

Exchange Rates

We will always consider exchange rates as the \$ price of a unit of foreign currency.

$e_f = \$ / \text{unit of foreign currency}$

E.g.  $e_{\pounds} = \$1.61 / \pounds$  That is, to obtain 1  $\pounds$ , you must give up \$1.61.  
 $e_{\yen} = \$0.01 / \yen$  This is, to obtain 1 Yen, you must give up \$0.01  
 $e_{\text{C}\$} = \$0.67 / \text{C}\$$  To obtain 1 Canadian \$, you must give up \$0.67

- A rise in  $e_f$  means the foreign currency is more expensive.

Consider an increase from \$1.61 /  $\pounds$  to \$1.65 /  $\pounds$ . You must now give up an additional \$0.04 to obtain the  $\pounds$ .

- A fall in  $e_f$  means the foreign currency is less expensive.

Consider a fall from \$1.61 /  $\pounds$  to \$1.57 /  $\pounds$ . You now only must give up \$1.57 for a  $\pounds$  instead of \$1.61.

To determine the \$ price of a foreign good:

$$P^{US} = e_f * P^f \quad (\text{for the } i^{\text{th}} \text{ good})$$

The price of the  $i^{\text{th}}$  good denominated in dollars = the foreign exchange rate \* the price of the good denominated in the foreign currency.

To determine the price in a foreign nation's currency of a US Good, rearrange:

$$P^f = P^{US} / e_f$$

The price of the  $i^{\text{th}}$  good (denominated in the foreign currency) = the price of the good denominated in \$ divided by the exchange rate.

Example: Beatles Album

Consider a Beatles album (made only in England). Its price is  $\pounds 10$  ( $P^f = \pounds 10$ ). Initially,  $e_f = \$1.61 / \pounds$ .

What is the U.S. price of the album?

$$P^{US} = e_f * P^f = (\$1.61 / \pounds) * \pounds 10 = \$16.10 \text{ (notice the } \pounds \text{ cancels out).}$$

Suppose the exchange rate rises to \$1.65 /  $\pounds$ . What is the US price?

$$P^{US} = e_f * P^f = (\$1.65 / \pounds) * \pounds 10 = \$16.50$$

What is the exchange rate falls to \$1.57 /  $\pounds$ . What is the US price?

$$P^{US} = e_f * P^f = \$1.57 / \pounds * \pounds 10 = \$15.70$$

Recall from above that when  $e_f$  rises, foreign currency becomes more expensive. That is, it takes more \$ to obtain a unit of the foreign currency. When this occurs, the US price of foreign goods increases, as we saw above. As the exchange rate moved from \$1.61 /  $\pounds$  to \$1.65 /  $\pounds$ , the price of the album increased from \$16.10 to \$16.50.

Also, recall that when  $e_f$  falls, foreign currency becomes less expensive. That is, it takes fewer \$ to obtain a given unit of foreign currency. When this occurs, the US price of foreign goods decreases, as we saw

above. As the exchange rate fell from \$1.61 / £ to \$1.57 / £, the price of the album decreased from \$16.10 to \$15.70

Take a look symbolically

$P^{US} = e_f * P^f$  Simply looking at the equation, if  $e_f$  rises, it must be the case that  $P_1^{US}$  rises.

### Imports

If the price of the foreign good rises, people will purchase less of the good (1<sup>st</sup> Law of Demand). US consumers will purchase (import) fewer Beatles albums. If the price of the foreign good falls, people will purchase more of the good. US consumers will purchase (import) more Beatles albums.

Thus, when  $e_f \uparrow$ ,  $P^{US} \uparrow$ , and US imports  $\downarrow$ .

And, when  $e_f \downarrow$ ,  $P^{US} \downarrow$ , and US imports  $\uparrow$ .

### Example: Computers

Consider computers (made only in US). Its price is \$1610. Initially,  $e_f = \$1.61 / \text{£}$ .

