Lecture 1: Exchange Rates and the Foreign Exchange Market

FT chapter 13

Topics:

- Exchange Rates
- Foreign exchange market
- Asset approach to exchange rates
- Interest Rate Parity Conditions

1) Definitions

a) **Define Exchange Rates**:

Def of exchange rate: price of one currency in terms of another.

The conventional way of reporting this in economics is home currency per foreign. In the U.S. this is $ per foreign currency.

For example, currently it would take about $1.28 to buy one European euro ($E_{\$/euro}$)

This is the convention in economics and will be used in this class.

Sometimes you will hear quoted the other way around, often called European terms.

ie: 1/1.28 = 0.78 $/euro.

b) **Exchange rates** are important for trade because they allow you to compare the cost of imports to that of domestic goods in common terms. There was a period when Americans were going to Germany to buy Mercedes and bring them home, rather than buying them in the U.S.

Example: Consider the Mercedes: suppose the going price is 60 thousand euros in Germany and 60 thousand dollars in the US.

Would people flock to Germany? Depends on the exchange rate - comparing $ and euro is like comparing apples and oranges.

Suppose the $/euro exchange rate is 1.28.

So the cost in Germany reported in dollar units is:

60 thousand euros * (1.28 $/euro) = $76,800

At this exchange rate, looks like it is cheaper to buy the car in the U.S.

How know using the rate not upside down? Look at units: have euro, want dollars, so multiply by $/euro and euro cancels out, and you left with units in dollars.

c) Note: the way we conventionally define the exchange rate can also make it confusing to talk about changes in the exchange rate, which we call appreciations and depreciations.

Appreciation: increase in value of the given currency relative to another.

Say the $E_{\$/euro}$ rate changed from 1.28 to 1.20, we say the dollar appreciated relative to the euro. Or we could say the euro depreciated relative to the dollar.

Note that this can be confusing. Given how we define the exchange rate as home currency per foreign, if this gets lower, it means that it takes less home currency units to buy a foreign currency unit, and this means the home currency is worth more. Hence an appreciation of the home currency.

d) Multilateral exchange rates:

Bilateral exchange rate is between one pair of currencies (as above). Note that sometimes the bilateral rate of the dollar with one currency may appreciate at the same time that another bilateral rate with another currency may depreciate (See chart from Economist magazine)

Nominal effective exchange rate: is a weighted average of several bilateral exchange rates, usually using trade shares as weights to reflect the relative importance of each of the bilateral pairs involved.

Example: suppose that:

$\Delta E_{\$/pound}$ = - 10%(appreciates 10%), and trade share of UK in US trade is 40%

$\Delta E_{\$/euro}$ = 30%(depreciates 30%), and trade share of EU in US trade is 60%

Then the change in the nominal effective exchange rate is:

= (0.4)(-0.1) + (0.6)(0.3) = +.14 (dollar depreciates 14% on average)

Look at the trends in the value of the dollar in recent years. Raises the question: why has dollar depreciated in recent years, and why it moves around so much in general? We will develop theories later to address these questions.

2) Features of foreign exchange market.

a) Actors

1) commercial banks: handle most of the e market transactions - involve a company having its commercial bank debit its account, change into foreign currency and pay a business partner by depositing in its foreign bank. Not usually direct exchange of currency and coins.

Interbank trading: bank gathers requests of its customers and enters foreign exchange market to execute trade as a unit, so are very large transactions. Entering market

is a matter of checking the postings on a computer network the rates at which other banks are willing to trade currency, then call on phone and finalize a price.

2) corporations: sometimes corporations enter e market directly. Increasingly common and corporations have plants abroad, or buy components from abroad.

3) Nonbank financial institutions: There has been much deregulation of financial markets, so financial institutions other than banks can compete with banks in providing services in e market. One example is pension funds.

4) Central banks. Governments sometimes intervene in the foreign exchange market to increase or decrease the supply of their currency or purposefully affect the exchange rate in the market. Some countries intervene to hold the value of the currency fixed at a desirable level (fixed exchange rate)

b) Characteristics

Volume is enormous: over a trillion dollars a day. GDP is under 10 tril in the whole year of 1994. Central bank

Banks dealing in e market tend to be concentrated in certain key financial cities: know which biggest? London largest, but also NY, Tokyo, Frankfurt and Singapore.

Highly integrated globally: when one major market is closed usually another is open, so people can trade around the clock, moving from one center to another.

Integration means exchange rate quotes in different centers must be the same.

