

**Financial Institutions and Markets**  
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**Lecture - 56**  
**Foreign Exchange Market – I**

So after the discussion on the different other markets like your money market, your stock market, then the bond market, then the derivatives market. We can start the discussion on another type of market that is the Foreign Exchange Market. As you know that in this globalized period the importance of the foreign exchange market is quite large in the context the financial markets are integrated. And foreign exchange market place a significant role in terms of trade in the financial system. That means, the export and import business are running through the foreign exchange markets.

The operation of the foreign exchange market mostly done by the export and import. Although there are other aspects of the foreign exchange market also there, but mostly foreign exchange market is responsible for the trade balances. And other issues if you take the foreign exchange market basically, talks about the how the exchange rates are determined?

What do you mean by the exchange rate? And as well as it also talks about the factors which influence the determination of exchange rate then as well as the mechanism of the foreign exchange market how the people go to the foreign exchange market? And what is the motivation of going to the foreign exchange market and the other issues related to that what kind of foreign exchange system we have.

Then as well as also we try to see that how the foreign exchange reserves are managed and how the central bank intervention to the foreign exchange market what is the mechanism into that. And as well as some issues related to the foreign investments; the foreign investments includes the foreign direct investment like FDI and FII. So, these are the measure issues what will be discussing in this particular sessions which are related to the foreign exchange market.

So, one by one we can discuss those issues, but today we are going to discuss that what exactly the exchange rate is which is the measure variable, which is determined in the

foreign exchange market and how the exchange rates are defined and what are those different concepts which are related to the foreign exchange determination. So, this is what basically our objective or the agenda for the discussion today.

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**Exchange Rates**

- Exchange rate measures the value of one currency in units of another currency.
- The rates at which spot and forward transactions take place are known as "spot rate" and "forward rate" respectively
- Nominal exchange rate (NER) and the real exchange rate (RER)
- RER indicates the real purchasing power of one currency relative to another currency; it is the NER adjusted for changes in the relative purchasing power of each currency since some base period.

*Real Ex rate = Nominal rate - inflation*

$$REER_t = NEER_t \times \frac{(1 \times INF_a)^t}{(1 + INF_h)^t}$$

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If you see that whenever you talk about exchange rate how the exchange rate is defined the exchange rate basically what? The exchange rate basically measures the value of one currency in units of another currency which is very popular in the sense if you see that everybody talks about that what is the value of rupee against the dollar what is the value of dollar against the rupee and all these things. So, these are basically nothing, but the exchange rate.

If you see today in the newspapers and other places we are studying or we are always reading that the rupee value is declining and dollar value is becoming stronger and stronger. What does it mean? It means that how the exchange rate is going to be changing or how they exchange rate is going to be fluctuating between dollar and rupee. So, that is why the exchange rate basically is nothing, but it measures the value of one currency in units of another currency. Among them one currency may be domestic currency another currency is the foreign currency.

So, once we are converting our home currency into the foreign currency or you are converting the foreign currency into the domestic currency or the home currency. Then

that particular thing is defined as the exchange rate in a layman perspective or from the economic perspective.

So, therefore, that is the first thing basically we can keep in the mind and second thing is there are 2 types of exchange rates; always we can have one is in terms of the market. One is your spot exchange rate and another one is the forward exchange rate or the forward rate. So, the spot rates are mostly determined by this spot market factors and the forward rates are determined by some other factors although this spot rate also is a factor which determine the forward rate. So, that we will see later, but this is the way the foreign exchange transactions are taking place in the foreign exchange market.

But in terms of even if it is the spot market rates, if you think about the spot market rates this spot market rates also can be defined in 2 ways or 2 parts; one is your nominal exchange rate another one is the real exchange rate. So, already all of you know that what is the basic difference between nominal and real etcetera already we discussed in the previous sessions that anything whenever you talk about the real on the economic sense so; that means, it is the real exchange rate if you talk about the real interest rate you talk about it is basically adjusted to the inflation.

So, nominal rate which is adjusted to inflation that is basically is considered as the real exchange rate or real interest rate or anything. So, whenever you talk about this real exchange rate in the context of foreign exchange market; then how this real exchange rate is basically determined if you have the nominal exchange rates. So, already what I told you the real exchange rate basically indicates the purchasing power of one currency relative to another currency. So, the purchasing power whenever we talk about the purchasing power is always measured through the inflation rate.

