

## 17 The Foreign Exchange Market

### 17.1 Exchange Rates

**Def<sup>n</sup>:** *Exchange Rate* - The price of one currency in terms of another currency

Exchange rates are highly volatile. They have an impact not only on the economy but our daily lives. When the U.S. dollar becomes more valuable relative to foreign currencies, foreign goods become cheaper for Americans and American goods become more expensive for foreigners and vice versa. Fluctuations in the exchange rate affect both inflation & output which makes exchange rates an important concern for monetary policy makers. In the section, we will see how exchange rates impact our daily lives and why policy makers watch this market so closely.

**Def<sup>n</sup>:** *Appreciation (depreciation)* - When a currency increases (decreases) in value

**Example: 17.1.** On June 15<sup>th</sup>, 2014, the Russian Ruble was valued at \$0.029 dollars. Six months later, on Dec 15<sup>th</sup>, 2014, the Russian Ruble was valued at \$0.015 dollars.

In other words, the Russian Ruble depreciated by:

$$\frac{0.015 - 0.029}{0.029} = -0.482 \Rightarrow -48.2\%$$

Equivalently, we can put this in terms of the U.S. dollar by flipping the exchange rate: In June 2014

$$0.029 \times \frac{\$}{\text{Ruble}} \Rightarrow \frac{1}{0.029} \times \frac{\text{Rubles}}{\$} = 34.65 \times \frac{\text{Rubles}}{\$}$$

Applying this to Dec 2014, the U.S. dollar was valued at 67.91 Rubles. Thus, the U.S. dollar appreciated by:

$$\frac{67.91 - 34.65}{34.65} = 0.959 \Rightarrow 95.9\%$$

### Why are Exchange Rates Important?

Because they affect the relative price of domestic and foreign goods. Consider the following example:

**Example: 17.2.** Suppose you want to buy an Audi S7 but it must be imported from Germany. If the price of this car is €82,000 and the exchange rate is \$1.42 \$/€, this car would cost you \$116,442 (€82,000 × \$1.42 \$/€) today.

Suppose you weren't sure about spending this amount of money on a car and you delay your purchase for two months. During this time the exchange rate has changed and is now \$1.70 \$/€. If the price in Germany remained at €82,000, your cost in dollars would increase to \$139,400 (€82,000 × \$1.70 \$/€).

Now suppose at the same time, a German citizen estimates the cost of his U.S. vacation at \$5,000. Originally, at \$1.42 \$/€, his trip would cost him €3520. If he delayed his purchase two months, his trip would cost him €2490. Thus, the appreciation of the euro makes U.S. goods cheaper.

**Conclusion:** All else equal, when a country's currency appreciates, their goods sold to foreigners become more expensive and foreign goods sold in that country become cheaper. Conversely, when a country's currency depreciates, their goods sold to foreigners become cheaper and foreign goods sold in that country become more expensive.

### How is FX traded??

Foreign Exchange is not traded on exchanges such as the NYSE. It is set up as an over-the-counter market which several hundred dealers (mostly banks) buy and sell deposits denominated in foreign currencies.

Although it is commonly referred to as "buying" foreign currency, they do not take a fistful of dollar bills and sell them for euro notes. Most trades involve buying/selling bank deposits denominated in different currencies. The volume of this market is about \$ 4 trillion per day.

## 17.2 Exchange Rates in the Long Run

### 17.2.1 Law of One Price

What are the long-run determinants of exchange rates?

**Def<sup>n</sup>:** *Law of One Price* - If two countries produce an identical good, the price of the good should be the same throughout the world no matter which country produces it (assumes transportation costs and trade barriers are significantly low).

**Example: 17.3.** Suppose that American steel costs \$100 per ton and the identical Japanese steel costs ¥10,000 yen per ton. For the *Law of One Price* to hold, the exchange rate must be  $\frac{¥10,000}{\$100} = 100 ¥/\$$ . If this did not hold and instead the exchange rate is 200 ¥/\$, Japanese steel would sell for \$50 per ton in the U.S. or U.S. steel would sell for ¥20,000 per ton in Japan. This would cause demand for American steel to converge to zero resulting in excess supply which can only be eliminated if the exchange rate falls to equilibrium of 100 ¥/\$

A prominent theory of exchange rate applies this Law of One Price to national price levels rather than to individual prices of goods:

### 17.2.2 Theory of Purchasing Power Parity

**Def<sup>n</sup>:** *Purchasing Power Parity (PPP)* - The exchange rates between any two currencies will adjust to reflect changes in the prices levels of the two countries.

**Example: 17.4.** Suppose the yen price of steel increases by 10% (¥11,000 per ton) while the American price remains constant at \$100 per ton. For the *Law of One Price* to hold, the exchange rate must rise to ¥110 per dollar. In other words, the U.S. currency must have appreciated by 10%.

Another way to think about purchasing power parity is through the concept of trading “stuff.”

