

## Currency Markets and Exchange Rates

In the modern economy, firms buy and sell products from more than just local or national markets. Often a firm's supplier is located in a different country. To make purchases and sell their own goods internationally, firms need to change units of one currency for units of another currency. For instance, when a British firm trades with a U.S. firm, the U.S. firm may pay in U.S. dollars. However, the British firm needs to pay many of its costs in British pounds. When the U.S. firm pays the British firm, then, one of two things has to occur: the U.S. firm must convert its dollars to pounds and then pay the British firm in pounds, or the British firm must accept dollars from the U.S. firm and then convert the dollars into pounds to pay its workers. And, to be sure that the sum in pounds is equivalent to the sum in dollars, all parties to the transaction must know the value of dollars in terms of pounds. Now multiply this single transaction by the number of countries and firms involved in all aspects of the production of all internationally traded goods and services and one can see that multiple currencies make international trade far more complex and difficult than domestic trade.

The desire to transact internationally provides the impetus for a huge, well-functioning market that facilitates such currency conversions and allows global economic integration and trade to take place smoothly and quickly at low cost. Both by volume of trade and ease of making transactions, currency markets today are the world's deepest, most liquid markets in the world. Currency markets range from simple markets where parties simply exchange one currency for another, to sophisticated markets where parties buy and sell currency far into the future.

In 2005 the United States imported and exported over \$3 trillion worth of goods and services. In addition, gross sales and purchases of long-term U.S. securities, such as corporate and Treasury bonds, to residents of foreign countries amounted to around \$41 trillion. Most of these transactions either directly or indirectly required a *foreign-exchange transaction*. A foreign-exchange transaction is a trade of any two currencies. For example, a purchase of Japanese yen with U.S. dollars is a foreign-exchange transaction.

As cross-border transactions have become larger and more frequent, foreign-exchange markets have become increasingly important to the global economy and have grown in relative size: whereas U.S. cross-border trade in goods and services and long-term securities are measured in trillions of dollars per month or year, turnover in foreign-exchange markets is measured in trillions of dollars *per day*. Daily average turnover in global foreign-exchange

markets averaged \$1.9 trillion in April 2004. (Note: Unless otherwise noted, all foreign-exchange transactions data in this chapter are from April 2004, the latest date for which global turnover data are available.)

Foreign-exchange transactions vary in size and complexity. A foreign-exchange transaction is simply a trade of one country's currency for that of another, whether the amount traded is a few dollars or a few billion dollars; whether the entity making the exchange is a tourist changing money at the border for a short holiday or a foreign company building a new factory needing to exchange millions in domestic currency to pay for materials and labor; or whether the form of money being acquired is foreign currency notes, foreign currency bank deposits, or assets such as stocks or bonds denominated in foreign currency. Key points of this chapter are:

- Foreign-exchange markets not only allow firms to trade goods and services across borders but also allow firms to manage the risks they face from fluctuations in the price of their domestic currency.
- As with any other good, the exchange value of a currency is determined by its supply, as well as the demand for the country's assets, goods, and services.
- Over much of the 20th century, countries tended to favor fixed exchange rates. In recent decades, there has been a shift away from fixed regimes toward freely floating exchange rates.
- Monetary and exchange-rate policies are tightly linked. A nation's government must decide between controlling its exchange rate and controlling its domestic inflation rate.

## Currency Markets Are Large

On an average day in April 2004, an amount equivalent to \$1.9 trillion was traded in the foreign-exchange market. These trades occurred between different agents (individuals, firms, banks, governments) and for different reasons, varying from tourist demand for currency to firms needing payment for goods in local currency. To put this number in perspective, on average in 2004, every 7 trading days a sum greater than the entire value of the U.S. annual GDP changed hands in the foreign-exchange market. Not surprisingly, turnover in the foreign-exchange market is larger than turnover in most other financial markets. For example, the dollar value of average daily trading on the New York Stock Exchange, the largest exchange in the world, was around \$46 billion in 2004, roughly 2 percent of the turnover in all world foreign-exchange markets.

When currencies are traded in the foreign-exchange market, participants need to know the value of their currency relative to other currencies, just as participants in a traditional stock market need to know the value of the stocks they wish to buy or sell. In foreign-exchange markets, this price is known as

the *exchange rate*, the number of units of one nation's currency that must be traded to acquire one unit of another nation's currency. For example, on October 11, 2006, a person wanting to acquire one British pound would have had to pay \$1.86 in U.S. dollars. By November 30, 2006, a person wanting to make the same trade would have had to pay almost \$1.97 for one British pound. In this case, the dollar is said to have *depreciated*. After the *depreciation*, more dollars are required to buy the same number of pounds. If the transactions are viewed from the perspective of the pound, the pound is said to have *appreciated*; fewer pounds are required to purchase each dollar.

In principle, an exchange rate exists between each possible pairing of the individual currencies in the world. Among the 52 nations (out of a world total of 193 nations) that reported formal exchange-market transactions in 2004, there are 820 possible bilateral exchange rates. If the 12 European nations that share the euro as their national currency had separate currencies, this number would be even higher.