What is the English (foreigner's) price of the computer?

$$P^f = P^{US} / e_f = \$1610 / (\$1.61 / \text{£}) = \text{£}1000$$

Be careful on the math... What this should look like is as follows:

$$P^f = \frac{\$1610}{\$1.61 / \text{£}} \quad \text{The dollar signs cancel out.}$$

Suppose the exchange rate rises to \$1.65 / £. What is the English price of the computer?

$$P^f = P^{US} / e_f = \$1610 / (\$1.65 / \text{£}) = \text{£}976$$

What is the exchange rate falls to \$1.57 / £. What is the US price?

$$P^f = P^{US} / e_f = \$1610 / (\$1.57 / \text{£}) = \text{£}1025$$

Look at  $e_f$  from a foreigner's perspective. When  $e_f$  rises, they get more \$ for the same one unit of foreign currency. Thus, dollars are less expensive, and US goods are less expensive. As the exchange rate moved from \$1.61 / £ to \$1.65 / £, (1 £ used to be able to buy \$1.61 but now it can buy \$1.65), the price of the computer fell from 1000 £ to 976 £.

Likewise, when  $e_f$  falls, they get fewer \$ for the same one unit of foreign currency. Thus, dollars are more expensive, and US goods are more expensive. As the exchange rate fell from \$1.61 / £ to \$1.57 / £ (1 £ used to be able to purchase \$1.61, now it can buy only \$1.57), the price of the computer increases from 1000 £ to 1025 £.

Take a look symbolically

$P^f = P^{US} / e_f$  Simply looking at the equation, if  $e_f$  rises, it must be the case that  $P^f$  falls.

### Exports

Now, apply the 1<sup>st</sup> law of Demand. In this case, we look at the goods that foreigners are purchasing from the US. These are US exports. When the foreign price falls, foreigners will purchase more US goods, and hence the US exports more goods to foreigners. When the foreign price rises, foreigners will purchase fewer US goods, and hence US exports (to foreigners) will fall.

Thus, when  $e_f \uparrow$ ,  $P^f \downarrow$ , and US exports  $\uparrow$ .  
 And, when  $e_f \downarrow$ ,  $P^f \uparrow$ , and US exports  $\downarrow$ .

Putting at all together

American's perspective

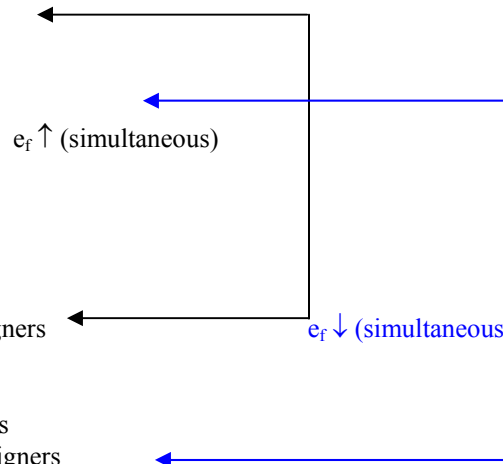
$e_f \uparrow \Rightarrow$  foreign currency more expensive  
 $\Rightarrow$  foreign goods more expensive  
 $\Rightarrow$  US imports less

$e_f \downarrow \Rightarrow$  foreign currency less expensive  
 $\Rightarrow$  foreign goods less expensive  
 $\Rightarrow$  US imports more

Foreigner's perspective

$e_f \uparrow \Rightarrow$  \$ are less expensive for foreigners  
 $\Rightarrow$  US goods less expensive for foreigners  
 $\Rightarrow$  US exports more

$e_f \downarrow \Rightarrow$  \$ are more expensive for foreigners  
 $\Rightarrow$  US goods more expensive for foreigners  
 $\Rightarrow$  US exports less



Net exports

Finally, net exports = exports - imports

$e_f \uparrow \Rightarrow$  US exports  $\uparrow$ , US imports  $\downarrow \Rightarrow$  US net exports  $\uparrow$   
 $e_f \downarrow \Rightarrow$  US exports  $\downarrow$ , US imports  $\uparrow \Rightarrow$  US net exports  $\downarrow$

What are the determinants of  $e_f$ . That, is, what causes  $e_f$  to change?