So, if your nominal exchange rate is adjusted for changes in the relative purchasing power of each currency which some base year or the base period, then we can call it the real exchange rate. So, that is why here we are adjusting this particular exchange rate with respect to the home inflation rate; home inflation rate and the foreign inflation rate. So, here  $\frac{1}{1 + \text{inflation rate}}$  this is the plus then this is your foreign currency inflation rate; foreign countries inflation rate or this is basically the home countries inflation rate. So, your real exchange rate is the nominal exchange rate multiplied by  $\frac{1}{1 + \text{inflation rate}}$



respect to different currencies we have. So, if you want to calculate a particular exchange rate which talks about the exchange rate across all the currencies. Then we calculate the weighted average of those exchange rate with respect to that respective currencies. And then if you want to calculate the real from that then we have to adjust the relative in place 100 with respect to that is currency with the other foreign currencies whatever we have.

So, then how the weights are given? For example, if you say that one Indian rupee is 1 dollar is equal to 70 rupees, let you talk about 1 pound is equal to 100 rupees. So, if you are giving the weights, then how the weights are given already you know that how to calculate the weighted average?

The weighted average is nothing, but in this particular context the particular exchange rate with respect to one currency multiplied by the weight, plus the another exchange rate that exchange rate 1, then you have exchange rate 2 multiplied by the weight and so on. If you have the n exchange rate then your exchange rate n multiplied by the weight of that n weight 2 weight 1 all these things.

Then how the weights are given, the weights are given on the basis of mostly the weights are given on the basis of the trade. So, the total amount of trade with respect to that particular country is considered as the weights; that means, you can calculate the total trade value. Then you see that how much trading is taken place with respect to that currency and how much trading is taken place with respect to the second currency third currency and all these things. Then let the total trading value is a 1000 crore, then let for US it is 500 crore for UK it is let 50 crore for Japanese yen it is 50 crore, then let there the another currency you can take that is 100 crore.

So, then what you can do the total is let 1000, then you can go on there are other currencies also then with respect to 1000 crore you can 0.5 50 percent weightage will be given into dollar then fifty dollar versus rupee exchange rate. Then 50 by 1000 whatever percentage you can find out from this that weightage will be given to the pound. And again 50 by 1000 whatever weightage you can get it to that particular currency, then 100 by 1000 you have the 10 percent gives to this 5 percent given to this and 50 percent given to this.

Then go on if you have any number of currencies then accordingly the weights can be calculated with respect to the trade. And that weights can be multiplied with respect to that particular exchange rate with respect to that currency then finally, the weighted average of all those exchange rates can be calculated. And that can be considered as the nominal effective exchange rate.

And when this nominal effective exchange rate is deflated by the relative inflation rate of home currency with respect to the foreign currency, then the real effective exchange rate can be calculated. So, this is the way the exchange rates both real effective and nominal effective exchange rates are calculated in the system.

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**Direct Vs. Indirect Exchange Rate Quotations**

- There is a practice of giving either number of home currency units, say rupees, per unit of foreign currency, say US Dollar or the number of units of foreign currency, say Dollar per unit of home currency, say a rupee, when banks deal with non-bank customers.
- When there is no transaction cost, direct exchange rate between any two currencies e.g. rupee and euro is exactly equal to the implicit indirect exchange rate via US dollar.

₹ 5000 → ₹ 100 → £ 1000

Then if you see that how the exchange rates are quoted, here you see that we are first discussing about the concept of exchange rate and the how the quotations of the exchange rates are made. And then further we can go to the discussion on the factors affecting the exchange rate or the determinants of the exchange rate. So, whenever you talk about the direct versus indirect exchange rate what does it mean? Let you have the different currencies, you have we are living in India our currency is the rupee, then we have the dollar, we have the pound.

Let you want to convert you have let 5000 rupees available with you and that 5000 rupees you want to convert into the pound. So, if you want to convert it to the pound then what basically you can do? Directly you can go let for pound is 100 rupees. Then you

can get 50 pounds let that pound is not available with that particular money exchanger from where you want to take the pound.

But whenever if you are going to UK and you need pound for that then what is happening you cannot go with the pound then what basically you can do? If pound is not available that with that particular company from where or particular agent from where you want to exchange it.