In reality, a substantial portion of foreign-exchange trading occurs through an *intermediate* or a *vehicle currency*, that is, a currency that is widely used throughout the world. For example, the U.S. dollar serves as a global vehicle currency and the euro is becoming an important vehicle currency in Europe. A Turkish bank that wishes to exchange Turkish lira for Swedish krona may first exchange lira for euros and then exchange the euros for krona. Vehicle currencies reduce transaction costs in foreign-exchange markets because a bank wishing to provide foreign exchange for its customers need not keep stores of large numbers of currencies on hand. Instead, it need only maintain stores of its own domestic currency and one or two other vehicle currencies.

The U.S. dollar is the most important vehicle currency in the world. The dollar has served as an important vehicle currency in part because it has remained remarkably stable over time. This stability is in part a result of the United States' long history of flexible exchange markets and its commitment to improving capital market and trade access to the United States. As of 2004, the U.S. dollar was used in almost 89 percent of world currency transactions; its average turnover was over \$1.5 trillion per day, more than twice as much as the next most-used currency, the euro. Most of this trading occurs outside of the United States.

Just as a few vehicle currencies dominate the transactions, two trading locations dominate foreign-exchange market transactions. In 2004, over half of the world exchange-market transactions occurred either in London (31.3 percent) or New York (19.2 percent). The next-largest location in terms of trading share was Japan, with 8.3 percent of transactions. Foreign-exchange market transactions are also concentrated among a few large banks. In the United States, 75 percent of transactions were conducted by only 11 banks in 2004. In the United Kingdom, 16 banks captured 75 percent of foreign-exchange market transactions.

Innovations in technology, such as computers and international communications networks, and breakthroughs in economic theory that have improved our understanding of the value of currencies, have made foreign-exchange markets among the most sophisticated markets in the world. Investors can easily take advantage of small differences in exchange values across the different global markets, buying a currency for a lower amount in one location and selling it for a higher amount in another, making the global currency market one global exchange.

The sophistication of modern currency markets also helps multinational firms protect themselves, or *hedge*, against *currency risk*. Because costs and revenues of multinational firms are often denominated in different currencies, currency risk is a fundamental part of international trade, and changes in the exchange rate affect the cash flow of the firm. For example, a Mexican manufacturer may enter into a contract with a U.S. firm, agreeing to sell its product at a fixed dollar price for a set period of time, for example, 1 year. The Mexican manufacturer must pay its employees in Mexican pesos but will receive a fixed dollar stream of revenue. If the peso appreciates over the year (that is, if the peso becomes more valuable so that it takes fewer pesos to buy one U.S. dollar), the manufacturer's dollar-denominated revenue will fall in value relative to his peso-denominated costs. If the peso appreciates sufficiently, the manufacturer may not be able to cover his costs. To see this dilemma more clearly, suppose that when the Mexican firm enters into the contract with its U.S. counterpart, the exchange rate is 10 pesos per dollar. If the firm has costs of 1,000 pesos, and it receives \$110, then the firm is able to cover its costs and has 100 pesos of profit after the transaction. However, if the peso appreciates over the year from 10 pesos per dollar to 8 pesos per dollar, after the firm receives payment of \$110, it will only hold 880 pesos. The firm would not be able to cover the costs from the revenue it receives. If the firm has no way to hedge this risk, its owner may be unable or unwilling to enter into the contract and thus the opportunity for Mexico and the United States to realize gains from this trade may not be realized. Advances in economic theory that have helped companies learn how to price risk appropriately have enabled financial markets to develop contracts that allow firms to sell their currency risk. Boxes 7-1 and 7-2 provide more detail.

**Box 7-1: Types of Currency Market Transactions**

A *spot transaction* is an immediate exchange of one currency for another. A tourist exchanging currency upon arrival at an airport is an example of a person making a spot transaction. Spot transactions between professional currency traders specify a *clearing date* that

requires the actual exchange of currency within 2 business days; the 2 days gives each side of the transaction ample time to move funds. As a share of total foreign-exchange market turnover, spot transactions have declined from 54 percent in 1989 to 33 percent in 2004. The share of spot market transactions has not shrunk because the spot market is smaller—the volume of spot transactions almost doubled between 1989 and 2004—but because the growth rate of other types of foreign-exchange transactions has grown at a much faster rate. For example, over the same time period, transactions with clearing dates in the future have increased almost eightfold.

A *forward transaction* is similar to a spot transaction except that the clearing date (also called the *settlement date*) is in the future. The price at which the parties agree to exchange currency on the settlement date is known as the forward exchange rate and it almost always differs from the spot rate at the time the contract is entered into. In a forward transaction, no currency changes hands until the settlement date. The primary purpose of a forward transaction is to allow multinational firms to hedge their currency market risk. A foreign-exchange *futures transaction* is virtually identical to a forward transaction. The main differences between a forward and a future transaction lie in the institutional details of the transaction. For example, futures contracts tend to be much more standardized than forward contracts and are sold on organized, centralized exchanges.