Is guaranteed by arbitrage, defined as making a riskless profit on a financial trade):

Suppose that $E_{\$/euro}^{NY} < E_{\$/euro}^{Frankfurt}$: NY offer more euros for a \$ (lower price of euros, higher price of \$, $E_{\$/euro}$ is low) than Frankfurt, then people will take their \$, sell in NY for bunch of euros, then sell these in Frankfurt for dollars again and end up with more dollars than they started.

Possibility for you to make riskless profit? No because short-lived due to arbitrage.

The increased demand for euros in NY would drive up the price of euros in terms of \$ - this is an exchange rate depreciation for the \$.

There are computers monitoring such openings and ready to take advantage of them. So gaps close up very quickly.

Vehicle currency. Most foreign exchange transactions are between banks and take place in \$, even if want to change Swedish kroner for Polish zloty, not dollars.

Easier to change kroner first to \$ and then \$ to zlotys. Since US is so important in world economy, there are many people willing to trade dollars for kroner and zloty for dollars, to take the opposite sides of your trade, rather than the opposite side of a direct kroner for zloty trade.

Euro and Yen are also used as vehicles, but less so at current time.

Note that arbitrage over three currencies requires:

$$E_{pound/euro} = \left(E_{\$/euro}\right)\left(E_{pound/\$}\right)$$

c) Spot and forward rates

The exchange transactions talked about so far take place on the spot. Spot rate: exchange rate for currency transactions that take place basically immediately.

In practice can't be right away because it typically takes two days for the checks to clear used to make the payments.

Forward exchange rates: Can also arrange currency trade for some date in future. Is one way of hedging against risk of e changes.

Suppose Best Buy electronics is expecting a shipment of Sony TVs in a month, for which it needs to pay yen.

Could wait until the shipment to buy the yen to pay Sony, but not know what will happen to value of that yen in meantime.

If yen appreciates a lot, the $ price store has to pay to get the TVs could change a lot.

To avoid this risk, the store can arrange for currency trade ahead of time to be executed later at a set exchange rate. This rate is the forward rate.

Swaps: another possibility is to combine a spot with a forward arrangement: i.e. A spot sale, then arrange a repurchase in the future at a set rate.

Why do this? Say our electronics store sold some computers in Japan and got yen, know will need them again in a month to buy Sony TVs, but not want to hang on the money in yen over the month, want to hold it in dollars for domestic expenses.

Might be lower brokers fees if arrange both transactions at one time.

Futures: like a forward arrangement, except you can sell the contract to someone else. Currency exchange occurs when contract comes due, and is delivered to whoever is holding the contract in the end.

Useful if your opinions about the exchange rate change. Some people just trade these contracts to make a profit, because expect the value of the contract to change as expectations for exchange rate movements change. This is an example of currency speculation.

i.e. if suddenly looks like $ will appreciate, a contract specifying dollars be delivered for a given amount of yen looks more profitable, and price of contact will go up.

Options: Call option: have the right to buy an amount of currency at a specified e rate any time before a specified date. Put option: right to sell. Like futures, options can themselves be bought and sold.

3) Asset approach to exchange rates:

a) **Preview: Theories of exchange rate determination**

Now we come to the question of how does the foreign exchange market determine what the exchange rate will be. There two main theories we well study here:

1) The asset approach – which is based upon "interest rate parity"
2) The monetary approach – which is based upon "purchasing power parity"

Each of these tells a logical but somewhat different story of how the e is determined. A general theme in the next couple lectures will be to discuss these stories, the empirical evidence on how well each explains e movements, and how the two theories perhaps could be integrated together.

Asset Approach: First we discuss the asset approach. Recall that most foreign exchange holdings are in form of bank deposits, which is a type of asset, and these can be analyzed as any other asset.

b) Determinants of demand for assets

1) Expected Rate of return: What are the determinants of the demand for a financial asset like a bank account? The main determinant is the rate of return that is paid.

- In the case of your saving account in dollars, you care about the interest rate.

- In the case of a Stock, you care about the dividend and the capital gain: Suppose you pay 100$ for a share of Ford, and you get a dividend payment of 5$ and resell it for 105$. So you made a total of 10$ off of the asset; divided by the initial 100$ investment the implies a rate of return of 10%.

So to refine this a bit, note that we may not know ahead of time what resale value will be. So when you make a decision now about buying an asset, you must base it on the expectation of what the return will be.

In addition to the return, some savers care about two other features: risk and liquidity.
2) risk: uncertainty about rate of return. Even if a stock has a higher expected payoff than a saving account, the fact that the payoff is uncertain means it may be less desirable, because people not like risk.
3) liquidity: how easy it is to convert the asset to cash if you want to buy a different one or use your savings for consumption.

c) Foreign currency assets

What is the expected return for the large bank accounts typically used in foreign exchange market transactions? The typically do pay an interest rate.