Then what you can do you can convert it to the dollar first, then that dollar again can be used there to exchange this particular money into the pound. So, one is you can directly convert from rupee to pound or you can convert it let this is your rupee and this is your pound and this is basically your dollar. So, then either you can directly converted from rupee to pound or you can go to dollar and from dollar to pound. So, if you are directly converting it or you are quoting that exchange it that 1 dollar is equal to 100 rupees then we call it that the exchange rate is quoted directly.

But if you are quoting the exchange rate via dollar, that you can go to the dollar from dollar to pound, then we can say that we are basically quoting the exchange rate in an indirect way. So, that is a proxy practice always the companies or the banks basically always use, let there is giving either number of home currency unit say rupees for unit of foreign currency that is a US dollar or the number of units of the foreign currency let dollar per unit of home currency say rupee. When banks deal with the non bank customers.

That means, either they can convert from directly tell you rupee versus dollar they can say that 1 dollar is equal to 70 rupees, but other way also it can be converted that 1 rupee is equal to  $1/70$  dollar, both ways it can be represented. So, whether you want the conversion per unit of the foreign currency how much home currency we are getting? Or it can be also reported that how much foreign currency you are getting in terms of your home currency in terms of one unit of the home currency. So, either of this way the quotations are made or this is the way it is direct to indirect quotations always we look at in the market.

Here one thing you observe there are sometimes also the quoting this particular exchange rate in terms of indirect way, is sometimes beneficial for the investors. And how it is

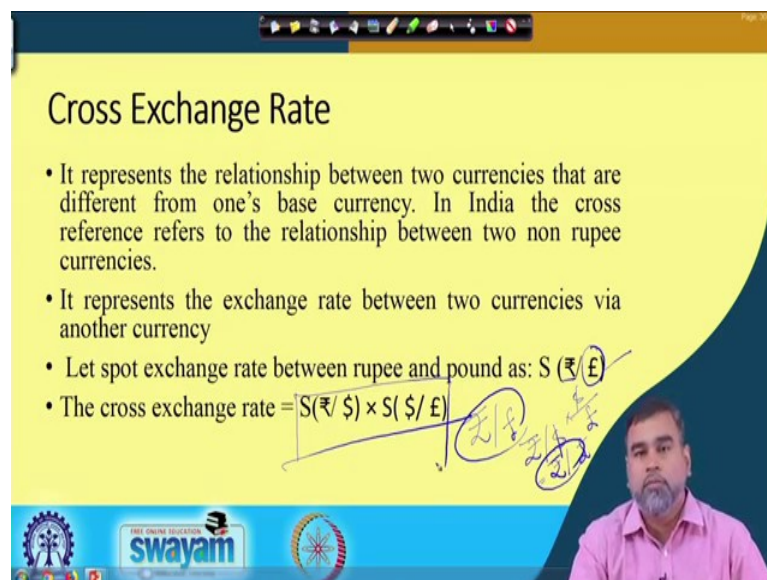
beneficial? If there is some kind of arbitrage opportunity exist in the market that we will see we will discuss it.

But one thing you can always keep in the mind, if there is no transaction cost and direct exchange rate between any two currency let rupee and euro let rupee versus pound rupee versus dollar, particular rupee versus pound or the euro is exactly equal to the implicit exchange rates via US dollar that is what basically what i have explained here.

Either, if there is no such transaction cost involved in this particular market, then either you can convert directly from rupee to pound or you can go via dollar you convert from rupee to dollar and dollar to pound that does not make any difference you get the same amount of pound in the end. Either you converted directly or you convert it indirectly. But in practical sense that may not be possible or that may not be always prevailed in the market.

So, if that does not prevail then there is a chance of arbitrage opportunity and already you know that what is the meaning of arbitrage opportunity that the investor can generate certain profit without taking any kind of risk. So, that is the way the indirect quotations are made in the system.

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**Cross Exchange Rate**

- It represents the relationship between two currencies that are different from one's base currency. In India the cross reference refers to the relationship between two non rupee currencies.
- It represents the exchange rate between two currencies via another currency
- Let spot exchange rate between rupee and pound as:  $S(\text{₹}/\text{£})$
- The cross exchange rate =  $S(\text{₹}/\text{\$}) \times S(\text{\$/£})$

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So, that is basically we call it the cross exchange rate. So, what do you mean by this cross exchange rate in a very practical sense or in an actual sense? That cross exchange



