any factor that changes the relative expected return on domestic assets will lead to changes in the exchange rate. Such factors include changes in the interest rates on domestic and foreign assets, as well as changes in any of the factors that affect the long-run exchange rate and hence the expected future exchange rate.
4. The asset market approach to exchange rate determination can explain the volatility of exchange rates, the rise in the value of of the dollar during the 1980–1984 period and its subsequent fall in value, and changes in the value of the dollar during the global financial crisis.

KEY TERMS

appreciation, p. 472
capital mobility, p. 495
depreciation, p. 472
effective exchange rate index, p. 487
exchange rate, p. 470
foreign exchange market, p. 470
forward exchange rate, p. 471
forward transaction, p. 471
interest parity condition, p. 495
law of one price, p. 473
quotas, p. 476
real exchange rate, p. 474
spot exchange rate, p. 471
spot transaction, p. 471
tariffs, p. 476
theory of purchasing power parity (PPP), p. 474

QUESTIONS

Select questions are available in MyEconLab *at* http://www.myeconlab.com.

1. When the euro appreciates, are you more likely to drink California wine or French wine?

2. "A country is always worse off when its currency is weak (falls in value)." Is this statement true, false, or uncertain? Explain your answer.
3. When the U.S. dollar depreciates, what happens to exports and imports in the United States?
4. If the Japanese price level rises by 5% relative to the price level in the United States, what does the theory of purchasing power parity predict will happen to the value of the Japanese yen in terms of dollars?
5. If the demand for a country's exports falls at the same time that tariffs on imports are raised, will the country's currency tend to appreciate or depreciate in the long run?
6. When the Federal Reserve conducts an expansionary monetary policy, what happens to the money supply? How does this affect the supply of dollar assets?
7. From 2009 to 2011, the economies of Australia and Switzerland suffered relatively mild effects from the global financial crisis. At the same time, many countries in the euro area were hit hard by high unemployment and burdened with unsustainably high government debts. How should this have affected the euro/Swiss franc and euro/Australian dollar exchange rates?
8. In the mid- to late 1970s, the yen appreciated in value relative to the dollar, even though Japan's inflation rate was higher than America's. How can this be explained by improvements in the productivity of Japanese industry relative to American industry?
9. Suppose the president of the United States announces a new set of reforms that includes a new anti-inflation program. Assuming the announcement is believed by the public, what will happen to the exchange rate on the U.S. dollar?
10. If the British central bank lowers interest rates to reduce unemployment, what will happen to the value of the pound in the short run and in the long run?
11. If the Indian government unexpectedly announces that it will be imposing higher tariffs on foreign goods one year from now, what will happen to the value of the Indian rupee today?
12. If nominal interest rates in America rise but real interest rates fall, predict what will happen to the U.S. dollar exchange rate.
13. If American auto companies make a breakthrough in automobile technology and are able to produce a car that gets 200 miles to the gallon, what will happen to the U.S. dollar exchange rate?
14. If Mexicans go on a spending spree and buy twice as much French perfume and twice as many Japanese TVs, English sweaters, Swiss watches, and bottles of Italian wine, what will happen to the value of the Mexican peso?
15. Through the summer and fall of 2008, as the global financial crisis began to take hold, international financial institutions and sovereign wealth funds significantly increased their purchases of U.S. Treasury securities as a safe haven investment. How should this have affected U.S. dollar exchange rates?
16. In September 2012, the Federal Reserve announced a large-scale asset-purchase program (known as QE3) designed to lower intermediate and longer-term interest rates. What effect should this have had on the dollar/euro exchange rate?

APPLIED PROBLEMS

Select applied problems are available in MyEconLab *at* http://www.myeconlab.com.

17. A German sports car is selling for 65,000 euros. What is the dollar price in the United States for the German car if the exchange rate is 0.80 euro per dollar?
18. If the Canadian dollar to U.S. dollar exchange rate is 1.24 and the British pound to U.S. dollar exchange rate is 0.68, what must be the Canadian dollar to British pound exchange rate?
19. The New Zealand dollar to U.S. dollar exchange rate is 1.38, and the British pound to U.S. dollar exchange rate is 0.65. If you find that the British pound to New Zealand dollar is trading at 0.5, what would be the riskless profit per U.S. dollar invested?
20. In 1999, the euro was trading at $0.90 per euro. If the euro is now trading at $1.18 per euro, what is the percentage change in the euro's value? Is this an appreciation or depreciation?
21. The Mexican peso is trading at 11 pesos per dollar. If the expected U.S. inflation rate is 1% while the expected Mexican inflation rate is 15% over the next year, given PPP, what is the expected exchange rate in one year?

