CHAPTER

10

Exchange Rates and Exchange Rate Systems

Learning Objectives

After studying this chapter, students will be able to:

10.1 List the reasons for holding foreign exchange and the main institutions in the foreign exchange market.

10.2 Diagram the effects on the home currency of a change in supply or demand for foreign currency.

10.3 Differentiate short-run, medium-run, and long-run forces that help determine the value of a currency.

10.4 State the three rules of the gold standard.

10.5 Compare and contrast hard pegs, crawling pegs, and flexible exchange rate systems.

10.6 Explain in words and with an equation the relationship between price changes and the real exchange rate.

10.7 State the necessary conditions for two or more countries to form a successful single currency area.

INTRODUCTION: FIXED, FLEXIBLE, OR IN BETWEEN?

Every country must choose an exchange rate system to determine how prices in the home country currency are converted into prices in another country's currency. Some countries peg their exchange rate to a fixed level, while others let market forces determine its value. Both approaches have advantages and disadvantages. The choice of an exchange rate system varies along the continuum from completely fixed with no variation to completely flexible with variation determined by supply and demand for the country's currency on a minute-by-minute basis. Between these two extremes are several other exchange rate systems with semi-fixed or semi-flexible rates.

Each exchange rate system requires that governments and central banks have credible policies to support the selected system as trade, capital flows, and other pressures from the world economy push exchange rates up and down. In this chapter we define the actors in currency markets, analyze the basic mechanisms that determine the value of a country's currency, and discuss the considerations that countries should make in selecting their exchange rate system. Each of these elements is an important determinant of a country's exchange rate system and the value of its currency.

# EXCHANGE RATES AND CURRENCY TRADING

LO 10.1 List the reasons for holding foreign exchange and the main institutions in the foreign exchange market.

The **exchange rate** is the price of one currency stated in terms of a second currency. An exchange rate can be given in one of two ways, either as units of domestic currency per unit of foreign currency or vice versa. For example, we might give the U.S.–Mexico exchange rate as dollars per peso (0.057 dollars) or pesos per dollar (17.5 pesos). The custom varies with the currency. For example, the U.S. dollar–British pound exchange rate is usually quoted in terms of dollars per pound, but the U.S. dollar–Mexican peso exchange rate is usually pesos per dollar.

Exchange rates are reported in every newspaper with a business section and on numerous Web sites. Figure 10.1 shows several years of U.S. dollar values for three of the most frequently traded currencies: the European Union's euro, the Japanese yen, and the British pound. The rates are taken from the U.S. Federal Reserve Bank's Web site and are the interbank rates that one bank charges another when buying large amounts of currency. Tourists and individuals purchasing relatively small amounts would have paid more. Notice that the pound and euro rates are dollars per euro or pound but the yen rate is yen per dollar.

All three are flexible exchange rates and subject to constant fluctuations in value, as shown in Figure 10.1. In the years leading up to the financial crisis and recession of 2007–2009, the pound and the euro appreciated against the dollar (more dollars per pound or euro, shown by a rising line). When the crisis began in late 2007, world demand for dollars rose, and it appreciated in value, or to say the same thing another way, the pound and euro depreciated. The most dramatic depreciation began in the middle of 2008 and lasted for approximately a year, until mid-2009, reflecting the flight of capital into dollars. The pound lost approximately 25 percent of its value in dollar terms, and the euro lost approximately 15 percent. In contrast, the Japanese yen continued to appreciate until late 2012 (fewer yen per dollar), gaining over 40 percent in value against the dollar. In late 2012, the yen began to depreciate, and by 2015, it was worth approximately the same as in 2006–2007. Considering that the changes in the real economies of each country were not nearly as large, Figure 10.1 gives an idea of the variability of exchange rates.

By March 2020, which is the end of the series in Figure 10.1, the yen–dollar exchange rate was 107.65 yen per dollar, or 0.0093 dollars per yen (1/107.65). By contrast, the euro and the pound were worth $1.10 and $1.24. Given that the yen was less than 1 cent (0.0093 dollars per yen), it is tempting to conclude that the yen was weak and the pound and euro were strong. This would be a mistake, however, because currencies are scales, just like Fahrenheit and Celsius or miles and kilometers. No matter how many of one it takes to equal another, we cannot conclude that the scale implies strength or weakness. Generally speaking, the strength or weakness of a currency is related to

FIGURE 10.1   **Dollar Exchange Rates, Monthly Values, January 2006 to March 2020**
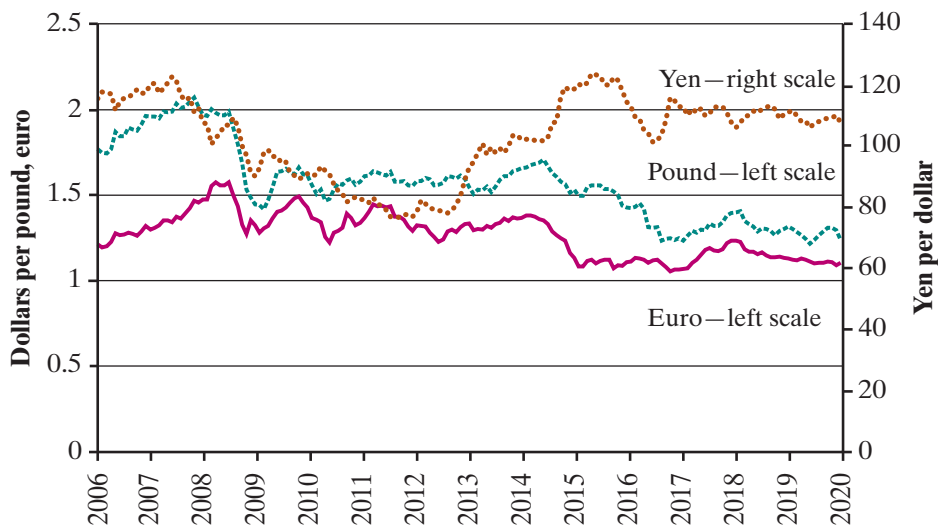
Euro and pound exchange rates are on the left scale; yen are on the right. Floating exchange rates can vary significantly, in both the short and the long run.

Source: Data from Board of Governors of the Federal Reserve System, © James Gerber.

the direction of change in its value and not its value at one point in time or the number of units it takes to buy a different currency.

Reasons for Holding Foreign Currencies

Economists identify three reasons for holding foreign currency. The first is for trade and investment purposes. Traders (importers and exporters) and investors routinely transact in foreign currencies, either receiving or making payments in another country's money. Tourists are included in this category because they hold foreign exchange in order to buy foreign goods and services.

The second reason for holding foreign exchange is to take advantage of interest rate differentials, or **interest rate arbitrage**. Arbitrage conveys the idea of buying something where it is relatively cheap and selling it where it is relatively expensive. Interest rate arbitrage is similar in that arbitrageurs borrow money where interest rates are relatively low and lend it where rates are relatively high. By moving financial capital in this way, interest rate arbitrage keeps interest rates from diverging too far and also constitutes one of the primary linkages between national economies. Over the past several years interest arbitrageurs have played a major role in keeping the Japanese yen strong by borrowing in Japan where interest rates are very low and lending where they are high. Various other factors, such as perceptions of risk, are important, but in general, interest rate arbitrage is a powerful force in the world economy and tends to be one of the main reasons for holding foreign currency.

The third reason for holding foreign exchange is to speculate. Speculators are businesses that buy or sell a currency because they expect its price to rise or fall. They have no need for foreign exchange to buy goods or services or financial assets; rather, they hope to realize profits or avoid losses through correctly anticipating changes in a currency's market value. Speculators are often reviled in the popular press, but in fact they help to bring currencies into equilibrium after they have become over- or undervalued. If speculators view a currency as overvalued, they will sell it and drive down its value. If they guess wrong, however, they can lose a lot of money. For this reason, some economists have argued that either speculation serves the useful function of bringing currency values into proper alignment or its practitioners lose money and go out of business. Not everyone agrees with this view, however, and some economists think that speculation against a currency can be destabilizing in the sense that it does not always push an exchange rate to its equilibrium value but instead sometimes leads to a grossly over- or undervalued currency, which is a major problem for the country involved.

Institutions

There are four main participants in foreign currency markets: retail customers, commercial banks, foreign exchange brokers, and central banks. Of these four, commercial banks are the most important. Retail customers include firms and individuals that hold foreign exchange for any of the three reasons given in the previous section—to engage in purchases, to adjust their portfolios, or to profit from expected future currency movements. In most cases, they buy and sell through a commercial bank. Commercial banks in many parts of the world hold inventories of foreign currencies as part of the services offered to customers. Not all banks provide this service, but those that do usually have a relationship with several foreign banks where they hold their balances of foreign currencies. When a surplus accumulates or a shortage develops, the banks trade with each other to adjust their holdings.

In the United States, foreign exchange brokers also play an important role. It is not very common for U.S. banks to trade currency with foreign banks. Instead, U.S. banks tend to go through foreign exchange brokers, who act as middlemen between buyers and sellers that do not usually hold foreign exchange. Brokers can also serve as agents for central banks. The market, then, works as follows. An individual or firm that needs foreign exchange calls its bank. The bank quotes a price at which it will sell the currency. The price is based on one of two possible sources of supply: The bank may have an account with another bank in the country where the currency is used, or it may call a foreign exchange broker. The broker keeps track of buyers and sellers of currencies and acts as a deal maker by bringing together a seller and a bank that is buying for its customer.