An additional feature with an account in a foreign currency is that changes in the exchange rate while holding the currency also affect the value of the asset when you switch it back to domestic currency terms.

So when you are deciding whether to hold your assets in $ accounts or euro accounts, you need to consider the interest rates on each deposit option and the expected change in the exchange rate in the meantime.

Example (where interest parity holds)

Lets say you have a 100$ and need to decide whether hold in $ or eruo account:

- Define: $i_{\$}$: net interest on a $ account = 10%.
  i_{euro} : net interest on a euro account = 5%. Is euro better?
- Represent the current spot exchange rate as $E_{\$/euro}$ and suppose this starts at 1.25
- So convert 100 $ into 80 euro. Get 5% interest so have 84 euro at end of year. But then you need to convert these back to $ in the end.
- Represent the expectation for the future spot exchange rate as $E^e_{\$/euro}$ and suppose this is 1.31. So when you are ready to convert back to $ these euro are worth more than they used to be; 84 euro are worth 110 $.

$ account				EURO account
100$	→	$E_{\$/euro} = 1.25$	→	80 euro
↓				↓
$i_{\$}$=10%				i_{euro}=5%
↓				↓
110$	←	$E^e_{\$/euro} = 1.31$	←	84 euro

4) Interest parity condition:

a) There is a simple rule to shorten this calculation:

Write total gross $ return on EURO asset as consisting of two parts: the EURO interest rate plus the percent appreciation of the EURO currency, this is:

$$\text{Total gross return on EURO deposit} = (1+i_{euro})\frac{E^e_{\$/euro}}{E_{\$/euro}}$$

In the example above, this exactly equals the gross return on the $ deposit, so:

In equilibrium:
Total gross return on $ deposit = Total grossreturn on EURO deposit (in $ terms)

$$(1+i_{\$}) = (1+i_{euro})\frac{E^{e}_{\$/euro}}{E_{\$/euro}}$$

We can write this in terms of net returns instead of gross returns, as an approximation:

Define the percentage expected appreciation of the euro as:

$$\frac{\Delta E^{e}_{\$/euro}}{E_{\$/euro}} = \frac{E^{e}_{\$/euro} - E_{\$/euro}}{E_{\$/euro}}$$

This allows us to write the UIP condition as:

$$(1+i_{\$}) = (1+i_{euro})\left(1+\frac{\Delta E^{e}_{\$/euro}}{E_{\$/euro}}\right)$$

$$= 1+i_{euro}+\frac{\Delta E^{e}_{\$/euro}}{E_{\$/euro}}+\left[i_{euro}\frac{\Delta E^{e}_{\$/euro}}{E_{\$/euro}}\right]$$

Since the last term in brackets is two small numbers multiplied by each other, we can drop it and still have a good approximation:

$$(1+i_{\$}) = 1+i_{euro}+\frac{\Delta E^{e}_{\$/euro}}{E_{\$/euro}}$$

$$i_{\$} = i_{euro}+\frac{\Delta E^{e}_{\$/euro}}{E_{\$/euro}}$$

Which means

net return on $ asset = total net return on euro asset
= euro net interest rate + expected euro appreciation

The idea is that the German interest rate might be lower than the $ interest rate, but the total return will be increased by an expected appreciation of the EURO currency while holding the EURO deposit in that currency.

This equation is called the uncovered interest rate parity condition.

Example from above: 0.10 = 0.05 + (1.31 - 1.25)/1.25 = 0.05 + 0.048 = 0.098

b) Equilibrium in the Foreign Exchange Market

We will take this interest rate parity condition to be a description of equilibrium in the foreign exchange market. Given a certain interest rate on $ deposits ($i_{\$}$) and a certain interest rate on EURO deposits (i_{EURO}), and given certain expectations about the future exchange rate ($E^{e}_{\$/EURO}$), then the interest parity condition tells us what the current spot exchange rate has to be in order for there to be no excess demand or supply in the foreign exchange market.

