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TABLE OF CONTENTS

1. Learning Outcomes

After studying this module, you shall be able to

- Understand the concept of Purchasing Power Parity
- Learn about Big-Mac Index
- Identify the absolute and relative purchasing power parity
- Analyze how interest rate and inflation affect foreign exchange rate
- Evaluate the Fisher and International Fisher effect

2. Introduction

Theories of Exchange Rate Determination

In a regime of floating exchange rate the demand and supply prices' interplay determines the exchange rate between two currencies. As an example, the exchange rate between the rupee and the British pound will depend upon the demand for the British pound and its availability in the Indian foreign exchange market. Apart from this, there are certain fundamental macroeconomic factors influence the exchange rates. The movement of exchange rate between countries is determined by factors like inflation rate, interest rate, etc. Arbitrage happens when the actual

exchange rate moves away from the rate determined by these fundamental relationships known as parity conditions. Hence, this module focuses on understanding these parity conditions and when deviations from these parity conditions occur.

3. Understanding the Concept of Purchasing Power Parity

3.1 Purchasing Power Parity

One of the basic theories on exchange rate relates the price level in a country to the exchange rate. **Purchasing power parity (PPP)** theory helps in determining the exchange rate between countries by comparing the average cost of goods and services between countries. The theory says that if similar products are sold in two different countries at different prices then the exchange rate should be such that the price would be the same even when quoted in different currencies.
So, it comes out that exchange rate between two countries should be equal to the ratio of almost identical goods and services of both the countries.
For example, if a kg of cucumber costs INR 18 in India and similar quality of cucumber costs 50 cents in USA, then the PPP exchange rate would be INR 36 per USD. This version of the theory of purchasing power parity is the absolute version.

In other words, the exchange rate between two currencies can be represented as

$$Spot\ Rate = \frac{Price^{INR}}{Price^{USD}} \quad (1)$$

The concept of purchasing power parity is quite old. It is believed to have been propounded by the sixteenth-century scholars of the University of Salamanca of Spain. Even though a lot of research has been undertaken to determine whether PPP holds or not, the Big Mac Index calculated by the Economist is the most widely known.

3.1.1 Big Mac index

The **"Big Mac index"** published by Economist tries to find out what should have been the PPP governed exchange rate. The McDonalds sells standardized burgers in various countries, the purchasing power parity exchange rate is calculated by comparing the prices of burgers in two countries and comparing it to the actual exchange rate prevailing at that point of time. The Big Mac Index is helpful to explain the Purchasing Power Parity.

For example, Price of a Big Mac is USD3.57 in the USA and price of a Big Mac is INR 90 in India. This means that the implied purchasing power parity is INR 25.21 per USD. However the actual exchange rate is INR 40 per USD. This indicates that INR is undervalued valued by [(25.21- 40)/40]*100= - 42.29%. It indicates that INR should appreciate in near future.

Let us take another example. Suppose a Big Mac costs about $2.99 in USA and costs €2.5 in UK. The prevailing exchange rate is GBP/USD 1.5371(USD 1.5371 per GBP). As per the

Big Mac exchange rate, the GBPUSD rate should be USD 0.8361 per GBP. As per the actual exchange rate, USD is undervalued by 45.6%. USD should appreciate by 45.6%.

However, Big Mac index as a universal product which can be compared across countries has been debatable. Big Mac is considered as daily consumable staple food in US unlike a luxury product in many countries. Therefore, people do not mind paying a premium to buy a Big Mac, in many countries. Hence the premium is in built into Big Mac price itself makes foreign currency undervalued.

Starbucks Tall Latte index exactly like Big Max Index, compares the price of Starbucks Latte in different countries. But it is yet to enjoy the cult status like the Big Max Index.

3.2 Absolute Purchasing Power Parity

PPP calculated by comparing price of one good across in different currencies is known as absolute purchasing power parity. The Absolute Law of One Price, however, does not hold good when prices of one commodity is compared. (For example, price of one KG of cucumber, Price of a similar brand vehicle, price of a similar electronic equipment etc.)