**Def<sup>n</sup>:** *Real Exchange Rate* - The rate at which domestic goods can be exchanged for foreign goods.

**Example: 17.5.** Suppose the nominal exchange rate is 100 ¥/\$. If the cost of a basket of drugs is \$50 in the U.S. and it is ¥7,500 in Japan (\$ 75), what is the real exchange rate?

$$\text{real exchange rate} = \frac{\$50}{\$75} = 0.66$$

Because it is below one, this indicates that it is cheaper to buy the drugs in the U.S. Currently, the real exchange rate for the U.S. dollar is low against many other currencies. This is why cities like New York are overwhelmed with foreign tourists going to shopping sprees.

**Example: 17.6.** Use the previous example to answer: if PPP holds, what is the real exchange rate?

The theory of PPP suggests that if one country's price level rises relative to another, its currency should depreciate and the other currency should appreciate. However, this predication only works in the long-run and is only partially correct then.

#### Does the PPP theory work?

Over the last 40 years, British prices have increased about 94% relative to the U.S. price level. PPP theory suggests the dollar should appreciate vs. the pound which it did. However, only by 53% which is much smaller compared to the price increase. Even though it can offer guidance in the long-run, it is a very poor predictor in the short-run. Why? Conclusions are based on unrealistic assumptions:

1. All goods are identical
2. Low trade barriers
3. Low transportation cost
4. All goods are traded

### 17.3 Factors that Affects the Exchange Rate in the Long Run

If a factor increases the demand for domestic goods relative to foreign goods then the domestic currency will appreciate because domestic goods will continue to sell well even when the value of the domestic currency is higher.

There are four major factors that affect the exchange rate in the long-run:

#### 1. Relative Price Levels

- A rise in the domestic price level (relative to foreign) causes the domestic currency to depreciate

$$E = \frac{P^{Foreign}}{P^{Home}} = \frac{P^{Foreign}}{P^{Home} \uparrow} \Rightarrow E \downarrow \text{ (Home depreciation)} \quad (17.1)$$

#### 2. Trade Barriers

- Increasing trade barriers causes a country's currency to appreciate.
  - For example, currently, the Brazilian Real (R\$) is valued at R\$3 per U.S. dollar. Also, assume the price of sugar is R\$ 18 per pound in Brazil and \$ 6 per pound in the U.S. The implied exchange rate ( $E$ ) is:

$$E = \frac{P^{BRA}}{P^{US}} = \frac{R\$18.00}{\$6.00} \Rightarrow R\$3 \text{ per US\$} \quad (17.2)$$

- Now, suppose the U.S. wants to protect its sugar industry (which is currently does). To do this, it places an import tax on foreign sugar. This will effectively make foreign sugar price increase.

$$E = \frac{P^{BRA}}{P^{US}} = \frac{R\$24.00}{\$6.00} \Rightarrow R\$4 \text{ per US\$} \quad (17.3)$$

- U.S. currency will appreciate as it takes more Real to get the same amount of Dollars.

#### 3. Preferences for domestic vs. foreign goods

- Increased demand for a country's exports causes its currency to appreciate
  - Suppose The Japanese develop an appetite for American goods, the increased demand for American goods (exports) tends to appreciate the dollar. This is because the American goods will continue to sell well even at a higher value for the dollar.
- Increased demand for imports causes the domestic currency to depreciate
  - Suppose the Americans start to fancy German cars. This increases the demand for German goods (American imports) will depreciate the dollar.

#### 4. Productivity

- When productivity in a county rises, it tends to rise the domestic sectors that produce traded goods rather than nongraded goods. Operating more efficiently causes the price of domestically produced traded goods to fall.
- Higher productivity relative to foreign will appreciate the domestic currency.

$$E = \frac{P^{Foreign}}{P^{Home}} = \frac{P^{Foreign}}{P^{Home} \downarrow} \Rightarrow E \uparrow \text{ (Home appreciation)} \quad (17.4)$$

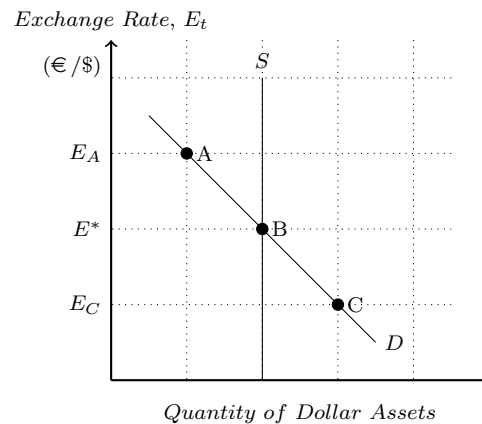
## 17.4 Exchange Rates in the Short Run

The exchange rate is the price of domestic assets (bank deposits, bonds, etc.) and like the price of any good, it is determined by the interaction of supply and demand.