*Foreign-exchange swaps* combine a spot and a forward transaction into one transaction. Foreign-exchange swaps are typically used by banks and other dealers when they wish to temporarily reallocate their portfolio into or out of a currency without incurring any exchange-rate risk. In the swap, one currency is swapped for another for a prespecified period of time. In about two-thirds of foreign currency swaps, the swap period is less than 1 week. In 2004, foreign-exchange swaps accounted for about 50 percent of the foreign-exchange market turnover. A foreign-exchange swap is particularly useful for a firm that has payments and expenses payable in the same currency but payable at different dates. For example, a U.S. firm may receive a euro-denominated payment from its German affiliate. The firm plans to use the payment to purchase euro-denominated goods in 1-month's time. However, over the month, the firm would like to invest the money in the United States. This firm could use a foreign-exchange swap in which it trades the euros for dollars today and trades the dollars for euros at the end of the month.

A *foreign-exchange or currency option* gives the buyer the right, but not the obligation, to purchase a prespecified amount of currency at a prespecified price. Depending on the type of option, the contract can either specify a date on which the option may be exercised (European option) or may specify an expiration date, where the buyer may exercise the option anytime prior to the expiration date (American option).

## **Box 7-2: Hedging Against Foreign-Exchange Rate Fluctuations**

In 2005 Volkswagen, a German automobile company, announced to the world that it was going to increase its hedging of foreign-exchange risk. Volkswagen was exposed to foreign-exchange risk because the majority of its operating costs, in particular a portion of its labor costs were denominated in euros, while a substantial share of its revenues were denominated in U.S. dollars. In other words, Volkswagen paid its workers in euros and received U.S. dollars for the cars it sold in the United States.

Between 2002 and 2004, the euro appreciated considerably relative to the dollar. That is, more dollars were required in order to purchase each euro. Since Volkswagen was unable or unwilling to change the price of cars sold in the United States enough to offset this swing in the exchange rate, the company's dollar revenues from sales in the United States lost substantial value in terms of euros. With costs holding steady and revenues falling, Volkswagen's profits on U.S. operations were reduced by an unfavorable change in the euro/dollar exchange rate.

To avoid similar losses in the future, the company chose to combat the appreciating euro by increasing its hedging of foreign-exchange risk. Between 2004 and 2005, Volkswagen more than doubled its use of a variety of currency market contracts. In essence, this hedging strategy involved buying forward contracts for euros at a predetermined rate so that if the euro were to appreciate relative to the dollar and cause an unexpected reduction in dollar revenue, the company would receive an offsetting profit from its forward contract. If the euro were to depreciate and cause an unexpected increase in dollar revenue, the company would incur an offsetting loss from its foreign currency position. In this way, Volkswagen was able to shield its revenue flow from foreign-exchange volatility for the duration of its futures contracts.

Volkswagen's strategy highlights the benefits of hedging against the currency risk posed by short-term fluctuations in exchange rates. When faced with a *permanent* shift in the exchange rate, however, companies operating in multiple currencies are forced to either change their prices, which are in one currency, or change their costs, which are in another. Volkswagen has therefore shifted some of its euro costs into dollar costs by expanding production facilities in the United States. This strategy, known as natural hedging, permanently eliminates the currency mismatch between revenues and costs.

## What Determines Currency Values?

The exchange rate is a market price, and like other market prices it is determined by the interaction of buyers and sellers in the market. In the foreign-exchange market, the demand for a country's currency arises from two sources: demand for a country's assets and demand for a country's goods and services. When analyzing foreign-exchange markets, the supply of a country's currency is usually taken as given and fixed at an amount determined by the country's central bank. The role of the central bank and the supply of money will be revisited when exchange-rate policies are examined later in this chapter.

The concept of *parity* is central to any analysis of how exchange rates are determined in the foreign-exchange market. Two types of parity are particularly important: *interest rate parity* and *purchasing power parity (PPP)*. Exchange rates and prices that move too far from either concept of parity will tend to move back toward the level implied by interest rate parity and purchasing power parity as economic agents try to exploit pricing differences across countries. In this way, the prices for currencies in the foreign-exchange market adjust. Just as prices across markets within a country tend to move toward each other as buyers tend to go to the lower priced market and sellers tend to go to the higher priced market until prices are equalized. The absolute volume and speed of asset trading tends to make interest rate parity a short-term condition while purchasing power parity tends to hold over a somewhat longer time horizon.

### Interest Rate Parity

For the United States, the volume of international trade in assets is many times larger than the volume of international trade in goods and services. As a result, day-to-day fluctuations in the exchange rate tend to be driven much more by the value and desirability of a nation's assets than by the value and the desirability of goods and services the nation is selling. That is, demand for assets tends to determine the value of a nation's currency in the very short run because asset trade drives such a large part of the day-to-day transactions in the foreign-exchange market.