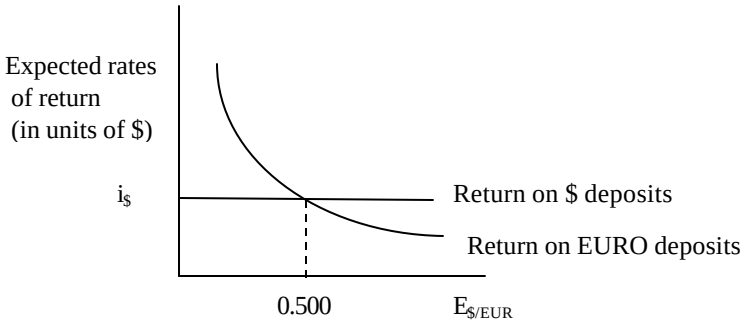
Equilibrating process:

For example, suppose a case where the total return on EURO assets are less than on $ assets, given the current spot exchange rate and given our expectation for the future spot exchange rate. In this case, holding EURO assets is less attractive than holding $ assets, and people will try to sell their EURO and buy $.

This excess supply of EURO will immediately bid down the current value of EURO and bid up the value of $; in other words the current spot exchange rate $E_{\$/EURO}$ will fall.

But since we still are expecting the same future value of the exchange rate in the future, $E^e_{\$/EURO}$, the fact that the current spot rate is lower means we expect a larger EURO appreciation over the time we are holding the EURO asset. This very fact raises the total return on the EURO asset, and makes it more attractive than before.

This process will continue until the current spot rate falls enough that the expected EURO appreciation over time makes the total EURO return exactly equals the return on the $ asset. At this point there is no excess supply of EURO foreign exchange, and the spot exchange rate has reached its equilibrium level.



c) Effect of changing interest rates: If any of the underlying conditions change, then this will require a change in the spot exchange rate.

If $i_\$$ rises, this shifts the horizontal line (dollar returns) upward, which means the equilibrium exchange rate $E_{\$/EURO}$ is lower (the EURO is worth less). The intuition goes like this: a rise in $i_\$$ makes $ deposits more attractive than before, so there is an excess demand for dollars which drives up the current value of the dollar and drives down the current value of the EURO ($E_{\$/EURO}$ falls).

Similarly, if R_{EURO} rises, this shifts the EURO-returns curve upward. Now the EURO assets become more attractive and there is excess demand for EURO. This bids up the current value of the EURO, which is a rise in $E_{\$/EURO}$.

In general we see that if the interest rate rises in a country, then this tends to raise the value of that country's currency.

We can also consider the effects of a change in the expected future exchange rate. If $E^e_{\$/EURO}$ rises , this shifts the EURO-return curve upward just like case above and raises the current spot exchange rate. The idea is that if you expect EURO

currency to rise in value over time, EURO assets become more attractive for this reason, and there is excess demand for EURO, which bids up their current value.

In future sessions, we will discuss some of the economic reasons for why these cases might arise, that is, why interest rates or expectations might change.

d) Empirical tests on interest parity.

It is difficult to test the interest rate parity condition, because it is difficult to get a measure of people's expectations.

Some economists have used the actual future exchange rate as a proxy for expectations in the past, assuming that people correctly predict the future rate.

Some economists have used survey data on expectations – they call people who take part in the foreign exchange market and ask them what rates they expect.

Both sets of tests tend to find the interest parity condition does not hold well. But this may simply reflect the fact that the expected future exchange rate component of the equation was measured with error, not that the theory was wrong.

Another reason why the tests may reject the interest parity condition is the role of risk. There is some risk involved because you do not know ahead of time what the future exchange rate will be; if your expectations turn out to be wrong, the payoff from your investment scheme may be different from what you expected. This may make people require an extra expected return on EURO deposits as compensation for uncertainty. In this case there would be an extra term in the interest parity equation: RP representing the risk premium:

$$i_{\$} = i_{EURO} + (E^{e}_{\$/EURO} - E_{\$/EURO})/ E_{\$/EURO} - RP$$

(Note: RP can in principle be either positive or negative, depending on how the risk is perceived both by people trading EURO for $ and those trading $ for EURO, since both groups are exposed to risks of different types).

e) COVERED interest parity.

If exchange risk is the problem, isn't there a way we know to get rid of that? Use forward contract. Create a risk-free version of the interest parity relation.

Denote the forward rate: $F_{\$/EURO}$

This suggests a risk-free version of interest rate parity: called covered interest rate parity:

$$i_{\$} = i_{EURO} + (F_{\$/EURO} - E_{\$/EURO})/ E_{\$/EURO}$$

The old equation then is often called "uncovered" interest rate parity.

Empirical evidence supports covered interest parity. In fact, it seems this is how forward rates are determined. Dealers scan current E and Forward rates F, and if see immediate arbitrage, take advantage of it, which closes it.

Does this imply that the forward rate F is the expected future value of the spot exchange rate? (Does $F_{\$/EURO} = E^{e}_{\$/EURO}$?) This is true only if both uncovered and covered interest rate parity conditions hold.