22. If the price level recently increased by 19% in England while falling by 6% in the United States, by how much must the exchange rate change if PPP holds? Assume that the current exchange rate is 0.58 pound per dollar.

For Problems 23–25, use a graph of the foreign exchange market for dollars to illustrate the effects described in each problem.

23. If expected inflation drops in Europe, so that interest rates fall there, what will happen to the exchange rate on the U.S. dollar?

24. If the European Central Bank decides to pursue a contractionary monetary policy to fight inflation, what will happen to the value of the U.S. dollar?

25. If a strike takes place in France, making it harder to buy French goods, what will happen to the value of the U.S. dollar?

DATA ANALYSIS PROBLEMS

The Problems update with real-time data in MyEconLab *and are available for practice or instructor assignment.*

1. Go to the St. Louis Federal Reserve FRED database, and find data on the exchange rate of U.S. dollars per British pound (DEXUSUK). A Mini Cooper can be purchased in London, England, for £17,865 or in Boston, United States, for $23,495.

a. Use the most recent exchange rate available to calculate the real exchange rate of the London Mini per Boston Mini.

b. Based on your answer to part (a), are Mini Coopers relatively more expensive in Boston or in London?

c. What price in British pounds would make the Mini Cooper equally expensive in both locations, all else being equal?

2. Go to the St. Louis Federal Reserve FRED database, and find data on the daily dollar exchange rates for the euro (DEXUSEU), British pound (DEXUSUK), and Japanese yen (DEXJPUS). Also find data on the daily three-month London Interbank Offer Rate, or LIBOR, for the United States dollar (USD3MTD156N), euro (EUR3MTD156N), British pound (GBP3MTD156N), and Japanese yen (JPY3MTD156N). LIBOR is a measure of interest rates denominated in each country's respective currency.

a. Calculate the difference between the LIBOR rate in the United States and the LIBOR rates in the three other countries using the data from one year ago and the most recent data available.

b. Based on the changes in interest rate differentials, do you expect the dollar to depreciate or appreciate against the other currencies?

c. Report the percentage change in the exchange rates over the past year. Are the results you predicted in part (b) consistent with the actual exchange rate behavior?

WEB EXERCISES

1. The Federal Reserve maintains a website that lists the exchange rates between the U.S. dollar and many other currencies. Go to http://www.newyorkfed.org/markets/foreignex.html . Go to the historical data for 1999 and afterward, and find the data on the euro.

a. Calculate the percentage change in the euro–dollar exchange rate from the time the euro was introduced until now.

b. Calculate the annual percentage change in the euro–dollar exchange rate for each year since the euro's introduction.

2. International travelers and business people frequently need to accurately convert from one currency to another. It is often easy to find the rate needed to convert the U.S. dollar into another currency. It can be more difficult to find exchange rates between two non-U.S. currencies. Go to http://www.oanda.com/convert/classic. This site lets you convert from any currency into any other currency. How many Lithuanian litas can you currently buy with one Chilean peso?

WEB REFERENCES

http://www.newyorkfed.org/markets/foreignex.html

Get detailed information about the foreign exchange market in the United States.

http://quotes.ino.com/chart/

Go to this website and click on Exchange List to get market rates and time charts for the exchange rate of the U.S. dollar to major world currencies.

http://www.oecd.org/general/searchresults/?q=purchasing%20power%20parities

The purchasing power parities home page includes the PPP program overview, statistics, research, publications, and OECD meetings on PPP.

http://www.federalreserve.gov/releases/

The Federal Reserve reports current and historical exchange rates for many countries.

http://fx.sauder.ubc.ca

The Pacific Exchange Rate Service at the University of British Columbia's Sauder School of Business provides information on how market conditions are affecting exchange rates and allows easy plotting of exchange rate data.