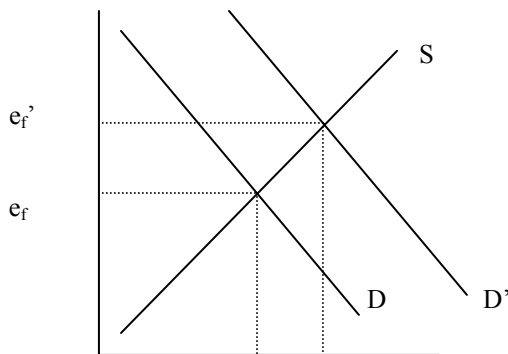
If you wish to purchase foreign goods, you must first obtain foreign currency. Most US consumers don't hold foreign currency, as they don't need it to conduct transactions. Likewise, most US producers won't accept foreign currency as a payment, as they want US dollars. Thus, if you want to buy goods in England, you must first get some pounds. If you are from England and want to purchase US goods, you must obtain US dollars. You don't hold on to foreign currency for kicks; you hold it when you want to purchase goods.

In this sense, the demand for foreign currency is a "derived demand". The demand for currency is derived from the underlying demand of US consumers wanting to purchase foreign goods. When US consumers want to purchase more foreign goods, they will demand more foreign currency to make these purchases. When foreign consumer want to purchase more US goods, they will demand more US \$ to make these purchases.

What are the things that will affect  $e_f$ ?

Suppose that suddenly, American consumers decide Japanese goods are more desirable and hence increase their demand for Japanese goods. This will then increase the demand for Yen, causing the price of Yen to increase (\$ / yen). The exchange rate is the price of Yen. Thus, this will increase the exchange rate for the Yen. (See graph below).

Below, I have drawn the supply and demand curve for foreign currency. In Econ 212, the demand for foreign currency is derived from US consumers wanting to purchase foreign goods. The supply of foreign currency is derived from foreign producers wanting to purchase US goods.



If consumers no longer want to purchase Japanese goods, they will no longer demand Yen. This will cause the price of the Yen to fall. That is, the exchange rate will fall.

It can also be reasoned that an increase in the demand for American goods (by foreigners) will decrease  $e_f$ , and a decrease in the demand for American goods (by foreigners) will increase  $e_f$ .

What about price levels in the two countries? Will they affect  $e_f$ ?

$$e_f = \alpha * (P^{US} / P^f)$$

Where

$\alpha$  is some (positive) constant (if it bothers you, ignore the  $\alpha$ )

$P^{US}$  = the price level in the US

$P^f$  = the price level in the foreign country

This equation tells us that if we were to increase the price level in the US, while leaving the price level in the foreign country unchanged, the exchange rate will rise.

Why might this be the case?

Suppose there are two identical TV sets, one made in England, one made in the US. The exchange rate between the pound and the US dollar is \$1.61 / £.

Initially, the price in the US is \$161, while the price in England is £100. Thus, consumers will be indifferent between buying either one (of course, assuming no transportation costs, etc.)

Now, suppose, for some reason that the price level in the US doubles ( $P^{US}$ ), while the price level in England is unchanged. The price of the TV in the US is now \$322. Suppose, that the exchange rate does not change. The price in England is still £100. You can obtain £100 for only \$161. You will want to buy your TV from England. (You convert \$161 into £100, and buy the TV in England)

An entrepreneur steps in and conducts **arbitrage**. He buys TVs in England for 100 pounds, which costs him \$161, puts them on a boat and sells them in the US for maybe \$320. He is making oodles of money. Others realize this as well, and begin purchasing TVs from England.

As this occurs (an increase in demand for English goods), the demand for pounds increases, and thus the exchange rate rises. This continues until the exchange rate adjusts so that price levels are back in line.

The idea is called Purchasing Power Parity. This suggests that after converting using the exchange rates, that identical goods must have the same prices in different locations. There are complications. This is generally true only over the long run, and other considerations such as transportation costs (it costs money to transport goods from the US to England), non-tradable goods (can you transport a hair cut from England to France – what about a Big Mac or an ice-cream cone?), and countless others complicate the story.

The brief summary about purchasing power parity -

You can think of it either of two ways. The first way is to look at the formula and see that, if the price level in the US rises, the exchange rate rises.

The other way to think of it is the arbitrage story above. If the price level increased in the US, the result is an increase in the demand for foreign goods (and hence currency), and this is then an increase in the demand for pounds. This then causes the exchange rate to rise.