

## Chapter 20: The Foreign Exchange Market

# 1 Foreign Exchange Market

- the exchange rate: the price of one currency in terms of another
- Figure 1

## 1.1 What Are Foreign Exchange Rates?

- spot transactions - the spot exchange rate
- forward transactions - the forward exchange rate

- appreciation of a currency
- depreciation of a currency

## **1.2 Why Are Exchange Rates Important?**

When a country's currency appreciates (rises in value relative to other currencies), the country's goods abroad become more expensive and foreign goods in that country become cheaper (holding domestic prices constant in the two countries). Conversely, when a country's currency depreciates, its goods abroad become cheaper and foreign goods in that country become more expensive.

## 2 Exchange Rates in the Long Run

### 2.1 Law of One Price

Imagine that two countries produce an identical good (say steel) and that there are no transaction costs and trade barriers.

Suppose that American steel costs \$100 per ton.

Suppose that European steel costs 74 euro.

Suppose that the exchange rate is 1.351 dollars per euro.

Then the European steel costs \$100 ( $1.351 \cdot 74 \cong 100$ ).

## 2.2 Theory of Purchasing Power Parity

The theory of purchasing power parity (PPP) applies the law of one price to national price levels.

Suppose that the price level in the U.S. is  $P$ .

Suppose that the price level in Europe is  $P^F$ .

Suppose that the exchange rate is  $E$  (dollar/euro).

Then the law of one price of the U.S. average good and the European average good tells us that

$$EP^F = P \quad (1)$$

(after we adjust units of price levels in two countries to be comparable).

Dividing both sides by  $P^F$ , we obtain

$$E = \frac{P}{P^F} \quad (2)$$

So the exchange rate should move with relative national price levels.

If the European price level rises 10% relative to the U.S. price level, then the dollar will appreciate against the euro.

See Figure 2.

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

- Goods in different countries are not identical.
- Some goods and services are not traded across borders: housing, land, services such as restaurant meals, haircuts, and golf lessons.

## **2.4 Factors That Affect Exchange Rates in the Long Run**

We will consider only one factor that affect exchange rates in the long run in this course.

Relative Price Levels: PPP theory

In the long run, a rise in a country's price level (relative to the foreign price level) causes its currency to depreciate, and a fall in the country's relative price level causes its currency to appreciate.

### **3 Exchange Rates in the Short Run**

Exchange rates are very volatile in the short run: sometimes exchange rates exhibit changes of several percent from day to day.

## 4 The Interest Parity Condition

The asset approach focuses on the asset markets in the short run.

Consider a world economy with two countries.

Imagine that domestic bonds are denominated in dollars and that the interest rate is  $i_t^D$  in period  $t$ , and that foreign bonds are denominated in euros and have  $i_t^F$ . We consider risk-free short-term bonds here. Let us compare expected returns on the U.S. bonds with those on the foreign bonds in terms of dollars.

Let  $RET_t^F$  be the expected rate of return on foreign bonds in terms of dollars. In order to see the relationship between  $RET_t^F$  and exchange

rates, suppose that the exchange rate  $E_t$  means that 1 euro is worth  $E_t$  dollars today. Imagine that a U.S. investor buys \$1 worth of the foreign bonds. Today, in period  $t$ , \$1 is converted into  $1/E_t$  euros, and  $1/E_t$  euros worth of the foreign bonds are purchased. At time  $t + 1$ , the investor will receive  $(1/E_t)(1 + i_t^F)$  euros. The money must be converted into dollars for the U.S. investors to buy goods. Let  $E_{t+1}^e$  be the expected exchange rate. Then the investor expects  $\$E_{t+1}^e(1/E_t)(1 + i_t^F)$  from this investment of \$1 at  $t$ . Thus  $RET_t^F = (E_{t+1}^e/E_t)(1 + i_t^F) - 1$ . It is convenient to simplify this expression, using the log approximation introduced in Chapter 4 above:

$$RET_t^F \cong \log(1 + RET_t^F) = \log\left(\frac{E_{t+1}^e}{E_t}(1 + i_t^F)\right) \quad (3)$$

$$= \log(1 + i_t^F) + \{\log(E_{t+1}^e) - \log(E_t)\} \quad (4)$$

$$\cong i_t^F + \frac{E_{t+1}^e - E_t}{E_t} \quad (5)$$

We employ this simplified expression

$$RET_t^F = i_t^F + \frac{E_{t+1}^e - E_t}{E_t} \quad (6)$$

Let  $RET_t^D$  be the expected return from the domestic bonds in terms of dollars. Then, simply,

$$RET_t^D = i_t^D \quad (7)$$

Because we assume that economic agents are risk neutral, these two returns must be the same when the bond markets clear.

$$i_t^D = i_t^F + \frac{E_{t+1}^e - E_t}{E_t} \quad (8)$$

must hold. This equation is called the (uncovered) *interest parity condition*.