In most cases, currency trades take the form of credits and debits to a firm's bank accounts. For example, a local U.S. importer that must make payment in yen can call and tell its bank to transfer yen to the Japanese bank of the firm that supplies the importer with goods. The importer will have a debit to its local bank account that is equivalent to the cost of the yen. If the U.S. bank has a branch

or correspondence bank in Japan, it can electronically notify the branch to debit the yen from the account of the U.S. bank and credit it to the Japanese bank of the supplier. If the U.S. bank goes through a currency trader instead of dealing directly with a Japanese bank, it first buys yen that are in an account with a Japanese bank. Next, it requests that some or all of its yen assets be transferred to the bank of the Japanese supplier of the U.S. importer.

Exchange Rate Risk

Firms that do business in more than one country are subject to **exchange rate risks**. These risks stem from the fact that currencies are constantly changing in value and, as a result, expected future payments that will be made or received in a foreign currency will be a different domestic currency amount from when the contract was signed.

Suppose, for example, that a U.S. semiconductor manufacturer signs a contract to send a British computer manufacturer a shipment of microprocessors in six months. If the U.S. manufacturer agrees on a price in British pounds, it must know the value of the pound six months from now in order to know the dollar equivalent of its future revenue. If the U.S. manufacturer specifies that the microprocessors be paid for in dollars, then it shifts the exchange rate risk to the British firm. The U.S. company knows the exact dollar amount it will receive in six months, but the British firm is uncertain of the price of the dollar and therefore the pound price of microprocessors.

Financial markets recognized this problem long ago, and in the nineteenth century, they created mechanisms for dealing with it. The mechanisms are the forward exchange rate and the forward market. The **forward exchange rate** is the price of a currency that will be delivered in the future; the **forward market** refers to the market in which the buying and selling of currencies for future delivery takes place. Forward markets for currencies are an everyday tool for international traders, investors, and speculators because they are a way to eliminate the exchange rate risk associated with future payments and receipts. Forward foreign exchange markets allow an exporter or importer to sign a currency contract on the day they sign an agreement to ship or receive goods. The currency contract guarantees a set price for the foreign currency, usually 30, 90, or 180 days into the future. By contrast, the market for buying and selling in the present is called a **spot market**. The prices of foreign currencies quoted in Figure 10.1 are "spot prices."

Suppose the U.S. semiconductor manufacturer signs a contract to deliver the microprocessors to the British firm in six months. Suppose also that the price is stated in British pounds. The manufacturer knows precisely how many pounds it will earn six months from now, but it does not know whether the pound will rise or fall in value, so it does not know what it will earn in dollar terms. The solution is to sign a forward contract to sell British pounds six months from now in exchange for U.S. dollars at a price agreed upon today. Using the forward market, the U.S. manufacturer avoids the risk that comes from exchange rate fluctuations.

Forward markets are important to financial investors and speculators as well as exporters and importers. For example, bondholders and other interest rate arbitrageurs often use forward markets to protect themselves against the foreign exchange risk incurred while holding foreign bonds and other financial assets. This is called **hedging**, and it is accomplished by buying a forward contract to sell foreign currency at the same time that the bond or other interest-earning asset matures. When interest rate arbitrageurs use the forward market to insure against exchange rate risk, it is called **covered interest arbitrage**.

THE SUPPLY AND DEMAND FOR FOREIGN EXCHANGE

LO 10.2 **Diagram the effects on the home currency of a change in supply or demand for foreign currency.**

LO 10.3 **Differentiate short-run, medium-run, and long-run forces that help determine the value of a currency.**

The value of one nation's money, like most things, can be analyzed by looking at its supply and demand. Under a system of flexible, or floating, exchange rates, an increase in the demand for the dollar will raise its price (cause an **appreciation** in its value), while an increase in its supply will lower its price (cause a **depreciation**). Under a fixed exchange rate system, the value of the dollar is held constant through the actions of the central bank that counteract the market forces of supply and demand. Consequently, supply and demand analysis is a useful tool for understanding the pressures on a currency regardless of the type of exchange rate system adopted. For this reason, we begin with the assumption that exchange rates are completely flexible. After examining the usefulness of supply and demand analysis, we will turn to alternative systems, including gold standards and other variations on fixed exchange rates.

Supply and Demand with Flexible Exchange Rates

Figure 10.2 shows the supply and demand for British pounds in the United States. The demand curve is a normal, downward sloping curve, indicating that as the pound depreciates relative to the dollar, the quantity of pounds demanded by Americans increases. Note also that we are measuring the price of the pound—the exchange rate—on the vertical axis. Because it is dollars per pound ($£), it is the price of a pound in terms of dollars, and an increase in the exchange rate (R) is a decline in the value of the dollar. Movements up the vertical axis represent an increase in the price of the pound, which is equivalent to a fall in the price of the dollar. Similarly, movements down the vertical axis represent a decrease in the price of the pound.

British goods are less expensive for Americans when the pound is cheaper and the dollar is stronger. Hence, at depreciated values for the pound, Americans

FIGURE 10.2   Supply and Demand in the Foreign Exchange Market
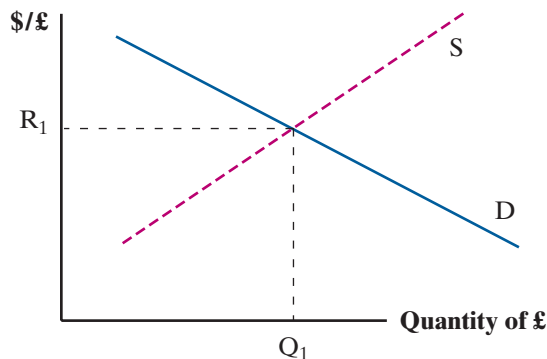
The intersection of the supply of British pounds to the U.S. market and the U.S. demand for British pounds determines the quantity of pounds available in the United States (Q_1) and their dollar price (exchange rate R_1).

will switch from U.S. or third-party suppliers of goods and services to British suppliers. However, before they can purchase goods made in Britain, first they must exchange dollars for British pounds. Consequently, the increased demand for British goods is simultaneously an increase in the quantity of British pounds demanded.

The supply curve in Figure 10.2 slopes up because British firms and consumers are willing to buy a greater quantity of American goods as the dollar becomes cheaper. That is, they receive more dollars per pound. However, before British customers can buy American goods, first they must convert pounds into dollars, so the increase in the quantity of American goods demanded is simultaneously an increase in the quantity of foreign currency supplied to the United States. The intersection of supply and demand determines the market exchange rate and the quantity of pounds supplied to the United States. At exchange rate R_1, the demand and supply of British pounds to the United States is Q_1.

Exchange Rates in the Long Run

We have determined that the supply curve slopes up to the right and the demand curve slopes down. The next step in supply and demand analysis is to consider the factors that determine the intersection of supply and demand and the actual exchange rate. We will continue to assume that the exchange rate is completely flexible. Later in the chapter we look at exchange rates that are fixed, and at intermediate rates between fixed and flexible.

In Figure 10.3, an increase in the U.S. demand for the pound (rightward shift of the demand curve) causes a rise in the exchange rate, an appreciation in the pound, and a depreciation in the dollar. Conversely, a fall in demand would shift the demand curve left and lead to a falling pound and a rising dollar. On the supply side, an increase in the supply of pounds to the U.S. market (supply curve

**FIGURE 10.3   An Increase in Demand for British Pounds**
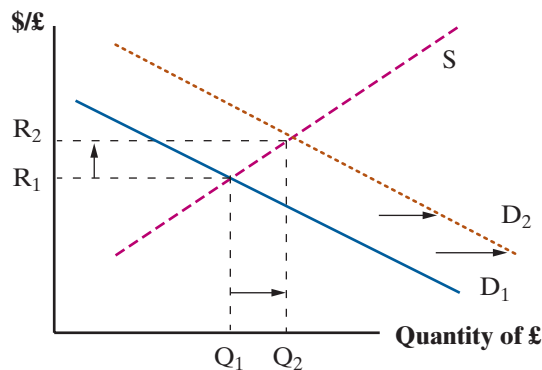
An increase in the U.S. demand for British pounds (rightward shift of the curve) causes the dollar to depreciate.

shifts right) is illustrated in Figure 10.4, where a new intersection for supply and demand occurs at a lower exchange rate and an appreciated dollar. A decrease in the supply of pounds shifts the curve leftward, causing the exchange rate to rise and the dollar to depreciate.

The causal factors behind the shifts in the supply and demand are easier to conceptualize if we divide the determinants of exchange rates into three periods: long run, medium run, and short run. This seems to be accurate empirically, as not all the factors that determine an exchange rate show up instantaneously. In fact, some causal factors take a very long time—a decade or more—to exert their full influence, and in the meantime, a number of short-run or medium-run factors may push in a completely opposite direction.