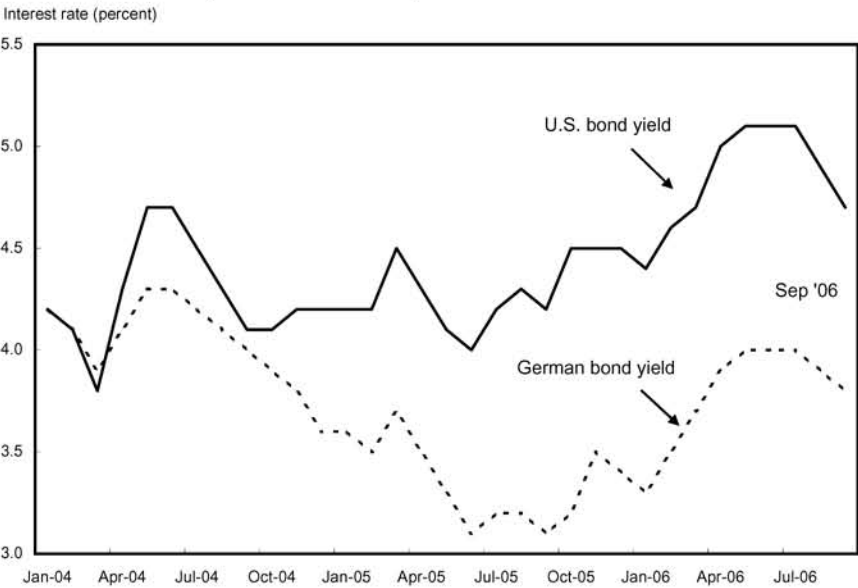
Goods and services are purchased for use today while assets are bought in order to purchase goods in the future. A financial asset is at its most basic a contract that offers a payment at some future date. For some assets, the contract is explicit: U.S. Treasury notes contain a promise to pay the face value of the bond at a certain date in the future as well as a fixed sequence of interest payments over the life of the note. For other assets, the contract is implicit: buying a stock in a company gives the holder the right to sell the stock at a future date but not at any explicit price. Because assets involve a future payment, the *return* on an asset—the return is the future payment

divided by the purchase price—is typically uncertain. Assets differ in the amount of risk they offer. For example, a Treasury bond is considered to be less risky than a stock. For any given level of risk, assets with higher future payments are more desirable and tend to have higher prices.

Further, because the payment of an asset may vary depending on the conditions at the time the payment is due—the stock may have a high price or a low price when the holder sells the stock—information about the likely amount of the future payment also affects how much of the asset people want to hold today. For example, when a firm announces an increase in future dividend payments, the price of the firm’s stock often increases. This increase in price reflects an increase in the desire to hold the stock. Every time new information is released, investors reevaluate their holdings of assets.

The foreign-exchange market plays an important role in determining the value and return to foreign currency assets. When buying assets that are denominated in a foreign currency, investors must take into consideration both the future payment in terms of the foreign currency and any change in the relative values of the two currencies, the exchange rate. For example, in August 2006 the interest rate paid on 10-year U.S. Treasury bonds was 4.9 percent and the interest rate paid on 9- to 10- year German Treasury bonds was 3.9 percent, a difference of 1 percentage point (see Chart 7-1). Does this difference imply that investors should have preferred U.S. Treasury bonds to German Treasury bonds?

**Chart 7-1 Interest Rates on U.S. and German Long-Term Bonds**  
U.S. bond yields were higher than German bond yields in 2006.



Source: U.S. Federal Reserve Board and Deutsche Bundesbank.



Not necessarily. The expected return for a U.S. resident who purchases a German bond includes both the interest paid on the bond, in euros, and the expected change in the exchange rate over the period during which the bond is held. In other words, the return on a German bond, from a U.S. investor's perspective, includes both the explicitly defined interest rate and the value of this return once converted back to U.S. dollars, an effect that can increase or decrease the return to the bond.

An example will clarify the concept. A German investor wishes to calculate the expected return on investing €100 in a savings deposit at a bank in the United States for 1 year. She needs three pieces of information to calculate the expected return: the current exchange rate between the dollar and the euro, the interest rate paid on the savings deposit, and the exchange rate that will prevail 1 year in the future. The investor knows the first two variables (today's exchange rate and the interest rate) with certainty. The one element of the calculation that is not readily available is the future exchange rate. For this example, let's first assume the investor knows all three variables: today's exchange rate is \$1 per euro, the interest rate to be paid on the savings deposit is 5 percent, and the future exchange rate is \$0.99 per euro (the euro *depreciates* relative to the dollar). The calculation of the investor's return is straightforward: after exchanging her €100 for dollars, she has \$100 in hand and deposits it in the U.S. bank account. At the end of one year, she withdraws \$105 from the bank account and takes it to the foreign-exchange market to trade the \$105 dollars for ( $\$105 / .99 =$ ) €106.06. The effective return on the savings deposit was 6.06 percent: the \$5.00 in interest earned by the \$100 at 5 percent plus the €1.06 gained because the euro depreciated by 1 percent.

In the example, the future exchange rate was taken to be 0.99, a 1-percent depreciation of the euro relative to the dollar. Holding the U.S. interest rate fixed, changes in the future exchange rate have large implications for the rate of return. For example, if the euro had appreciated by 1 percent, the return would have been just under 4 percent: the \$5.00 in interest earned by the \$100 at 5 percent minus the €1.04 lost because the euro appreciated by 1 percent. Had the future exchange rate been the same as the initial exchange rate, the return would have been the 5 percent paid on the deposit. Investors must take into consideration future changes in the exchange rate in order to decide which asset has a higher expected return.