## 5 Equilibrium in the Foreign Exchange Market

Imagine that  $i_t^D$ ,  $i_t^F$ , and  $E_{t+1}^e$  are given. The expected exchange rate is considered as being determined mainly by PPP in long run. Hence it is reasonable to treat  $E_{t+1}^e$  as given. We will see how changes in monetary policy might affect  $E_{t+1}^e$  below.

Note that

$$RET_t^F = i_t^F + \frac{E_{t+1}^e - E_t}{E_t} \quad (9)$$

as in (6).

Here  $E_t$  and  $RET_t^F$  are negatively related.

On the other hand,  $RET_t^D$  does not depend on  $E_t$ .

Both  $RET_t^F$  and  $RET_t^D$  are plotted against  $E_t$  in an *expected return diagram* Figure 1.

## 6 Explaining Changes in Exchange Rates

### 6.1 Factors That Shift Expected Return Schedules

#### 6.1.1 Changes in the Foreign Interest Rate, ( $i^F$ )

Suppose that the foreign interest rate  $i_t^F$  rises with  $E_{t+1}^e$  being constant. The curve for the expected return on foreign bonds shifts to the right.

**Problem 1:** Suppose that the expected future exchange rate  $E_{t+1}^e$  falls with  $i_t^D$  and  $i_t^F$  being constant. Explain what will happen to  $E_t$  by using an expected return diagram.

### 6.1.2 Changes in the Expected Future Exchange Rate, ( $E_{t+1}^e$ )

Suppose that the expected future exchange rate  $E_{t+1}^e$  rises with  $i_t^F$  constant. The curve for the expected return on foreign bonds shifts to the right.

**Problem 2:** Suppose that the domestic interest rate  $i_t^D$  falls with  $E_{t+1}^e$  and  $i_t^F$  being constant. Explain what will happen to  $E_t$  by using an expected return diagram.

### 6.1.3 Changes in the Domestic Interest Rate, ( $i^D$ )

Suppose that the domestic interest rate  $i_t^D$  rises. The curve for the expected return on domestic bonds shifts to the right.

**Problem 3:** Suppose that the domestic interest rate  $i_t^D$  falls with  $E_{t+1}^e$  and  $i_t^F$  being constant. Explain what will happen to  $E_t$  by using an expected return diagram.

## 6.2 Changes in the Money Supply and Exchange Rates

Suppose that the money supply has been constant and unexpectedly increases today at  $t$  in the domestic country (say, United States). The money supply is expected to stay at the new level forever. We assume that the expected inflation stays at zero. The foreign price level and the foreign interest rate are assumed to be constant.

The change in the money supply will affect the domestic price level and the domestic interest rate.

**1. The domestic price level:** We assume that the price is constant in this period *sticky prices*: the fact that the aggregate price level adjusts slowly over time.

In the long run, prices affect exchange rates through PPP. Recall that the law of one price of the U.S. average good and the foreign average good tells us that

$$EP^F = P \quad (10)$$

(after we adjust units of price levels in two countries to be comparable).

Dividing both sides by  $P^F$  (the foreign price level), we obtain

$$E = \frac{P}{P^F} \quad (11)$$

*monetary neutrality*

Money is likely to be neutral in the long run after all prices adjust to new economic environments.

Because  $M$  is greater,  $P$  need to increase in order for  $M/P$  to fall back to the original level in the long run.

Assume that prices are constant in this period, but the prices and exchange rate adjust so that money neutrality and PPP hold at  $t + 1$ .

PPP:  $E_{t+1} = P_{t+1}/P_{t+1}^F$ .

Because the foreign price is constant, the exchange rate rises as the domestic price rises (the dollar depreciates).

This expected increase in  $P$  causes  $E_{t+1}^e$  to increase.

This increase in  $E_{t+1}^e$  will shift the  $RET^F$  schedule to the right at time  $t$ .

**2. The domestic interest rate:** The interest falls from  $i_1$  to  $i_2$  in the U.S. as in Figure 2.

This will shift the  $RET^D$  schedule to the left at  $t$ .

Figure 3:

- The  $RET^D$  schedule shifts to the left because of a lower  $i^D$
- The  $RET^F$  schedule shifts to the right because  $E_{t+1}^e$  is higher.

Hence *a higher level of the domestic money supply causes the domestic currency to depreciate*. This depreciation is associated with lower domestic interest rates.

### 6.2.1 Exchange Rate Overshooting

Money neutrality in the long run

- $P$  rises so that  $M/P$  is constant.
- $i^D$  rises because the rise in  $P$  shifts the money demand curve to the right.

See Figures 4 and 5.

The phenomenon in which the exchange rate rises by more in the short run than it does in the long run when the money supply increases is called *exchange rate overshooting*.

See Figures 6-9 for time paths of U.S. economic variables.

The asset approach model is consistent with the stylized fact that exchange rates are volatile in the short run. The exchange rate overshooting implies

that small changes in the money supply can cause large fluctuations in exchange rates.