Chapter 14
Foreign Exchange Markets and Exchange Rates

"International transactions have one common element that distinguishes them from domestic transactions: one of the participants must deal in a foreign currency."
Robert Aliber, The International Money Game, Chapter 2.

I. Chapter Outline

II. Chapter Summary and Review

As stated by this chapter's introductory quote, an international transaction means someone must deal in foreign currency. If a U.S. exporter sells goods, where the price of good is stated in foreign currency, then the U.S. exporter will receive foreign currency and will sell the foreign currency in exchange for dollars. If instead the U.S. exporter's contract is stated in dollars, then the foreign buyer must buy dollars by selling foreign currency. Either way, a U.S. export (or any transaction that produces a credit in the U.S. balance of payments accounts) produces sales of foreign currency and a purchase of dollars. Similarly, a U.S. import (or any transaction that produces a debit in the U.S. balance of payments accounts) produces purchases of foreign currency and a sale of dollars. The purchase and sale of foreign exchange is conducted on the **foreign exchange market**.

The foreign exchange market is comprised of all the banks and foreign exchange dealers located around the world where one currency can be traded for another. Dollars can be exchanged for **Euros** in Tokyo, London, and Bonn, as well as in New York and Paris. The **exchange rate** between the U.S. dollar and foreign currency can be expressed as the dollar price of foreign currency, or as the foreign currency price of the dollar. Because one is the inverse of the other it is immaterial which is used, but it is standard to express the exchange rate as the dollar cost of foreign currency. Thus the exchange rate, *R*, for the British pound will be defined as

$$R = \$/£.$$

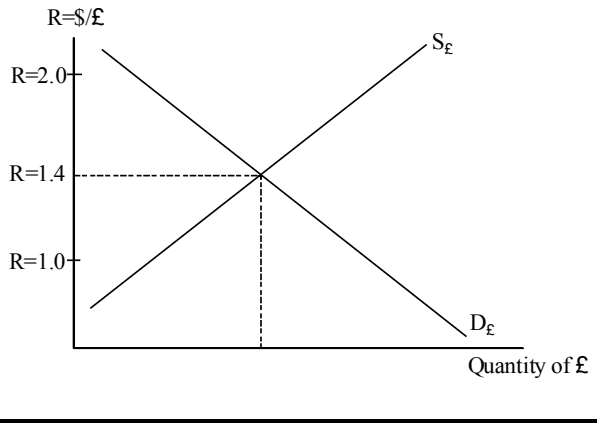
If R = 1.5, then it costs $1.50 to buy one British pound.

The total number of pounds sold on the dollar-pound foreign exchange market in any time period is determined by the willingness of owners of pounds, including U.K. residents as well as anyone else who owns pounds, to sell (supply) their pounds for U.S. dollars at a particular exchange rate, and by the willingness of those who own dollars to buy (demand) pounds.

As the exchange rate increases (more dollars per pound), the quantity of pounds supplied increases because to owners of pounds it appears as if U.S. goods and services have become cheaper relative to the same goods and services in the U.K.. A candy bar that costs $1 in the United States will cost pound holders £1 when R=1, but will cost pound holders only one-half of a pound

when R=2. Therefore, as R increases, those individuals who own pounds will purchase more goods and services in the United States. An increased R increases the quantity supplied of pounds to buy things in the U.S., producing the upward sloping supply, $S_{£}$, in Fig. 14.1.

Figure 14.1



The demand curve for pounds, $D_{£}$ in Fig. 14.1, is downward sloping, because as the dollar cost of pounds decreases, it appears as if goods and services in the United Kingdom are relatively cheaper, motivating increased purchases of U.K. goods and services and an increased quantity demanded for pounds by those who own dollars.

In a **flexible exchange-rate system (or floating-rate system)**, the price of foreign currency is determined solely by market conditions and so will move to equate the quantity supplied and quantity demanded, which occurs at R=1.4 in Fig. 14.1. The equilibrium exchange rate will change —**appreciate or depreciate**—as the demand and supply schedules shift. A shift to the right of the demand for pounds (increased demand for pounds) or a shift to the left in the supply of pounds (a decrease in the supply of pounds) will cause the pound to appreciate—increase in value to a higher dollar cost per pound. A shift to the left of the demand for pounds or a shift to the right of the supply curve will cause the pound to depreciate—decrease in value to a lower dollar cost. Note that an appreciation of the pound means a depreciation of the dollar and vice versa.