Now, what happens if investors all decide that the expected return—the return considering both the exchange rate and the interest rate—is higher on German bonds than on U.S. bonds? In this case, U.S. investors will sell U.S. dollars and purchase euros and then use the euros to purchase German bonds. The investors will keep doing this until they no longer perceive German bonds as having a higher return than U.S. bonds. That is, investors keep buying German bonds until prices adjust. In this example, there are three

prices: the two interest rates and the exchange rate. Here, the euro would appreciate because the demand for euros is rising; the yields on German bonds would fall; and the yields on U.S. bonds would tend to rise.

Interest rate parity is one of the key equilibrium relationships in international economics: The foreign-exchange market is in equilibrium when deposits of all currencies offer the same expected risk-adjusted rate of return. Interest parity is expected to hold except when countries prevent the free flow of assets. If, in the example above, German and U.S. residents could only buy their own domestic bonds, interest parity would not necessarily hold. The return on the bonds would be determined independently in each country. This issue is revisited in Box 7-4 later in the chapter.

## Purchasing Power Parity

The last section focused on the influence the return on a country's assets tends to have on the country's exchange rates. Purchasing power parity is a second equilibrium concept that also helps determine exchange rate. PPP also relies on the concept that prices (and returns) must be consistent internationally. At a weekend farmer's market, the price of corn cannot vary too much between any two vendors. If there is a large difference in price for the same corn, most of the corn sales will be at the cheaper booth. In other words, people at the market, perceiving the corn to be the same quality, will tend to buy from the cheaper vendor until either that vendor's supply is exhausted or the prices at the two booths adjust so that they are closer together. Purchasing power parity is an extension of this simple concept on a global scale. That is, prices of goods sold in any two countries should exhibit about the same price once those prices are converted to a common currency. If goods are sold for different prices in different countries, then either the prices of those goods or the exchange rate would be expected to change until the exchange-adjusted prices in the two countries were similar.

An example may clarify how this process works. Imagine a farmer's market with three booths. One booth sells corn in U.S. dollars, the second booth sells identical corn in euros, and a third booth (the foreign-exchange market) sells and buys euros at a posted price. A buyer arrives at the market with a single U.S. dollar in his pocket and wishes to buy corn. The prices are as follows: 1 bushel of corn from the U.S. dollar booth sells for \$1, the same bushel of corn sells for 1 at the euro booth, and at the foreign-exchange booth \$1 can buy 1.1. Therefore, the buyer finds that euro-corn is cheaper; he exchanges his U.S. dollar for 1.1 and is able to buy 1.1 bushels of corn instead of the 1 bushel he could buy at the dollar market. If nothing changes, all buyers who show up to the market will prefer euro corn. In response to this preference, two things are likely to occur. The price of corn at the dollar booth will begin to fall as the dollar booth sees less demand for its corn, and the

foreign-exchange booth will raise the price of euros relative to dollars as it perceives an increased demand for euros.

The above example is quite stylized; however, the economic forces in the global marketplace work in exactly the same way. Buyers and sellers search for the best location to sell their goods. However, unlike asset markets in which the adjustments can happen on a large scale very quickly, purchasing power parity depends in part on the adjustment of goods markets, which tend to take place over a relatively long period of time. Therefore, purchasing power parity tends to hold over a very long time horizon—months and years rather than day-to-day. In addition, because there are real costs to shipping goods internationally, very small differences in purchasing power parity will not necessarily disappear. Nevertheless, purchasing power parity is a powerful concept.

## Fixed versus Floating Exchange Rates

The previous sections assumed that currency values could immediately adjust as the demand for either goods or assets changes. In reality, some countries do not allow the value of their currencies to fluctuate. Instead, by systematically changing the supply of their own currency through changes in monetary policy, they control the changes in the value of their currencies and limit exchange-rate movements. The choice of exchange-rate policy is often called the exchange-rate regime of a country. This section discusses the two most basic categories of exchange-rate regimes, fixed and floating. Defining a country's exchange-rate regime is, in practice, not an easy task. For example, in 2004 the International Monetary Fund (IMF) identified eight distinct exchange-rate regimes (see Box 7-3). Using the simplification of fixed versus floating allows a simpler discussion of the links between the exchange rate and monetary policy, a topic discussed in the next section.

### Floating Exchange-Rate Regimes

Floating exchange-rate regimes are regimes in which the government takes no action to influence the exchange rate. Under this regime, the exchange rate is completely determined by the general market forces discussed above. One advantage of a floating exchange rate is that the government does not have to have any knowledge over what the correct or true exchange rate should be. Market forces drive the exchange rate toward its true value.

Over the past 25 years, there has been a general trend away from fixed exchange rates and toward floating exchange rates. Chart 7-2 illustrates this general trend. The chart shows that the number of countries using floating exchange rates has risen gradually over time. In 1980, over 75 percent of the

### **Box 7-3: A Description of the IMF Classification of Exchange-Rate Regimes**

*Exchange arrangements with no separate legal tender:* A country gives up its own currency and allows the currency of another country to circulate as the sole legal tender. This exchange regime is often referred to as *dollarization*. This classification includes countries, such as members of the euro area, that form *currency unions*: arrangements by which the same legal tender is shared by the member countries.