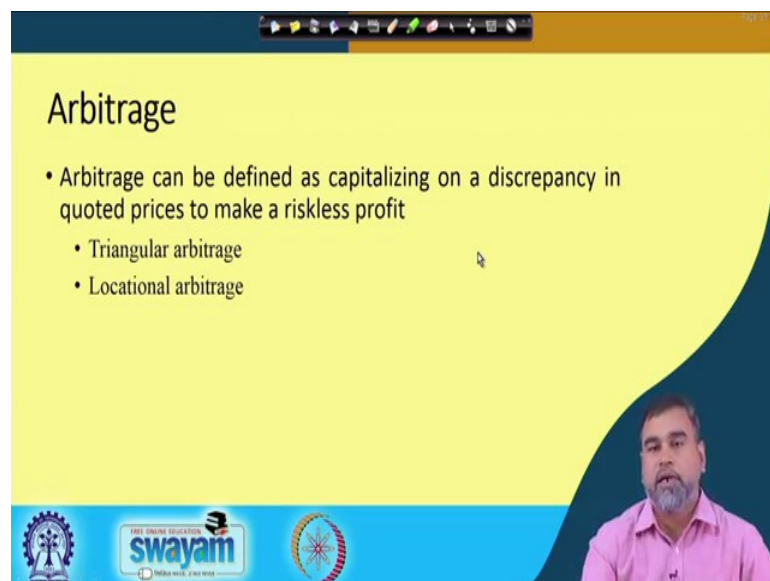
rate basically represents the relationship between the two currencies that are different from one's base currency. If you take the India example, then the cross reference basically or the cross exchange rate refers to the relationship between the two non rupee currencies. So, it represents the exchange rate between the two currencies via another currency that already I told you.

So, if the spot exchange rate between the rupee and pound that already just now I was showing you let this represent as the spot this is rupee versus pound. That means, if the denominator is the pound; that means, what I am trying to find out one pound is equal to how much rupees?

So, if you want to convert that particular term, via another exchange rate let dollar, then that can be represented as let here you have the rupee versus you have the pound that you want; then what you can do? You can get it rupee versus your dollar into dollar versus pound. So, the dollar will be cancelled and end of the day you are finding that what you are finding the rupee versus pound.

So, that is basically the cross exchange rate. So, this is the way the cross exchange rates are basically shown in the market. So, you can calculate the cross exchange rate between them.

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## Arbitrage

- Arbitrage can be defined as capitalizing on a discrepancy in quoted prices to make a riskless profit
  - Triangular arbitrage
  - Locational arbitrage

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Why basically we take this help of the cross exchange rate? There are reason behind that, the reason is the arbitrage basically is possible in most of the time in the foreign exchange market, whenever you are using or taking this concept of the cross exchange rate in the trading process. So, arbitrage when it is possible whenever you are capitalizing on a discrepancy in quoted prices to make that riskless profit.

So, there are although different types of arbitrage concept is existing in the system financial system or the foreign exchange market also, but the major type of arbitrage always we find or we will see that is your, time triangular arbitrage and the locational arbitrage. These are the 2 types of arbitrage is possible and the investor can use these quotations or to find out whether there is an arbitrage opportunity exist in the market.

If the investor finds that there is an arbitrage opportunity exist in the market, then they can create that kind of profit without any kind of risk that is the basic job of the investor by considering this concept of arbitrage or by exploring the probability of arbitrage which may exit in this particular system. So, we will see that what do you mean by this triangular arbitrage?

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**Triangular Arbitrage**

Triangular arbitrage is possible when a cross exchange rate quote differs from the rate calculated from spot rate quotes.

Example: Suppose we have Rs. 700 we have to convert it to pound.  $1\$ = ₹70$ ,  $1£ = ₹90$ ,  $1£ = \$1.2$

Direct: Rupee to pound =  $₹700 / 90 = ₹7.77$

Indirect: Rupee to Dollar =  $₹700 / 70 = \$10$

Dollar to Pound =  $\$10 / 1.2 = £8.33$

*Handwritten notes:* A box labeled "No Transaction Cost" contains the calculation  $1.2 \times 10 = 12$  and  $12 / 1.2 = 10$ .

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If you see the triangular arbitrage, when the triangular arbitrage is possible the triangular arbitrage possible, when a cross exchange rate quote differs from the rate calculated from the spot rate quotes. Then there is a possibility of the triangular arbitrage and how it happens if you see if suppose you have 700 rupees, if you see this example you have 700

rupees and you have to convert that 700 rupees into pound. And what basically data is given to you or you know that 1 dollar is equal to let 70 rupees and 1 pound is equal to 90 rupees.