Looking at the long run first, **purchasing power parity** states that the equilibrium value of an exchange rate is at the level that allows a given amount of money to buy the same quantity of goods abroad that it will buy at home. By this criterion, the equilibrium exchange rate is the point where the dollar buys pounds at a rate that keeps its purchasing power over goods and services constant. That is, in equilibrium $100 is equivalent to the number of pounds needed to buy the same basket of goods and services in Britain that $100 buys in the United States. Table 10.1 illustrates this idea.

In Table 10.1, a hypothetical basket of goods costs $1,000 or £500, depending on the country where it is purchased. Accordingly, the long-run tendency is for the exchange rate to move to $2 per pound. If it is above that, the pound is overvalued and the dollar is undervalued. An overvalued pound buys more in the United States than in Britain since it would be possible to convert £500 to more than $1,000 and buy a larger basket of goods than can be bought in Britain. Exchange rates less than $2 would imply the opposite—the pound is undervalued, and the dollar overvalued.

FIGURE 10.4   An Increase in the Supply of British Pounds
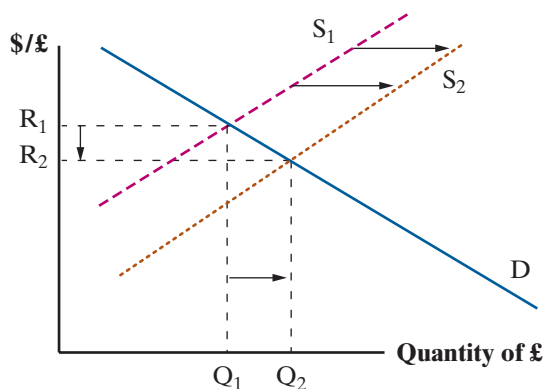
An increase in the supply of British pounds to the U.S. market (rightward shift of the curve) causes the dollar to appreciate.

TABLE 10.1   A Hypothetical Example of the Exchange Rate in the Long Run

	Cost of the Same Basket of Goods in Each Country
Price in dollars	$1,000
Price in pounds	£500
Long-run equilibrium exchange rate	($1,000/£500) = $2/£

Purchasing power parity states that dollars will tend to exchange for pounds at a rate that maintains a constant purchasing power of a given quantity of currency.

It should be stressed that this is an underlying tendency and not a description of actual exchange rates at any point in time. Over the long run, purchasing power parity exerts influence over exchange rates, but in the short to medium run, there are significant deviations from this pattern. If you have traveled outside your home country, you are probably aware of cases where your domestic currency buys you so much foreign currency that your standard of living is higher when you travel. You might be able to stay in a better class of hotel, eat in better restaurants, and shop for items that you cannot afford at home; or you may be familiar with the opposite scenario, where your standard of living declines because you get so little foreign currency in exchange for your domestic currency that everything seems inordinately expensive.

Purchasing power parity influences currency values indirectly. When a currency is overvalued or undervalued, it creates profit-making opportunities for merchants that can move goods across international borders. Suppose, for example, that the dollar is overvalued and that instead of $2 per pound, the exchange rate is $1.75 per pound. Prices are assumed to be the same as those shown in Table 10.1. In this case, $1,000 buys £571.43 ($1,000/$1.75 per pound). If merchants take the £571.43 and buy British goods and then ship the goods to the

United States, they can earn more than $1,000. (They earn $1,142.86 since goods prices are 2 to 1.) In the long run, the demand for British pounds increases and, as shown in Figure 10.3, the exchange rate rises. The process will continue until the exchange rate hits $2 per pound and there are no more profit-making opportunities from shipping goods from Britain to the United States.

The process just described is reinforced by the flow of goods from Britain to the United States. The supply of goods shrinks in Britain, leading to rising prices there. In the United States, supply rises, and under normal competitive conditions, prices will fall. These effects will take a while to exert themselves, but they are another factor reinforcing purchasing power parity. In this case, however, prices are moving in the direction that equalizes the purchasing power of the two currencies instead of equalization through exchange rate movement as in the previous example. In theory, it does not matter which changes—prices or exchange rates—but given that prices in many countries tend not to fall easily while exchange rates are relatively easily moved, most of the equalization probably occurs through exchange rate movements.

The story of goods arbitrage—buying where the goods are cheaper and selling where they are more expensive—which stands behind purchasing power parity, obviously has a few unrealistic assumptions. In particular, it requires that goods flow costlessly across international borders and that all goods and services can be traded. In reality, there are transportation costs involved with moving goods and some goods and services are not traded. This means that our merchant who buys £571.43 of goods in Britain and sells them for $1,142.86 in the United States loses some of his or her $142.86 profit to shipping, insurance, and other transaction costs. In addition, he or she pays a fee to a bank or a currency broker when buying the needed pounds. And finally, some of the goods and services bought and sold—haircuts, for example—are never traded, and arbitrage is not possible.

Finally, it is also the case that few nations have eliminated all their barriers to the entry of foreign goods and services. The merchant may face a tariff, import license fees, inspection fees, or some other barrier at the border that adds to his or her cost. In the limit, imports of the goods in question may be prohibited and goods arbitrage may be impossible at any price differential. In addition, some goods and many services are not traded. For example, restaurant meals, haircuts, landscape maintenance, and a host of other services that must be consumed on the spot are rarely, if ever, traded.

Once the assumptions of purchasing power parity are examined, it is not surprising that it exerts its influence over exchange rates only in the long run. If there are significant profit-making opportunities through goods arbitrage, then in spite of today's obstacles, entrepreneurs will work to create the conditions that will allow them to take advantage of the price differentials across markets. They will look for ways to lower transport costs, to minimize the costs of compliance with import rules and regulations, and to change the rules where it is feasible. All of these steps take time, but in spite of the real obstacles to its operation, purchasing power parity remains a significant long-run force in the determination of exchange rates.

Exchange Rates in the Medium Run and Short Run

While purchasing power parity is working slowly in the background, other forces have more immediate impacts on the position of the supply and demand curves for foreign exchange. We turn first to the forces that are correlated with the business cycle, the natural but irregular rhythms of expansion and recession that every country undergoes. Given that the time period from the peak of one expansion to the next is usually several years in duration, the forces that are tied to the business cycle can be considered medium run. That is, they are pressures on an exchange rate that may last for several years, but almost always less than a decade and usually less than five to seven years.

The most important medium-run force is the strength of a country's economic growth. Rapid growth implies rising incomes and increased consumption. When consumers feel secure in their jobs and at the same time experience a rapid growth in their incomes, they spend more, some of which will be on imports and travel abroad. As a result, rapid economic growth at home is translated into increased imports and an outward shift in the demand for foreign currency, as shown in Figure 10.3. Holding constant a host of short-run forces that may be in play at the same time, the effect of rapid economic growth at home is a depreciating currency.

The effect of growth is symmetrical, both with respect to slower growth at home, and with respect to the rate of economic growth abroad. Slower growth, such as a recession during which output declines (negative economic growth), raises consumer uncertainty about jobs and reduces many people's incomes. For the economy as a whole, as consumption expenditures fall, expenditures on imports decline as well, and the demand for foreign exchange falls. A leftward shift of the demand curve reduces the exchange rate and appreciates the currency. In other words, just as more rapid economic growth can cause a depreciation in a country's currency, slower growth sets forces in motion that lead to an appreciation.

Growth abroad does not have a direct effect on the home country's demand for foreign exchange (although it may have an indirect effect through its stimulation of the home economy), but it will directly affect the supply curve. More rapid foreign growth leads to more exports from the home country, and slower foreign growth results in fewer exports. More exports to foreigners increase the supply of foreign currency and shift the supply curve rightward, as shown in Figure 10.4. Fewer exports have the opposite effect. You should practice drawing the effects of changes in the rates of home and foreign economic growth on the supply and demand curves for foreign exchange.

Turning from the medium run of the business cycle to short-run periods of a year or less, a number of forces are constantly at work shaping currency values. The foremost short-run force is the flow of financial capital. The effects of financial flows range from minor and subtle to dramatic and, at times, catastrophic. They are as capable of creating slight day-to-day variations in the value of a currency as they are of creating complete financial chaos and bringing down governments. The degree of volatility in financial flows varies greatly and is highly responsive to governmental policies and conditions in the world economy.

The impact on exchange rates of large-scale, short-run movements in financial capital has become one of the most serious issues in international economics.

Two variables in particular are responsible for a large share of short-run capital flows: interest rates and expectations about future exchange rates. These two forces often influence each other and are capable of creating unpredictable interactions, as when a change in interest rates reshapes investor confidence or catalyzes speculative actions in currency markets.

The role of interest rates in the short-run determination of exchange rates is crucial. The interest rate–exchange rate relationship is summed up in the **interest parity** condition, which states that the difference between any pair of countries' interest rates is approximately equal to the expected change in the exchange rate:

$$i - i^* \approx (F - R)/R,$$

where home and foreign interest rates are given by i and i^* and F and R are the expected future current exchange rates, respectively. The appendix at the end of this chapter develops the algebra of this relationship, but the intuition is not difficult to grasp. Suppose an investor has a choice between investing at home and earning interest rate i or investing abroad and earning interest rate i^*. If foreign interest rates are higher than domestic ones, it may seem advantageous to invest abroad, but this is not necessarily the case. The best choice is also determined by exchange rate movements during the investment period. If investors want to convert their future earnings back into their home currency, then exchange rate movements must be taken into account during the investment period. To protect against unanticipated losses due to currency fluctuations, cross-border investors can sign a forward contract to sell the foreign exchange from their future earnings. This is known as covered interest arbitrage and is a common way to take advantage of interest differentials while guarding against the risk of exchange rate losses.