*Currency board arrangements:* An exchange-rate regime in which a country commits to exchange domestic currency for a foreign currency at a preannounced price. Currency board arrangements feature restrictions on the nation to ensure that it will abide by its legal obligation.

*Conventional fixed peg arrangements:* A regime in which a nation announces that it will buy or sell its currency in exchange for a foreign currency at a preannounced price. This regime differs from a currency board arrangement only in the legal structure of the regime.

*Pegged exchange rates within horizontal bands:* A regime in which a country allows only limited movements in the exchange rates. The nation announces a high and a low value for the currency and only agrees to sell the domestic currency at the high price and to buy the domestic currency at the low price.

*Crawling pegs:* A crawling peg is essentially the same as a pegged exchange rate except that the price at which the currency is traded changes over time. For example, a nation that wishes to allow a long-term appreciation of its currency may choose to do so by adopting a crawling peg that allows the currency to appreciate on average.

*Exchange rates within crawling bands:* This regime is a combination of a crawling peg and a pegged exchange rate with horizontal bands.

*Independently floating:* The exchange rate is driven by the market. The country does not attempt to influence the value of the exchange rate. For example, the United States has an independently floating exchange rate.

*Managed floating:* The exchange rate is driven by the market part of the time but on occasion the government seeks to systematically influence the exchange rate through purchases or sales of the currency.

countries listed in the IMF exchange classification maintained a specific target for their exchange rate. By 2005, this number had dropped to 55 percent.

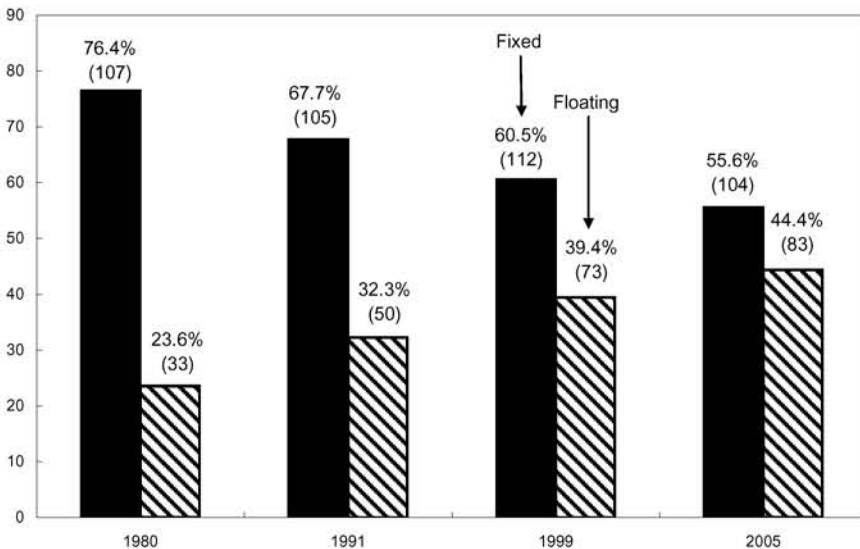
Even among countries that are considered to be freely floating, the government may occasionally or even periodically intervene in the exchange market. For example, Turkey, listed as freely floating in the IMF classification system, does not have a fixed exchange rate but reserves the right to intervene in the exchange market to limit volatility in its exchange rate (and has done so many times over the past few years).

## Fixed Exchange-Rate Regimes

A fixed exchange-rate regime is a regime in which a nation's government announces the price at which its currency will trade for another currency. To maintain the exchange rate, the government must stand ready to buy or sell unlimited quantities of currency at the preannounced price. To keep the exchange rate from appreciating, the government sells its domestic currency in exchange for foreign currency. The increased supply of the currency lowers the value of the currency. To keep the exchange rate from depreciating, the government buys its domestic currency using foreign currency. To make these transactions, the government must have sufficient supplies of both domestic and foreign currency. Maintaining a supply of domestic currency is simple, as

Chart 7-2 Exchange Rate Policy Has Moved Away from Fixed Rates

Countries as a percentage of total



Note: The number of countries is listed in parenthesis.

Source: International Monetary Fund, *International Financial Statistics, Annual Report on Exchange Arrangements and Exchange Restrictions*.

the government has the right to print unlimited quantities of its own currency. However, supplies of foreign currency must be held in reserve and the government does not have the option of increasing its supply. The possibility of running out of foreign currency and being unable to keep the currency from depreciating is one of the reasons that many nations have given up fixed exchange-rate regimes.

Fixed exchange rates have been used by a large number of countries and for a large portion of modern economic history. Following World War II, the major industrialized countries agreed to fix the value of their currencies with respect to each other. This agreement was known as the Bretton-Woods agreement, and the IMF was established in 1949 to monitor this system of exchange rates. To a greater or lesser degree, this system remained in place until the early 1970s, when countries began to allow their exchange rates to drift.