APPENDIX TO CHAPTER

18 The Interest Parity Condition

All of the results stated in the text can be derived using a concept that is widely used in international finance. The *interest parity condition* gives the relationships among domestic interest rates, foreign interest rates, and the expected appreciation of the domestic currency. To derive this condition, we examine how expected returns on domestic and foreign assets are compared.

COMPARING EXPECTED RETURNS ON DOMESTIC AND FOREIGN ASSETS

As in the chapter, we treat the United States as the home country, so domestic assets are denominated in dollars. For simplicity, we use euros to stand for any foreign country's currency, so foreign assets are denominated in euros. Suppose that dollar assets pay an interest rate of i^D and do not have any possible capital gains, so that they have an expected return payable in dollars of i^D. Similarly, suppose that foreign assets have an interest rate of i^F and an expected return payable in the foreign currency, euros, of i^F. To compare the expected returns on dollar assets and foreign assets, investors must convert the returns into the currency unit that they use.

First, let us examine how François the Foreigner compares the returns on dollar assets and foreign assets denominated in his currency, the euro. When he considers the expected return on dollar assets in terms of euros, he recognizes that it does not equal i^D; instead, the expected return must be adjusted for any expected appreciation or depreciation of the dollar. If François expects the dollar to appreciate by 3%, for example, the expected return on dollar assets in terms of euros would be 3% higher than i^D because the dollar is expected to become worth 3% more in terms of euros. Thus, if the interest rate on dollar assets is 4%, with an expected 3% appreciation of the dollar, the expected return on dollar assets in terms of euros is 7%: the 4% interest rate plus the 3% expected appreciation of the dollar. Conversely, if the dollar is expected to depreciate by 3% over the year, the expected return on dollar assets in terms of euros will be only 1%: the 4% interest rate minus the 3% expected depreciation of the dollar.

Writing the current exchange rate (the spot exchange rate) as E_t and the expected exchange rate for the next period as E^e_{t+1}, the expected rate of appreciation of the dollar is $(E^e_{t+1} - E_t)/E_t$. Our reasoning indicates that the expected return on dollar assets

R^D in terms of foreign currency can be written as the sum of the interest rate on dollar assets plus the expected appreciation of the dollar.[1]

$$R^D \text{ in terms of euros} = i^D + \frac{E^{\,e}_{t+1} - E_t}{E_t}$$

However, François's expected return on foreign assets R^F in terms of euros is just i^F. Thus, in terms of euros, the relative expected return on dollar assets (that is, the difference between the expected returns on dollar assets and euro assets) is calculated by subtracting i^F from the expression above to yield

$$\text{Relative } R^D = i^D - i^F + \frac{E^{\,e}_{t+1} - E_t}{E_t} \tag{1}$$

As the relative expected return on dollar assets increases, foreigners will want to hold more dollar assets and fewer foreign assets.

Next let us look at the decision to hold dollar assets versus euro assets from Al the American's point of view. Following the same reasoning we used in François's case, we know that the expected return on foreign assets R^F in terms of dollars is the interest rate on foreign assets i^F plus the expected appreciation of the foreign currency, which is equal to minus the expected appreciation of the dollar, $(E^{\,e}_{t+1} - E_t)/E_t$:

$$R^F \text{ in terms of dollars} = i^F - \frac{E^{\,e}_{t+1} - E_t}{E_t}$$

If the interest rate on euro assets is 5%, for example, and the dollar is expected to appreciate by 3%, then the expected return on euro assets in terms of dollars is 2%. Al earns the 5% interest rate, but he expects to lose 3% because he expects the euro to be worth 3% less in terms of dollars as a result of the dollar's appreciation.

Al's expected return on the dollar assets R^D in terms of dollars is just i^D. Hence, in terms of dollars, the relative expected return on dollar assets is calculated by subtracting the expression just given from i^D to obtain

$$\text{Relative } R^D = i^D - \left(i^F - \frac{E^{\,e}_{t+1} - E_t}{E_t}\right) = i^D - i^F + \frac{E^{\,e}_{t+1} - E_t}{E_t}$$