A simple example will help clarify. Suppose a U.S.-based investor has a choice between one-year bonds issued by U.S. and German banks. For the sake of simplicity, assume that the bonds are similar with respect to risk, transaction costs, and other characteristics. The U.S. investment is denominated in dollars and pays 3 percent (i) while the German investment is in euros and pays 2 percent (i^*). In one year, $1,000 invested in the United States will pay $1,000 × 1.03, or $1,030, while the return on the German bond depends on the fixed interest rate and the exchange rate a year from now. If the dollar-euro spot rate is 1.2 today, then the investor can use the $1,000 to buy €833.33 (1,000/1.2) and invest it at 2 percent in Germany. In one year, the investor will have €833.33 × 1.02, or €850. If the exchange rate is 1.3 a year from now, then the $1,000 converted to euros and invested in Germany at 2 percent will be worth €850 × $1.3 per euro, or $1,105. That is, a dollar invested today in a German bond at 2 percent will earn the investor F/R × 1.02 in one year, where F is the future exchange rate and R is today's spot rate of exchange.

The problem for the investor is that he or she cannot know what the exchange rate will be one year from now. Our example fudged this point by assuming that the rate was 1.3 dollars per euro in one year's time, but in fact we cannot know what

the spot exchange rate will be in a year. Given this uncertainty, investors turn to the forward market where they can sign a contract guaranteeing them a fixed amount of dollars for the euros they will have in one year when the bond matures.

The difference between the spot rate of exchange, R, and the forward rate, F, is the expected appreciation or depreciation. If $F > R$, then the dollar is expected to depreciate and is said to be selling at a discount. If $F < R$, then the dollar is expected to appreciate and is selling at a premium. Given information about F and R, our investor is prepared to select between the dollar and euro bonds.

In our previous example, R is 1.2 and F is 1.3, implying that the dollar is at a discount in the forward market and people expect it to depreciate over the next year. The choices are as follows. An investor with \$1,000 can earn \$1,000 × 1.03, or \$1,030 in the United States, or she can earn $(1.3/1.2) × 1.02 × \$1,000$, or \$1,105 in Germany. Clearly the German investment is better and will attract capital. Money flowing into German bonds will push down German interest rates (i^* falls) and increase the spot price of the euro (R rises). Both changes reduce earnings on the German bond until, in the end, we reach the interest parity condition

$$i - i^* \approx (F - R)/R$$

where interest rate differences are approximately equal to the expected change in the exchange rate.

The utility of the interest parity condition is that it brings together capital flows, domestic interest rate policy, and exchange rate expectations. Suppose, for example, that domestic interest rates are above foreign rates, so that $i > i^*$. In that case, investors expect a discount in the forward market, so that $F > R$. If the expected depreciation in the domestic currency is not sufficient to compensate for higher interest rates at home, then capital flows into the home country and increases demand for domestic currency, pushing down domestic interest rates until the difference between i and i^* is approximately equal to the percentage difference between the forward and spot exchange rates.

Consider another example. Suppose that home interest rates are less than foreign rates ($i < i^*$) and that forward rates are less than spot rates ($F < R$) by an appropriate amount so that the interest parity condition holds. Beginning at this point, home policymakers decide for some reason to raise their interest rates to the same level as foreign rates: $i = i^*$. Now, investors in both home and foreign markets will invest more in the home country because they earn the same rate of interest, and they expect domestic currency to appreciate in value (since $F < R$). Figure 10.5 illustrates these shifts. Note that both the demand curve for foreign currency and the supply curve of foreign currency shift, with demand moving in and supply moving out. Taken together, both shifts reinforce a downward movement in the spot rate. As R falls, domestic currency appreciates and the gap between F and R closes. If $i = i^*$, the process ends when $F = R$.

In addition to their impact on the forward-spot rate differential, expectations play a crucial role in the determination of exchange rates in another way. A sudden change in the expected future value of an exchange rate can have a dramatic and often self-fulfilling impact on a country's currency. For example, if investors

FIGURE 10.5   The Effects of an Increase in Home's Interest Rate
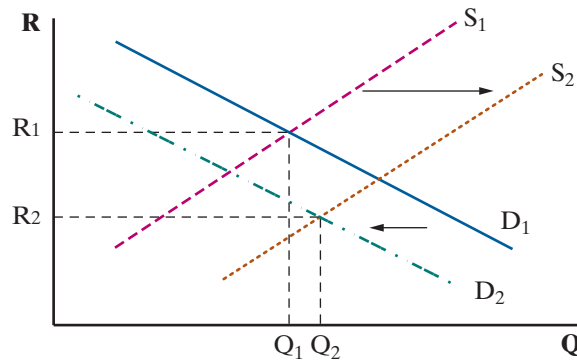
An increase in domestic interest rates causes a decrease in demand and an increase in supply of the foreign currency. Both effects cause an appreciation in the exchange rate from R_1 to R_2.

suddenly come to believe that a currency must depreciate more than they had anticipated, it lowers the expected value of assets denominated in that currency. This can create a sudden exodus of financial capital and put enormous pressure on the country's supply of foreign exchange reserves. To a significant extent, episodes of capital flight can be self-fulfilling in their expectations about an exchange rate. If investors expect depreciation, they try to convert their assets to another currency. This raises the demand for foreign exchange and depresses the supply, fulfilling the expectation of a depreciation.

There are numerous potential causes of this type of volatility in financial capital flows and exchange rate shifts. It also seems likely that technological changes in telecommunications have altered the sensitivity of markets toward changes in expectations, although this is yet to be established definitively. Nevertheless, it is certain that a frequent cause of sudden shifts in expectations is the realization that a particular government is practicing economic policies that are internally inconsistent and unsustainable. We will examine this in more detail in Chapters 11 and 12, but it is relatively easy to get a sense of the meaning of inconsistent policies. An example is policies that are designed to stimulate the economy strongly (more growth → more imports → more demand for foreign exchange) when the supply of foreign exchange is severely limited (not enough exports, very low interest rates).

The mechanisms from inconsistent policy to exchange rate crisis and collapse are fairly well understood, but this begs the question about the cause of a sudden shift in expectations. Many recent episodes of sudden exchange rate shifts have occurred when investors lost confidence in a particular currency. Yet why the sudden change in investor confidence? Government policies are often in place for years before they become unsustainable. Quite frequently, an external shock such as a sudden shift in the price of a key input such as oil, or a sudden change in policy by an important trade partner, are the tipping point.

CASE STUDY

The Largest Market in the World

In 2019, the world's foreign exchange markets traded an estimated $6,595 billion worth of currency per day. Another way to look at this is that every three days, currency trades were approximately equal to the value of U.S. annual gross domestic product (GDP). These estimates come from a survey of central banks and over 1,000 foreign exchange trading desks conducted every three years by the Bank for International Settlements (BIS), a "central bank for central banks." The BIS survey is the *Triennial Central Bank Survey,* conducted in April 2019 and available from the BIS at http://www.bis.org.

Between 1992 and 2019, the volume of exchange rate transactions grew from $880 billion per day to $6,595 billion. In 2019, the top four currencies traded around the world were the U.S. dollar (88.3 percent of all trades), the EU euro (32.3 percent), the Japanese yen (16.8 percent), and the British pound (12.3 percent). (See Table 10.2.) Not surprisingly, the most common trade (24 percent of all trades) was between the U.S. dollar and the euro, the two most frequently traded currencies.

Note that the total in Table 10.2 is 200 percent rather than 100 percent because every sale is simultaneously a purchase. The dollar is so often traded because it is used as an international medium of exchange and because of the cross-trading that occurs between pairs of currencies. That is, a Chilean importer may pay her Mexican supplier in U.S. dollars, or she may use Chilean pesos to buy dollars and use the dollars to buy Mexican pesos. It is unlikely

TABLE 10.2   Composition of Currency Trades, April 2013

Currency	Percent of Total Trades
U.S. dollar	88.3
EU euro	32.3
Japanese yen	16.8
U.K. pound	12.8
Australian dollar	6.8
Swiss franc	5.0
Canadian dollar	5.0
Chinese renminbi	4.3
Hong Kong dollar	3.5
Other	25.2

Source: Data from Bank for International Settlements, © James Gerber.

that the Mexican exporter would accept Chilean pesos, so one way or another the importer has to come up with dollars.

Currency trading is concentrated in just a few financial centers. London is by far the largest center of foreign exchange trading, as is illustrated by the BIS survey's finding that more U.S. dollars are traded in London than in New York (see Table 10.3). Given the preponderance of the U.S. dollar in currency trades and the importance of London as a trading center, it follows that most of the trades in London do not involve the British pound.

TABLE 10.3   Currency Trading Centers

Location	Percent of World Currency Trading
United Kingdom	43.1
United States	16.5
Singapore	7.7
Hong Kong	7.6
Japan	4.5
Switzerland	3.3
France	2.0
China	1.6
Other	13.7

Source: Data from Bank for International Settlements, © James Gerber.

Table 10.4 summarizes the long-, medium-, and short-run factors that have been discussed. The list is not exhaustive, but the main elements are included.