Following the breakdown of the Bretton-Woods agreement, the Western European nations joined together in a fixed exchange-rate regime. After suffering several major exchange-rate crises, 12 of the European nations preferred so strongly to maintain a fixed exchange rate that they agreed to give up their national currencies and the euro area was established. By giving up their national currencies and forming a monetary union, the member nations hope to avoid future crises. While the euro area is still relatively young (it was formally established in 1999), the currency union has not yet suffered a major crisis.

## The Links Between Monetary and Exchange-Rate Policies

A nation's choice of exchange-rate policy is tightly linked to a nation's choice of monetary policy. They are tightly linked because exchange-rate policy is a form of monetary policy. Monetary policy, broadly defined, is the policy that controls the growth rate of the money supply. In order to fix the exchange rate, a government must use its ability to control the money supply to sustain a fixed level of the exchange rate. If the supply of money is dedicated to controlling the level of the exchange rate, it cannot simultaneously be dedicated to controlling inflation. Given the earlier discussion of interest rate parity, the choice of monetary target is essentially a choice between stabilizing domestic prices and stabilizing the exchange rate. If the exchange rate is fixed, then domestic prices, both asset prices and goods prices, must do all of the adjusting.

The increase in the number of economies preferring floating exchange rates and the rise of independent central banks with mandates to maintain price stability is not a coincidence. An increasing number of countries have come to desire central banks charged with maintaining low and stable inflation. To achieve this goal, central banks need a nominal target to automatically stabilize the money supply. Most modern central banks have chosen a domestic short-term interest rate for the nominal target. The short-term

policy rate allows the central bank complete autonomy over choosing the rate of domestic inflation.

The short-term policy rate is not the only nominal anchor available to the central bank, however. The central bank could choose to fix the domestic price of gold or any other commodity. The use of the gold standard has a long and reputable history. A nation's exchange rate with another country can also be used as the nominal anchor for monetary policy. By fixing the value of the domestic currency against another currency, a country essentially adopts the monetary policy of the foreign country; one of the problems of using a strict fixed exchange rate is that the monetary policy of the foreign country may differ from what the central bank would have chosen given complete autonomy. That is, the bank could be forced to print either more or less currency than it would have otherwise chosen.

Thinking through a specific example will help clarify the relationship between exchange-rate policy and overall monetary policy. For a long time, China had a fixed exchange rate with the United States. To maintain its fixed exchange rate, the Chinese government had to stand ready to buy or sell yuan, China's domestic currency, for U.S. dollars at a fixed price. From 2000 to July 2005, this price was set at approximately 8.28 yuan per dollar. Over this time period, Chinese productivity growth was much higher than U.S. productivity growth and Chinese prices on average grew much more slowly than U.S. prices. High productivity growth implies a high return to investment in China relative to the United States. The slow growth of Chinese prices implies that, holding the exchange rate constant, Chinese goods were becoming cheaper relative to goods in the United States. Therefore, both in terms of maintaining interest rate parity and in terms of maintaining PPP, there was pressure for the yuan to appreciate relative to the U.S. dollar. How did the Chinese authorities prevent the appreciation?

The Chinese authorities prevented the appreciation by buying U.S. dollars and exchanging these dollars for yuan. The pressures for appreciation of the yuan implied that the yuan was facing higher demand—that more goods could be purchased for dollars converted to yuan, and investments in China delivered, on average, a higher return. To offset the increase in demand, the Chinese government effectively increased the supply of Chinese assets and decreased the supply of U.S. assets. Chinese foreign-exchange reserves increased from around \$150 billion in early 2000 to almost \$1 trillion by September 2006, a truly remarkable increase. In other words, the Chinese prevented an appreciation of the exchange rate by effectively printing yuan and using those yuan to accumulate U.S. dollar assets.

By fixing the exchange rate, the Chinese monetary authority is unable to use monetary policy for any other goal. By printing yuan, the Chinese raise the amount of currency in the country, which in turn, holding all else equal, raises the domestic price level, thus raising the economy's inflation rate.

But if they are just printing enough to buy and hold U.S. assets, from where does the domestic price pressure arise? The price pressure arises as the yuan, which are used to purchase the dollar assets, flow back into the Chinese economy. In other words, the prices increase because of foreign demand for Chinese goods. On the surface, this foreign demand appears to arise as a result of the Chinese exchange-rate regime; however, this demand is the same demand which was originally putting pressure on the Chinese exchange rate. At the old prices, there was not enough supply of Chinese goods to meet all of the demand. Because the exchange rate was unable to adjust, the price of Chinese goods had to adjust.

Could the Chinese conduct a monetary operation to lower inflation? To lower inflation, the Chinese would need to remove yuan from circulation, perhaps by selling domestic bonds. This transaction is sometimes referred to as sterilization. The action, however, will tend to raise the value of the currency: the currency would become scarcer as a result of the reduction in supply. As the currency becomes more valuable the foreign-exchange value of the currency would tend to appreciate. Any monetary action the Chinese undertake to reduce domestic inflation tends to undo their exchange-rate intervention (see Box 7-4).