Another, less stringent form of purchasing power parity is comparing the price of a basket of goods/services in both the countries rather than comparing any one good or service.

$$Spot\ Rate = \frac{Price^{INR}}{Price^{USD}} \qquad (2)$$

It indicates that if a country is experiencing higher inflation (higher price level) compared to another country, its currency will depreciate relative to other currency.

In other words, the spot rate between two countries can be determined by comparing the price index of a basket of similar goods and services. It is very important to understand at this point is that price index should comprise of “similar” goods & services” consumed by residents of both countries.

On a given date, suppose a basket of goods & services costs INR 5000 and a similar basket of goods & services cots USD300, the spot exchange rate on that date should be

Spot Rate = INR5500/350USD = 15.71/USD

If the actual spot exchange rate equals the rate calculated by PPP, then PPP holds true. However, it is empirically proved that PPP in absolute form based on single product or based on a price index does not hold good.

3.3 Purchasing Power Parity and Law of One Price (LOOP):

PPP is based on the concept of **"Law of One Price".** The LOOP indicates that identical good/services should sell for the same price in two separate markets when there are no transportation costs and no differential tax rates exists in the two markets. If there is a price difference, then exchange rate would move in such a manner so that, in both markets the product will sell at same price.

For example, Blackberry E75 model mobile phone costs INR 25,000 in India. The same model costs 34000 of Bangladeshi Taka. Suppose the exchange rate between BTK and INR is INR 0.542/BTK. With this exchange rate, mobile handset costs INR 18428 at Bangladesh. So, why anybody would buy the handset in India? Indian people would sell INR and buy BTK and purchase the mobile in Bangladesh and sell the handset in India at a price of INR26000. For every handset sold in India, the trader makes a profit of INR6572. This profit is the arbitrage profit i.e. buying low and selling high and no risk. So many people would flock to sell INR to buy BTK. Suppose exchange moves to INR0.613/BTK. The mobile handset now costs INR 20842. Still there is possibility of arbitrage opportunity. The exchange rate would keep on adjusting so that the arbitrage opportunity is completely done away with.

Suppose the exchange rate moves to INR 0.846/BTK, then buying in Bangladesh and selling in India becomes a loss making proposition. In this case, the trader would buy the handset in India and start selling Bangladesh. This process will go on till the price of the handset is same in both countries.

In this example, we have ignored, the transaction cost, the import duty, the sales tax and cost associated with conversion of INR to BTK etc. have been ignored. With inclusion of these duties/taxes and levies, the arbitrage opportunity may not exists, Also another inherent assumption in this example is that the Blackberry E75 model is demanded in both India and Bangladesh.

It is to be noted that law of one price is based on the assumptions which are not practicable in todays' time. During the era of globalisation and open environment, it is not possible to rely on the applicability of LOOP at global level. Therefore, it is important to note that LOOP holds well only if three conditions are satisfied. These three are:-

- ✓ Transportation costs, barriers to trade (import-export levies, customs duty etc.) and other transaction costs (currency conversion fee) are insignificant.
- ✓ There must be competitive markets for the goods and services in both countries.

- ✓ The LOOP applies only to tradable goods. LOOP is not applicable to immobile goods such as houses, and many services that are local

3.4Relative Purchasing Power Parity

Relative PPP postulates that the change in inflation rate governs the change in exchange rate.

$$\frac{S_t}{S_{t-1}} = \frac{P_{foriegn(t)} / P_{foriegn(t-1)}}{P_{domestic(t)} / P_{domestic(t-1)}} \quad \textbf{(3)}$$

Where S_t is the spot rate of foreign currency/domestic currency and $P_{(t)}$ is the price level prevailing now and $P_{(t-1)}$ price level prevailing before one period

With two countries having different inflation rate, the relative prices of goods in the two countries, will change so that the goods and services offered in these countries are priced same.