### 17.4.1 Supply Curve for Domestic Assets

To simplify the analysis, we treat the U.S. as the home or domestic country and the European Union as the foreign country. This implies all domestic assets are denominated in dollars and foreign assets are denominated in euros.

The supply curve relies on the quantity of dollar assets (bank deposits, bonds, equities) supplied in the U.S. For our purposes, we can take this amount to be fixed with respect to the exchange rate. Thus the quantity supplied at any exchange rate is the same.



### 17.4.2 Demand Curve for Domestic Assets

Demand curve displays the quantity demanded at each current exchange rate by holding all else equal.

#### Deriving the Demand Curve:

Suppose the future exchange rate is held constant at  $E_{t+1}^e = E_A$ . If the exchange rate were to drop below  $E_A$ , say  $E_C$ , the dollar would be expected to appreciate. The expected appreciation of the dollar implies a expected return on dollar assets. The theory of portfolio choice tells us that because the dollar assets are more desirable to hold the quantity of dollar assets demanded will rise.

## 17.5 Shifting Demand

As I previously mentioned, the quantity of domestic assets demanded depends on the relative expected return of dollar assets. To help you better understand which direction demand is going to shift, assume you are an investor who is considering putting funds into dollar assets. Holding all else constant, when a some factor changes, decide whether you would earn a higher or lower expected return on dollar assets vs. foreign assets.

#### Factors that shift Demand:

1. Domestic Interest Rate:  $i^D \uparrow \Rightarrow D \uparrow \Rightarrow E_t \uparrow$  (Dollar Appreciates)
  - Return on dollar assets increases relative to foreign assets. People want to hold more dollar assets.  
 $\Rightarrow$  The quantity of dollar assets demanded increases at every exchange rate
2. Foreign Interest Rate:  $i^F \uparrow \Rightarrow D \downarrow \Rightarrow E_t \downarrow$  (Dollar Depreciates)
  - Return on dollar assets falls relative to foreign assets. People want to hold less dollar assets.  
 $\Rightarrow$  The quantity of dollar assets demanded decreases at every exchange rate
3. Expected Future Exchange Rate:  $E_{t+1}^e \uparrow \Rightarrow D \uparrow \Rightarrow E_t \uparrow$  (Dollar Appreciates)
  - The demand for domestic assets depends on the future resale price.
  - Any factor causing  $E_{t+1}^e$  to rise will increase the expected appreciation of the dollar resulting in  
 $\Rightarrow$  higher relative expected return on dollar assets which increases current dollar demand

4. Expected Domestic Price Level $\uparrow \Rightarrow E_{t+1}^e \downarrow \Rightarrow D \downarrow \Rightarrow E_t \downarrow$  (Dollar Depreciates)
- PPP theory suggests, if high U.S. price level expected to persist, the dollar should depreciate
  - This means a high U.S. price level should lower  $E_{t+1}^e$   
 $\Rightarrow$  Causing relative expected return on dollar assets to fall. Thus, current dollar demand falls
5. Expected Trade Barriers $\uparrow \Rightarrow E_{t+1}^e \uparrow \Rightarrow D \uparrow \Rightarrow E_t \uparrow$  (Dollar Appreciates)
- More Relative Domestic Trade Barriers will increase the relative demand for domestic goods
  - This increases the expected return on dollar assets causing demand of dollar assets to increase  
 $\Rightarrow$  As a result,  $E_t$  will rise and the dollar will appreciate
6. Expected Import Demand $\uparrow \Rightarrow E_{t+1}^e \downarrow \Rightarrow D \downarrow \Rightarrow E_t \downarrow$  (Dollar Depreciates)
- When expected import demand rises, Americans convert dollars to purchase foreign goods
  - Thus, flooding the market with dollars, we expect the dollar to depreciate in the long run
  - This decreases the expected return on dollar assets which decreases the demand of dollar assets  
 $\Rightarrow$  As a result,  $E_t$  will fall and the dollar will depreciate
7. Expected Export Demand $\uparrow \Rightarrow E_{t+1}^e \uparrow \Rightarrow D \uparrow \Rightarrow E_t \uparrow$  (Dollar Appreciates)
- When expected export demand rises, foreigners convert their currency to purchase U.S. goods
  - Thus, there's an increase in demand for dollars, we expect the dollar to appreciate in the long run
  - This increases the expected return on dollar assets which increases the demand of dollar assets  
 $\Rightarrow$  As a result,  $E_t$  will increase and the dollar will appreciate
8. Expected Productivity $\uparrow \Rightarrow E_{t+1}^e \uparrow \Rightarrow D \uparrow \Rightarrow E_t \uparrow$  (Dollar Appreciates)
- When productivity is expected to increase, the dollar is expected to increase in the long run
  - This increases the expected return on dollar assets which increases the demand of dollar assets  
 $\Rightarrow$  As a result,  $E_t$  will increase and the dollar will appreciate