[1]This expression is actually an approximation of the expected return in terms of euros, which can be calculated more precisely by thinking about how a foreigner invests in dollar assets. Suppose that François decides to put one euro into dollar assets. First he buys $1/E_t$ of U.S. dollar assets (recall that E_t, the exchange rate between dollar and euro assets, is quoted in euros per dollar), and at the end of the period he is paid $(1 + i^D)(1/E_t)$ in dollars. To convert this amount into the number of euros he expects to receive at the end of the period, he multiplies this quantity by E^e_{t+1}. François's expected return on his initial investment of one euro can thus be written as $(1 + i^D)(E^e_{t+1}/E_t)$ minus his initial investment of one euro:

$$(1 + i^D)\left(\frac{E^e_{t+1}}{E_t}\right) - 1$$

This expression can be rewritten as

$$i^D\left(\frac{E^e_{t+1}}{E_t}\right) + \frac{E^e_{t+1} - E_t}{E_t}$$

which is approximately equal to the expression in the text because E^e_{t+1}/E_t is typically close to 1. To see this, consider the example in the text in which $i^D = 0.04$; $(E^e_{t+1} - E_t)/E_t = 0.03$, so $E^e_{t+1}/E_t = 1.03$. Then François's expected return on dollar assets is $(0.04 \times 1.03) + 0.03 = 0.0712 = 7.12\%$, rather than the 7% reported in the text.

This equation is the same as Equation 1 describing François's relative expected return on dollar assets (calculated in terms of euros). The key point here is that the relative expected return on dollar assets is the same whether it is calculated by François in terms of euros or by Al in terms of dollars. Thus, as the relative expected return on dollar assets increases, both foreigners and domestic residents respond in exactly the same way—both will want to hold more dollar assets and fewer foreign assets.

INTEREST PARITY CONDITION

We currently live in a world in which **capital mobility** exists: Foreigners can easily purchase American assets, and Americans can easily purchase foreign assets. If few impediments to capital mobility are present and we are looking at assets that have similar risk and liquidity—say, foreign and American bank deposits—then it is reasonable to assume that the assets are perfect substitutes (that is, equally desirable). When capital is mobile and assets are perfect substitutes, if the expected return on dollar assets is greater than that on foreign assets, both foreigners and Americans will want to hold only dollar assets and will be unwilling to hold foreign assets. Conversely, if the expected return on foreign assets is higher than that on dollar assets, both foreigners and Americans will not want to hold dollar assets and will want to hold only foreign assets. Therefore, for existing supplies of both dollar assets and foreign assets to be held, it must be the case that no difference exists in their expected returns; that is, the relative expected return in Equation 1 must equal zero. This condition can be rewritten as

$$i^D = i^F - \frac{E^e_{t+1} - E_t}{E_t} \tag{2}$$

This equation, called the **interest parity condition**, states that the domestic interest rate equals the foreign interest rate minus the expected appreciation of the domestic currency. Equivalently, this condition can be stated in a more intuitive way: The domestic interest rate equals the foreign interest rate plus the expected appreciation of the foreign currency. If the domestic interest rate is higher than the foreign interest rate, there is a positive expected appreciation of the foreign currency, which compensates for the lower foreign interest rate. A domestic interest rate of 5% versus a foreign interest rate of 3% means that the expected appreciation of the foreign currency must be 2% (or, equivalently, that the expected depreciation of the dollar must be 2%).

The interest parity condition can be looked at in several ways. First, recognize that interest parity simply means that the expected returns are the same on both dollar assets and foreign assets. To see this, note that the left side of the interest parity condition (Equation 2) is the expected return on dollar assets, while the right side is the expected return on foreign assets, both calculated in terms of a single currency, the U.S. dollar. Given our assumption that domestic and foreign assets are perfect substitutes (equally desirable), the interest parity condition is an equilibrium condition for the foreign exchange market. Only when the exchange rate is such that expected returns on domestic and foreign assets are equal—that is, when interest parity holds—will investors be willing to hold both domestic and foreign assets.

With some algebraic manipulation, we can rewrite the interest parity condition in Equation 2 as

$$E_t = \frac{E^e_{t+1}}{i^F - i^D + 1}$$

This equation produces exactly the same results that we derived in the supply and demand analysis given in the text: If i^D rises, the value of the denominator decreases and so E_t rises. If i^F rises, the value of the denominator increases and so E_t falls. If E^e_{t+1} rises, the value of the numerator increases and so E_t rises.