4. Know How Prices and Interest Rates Influence Exchange Rate Determination

4.1 Inflation Rates and Exchange Rate Determination

It is normally the inflation rate differential between the two countries that influences the exchange rate between the two currencies. For explaining the impact of inflation on the equilibrium value of exchange rate of two different currencies, we take into account the case of two countries inflation position at a point of time. The countries are United States and United Kingdom. Here, we take a case of rising U.S. inflation on the equilibrium value of the British Pound.

Consider how the demand and supply schedules would be affected if U.S. inflation suddenly increased substantially while British inflation remained the same. For measuring the impact of inflation on the equilibrium value of exchange rate, we are assuming that, both British and U.S. firms sell goods that can serve as substitutes for each other. The sudden jump in U.S. inflation should cause an increase in the U.S. demand for British pounds. In addition, the jump in U.S. inflation should reduce the British desire for U.S. goods and therefore, reduce the supply of pounds for sale. These market reactions are explained in the Figure 1.

At the equilibrium exchange rate of $1.50, there would be a shortage of pounds in the foreign exchange market. The increased U.S. demand for pounds and the reduced supply of pounds for sale place upward pressure on the value of the pound. According to Figure 1, the new equilibrium value is $1.57.

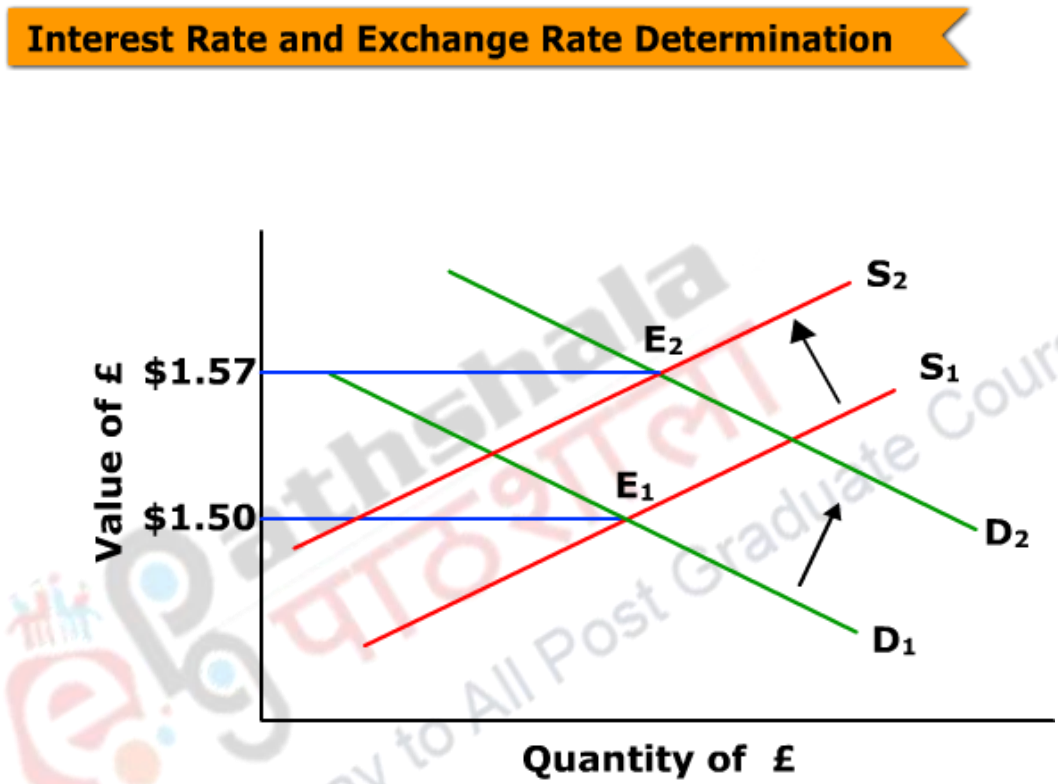

Figure 1: Impact of rising U.S. inflation on the equilibrium value of the British Pound

4.2 Interest Rates and Exchange Rate Determination

Like inflation rate differential, interest rates between two different countries, also influences the equilibrium value of exchange rate. Changes in relative interest rates affect investment in foreign securities, which influences the demand and supply of currencies and therefore influences exchange rates. Therefore, for explaining the impact of interest rates on the equilibrium value of exchange rate of two different currencies, we take into account the case of two countries interest rates position at a point of time. Here, we take a

case of rising U.S. interest rate and its impact on the equilibrium value of the British Pound.