The popular press often draws attention to the change in the value of a currency relative to one of its trading partners, e.g., a depreciation of the dollar with respect to the Japanese yen, or depreciation of the euro with respect to the Canadian dollar. Although such bilateral exchange rates are important, exchange

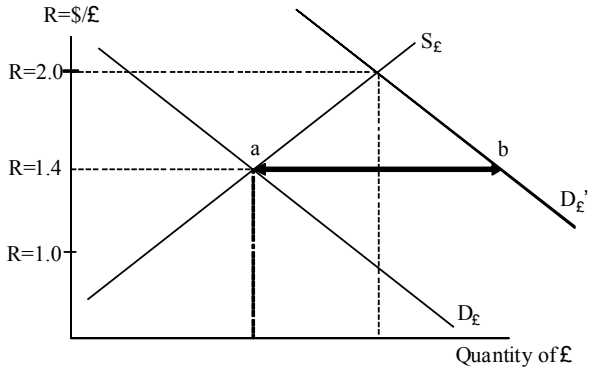
rates should also be considered relative to all trading partners. The general value of a currency is measured by the **effective exchange rate**, which is a weighted average of the value with respect to all other currencies, where the weights are usually determined by the relative importance of trade with each of the other nations.

Although many currencies can be purchased in many different financial centers, the cost of any one currency is the same in all locales due to **arbitrage** (riskless gain that requires no funds). If the U.S dollar cost of a pound is lower in Paris than the U.S. dollar cost of a pound in London, then arbitragers will buy pounds in Paris and simultaneously sell them in London, profiting from the difference. The act of buying in the cheap market will cause the cheap rate to rise, and the act of selling in the expensive market will cause the expensive rate to fall, until the rates are identical except for very small transaction costs. Arbitrage can also occur across three or more financial centers (triangular arbitrage). If dollars bought with francs in Paris can be converted to marks in New York more cheaply than directly using dollars to buy marks in Frankfurt, then arbitragers can profit from the difference, and will cause rates to be consistent everywhere in the world.

The supply and demand curves for foreign currency represent the autonomous balance of payments transactions described in Chapter 13. The autonomous transactions represent the purchases and sales of pounds by the private sector in order to buy and sell goods, services, and assets in the U.S. and the U.K.

If, in a floating-rate system, the demand for pounds increases from $D_£$ to $D_£'$, as shown in Fig. 14.2, the pound will appreciate to R=2.

Figure 14.2



In a floating-rate system, the exchange rate continually adjusts to produce an equality of outflows of a currency (quantity supplied) and inflows of a currency (quantity demanded), so the balance of payments for all autonomous transactions net to zero.

If, however, a nation wishes to adopt a **fixed exchange-rate system** and keep the exchange rate fixed at R=1.4, then the monetary authorities will have to intervene in the foreign exchange market. At R=1.4, there is an excess demand for pounds equal to the distance **ab**. In order to keep the exchange rate fixed the excess demand for pounds must be supplied by the monetary authorities. Either the United States must supply pounds (and buy dollars) from its foreign exchange reserve holdings of pounds, or the United Kingdom must satisfy the excess demand for pounds by buying dollars with newly created pounds. At R=1.4, the excess autonomous demand for pounds is equivalent to a deficit in the official settlements balance for the United States because there is a desired outflow of dollars that exceeds the desired inflow (an excess demand for pounds is an excess supply of dollars).

Of course, the United States could opt for a combination of a change in the exchange rate and a use of reserves, limiting the exchange rate to something in between R=1.4 and R=2.0. An exchange rate system in which some combination of exchange rate systems and intervention is used is called a **managed floating exchange-rate system**.

The exchange rate just discussed is the cost of currency for immediate (on-the-spot) delivery and so is referred to as the **spot rate**. There are a number of other types of foreign exchange transactions that are used by traders and investors to accomplish their objectives. One of these is a forward transaction. A forward transaction in the foreign exchange market is an agreement to buy or sell foreign exchange for future delivery at a price determined today. For example, the current spot rate for pounds may be R=1.4, while the current **forward rate**, FR, might be FR=1.39. This says that pound may be bought or sold at today's forward rate, $1.39/£, with settlement to occur in the future. Standard maturities of forward contracts are for one month, three months, and six months. If you agree to buy pounds in the one-month forward market and the current forward rate is FR=$1.39/£, then in one month you will be obligated to buy the contracted number of pounds and deliver $1.39 per pound bought. Notice that the forward rate locks in a price that does not change no matter what happens to the spot rate over the next month.