And 1 pound is equal to 1.2 dollar that conversion also you know. If you are going for a directly converting from rupee to pound, then how much you are getting how much pound you are getting? You are getting 700 rupees divided by 90 that is 7.77; 7.77 pound you are getting whenever you are converting from rupee to pound.

But now we will see and you are assuming no transaction cost, there will be no transaction cost in the market. If there is no transaction cost then what is happening, if you are converting from rupee to dollar first, then how much dollar you are getting 10 dollar 700 divided by 70 that is 10 dollar you are getting.

Now, you are converting dollar to pound right. Then how basically you can convert it because you have already you know that 1.2 dollar is equal to 1 pound. Then your 10 dollar is equal to 10 by 1.2 dollar. So, then finally, you are getting 8.33 pound. If you see whenever you are converting directly you are getting 7.77 pound. But whenever via dollar you are converting from rupee to pound and without we are assuming here there is no transaction cost, then you are getting 8.33 pound. What does it mean? It means that there is a chance of arbitrage, if you are going or without any risk you are basically creating the profit here.

So that means, that time only the arbitrage opportunity will not be possible, whenever this particular conversion will be perfectly matched to it the direct conversion what basically we are getting between the different two different currencies. So, then there is a chance, there will be no chance of arbitrage opportunity then when that can be possible.

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**Example:**

Suppose we have Rs. 700 we have to convert it to pound.  $1\$ = ₹70, 1£ = ₹98, 1£ = \$1.4$

Direct: Rupee to pound =  $₹700 / 98 = £7.142857$

Indirect: Rupee to Dollar =  $₹700 / 70 = \$10$

Dollar to Pound =  $\$10 / 1.4 = £7.142857$

(No arbitrage)

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If you see let suppose same data 1 dollar is equal to 70 rupees let you assume 1 pound is equal to 98 rupees and 1 pound is equal to 1.4 dollar. And now if you convert the same process if you follow, then you are directly converting from rupee to pound how much you are getting, previously the data what we have taken that is 1 dollar is equal to 70 rupees then 1 pound is equal to 90 rupees and 1 pound is equal to 1.2 dollar.

So, now let the 700 rupees you want to convert, but now in the market 1 dollar is equal to 70 rupees that remains, but 1 pound is equal to 98 rupees and 1 pound is equal to 1.4 dollar. So, now, if you are converting from rupee to pound, then 700 by 98 you are getting 7.142857 pound. Now rupee to dollar again 10 you are getting, now dollar to pound if you convert then will be getting the same 7.142857. So, in this context whether you are directly converting from rupee to pound or you are going via dollar that does not make any differences.

Here also it is 7.14 here also it is 7.14. And here; that means, there is no arbitrage opportunity exist in this particular context or this particular data where you can generate some profit out of this without any risk. So, this is the concept of the triangular arbitrage always we find in the foreign exchange market.

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### Locational Arbitrage

- Locational arbitrage is possible when a bank's buying price (bid price) is higher than another bank's selling price (ask price) for the same currency.

Example

Bank A	Bid	Ask	Bank B	Bid	Ask
Indian(₹)	\$0.015	\$0.017	Indian(₹)	\$0.019	\$0.020

Buy Indian(₹) from Bank A @ \$0.017, and sell it to Bank B @ \$0.019.  
Profit = \$.002/ Indian ₹.

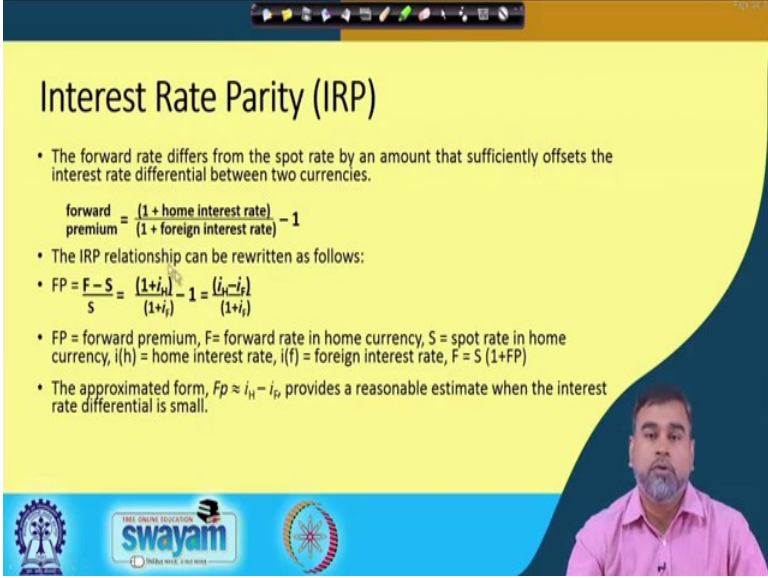
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And another one is your locational arbitrage and why the locational arbitrage happens it is possible when the banks buying price; that means, the bid price because in the price already you have to one price is the bidding price another one is the quoting selling price.