TABLE 10.4   Major Determinants of an Appreciation or Depreciation

	R Falls: An Appreciation in the Domestic Currency	R Rises: A Depreciation in the Domestic Currency
Long run: Purchasing Power Parity	Home goods are less expensive than foreign goods	Home goods are more expensive than foreign goods
Medium run: The Business Cycle	Domestic economy grows more slowly than foreign	Domestic economy grows faster than foreign
Short run (1): Interest Parity	Home interest rates rise, or foreign rates fall	Home interest rates fall, or foreign rates rise
Short run (2): Speculation	Expectations of a future appreciation	Expectations of a future depreciation

FIXED EXCHANGE RATES

LO 10.4 **State the three rules of the gold standard.**

LO 10.5 **Compare and contrast hard pegs, crawling pegs, and flexible exchange rate systems.**

Fixed exchange rate systems are also called **pegged exchange rate** systems. In these types of systems, there are several possibilities for setting the value of the country's currency. At one extreme, a few (mostly very small) countries give up their currency altogether and adopt the currency of another country, usually the dollar or the euro. More commonly, the value of a nation's money is set equal to a fixed amount of another country's currency, or less commonly to a basket of several currencies. If the exchange rate is not allowed to vary, then it is called a **hard peg**. Fixed exchange rates that fluctuate within a set band are **soft pegs** and these, in turn, can take several forms depending on the amount of variation allowed. Table 10.5 shows that in 2018, there were twenty-four countries with hard pegs and eighty-eight with soft pegs in which the currency is fixed but allowed to vary within set limits. Table 10.5 also shows that sixty-five countries have floating exchange rates. Of these, thirty-five intervene in currency markets when their currencies rise or fall too much in value, while thirty countries let their currencies float independently and usually without intervention. A final residual category includes thirteen countries that have a variety of methods and strategies for managing their currency. The arrangements for this last group are in response to wars, natural disasters, and other emergencies.

Through the first seventy years of the twentieth century, fixed exchange rates were the norm, often within a framework that defined the value of a country's currency in terms of a fixed amount of gold. After World War II, many nations shifted away from gold and pegged the value of their currencies to the U.S. dollar or to the currency of another country with which they had strong historical ties. Beginning in the 1970s, the use of flexible exchange rate systems began to increase, first in the high-income industrial economies and then in many

TABLE 10.5   Types of Exchange Rate Systems, 2014

Currency Regime	Countries
Hard pegs	24
Soft pegs	88
Managed floating	35
Independently floating	30
Other	13
Total	190

More countries have fixed exchange rates than floating.

Source: Data from International Monetary Fund, © James Gerber.

developing countries in the 1980s and 1990s. By the end of the twentieth century, **flexible exchange rate systems** were common.

There is no best exchange rate system. Individual country conditions are unique, and no single type of exchange rate system can be appropriate for every country. While the number of countries using flexible exchange rate systems grew rapidly after the early 1970s, it began to decline after 2001. Currently, less than half of the world's nations have flexible rates.

Gold standards are one type of fixed exchange rate. The gold standard was abandoned nearly everywhere in the 1930s during the Great Depression and then was restored in a modified form after World War II but has completely disappeared since the 1970s. Professional economists are overwhelmingly opposed to a return to the gold standard, and recent research shows that the first countries to end the gold standard were the first ones to escape the Great Depression. After World War II, Western economies adopted a modified gold standard under the **Bretton Woods exchange rate system** (1947–1971), but this too was abandoned in the early 1970s. While mainly of historical interest, gold standards highlight a pure form of fixed exchange rate with a hard peg. Under a pure gold standard, nations keep gold as their international reserve. Gold is used to settle most international obligations, and nations must be prepared to trade it for their own currency whenever foreigners attempt to "redeem" the home currency they have earned by selling goods and services. In this sense, the nation's money is backed by gold.

There are essentially three rules that countries must follow in order to maintain a gold exchange standard. First, they must fix the value of their currency unit (the dollar, the pound, the yen, and so on) in terms of gold. This fixes the exchange rate. For example, under the modified gold standard of the Bretton Woods exchange rate system, the U.S. dollar was fixed at $35 per ounce and the British pound was set at £12.5 per ounce. Since both currencies were fixed in terms of gold, they were implicitly set in terms of each other: $35 = one ounce of gold = £12.5, or $2.80 = £1 (2.80 = 35/12.5).

The second rule of the gold standard is that nations keep the supply of their domestic money fixed in some constant proportion to their supply of gold. This requirement is an informal one but is necessary to ensure that the domestic money supply does not grow beyond the capacity of the gold supply to support it. The third rule of a gold standard is that nations must stand ready and willing to provide gold in exchange for their home country currency.

Consider what would happen if a country decided to print large quantities of money for which there is no gold backing. In the short run, purchases of domestically produced goods would rise, causing domestic prices to rise as well. As domestic prices rise, foreign goods become more attractive, since a fixed exchange rate means that they have not increased in price. As imports in the home country increase, foreigners accumulate an unwanted supply of the home country's currency. This is the point at which the gold standard would begin to become unhinged. If gold supplies are low in relation to the supply of domestic currency, the gold reserves will begin to run out at some point as the country pays out gold in exchange for its currency. This spells crisis and a possible end to the gold standard.

Under a fixed exchange rate system, the national supply and demand for foreign currencies may vary but the nominal exchange rate does not. It is the responsibility of the monetary authorities (the central bank or treasury department) to keep the exchange rate fixed. Figure 10.6 illustrates the task before a national government when it wishes to keep its currency fixed. Suppose that the United States and the United Kingdom are both on the gold standard and the U.S. demand for British pounds increases.

In the short run or medium run, a rise in demand for pounds from D_1 to D_2 is caused by one of the factors listed in Table 10.4: increased U.S. demand for U.K. goods, higher U.K. or lower U.S. interest rates, or speculation that the value of the dollar might not remain fixed for much longer. If R_1 is the fixed U.S.–U.K. exchange rate, then the United States must counter the weakening dollar and prevent the rate from depreciating to R_2. One option is to sell the United States' gold reserves in exchange for dollars. This puts gold in the hands of merchants, investors, or speculators who are trying to obtain British pounds. The quantity of gold that must be sold is equivalent to the value of the pounds represented by line segment AB. In effect, the United States meets the increased demand for British pounds by supplying international money—gold—to the market through a sale of some of its gold stock. Since gold and pounds are interchangeable, an increase in the supply of gold is equivalent to an increase in the supply of pounds, as shown in Figure 10.7, and the exchange rate stays at R_1.

Under a pure gold standard, countries hold gold as a reserve instead of foreign currencies and sell their gold reserves in exchange for their own currency. This action increases the supply of gold—which is international money—and offsets the pressure on the home currency to depreciate. There are two possibilities for the home country as it sells its gold reserves. Either the demand for gold is satisfied and the pressure on its currency eases, or it begins to run out of gold. If the latter happens, the home country may be forced into a devaluation that is

FIGURE 10.6   Fixed Exchange Rates and Changes in Demand
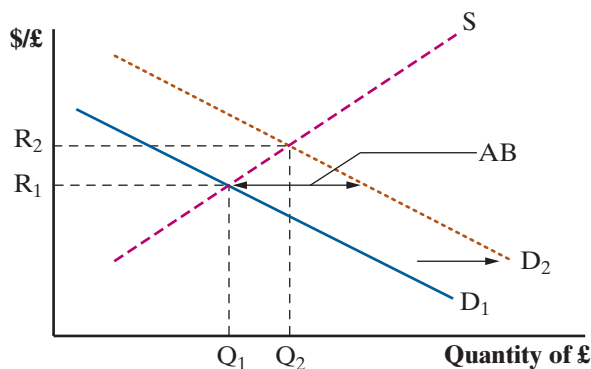
An increase in the demand for British pounds puts pressure on the exchange rate and will cause the dollar to depreciate to R_2 unless the increase in demand is countered by an increase in supply equal to line segment AB.

FIGURE 10.7   Selling Reserves of Pounds to Counter a Weakening Dollar
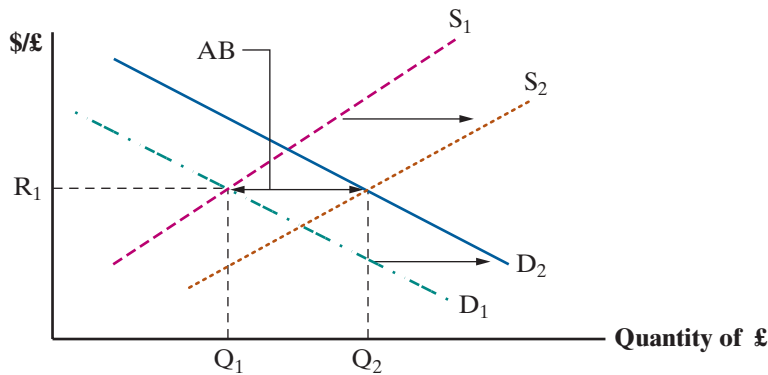
By selling gold equal in value to AB pounds, the United States prevents a depreciation in the dollar–pound exchange rate.

accomplished by changing the gold price of its currency. As an illustration, if the dollar is fixed at \$35 per ounce of gold, a devaluation would shift the price of gold to something more than \$35—say, \$50—and each ounce of gold sold by the United States buys back a greater quantity of dollars.