If the forward rate is less than the current spot rate, then forward currency is said to be selling at a **forward discount**. If the forward rate exceeds the current spot rate, then forward currency is selling at a **forward premium**. Forward discounts and premia are often expressed as a percentage of the spot rate, with an adjustment for the time period to express the result on an annual basis.

Foreign exchange futures are roughly equivalent to forward currency transactions. The principal difference is that futures are standardized with respect to denomination and the date at which the contract matures (rather than the length of maturity) and the size of the transaction. Also, futures transactions can be "undone" at any point before maturity while forward positions must be maintained until maturity.

A **currency swap** is a combination of a spot transaction and a forward transaction. In a currency swap, one party agrees to sell a currency at the current spot rate and to buy it back in the future at a price agreed upon today. (The other party to the transaction agrees to do the opposite.) Currency swaps can be ongoing rather than one-time transactions, meaning that the parties to the transaction agree to continually swap currencies every month. Ongoing currency swaps are equivalent to a series of spot and forward transactions. Currency swaps, especially ongoing currency swaps, are useful because there are fewer transactions, and therefore smaller transaction costs, than entering into a series of separate spot and forward transactions.

Foreign exchange options are similar to foreign exchange forward and futures transactions in that they allow future transactions at prices negotiated today, but they do differ in one crucial respect. Options confer the *right* to sell (a put option), or a *right* to buy (a call option) foreign exchange in the future, but not the obligation to buy or sell. That is, futures and forward contracts must be honored, but buyers of put options and buyers of call options can allow the option to lapse without completing the transaction. Sellers of put and call options, known as option writers, must honor if the buyer chooses. Unlike futures transactions which have no contract costs, options cost the buyer of the option a price (generally ranging from 1 to 5% of the value of the contract). (Of course, both futures transactions and options transactions do require fees and commissions that are paid to brokers that manage the transactions.)

The markets for forward, futures, swap, and options transactions in the

foreign exchange market are examples of derivative markets, and like any derivative market, allow two basic types of strategies by participants in the market. First, they allow traders and investors to **hedge** their foreign exchange positions, meaning to reduce or eliminate the risk associated with foreign exchange exposure. For example, a U.S. exporter may sell goods to a French firm, where the terms of the contract give the French firm 30 days to deliver the agreed upon number of euros. (It is assumed that the contract is denominated in euros.) The exporter is exposed to **foreign exchange risk** because the euro may depreciate by the time euros are delivered. If the euro converts into fewer dollars than anticipated, the exporter may realize a loss on the sale of goods to the French firm. In this case, the U.S. exporter is "open" or “exposed” to exchange-rate fluctuations. The exporter can "close," or hedge, the exposure in a number of ways by using foreign exchange derivatives.

One strategy is to *sell* the anticipated euro proceeds on the forward or futures market. Recall that a forward contract allows the sale (or purchase) of currency at a rate agreed upon today. Thus the exporter can lock in a known forward price today in the forward market. When the euros are received, they can be converted to dollars at the previously contracted forward rate. If the current forward rate is acceptable to the firm, then the goods can be exported with no fear of a change in the exchange rate. The forward contract does, though, eliminate the gains from any favorable change in the spot exchange rate as well as the losses from unfavorable changes in the spot exchange rate.

The U.S. exporter could also buy the option to sell foreign exchange (buy a put). If the exchange rate turns against the importer, then the option could be exercised. If the change in the spot exchange rate is favorable, then the option could be allowed to lapse and the francs sold at the favorable spot rate. Remember, though, there is a cost to the option that must be paid, much like an insurance premium that must be paid whether an insurance claim is made or not.

Hedging eliminates exchange risk through the use of forward, futures, and options contracts. Derivatives are also excellent vehicles for assuming risk, i.e., **speculation**. If you expect the pound to appreciate, you can speculate in the pound by buying it now (in the spot market) and waiting for it to appreciate. Buying pounds outright, however, requires a current use of funds. You can speculate on an appreciation of the pound much more cheaply by buying pounds in the forward or futures market, or by buying a call option on pounds. If the pound appreciates, then you can buy at the contracted price stipulated in the forward, futures, or options contract, and sell at the higher spot rate.