That means one is bid price one is ask price that already you know. So, let this same bank when a banks buying price is higher than another bank selling price for the same currency, you take this example let there is a bank and let 1 rupee is equal to 0.15 dollar ask is 0.017 dollar, but bank B at the same time, the bid price is 0.019 ask price is 0.020. Then what the particular agent can do or the investor can do buy the particular currency from bank A at a price of 0.017 and sell it to the bank, at a price of 0.019 this is your price at which you are buying it; that means, this is the asking price for bank and for us it is the buying price.

And now you can this is the buying price for the bank and for us basically it is the ask price what we are getting, after if you sell the particular currency to the bank. Then end of the day what is happening, that you are buying at this price and sell it that price then finally, for rupee you are generating a profit of 0.002 dollar. So, then we can say that the locational arbitrage is existing in the system.

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### Interest Rate Parity (IRP)

- The forward rate differs from the spot rate by an amount that sufficiently offsets the interest rate differential between two currencies.

$$\text{forward premium} = \frac{(1 + \text{home interest rate})}{(1 + \text{foreign interest rate})} - 1$$

- The IRP relationship can be rewritten as follows:
- $FP = \frac{F - S}{S} = \frac{(1 + i_h)}{(1 + i_f)} - 1 = \frac{(i_h - i_f)}{(1 + i_f)}$
- FP = forward premium, F = forward rate in home currency, S = spot rate in home currency,  $i(h)$  = home interest rate,  $i(f)$  = foreign interest rate,  $F = S(1 + FP)$
- The approximated form,  $FP \approx i_h - i_f$ , provides a reasonable estimate when the interest rate differential is small.

Then another concept we have the interest rate parity, what exactly the interest rate parity means? The interest rate parity basically says the forward rate and there is the difference between the spot rate and the forward rate and that difference basically is compensated by the interest rate differential between the two currencies, the forward exchange rate and spot exchange rate. Exactly or sufficiently offsets the interest rate differential between the 2 currencies. So, this is the calculation of the forward premium the forward premium is equal to  $[(1 + \text{home interest rate}) / (1 + \text{foreign interest rate})] - 1$ .

And how it can be established? Your forward price already you have a forward premium is nothing, but the (future price - spot price) / spot price which is nothing, but  $[(1 + \text{interest rate of the home currency}) / (1 + \text{the interest rate of the foreign currency})] - 1$  which is nothing but  $i_H - i_F$  if you divided by  $1 + i_F$ . And if you approximately see then the forward premium exactly what you are getting that is basically nothing, but the interest rate differential between the two currencies. And if the interest rate differential is very small then the forward premium can be calculated as  $i_H - i_F$ .

The interest rate of the home currency minus the interest rate of the foreign currency; so that is the way if that condition does not hold good then we can say that interest rate parity does not hold good in that particular market or between that particular different home country and the foreign country. So, this is about the different ways how the

quotations are made and how the risk profit the investor can generate out of the quotations.

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## References

- Bhole, L. M., and Mahakud, J. *Financial institutions and markets: structure, growth and innovations*, 6e. Tata McGraw-Hill Education, 2017.
- Madura. J. *International Financial Management*, 7<sup>th</sup> edition, Thomson South-Western 2004.

At the bottom of the slide, there are three logos: the UGC logo on the left, the Swayam logo in the center (with the text 'FREE ONLINE EDUCATION' above it and 'THINKING MADE, LEARNING MADE' below it), and the Government of India logo on the right. A small video inset in the bottom right corner shows a man with a beard and glasses, wearing a pink shirt, looking down.

So, these are the references what you can go through for this particular session.

Thank you.