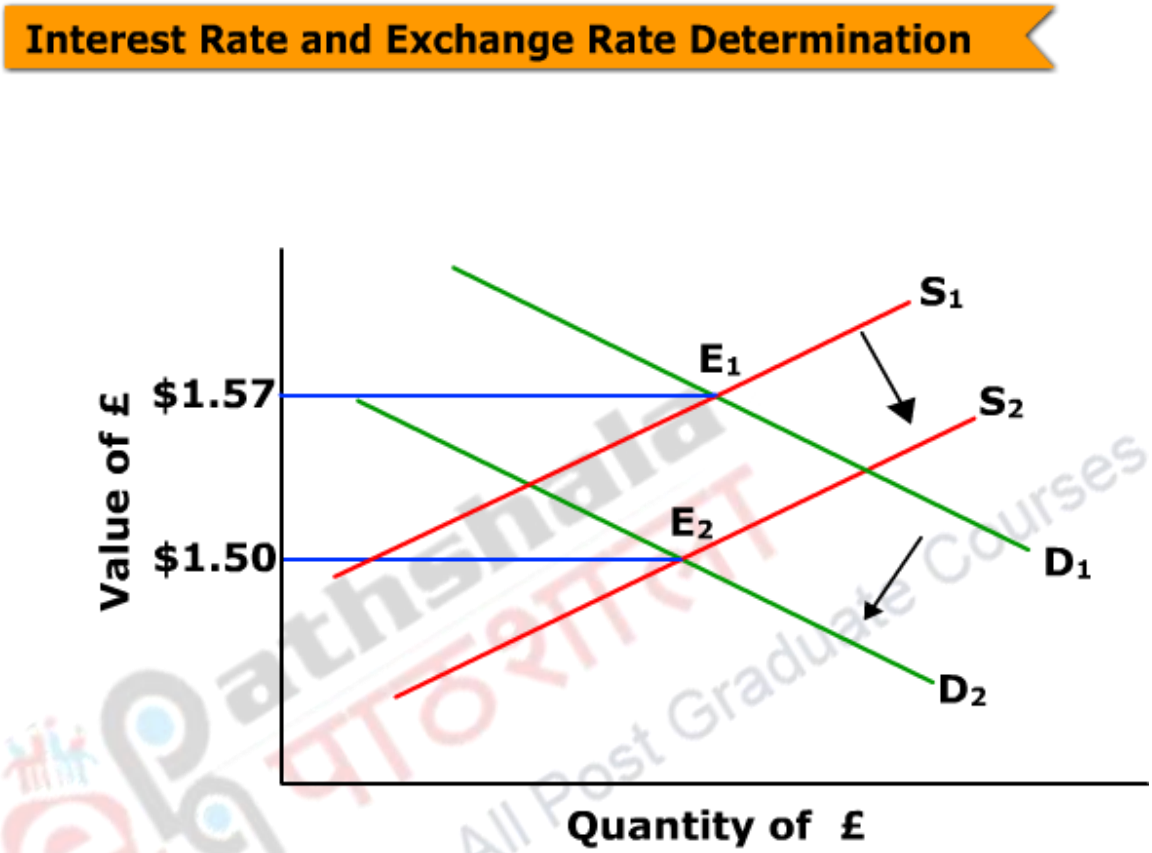

Figure 2 Impact of rising U.S. interest rates on the equilibrium value of the British Pound

Assume that U.S. interest rates rise while British interest rates remain constant. In this case, U.S. investors will likely reduce their demand for pounds, since the U.S. rates are now more attractive relative to British rates, and there is less desire for British bank deposits. Because U.S. rates will now look more attractive to British investors with excess cash, the supply of pounds for sale by British investors should increase as they establish more bank deposits in the United States. Due to an inward shift in the demand for pounds and an outward shift in the supply of pounds for sale, the equilibrium exchange rate should decrease. This is graphically represented in the Figure 2.