Speculators can serve a very useful function in foreign exchange markets. If speculators are correct, on average, about the future movements of a currency, then they will, on average, buy when the currency is low and sell when it is high. Buying at a low price will increase the price; selling when it is high lowers the price. Thus, if speculation is, on average, correct it will reduce the peaks and valleys of exchange rate movements. Such speculation is **stabilizing speculation**. If, on the other hand, speculators sell when the currency is low, making its value even lower, and buy when it is high, making its value even higher, then speculation is **destabilizing speculation**.

When speculation occurs in the spot market, say buying a currency when the value of the currency is expected to increase in value, the foreign exchange purchased is not held in the form of currency. Rather, it is held in the form of interest-bearing deposit accounts. Thus speculators must consider not only the changes in the value of a currency, but also the interest rate in foreign markets relative to the interest rate that could be earned in the home market. Taking advantage of differences in interest rates and expected changes in currency values is called **uncovered interest arbitrage**, uncovered referring to the fact that such transactions are *not* hedged, i.e., *not* covered. (Although the term "uncovered interest arbitrage" is conventionally used here, the term "arbitrage" is not correct because there is risk. Recall that true arbitrage is riskless.)

Letting i* be the foreign interest rate, the expected return on a foreign investment is

$$i^* + \frac{[E(SR) - SR]}{SR}$$

where SR is the current spot rate and E(SR) is the expected spot rate when the foreign asset matures. [E(SR)-SR]/SR is the expected gain (or loss) on the foreign exchange conversion from buying and selling a foreign asset, expressed as a fraction of the spot rate. If you buy a foreign asset when the spot rate is SR=1.4 and expect to sell your foreign exchange at maturity at a value of 1.5, then E(SR)=1.5, and the expected gain from currency conversion is [1.5-1.4]/1.4 = .071, or 7.1%. If the foreign interest rate is 5%, then the expected gain on a foreign deposit is 12.1%. If this exceeds the domestic interest rate, i, then funds will flow abroad. If the domestic interest rate exceeds 12.1%, then funds will flow to the domestic market. **Uncovered interest parity** occurs when the two are equal, i.e.,

$$i = i^* + \frac{[E(SR) - SR]}{SR}$$

Suppose

$$i < i^* + \frac{[E(SR) - SR]}{SR}$$

Funds will flow abroad causing an increased demand for foreign currency, which will cause the spot rate, SR, to increase. As SR increases, $\frac{[E(SR)-SR]}{SR}$ will decrease and cause the right-hand side of the equality to decrease. Also, a movement of funds abroad is a greater supply of funds to the foreign market, which will decrease i^*, and a reduced supply of fund to the domestic market, which will increase i, the movements of which move to create equality of i and $i^* + \frac{[E(SR)-SR]}{SR}$.

Funds will continue until uncovered interest parity holds. Uncovered interest parity can only be expected to be approximately true because the expected spot rate is not known with certainty, so investors may require an exchange-risk premium to enter into the risky transaction. (In general the greater the risk of a transaction the greater will be the return required by an investor to compensate for that risk.) (**Carry trade** is conceptually the same as uncovered interest arbitrage. Carry trade is the practice of borrowing currencies where the cost of borrowing is low in order to fund lending in currencies where the return for lending is high. Such transactions are profitable only if the high interest yield currency does not depreciate by the difference.)

Investors in foreign currency can choose to eliminate foreign exchange risk. Instead of buying a foreign asset and remaining open to exchange rate changes, the expected proceeds can be sold in the forward market at a known forward rate. In this case the proceeds will be sold at the forward rate, indicated by FR. Now the return on a foreign investment is

$$i^* + \frac{FR - SR}{SR}$$

Because FR is known with certainty at the time of the transaction, the return, including the return from selling the proceeds at the forward rate and buying at the spot rate, is known with certainty. Now if $i < i* + [FR - SR]/SR$, then funds will flow abroad, causing an increased demand in the spot market, causing SR to increase as before. In addition, there will be increased sales in the forward market, causing FR to decrease. The movement of funds will also increase i and

decrease $i*$. These changes will produce an equality of total returns in both currencies, so

$$i = i^* + \frac{FR - SR}{SR}$$

This equality is called **covered interest arbitrage parity (CIAP)**, or **covered interest rate parity**. Because there is no uncertainty associated with holding foreign securities when the position is hedged, covered interest rate parity can be expected to hold precisely, except for small transaction costs. Empirical evidence does support the existence of covered interest arbitrage parity.