Pure gold standards have been rare since the 1930s. More commonly, countries have adopted modified gold standards, such as the Bretton Woods system (see the Case Study), or fixed exchange rate systems called *pegged exchange rates*. Pegged exchange rate systems operate similarly to a gold standard except that instead of gold, another currency is used to "anchor" the value of the home currency.

One potential source of problems with a pegged currency is that the home currency's value is synchronized with its peg, or anchor, so changes between the anchor currency and a third-party currency are identical for the home currency and the third party. For example, as discussed later in the chapter, Thailand pegged its currency to the dollar for many years. When Japan and China devalued against the dollar, they also devalued against the Thai currency, and Thai exports were suddenly less competitive. The simplest way to avoid this type of problem is to peg the currency not to one single currency but to a group of currencies. This reduces the importance of any single country's currency in the determination of the home country's currency value. Typically, countries that adopt this strategy select the currencies of their most important trading partners as elements of the basket.

Another type of pegged exchange rate is called a **crawling peg**. Countries that use a crawling peg may peg to a single currency or a basket of currencies, but they regularly adjust the exchange rate. The changes in the peg may occur on a daily basis by a predetermined amount. In effect, there is a peg, but it is crawling. This may prevent some types of problems with a fixed rate but can be difficult to manage and has been associated with numerous exchange rate crises.

There are several other variations on the theme of fixed exchange rates. One of the key points to keep in mind is that purely fixed or purely flexible exchange rate arrangements are rare. When a currency is fixed in value, it is still subject to market pressures of supply and demand, which, at times, can force the government to alter the currency's value. Similarly, when countries adopt a flexible exchange rate system, there is frequently some degree of government intervention in currency markets to try to shape its value.

CASE STUDY

The End of the Bretton Woods System

The Bretton Woods system of exchange rates was enacted at the end of World War II. It included most nations outside the former Soviet Union and its allies. The exchange rate system was a major component of the institutions designed to manage international economic conflict and to support international economic cooperation. In addition to the exchange rate system, the other institutions created at the same time included the International Monetary Fund (IMF), the International Bank for Reconstruction and Development (IBRD) or World Bank, and the General Agreement on Tariffs and Trade (GATT). (See Chapter 2.)

Each institution had its own role in the management of world economic affairs. The roles of the exchange rate were to provide stability by eliminating excess currency fluctuations, to prevent nations from using exchange rate devaluations as a tactic for gaining markets for their goods, and to ensure an adequate supply of internationally accepted reserves so that nations could meet their international obligations.

In the Bretton Woods exchange rate system, the dollar was fixed to gold at the rate of $1 equaling $\frac{1}{35}$ ounce of gold, or $35 per ounce. Every other currency within the system was fixed to the dollar and, therefore, indirectly to gold. Unlike a pure gold standard, however, countries could use U.S. dollars as their international reserve and did not have to accumulate gold or tie their money supply to their gold reserves.

The Bretton Woods exchange rate system had one fatal flaw—the dollar. The United States was in a privileged position since its currency was treated the same as gold. This meant that the United States could simply increase its money supply (the supply of dollars) and gain increased purchasing power over European, Japanese, and other countries' goods. Other nations preferred the United States to maintain a relatively robust supply of dollars, since this ensured that there was an adequate supply of international reserves for the world economy.

Problems with this arrangement began when the U.S. economy expanded at a different rate than the economies of its trading partners. In the mid-to-late

1960s, the United States deepened its involvement in the Vietnam War while it simultaneously created the "War on Poverty" at home. Both policies generated large fiscal expenditures that stimulated the economy. While U.S. expansion raced ahead of expansion elsewhere, Europeans found themselves accumulating dollars more rapidly than they desired. The dollars were a by-product of U.S. economic expansion and partially reflected the price increases accompanying the expansion.

Under a different type of exchange rate system, it would have been appropriate for the United States to devalue its currency. U.S. prices had risen relative to foreign prices, the real exchange rate had appreciated as a consequence, and trade deficits were beginning to become a permanent feature of the U.S. economy.

One policy would have been to devalue the nominal dollar exchange rate, but this was not an option. Since every currency was tied to the dollar, there was no way for the United States to devalue against a group of other currencies selectively. An alternative was for the United States to devalue against all currencies by changing the gold value of the dollar. By the late 1960s, it was becoming apparent that this would be necessary.

Persistent U.S. deficits had led to an accumulation of dollars outside the United States, which greatly exceeded the United States' supply of gold. In other words, the United States lacked the gold reserves to back all of the dollars in circulation. Official recognition of this fact led to the **Smithsonian Agreement** of December 1971, in which the major industrialized countries agreed to devalue the gold content of the dollar by around 8 percent, from $35 per ounce to $38.02. In addition, Japan, Germany, and other trade surplus countries increased the value of their currencies.

Although the Smithsonian Agreement was hailed by President Nixon as a fundamental reorganization of international monetary affairs, it quickly proved to be too little and of only temporary benefit. The gold value of the dollar was realigned again in early 1973, from $38.02 to $42.22. In addition, further devaluation occurred against other European currencies. The end of the system came in March 1973 when the major currencies began to float against each other. A few currencies, such as the British pound, had begun to float earlier.

In each case, the strategy of allowing the exchange rate to float in response to supply and demand conditions was adopted as a means of coping with speculation. When speculators had perceived that the dollar was overvalued at $38 per ounce or $42 per ounce, they sold dollars in anticipation of a future devaluation. Nor was the dollar the only currency speculated against. Other weak currencies such as the pound and the Italian lira had also been correctly perceived as overvalued and had been sold off by speculators. In the end, the central banks of the weak-currency countries found it impossible to support an unrealistically high value of their currency. The costs of buying up the excess supply of their currencies at overvalued prices proved to be too great. The simplest solution was to let the currencies float.

THE REAL EXCHANGE RATE

LO 10.6 **Explain in words and with an equation the relationship between price changes and the real exchange rates.**

The concept of the exchange rate that has been used so far and that is exemplified by the values shown in Table 10.2 does not really tell us what a foreign currency is worth. Exchange rates tell us how many units of domestic currency we give up for one unit of foreign currency, but unless we know what foreign prices are, we still do not know the purchasing power of our domestic money when it is converted to a foreign currency. As an illustration of this problem, suppose that the U.S. dollar–Malaysian ringgit exchange rate is $0.25 and that it stays constant over the year. However, suppose also that Malaysian inflation is 4 percent while U.S. inflation is 1 percent. After one year, the four ringgits that cost one dollar will buy 3 percent less in Malaysia than the dollar buys in the United States. The relatively higher inflation in Malaysia erodes the value of a dollar's worth of ringgits more rapidly than the dollar loses value at home. Consequently, when converted to ringgits, the real purchasing power of the dollar has declined even though the exchange rate is still $0.25 per ringgit.

From the point of view of tourists and businesspeople who use foreign exchange, the key item of interest is the purchasing power they get when they convert their dollars, not the number of units of a foreign currency. An American importer trying to decide between Malaysian and Chinese textiles does not really care if she gets four ringgits per dollar or eight Chinese yuan per dollar. The biggest concern is the volume of textiles that can be purchased in Malaysia with four ringgits and in China with eight yuan.

The **real exchange rate** is the market exchange rate (or **nominal exchange rate**) adjusted for price differences. The two are closely connected. By way of illustration, let's consider the case of a wine merchant who is trying to decide whether to stock her shop with American or French wine. Let's say that French wine of a given quality costs 200 euros and American wine of the same quality costs $180. Suppose that the nominal exchange rate is $1.20 per euro so that $180 is equivalent to 150 euros. In this case, French wine costs one-third more than American wine, and the real exchange rate is 1.33 cases of American wine per case of French wine. The algebra is straightforward:

Real exchange rate
= [(Nominal exchange rate) × (Foreign price)]/(Domestic price)
= [($1.20 per euro) × (€200 per case)]/($180 per case)
= ($240 per case of French wine)/($180 per case of American wine)
= $1\frac{1}{3}$ cases of American wine per 1 case of French wine

Because the real purchasing power of the dollar is much less in France than in the United States, the choice facing the wine merchant is obvious.

In this example, the main lesson is clear. What matters most to exporters and importers is not the nominal exchange rate but the real exchange rate because

it tells them how much purchasing power they have in the countries under comparison. Let R_r symbolize the real exchange rate and R_n the nominal rate. Since we are interested in the whole economy rather than just one market such as the market for wine, we will use a price index to measure overall prices in the two countries. Price indexes are equivalent to the average price of a basket of goods and services in each economy. Let P stand for the home country price index and P^* represent foreign prices. Then, following the algebra of the wine merchant's calculation:

> Real exchange rate
> = Nominal exchange rate $\times$ Foreign prices /(Domestic prices),

or, more compactly,

$$R_r = R_n\,(P^*/\,P).$$

Suppose, for example, that the U.S. dollar–EU euro nominal exchange rate is $1.20 per euro and that both price levels are initially set at 100. In this case, the cost of a basket of goods and services is the same in real terms in both countries and

$$R_r = R_n\,(P^*/P) = R_n\,(100/100) = R_n.$$

The real rate equals the nominal rate when the purchasing power is the same in both countries. Note that purchasing power parity indicates that this is the long-run equilibrium. Over time, however, if inflation is higher at home than in the foreign country, P rises more than P^*, and R_r falls, meaning the domestic currency appreciates in real terms.