This example also illustrates why the Chinese intervention does not systematically change the relative real prices between the United States and China. Had the Chinese government not intervened, Chinese domestic prices would have remained the same in terms of yuan and become more expensive in terms of dollars through a change in the exchange rate. With the intervention, Chinese domestic prices rose in terms of yuan and became more expensive in terms of dollars even though the value of the nominal exchange rate was unchanged. This outcome occurs any time a country takes actions to fix its exchange rate: fixing the nominal exchange rate does not necessarily have any impact on the relative prices between two countries. In other words, fixing the nominal exchange rate does not tend to move countries away from purchasing power parity. The only effect is that domestic goods prices have to do all of the adjustment since the exchange rate is fixed.

In the end, central banks that choose to fix the value of their exchange rate relative to another currency and central banks that choose to set a short-term interest rate are each choosing a different tool to conduct monetary policy. Economic theory does not dictate a clear preference between the two tools; however, by 2006 no central bank from any major industrialized nation has opted to use a fixed exchange rate, while maintaining their own domestic currency, as a monetary policy instrument. These central banks understandably believe that interest rate targeting, in practice, is a preferred tool in the conduct of monetary policy.



### **Box 7-4: The Impossible Trinity**

A fixed exchange-rate regime forces a country to choose between allowing free flows of assets in and out of the country or restricting the flows in order to preserve independent monetary policy. This choice is forced on countries because only two of the following three policies—free asset flows, a fixed exchange rate, and an independent monetary policy—can be maintained at any point in time.

The underlying reason for this restriction is that free asset flows and monetary policy operations may yield a foreign-exchange value of the currency which is inconsistent with the fixed rate that the government is trying to maintain. The United States, for example, allows free asset flows and maintains an independent monetary policy. As a result, the U.S. central bank, the Federal Reserve Board, can influence domestic interest rates relative to foreign rates. If the Federal Reserve elects to raise domestic rates, however, then the United States becomes a more attractive investment environment relative to other countries, and assets flow into the U.S. economy. Because this shift in asset flows raises demand for the U.S. dollar, the exchange rate appreciates. Since the U.S. government lets the market determine the dollar's foreign-exchange value, the dollar's appreciation can occur without any active intervention by the Federal Reserve.

In this example, the only way to break the direct link between the exchange rate and the interest rate would be for the United States to restrict asset flows. If assets cannot flow into the United States, demand for the dollar does not rise with the increase in interest rates, and the exchange rate does not necessarily appreciate. In other words, one of the key assumptions of interest rate parity—that assets can flow to the location with the highest return—is broken.

Denmark, on the other hand, effectively pegs its domestic currency to the euro and allows free flows of assets, as evidenced by the nearly 632 billion kroner of foreign direct investment in Denmark in 2005 (over 40 percent of Denmark's GDP). By pegging its currency and allowing free asset flows, Denmark essentially loses the ability to independently determine its domestic inflation rate. If Denmark were to alter interest rates so that they deviated from world rates, assets would flow in or out of the Danish economy and lead to a shift in the exchange rate. To correct this shift and maintain its fixed exchange rate with the euro, Denmark would then have to buy or sell kroner, thus negating the interest rate changes it achieved through its monetary policy. In this sense, free asset flows and a fixed exchange rate make an independent monetary policy virtually impossible.

*continued on the next page*

**Box 7-4 — *continued***

In the middle of the spectrum are countries such as China, which has pegged its exchange rate to the U.S. dollar. China can, to a limited extent, operate an independent monetary policy, however, because it restricts the ability of its residents to move capital out of the country. In China's case, world and domestic interest rates can differ since restrictions on the flow of funds out of the domestic economy limit the resulting changes in the money supply and the corresponding pressures on the exchange rate.

## Conclusion

Currency markets facilitate global trade and investment by making it easy for firms and investors to buy or sell the currencies they need to do business globally. In the absence of global currency markets, the benefits of international openness would be nearly impossible to realize—international trade would effectively be reduced to barter arrangements. The growing importance of international trade and investment has been accompanied by an increasing number of transactions in the foreign-exchange markets.

The value of a nation's currency is determined like any other good, service, or asset. The more people demand the currency and the scarcer the supply of the currency, the higher the currency's value. The value of a currency is measured by its purchasing power relative to other currencies. In other words, the value of a currency is measured by its exchange rate with other currencies.

Exchange-rate policy is a form of monetary policy. When a country fixes its exchange rate relative to another country, that country must use its monetary policy to maintain the exchange rate. A country with a fixed exchange rate does not have the ability to use monetary policy for any other purpose, just as a nation which sets a short-term interest rate must devote its monetary policy to achieving that goal.

In addition, the value of a country's currency is in large part determined by the value of that country's goods, services, and assets and the ability of people and firms to freely trade these items across national borders. Any policy that restricts the free flow of these items will lower the value of the currency, in addition to lowering the value of the restricted asset. The value of a nation's currency is tied to people's ability to move assets and goods. Small changes in a nation's openness to trade and investment will likely have a small impact on the value of the currency; however, every movement towards more protectionist policies is likely to be associated with a lower value of a nation's currency than would have been true otherwise.