Interestingly, an investor can invest in U.S. dollars not only in the U.S. market, but also in U.S. dollars in other countries. Deposit accounts denominated in dollars outside the U.S. market, e.g., a dollar deposit in London, are called **Eurodollars**. Such deposits have also become available in other major currencies like the euro, the Japanese yen, and the British pound, so the market is referred to more generally as the **Eurocurrency market** or as **offshore deposits**. The better term seems to be "offshore deposits" because the market for such currencies flourishes both in and outside Europe.

The primary reason for the growth of the Eurodollar market since the 1960s is that the market is not subject to the regulations of the home nation. For example, deposits in the U. S. were subject, until the mid-1980s to an interest rate ceiling that did not apply outside the U.S. If rates outside the U.S. exceeded the ceiling, then markets outside the U.S. for dollar deposits would develop. Similarly, communist nations during the cold war established accounts outside the U.S. for fear that they would be frozen in times of crisis. This fear of regulation in the U.S. by the communist nations produced a demand for dollar deposits outside the U.S. (Although dollar deposits off of U.S. soil are allowed by other nations, non-dollar accounts located in the U.S. are not permitted.)

The Eurocurrency market is a short-term market, but has been extended by participating nations to longer-term notes and bonds called **Eurobonds and Euronotes**. The distinction between notes and bonds is simply one of maturity. Bonds are long term (e.g., 10- and 30-year maturities) and notes are medium term (5-year maturities). Thus, a U.S. manufacturer can raise funds in Germany by issuing bonds denominated in euros.

Although the Eurocurrency markets provide distinct benefits, there are potential costs. For example, the large Eurodollar market, for example, means

that it may be more difficult for the United States to conduct monetary policy. If the United States attempts to reduce the money supply in order to curb lending to control inflation, the funds may be borrowed in the Eurodollar market. Although the effect is relatively small for the large U.S. economy, it can be significant for smaller economies. Additionally, the Eurodollar is unregulated. To the extent that regulations help avoid financial crises, the Eurodollar market increases the probability of such crises occurring.

III. Questions

1. Describe the forward transaction necessary to hedge the transactions described below:

a) A U.K. firm imports wine from Germany, agreeing to deliver Euros in thirty days

b) A U.S. bank lends dollars to a French bank and agrees to accept Euros in thirty days

c) A Canadian investor buys a one-year U.S. government security

d) A U.S. firm borrows Japanese yen and agrees to repay the yen in ninety days

e) A U.S. importer expects to receive Japanese yen in thirty days and borrows an equivalent amount of yen in Tokyo today, and converts the yen to dollars today

2. a) The dollar price of British pounds in Tokyo and Bonn are as shown below:

Tokyo	Bonn
R = $/£ = 1.45	R = $/£ = 1.40

Explain why the above is a disequilibrium situation and what will happen to force the two prices towards equality.

b) Suppose the exchange rates in three financial centers are as shown below:

New York	London	Paris
R=$/£=1.45	R=$/euro=0.20	R=euro/£ = 7

If you have dollars and are interested in buying pounds, where would you obtain them?

c) Explain why the situation presented in the table in part b) is a disequilibrium situation and what will happen to produce equilibrium.

3. Explain three ways to bet on your forecast of an increase in the dollar value of the yen.

4. a) Use uncovered interest parity combined with covered interest parity to show what the relationship is between the expected future spot rate and the current forward rate.

b) In part a) you found the implied relationship between the expected future spot rate and the current forward rate. What is the direct (as opposed to implied) cause of this relationship?

c) Do you think the relationship that you found in part a) is precise? Why?

5. Assume that the foreign exchange market is initially in equilibrium. What effect will the following changes have on the dollar value of the yen ($/¥) if exchange rates are allowed to float freely? Use foreign exchange supply and demand curves to explain your answer.

a) An increase in interest rates in Japan

b) Lowered incomes in the U.S. (recession)

c) A reduction in import barriers in Japan

d) An increase in inflation in the U.S.

6. Assume the foreign exchange market is initially in equilibrium and the United States has decided to keep its exchange rate fixed relative to the yen. Explain the effect each of the changes in Question 5 will have on U.S. reserves.

7. Suppose $i > i* + [FR - SR]/SR$. How will (covered) interest arbitragers respond, and what effect will this have on the inequality?

8. Suppose IBM sells computers in Japan and receives revenues in yen. IBM's expenses however are in dollars.

a) Does IBM risk an appreciation or depreciation of the yen?

b) What can IBM do in the forward market to eliminate the risk you described in part a?

c) What can IBM do in the swap market to eliminate the risk of part a?

9. Why might U.S. companies wish to issue bonds denominated in Euros?