By way of illustration, suppose that the United States has 10 percent inflation while the EU has 0 percent. Then the real U.S.–EU exchange rate (in terms of dollars per euro) would be as follows:

$$R_r = (\$1.20 \text{ per euro}) \times (100/110) = \$1.0909 \text{ per euro.}$$

Tourists, investors, and businesspeople can still trade dollars and euros at the nominal rate of $1.20 per euro (plus whatever commissions they pay to the seller), but the real purchasing power of the U.S. dollar has risen in the EU compared to what it buys at home. The real exchange rate of $1.0909 per euro tells us that EU goods are now 9 percent cheaper than the U.S. goods that have risen in price. As a result, unless the nominal rate changes, the dollar goes further in the EU than at home. In real terms, the euro has depreciated, and the dollar has appreciated.

Changes in the value of real exchange rates play an important role in international macroeconomic relations. When countries control the value of their nominal exchange rate, for example, they must be certain that their prices do not change in relation to the prices of their trading partners. If inflation runs higher at home, then the real value of their currency appreciates. Over a period of time, if uncorrected, this can lead to a build-up in the current account deficit as imports increase and exports decrease. In a number of cases, the end result has been currency crises and the collapse of nominal exchange rates (for example, Mexico in December 1994 and Thailand in July 1997).

CASE STUDY

The Collapse of Thailand's Currency, 1997–1998

Pegged exchange rates can work very well under many circumstances, but another factor that can cause them to unravel is a significant difference in inflation rates between the home country and its peg. This is exactly what happened in July 1997, when the Thai currency, the baht, suffered a devastating speculative attack that led to its collapse and the onset of the Asian financial crisis of 1997–1998. The crisis is widely remembered because it created contagion that spread to Russia, Latin America, the United States, and other countries and almost caused a worldwide crisis. Chapter 12 looks more closely at the crisis, but in this case study, we focus on the exchange rate and the problems of a pegged rate that becomes misaligned.

Before the crisis, Thailand pegged its currency, the baht, to the dollar at a rate of 25 baht per dollar. The rate was very stable and did not change much during the ten years before the crisis. From Thailand's point of view as the home country, its real rate of exchange with the United States was as follows:

$$R_r = (25 \text{ baht per dollar}) \times [(\text{U.S. price level})/(\text{Thai price level})]$$
$$= R_n(P^*/P)$$

Two factors were instrumental in triggering a crisis and the collapse of Thailand's currency in July 1997. First, its rate of inflation was slightly higher than the rate in the United States and averaged about 3 percent more during the four years leading up to the crisis. Although that is not a huge difference, it cumulated over time. Since the baht held steady at 25 to the dollar, the real rate of exchange appreciated more than 12 percent. Under these circumstances, Thai producers were relatively less competitive than U.S. producers.

The second and perhaps most important factor was the peg to the dollar. Thai semiconductor firms competed in international markets with producers in China and Japan. Therefore, when both of those countries devalued their currencies against the dollar, it also meant that they were devaluing against the Thai baht. Given the baht's peg to the dollar, Thailand could not devalue to meet the challenge of more intense Japanese and Chinese competition.

By June 1997, currency speculators saw that Thailand was losing export markets, was earning fewer dollars, and would most likely have to devalue. Hence, they began to sell the baht and all financial assets denominated in the currency. The sudden drop in demand for the currency put pressure

on the government to fill the demand by buying the currency, but in the end, the government began to run out of dollar reserves and was forced break the peg to the dollar. Between Monday, June 16, 1997, and Monday, January 12, 1998, the baht lost more than half its value as it fell from 24.0 to the dollar to 56.1. Since then, Thailand has used a floating exchange rate system.

CHOOSING THE RIGHT EXCHANGE RATE SYSTEM

LO 10.7 **State the necessary conditions for two or more countries to form a successful single currency area.**

Given the menu of choices for exchange rate systems, an active area of economic research has focused on the performance characteristics of systems under different economic conditions and institutional arrangements. For many years, economists debated the pros and cons of fixed and flexible rates, but as the variety of exchange rate options has grown, as capital mobility has increased, and as international trade and investment relations have deepened, researchers have become more concerned with understanding how varying degrees of flexibility or fixity might best serve the interests of individual countries. In particular, economists have tried to learn how different exchange rate systems might influence the core elements of a country's macroeconomy such as the rate of economic growth, the rate of inflation, and the frequency of currency crises.

Traditional views held that countries with fixed exchange rate systems were better at controlling inflation but that they paid a price in the form of slower economic growth. The reasoning behind this view was that in order to maintain a fixed rate, governments have to be very careful about issuing new money. Since most of the episodes of hyperinflation during the second half of the twentieth century resulted from overexpanding the money supply, it seems reasonable that an exchange rate policy that limits the supply of money would also help avoid inflation. In the view of some economists, however, the limits placed on the ability of a country to manipulate its money supply also remove an important tool that governments use to help manage the rate of economic growth. Therefore, the trade-off was lower growth for lower inflation.

More recent research, particularly with data from the 1990s, has failed to demonstrate a strong relationship between the type of exchange rate system and either inflation or economic growth. Before the 1990s, countries with fixed or pegged exchange rates tended to have lower rates of inflation, but during the 1990s the differences disappeared. Similarly, there is evidence that countries with more flexible rates tend to have higher average rates of economic growth, but this result depends on the classification of the fastest growing Asian economies. Technically, many of these countries have flexible exchange rates, but at the same time they manage them very closely. When they are omitted from the analysis, there is no significant difference in the rate of growth between countries

with relatively fixed and relatively flexible rates. And finally, neither fixed nor flexible rates seem to offer superior protection against a currency crisis. As a result, no particular system seems to rank above any other in its ability to provide superior macroeconomic performance.

Insofar as economists have been able to devise a set of rules for selecting an exchange rate system, they are very general and very basic. If the goal is to find the system that helps minimize negative shocks to an economy, then the source of the shock determines whether a more flexible or more fixed system should be adopted. When the shocks originate in the monetary sector—for example, a central bank that goes overboard in printing new money—a fixed rate is better since it imposes discipline on the central bank. On the other hand, if the shocks to an economy originate in the external environment—for example, a sudden change in the price of imported oil—then relatively more flexibility in the exchange rate enables the country to adapt to the changes more easily. The general argument here is that individual country characteristics matter a great deal. The problem with these rules, however, is that the source of the shocks to an economy are likely to vary from episode to episode and, as a consequence, the basic rules outlined above provide less practical guidance than desired.

Exchange rate pegs are popular, particularly with many developing countries. There are a couple of reasons for this. First, all economists agree that one of the most important elements of an exchange rate system is its credibility. That is, no matter what type of exchange rate is adopted, a successful system must generate confidence and the widespread belief that it is sustainable. Exchange rate systems that lack credibility are guaranteed to fail in their basic job of providing a smooth and reliable conversion between domestic and foreign money. Under some conditions, exchange rate pegs may offer greater credibility. One of the conditions, and the second reason why some countries continue to peg their currencies, is a relatively high degree of trade dependence on a single, major economy. Consider the case of Mexico, with about 80 percent of its trade with the United States. Because of its trade dependence on the United States, Mexico pegged its peso to the U.S. dollar for many years. Because Mexican inflation ran higher than the U.S. rate, a crawling peg was favored as the means of keeping the real exchange rate relatively constant. The purpose of the dollar peg was to provide benefits to Mexican businesses and consumers by eliminating some of the price variation in Mexican imports and exports. The rule seems to be that when a country is closely tied to the economy of a large, industrial country such as the United States, pegging to its currency may provide additional stability and help businesses plan their futures with greater confidence.

This view is shared by many, but at the same time it is widely accepted that, in Mexico's case, a flexible exchange rate has served it better than the pegged rates it used before 1994. The reason for the discrepancy between what might work in theory and what has worked in practice highlights the complexity of choosing an exchange rate system when every country has unique economic factors and its own set of institutions shaping its economic outcomes. Mexico, due to a set of agreements between the business sector, organized labor, and government, was

unable to make the periodic adjustments to its nominal exchange rate that are required with a crawling peg. In effect, Mexico's institutional inability to adjust its nominal exchange rate undermined the credibility of the exchange rate system. The lack of credibility led to periodic bouts of speculation against the peso whenever it was perceived to be overvalued and vulnerable. Several of these speculative bouts were followed by a peso collapse and economic recession. The lesson, in the end, seems to be that the first criterion for choosing an exchange rate system is that it must have credibility in currency and financial markets.

CASE STUDY

Monetary Unions

Some countries prefer not to have their own currency. Nineteen of the twenty-seven countries of the EU use a common currency, the euro, and more are expected to join. Panama adopted the dollar as a legal tender alongside its own currency, called the *cordoba*, in the early twentieth century, and in 2000 Ecuador and El Salvador eliminated their currencies altogether and adopted the dollar.

Dollarization is the term given to the adoption of another country's currency. Dollarization differs from a monetary union, such as the Eurozone, because a union has a common central bank that issues the currency and carries out monetary policy. By contrast, the central banks of El Salvador and Ecuador have no ability to issue money and no control over monetary policy because they cannot expand or contract the money supply. There is no barrier in international law to using another country's money, but in doing so, a country becomes powerless to influence its exchange rate or the quantity of money in circulation.

There are currently four monetary unions in the world (Table 10.6). They are the European Monetary Union (EMU or Eurozone, discussed in Chapter 14), the Eastern Caribbean Currency Union (ECCU), the West African Economic and Monetary Union (WAEMU), and the Central African Economic and Monetary Community, which is known by its French acronym, CEMAC.

The two African unions, WAEMU and CEMAC, are the oldest of the monetary unions. Both were formed in 1939 out of former French colonies in Western Africa, and both use the CFA franc as their currency. (*CFA* stands for "Communauté Française Africaine," or French African Community.) Both the WAEMU and the CEMAC have central banks that issue their currencies, both fix it to the euro at approximately 656 CFA francs per euro, and the two currencies are interchangeable. The French

<div align="right">(continued)</div>

TABLE 10.6   Monetary Unions

Monetary Union	Members	Exchange Rate System
European Monetary Union (EMU)	Nineteen of twenty-seven EU countries	Flexible
West African Economic and Monetary Union (WAEMU)	Eight countries in sub-Saharan West Africa	Fixed to euro
Central African Economic and Monetary Community (CEMAC)	Six countries in West-Central Africa	Fixed to euro
Eastern Caribbean Currency Union (ECCU)	Six island countries	Fixed to dollar

Treasury Department backs both currencies and stands ready to provide currency reserves if either of the two central banks of the monetary unions runs short.

According to most observers, the advantages of CFA francs over independent currencies is that they have lowered inflation in the participating countries and reduced macroeconomic instability. Since the central banks are responsible for more than one economy, it has probably reduced the political influence of individual governments and led to a steadier, less volatile monetary policy. The disadvantages are the same as those for a fixed exchange rate: Changes in the value of the currency cannot be used to protect the domestic economy against shocks that begin outside the country. For example, as the euro gained value against the dollar after 2000, the CFA franc also appreciated against the dollar, and goods produced in the CFA franc zone became more expensive when priced in dollars. This particularly affected the WAEMU, which mainly exports cotton and other agricultural products.

Some critics also view the arrangement as an effort by France to maintain influence in its former colonies. Accordingly, the WAEMU has announced that it will change the name of the currency and no longer keep its reserves with the Bank of France. The CAEMU is expected to follow.

All of the monetary unions are also economic unions (for example, the EU), common markets (ECCU is the basis for the Caribbean Common Market), or customs unions (WAEMU and CEMAC). Monetary union implies a high level of integration and coordination and is only worthwhile if other elements of the economy are also integrated. There is not a great deal of agreement as to the value or necessity of monetary unions, but without additional economic integration they make little sense.

Single Currency Areas

On January 1, 1999, eleven members of the EU adopted the euro as their official currency. As the EU added new members in the first decade of the new century, several chose to use the euro, and as of 2016, nineteen of the EU's then twenty-eight members had replaced their national currencies with the euro. This was the result of a shared vision developed over many decades of deeper economic, monetary, and political integration. Given that a nation's currency is one of its strongest symbols of national sovereignty, the fact that so many countries have decided to give up their currencies and their ability to set monetary policy is a remarkable set of events.

There are at least four potential reasons why a group of countries might want to share a common currency. First, a single currency eliminates the need to convert each other's money and thereby reduces transaction costs in a number of ways. It eliminates fees paid to the banks or to the currency brokers that arrange the conversion, it simplifies accounting and bookkeeping, and it enables consumers and investors to compare prices across international boundaries more accurately. Each of these advantages provides some gain in efficiency and a reduction in business costs. Second, a single currency eliminates price fluctuations caused by changes in the exchange rate. When speculators move their money into or out of a country or when temporary interest rate changes in one country alter the supply and demand for foreign exchange, one country may become (temporarily) cheaper or more expensive for business. As a result, business decisions may reflect temporary shifts in currency values rather than underlying issues of economic efficiency. The elimination of misleading price signals that result from exchange rate fluctuations is also a potential gain in efficiency.

Third, the elimination of exchange rates through the adoption of a single currency can help increase political trust between countries seeking to increase their integration. A single currency removes some of the friction between integrating nations by eliminating the problems that are caused by exchange rate misalignments. Fourth, in some developing countries the adoption of a common currency may give their exchange rate system greater credibility. Use of such a currency can reduce exchange rate fluctuations and create greater confidence in the financial system of the adopting country, possibly leading to lower interest rates and increased availability of credit, although this depends on the overall soundness of the financial system.

Nations that give up their national money do not do so without cost. In addition to its political symbolism, the adoption of a common currency also means that the country no longer has its own money supply as a tool for managing its economic growth. The topic of monetary policy is taken up in more detail in Chapter 11, but the basic point is easy to grasp. Countries with their own currency can influence the rate of growth of the economy in the short run (but not in the long run) through a change in the supply of money. When a country adopts a common currency with one or more other countries, it gives up this tool. After the introduction of the common currency, there is only one money supply and,

consequently, one rate of growth of the money supply. New York, for example, shares a common currency with California, and, as a consequence, both states experience the same changes in the money supply. If New York is growing fast and California is growing slowly, it would be impossible for the Federal Reserve to alter the money supply in a way that would speed up growth in California and slow it down in New York. With a single currency, there is a "one-size-fits-all" monetary policy.

A second potential cost to adopting a single currency is that countries give up their ability to alter their exchange rates. Exchange rate adjustments are sometimes the least costly way to restore competitiveness after a round of price increases. For example, during the years leading up to the financial crisis of 2007–2009, a number of Eurozone countries in the Mediterranean region experienced housing and construction bubbles that pushed up their prices and wages. Once the crisis began, they were less competitive against northern European nations where prices had not increased as much. In order to restore competitiveness, they were expected to implement policies aimed at pushing down prices and wages inside their countries and did not have the option to devalue their currencies to make their goods cheaper. Policies that attempt to create deflation are usually very painful to implement since they entail lower demand and slower or negative growth.

Conditions for Adopting a Single Currency

The starting point for analyzing the costs and benefits of a single currency area is the work of Robert Mundell on the theory of **optimal currency areas**. Mundell developed the first set of criteria to determine whether two or more countries are better off sharing a currency instead of using their separate national moneys. Mundell and subsequent research points to four conditions for deciding whether the gains are greater than the costs.

The first condition is that the business cycle must be synchronized and national economies must enter recessions and expansions at more or less the same time. In this case, a single monetary policy is appropriate since each country is individually at the same point in the business cycle and there is no cost associated with the loss of national monetary policy and its replacement with a single policy for all member states. In fact, however, few countries are that well synchronized in their business cycles. Even the states of the United States enter and leave recessions at different points in time, and the national figures on growth only reflect an average across all fifty states.

The second condition is a high degree of labor and capital mobility between the member countries. This allows workers and capital to leave countries or regions where work is scarce and to join the supply of labor and capital in booming regions. In effect, free migration of the factors of production smooths out some of the differences in the business cycle by taking unemployed inputs and moving them to where they are needed. This is how the fifty states of the United States compensate for a lack of complete synchronization in the

business cycles of individual states. When conditions are bad in one region, workers and investors move their labor and capital to another region, freeing inputs from areas where they are not needed and providing them to areas where they are.

While capital tends to be relatively mobile, labor is less so, even within countries. Therefore, a third condition is that there are regional policies capable of addressing the imbalances that may develop. Depressed areas may remain depressed if people cannot move or choose not to move because the psychological or other costs are too high or resources outside the region are not available. In the United States, federal taxes and transfer payments help depressed regions adjust and limit some of the shock. When a state is in recession, for example, people still receive their social security checks, Medicare, and other federal transfers. Federal taxes and payments spread the adjustment across the nation and ensure that it is not left up to the state alone. Insofar as the economics of regional policies are concerned, they may be determined at any level, from the currency area (multicountry), to individual nation-states, to subnational units (provinces or cities). The key point is not the agency responsible, but that there are effective policies for assisting regions that may not be synchronized with the majority of the currency area's economy.

Finally, the first three conditions point to the fourth: The nations involved must be seeking a level of integration that goes beyond simple free trade. Free trade requires that nations remove their tariffs, quotas, and other border barriers that inhibit the flow of goods. If this is the goal, a common currency is unnecessary. If something much deeper is sought, however, such as a greater harmonization of national economies and much closer economic and political ties, then a single currency can be helpful, provided the other three conditions are observed. This condition is admittedly ambiguous and is part of the reason why policymakers do not always agree in their analysis. It is somewhat circular reasoning, but true nevertheless, that the desirability of a single currency partly depends on the goals of the countries involved.

Summary

- People hold foreign currency to buy goods and services, to take advantage of interest rate differentials, and to speculate. The primary institutions in the exchange-rate market are commercial banks and foreign exchange brokers.

- Exchange rates can be analyzed with supply and demand analysis, as if they are just another commodity in the economy. Increases (decreases) in the supply of foreign exchange cause the domestic currency to appreciate (depreciate). Increases (decreases) in the demand for foreign exchange cause the domestic currency to depreciate (appreciate).