5. Understand the Fisher Effect and International Fisher Effect

5.1 Fischer Effect: Relationship between the Nominal and Real exchange Rate

In an economy, the relationship between the real interest rate, nominal interest rate and inflation is known as **"Fischer Effect".** Irving Fischer postulated that the nominal interest rate in an economy is equal to the sum of real rate of return and inflation rate. Mathematically,

$$(1+i) = (1+r)\,(1+\text{Inflation Rate}) \quad (4)$$

Where i= nominal interest rate and r = real interest rate.

The nominal interest rate is the interest rate we get when we approach bank for a fixed deposit. If a bank informs us that nominal interest rate is 7.25% per annum that means that an investor would receive INR1070.25 after one year on an investment of INR 1000

The real interest rate is the inflation adjusted nominal rate. The speed of rise in purchasing power of your savings account is depicted by real rate.

A numerical example will make us understand this:

Nominal interest rate is 12%, i.e. a bank fixed deposit holder is earning 12% per annum as interest rate Expected Inflation rate during this period is 8%.

$(1+12\%) = (1+r)\,(1+8\%)$. Solving for r, the real rate (r) is 3.70%.

Many a times we come across and easy estimation of real interest rate i.e., real interest rate is the nominal interest rate minus the expected inflation rate.

Nominal Interest Rate = Real Interest Rate + Inflation rate.

So when Nominal interest rate is 12%, expected inflation rate during this period is 8%, the real interest rate is 4%. If the expected inflation rate increases to 13%, then real interest rate is -1%.

Country specific Fischer effect is expressed as

$$(1+i_{us}) = (1+r_{us})\ (1+\text{Inflation Rate}_{us})$$

$$(1+i_{india}) = (1+r_{india})\ (1+\text{Inflation Rate}_{India})$$

5.2 International Fisher Effect

International Fisher Effect suggests that the estimated change in the current exchange rate between any two currencies is directly proportional to the difference between the two countries' nominal interest rates at a particular time. In other words, the percentage change in the spot exchange rate over time is governed by the difference between the nominal interest rate for the two currencies.

Mathematically, International Fischer effect is expressed as:

$$\frac{Spot_{today} - Spot_{afterayear}}{Spot_{afterayear}} = \frac{i_{USA} - i_{India}}{1 + i_{India}} \quad (5)$$

For example, if the nominal interest rate in India is 14% per annum and it is 10% in USA, then INR is expected to depreciate viz-a viz USD.

$$\frac{i_{USA} - i_{India}}{1 + i_{India}} = \frac{10\% - 14\%}{1 + 14\%} = (-)3.51\%$$

This indicates that the left hand side of the equation 5 should also be equal to (-) 3.51%. Hence, the percentage difference between the spot rate prevailing today and spot rate to prevail after a year should be equal to (-) 3.51%

In nutshell, the International Fisher's effect relates the nominal interest rate between two countries and the movement of exchange rate between the currencies of the two countries. It indicates that the country with lower nominal interest rate will appreciate in the future compared to other relative currency.

6. Summary

- Exchange rate denotes the ratio between the values of two currencies.
- It is not an exaggeration to say that the exchange rate is the single most important macroeconomic variable in an open economy. This is so much the case in the present environment of financial deregulation and globalization of financial markets.
- The exchange rate between two currencies in a floating rate regime is determined by the interaction of demand and supply forces in the market.
- Certain fundamental macroeconomic factors influence the exchange rates between two countries.
- Purchasing power parity (PPP) is a theory of exchange rate determination which compares the average costs of goods and services between countries.
- Purchasing power parity (PPP) proposes that if similar products are sold in two different countries at different prices then the exchange rate should be such that the price would be the same even when quoted in different currencies. In other words, exchange rate between currency pairs is in equilibrium when purchasing power is same.
- Absolute form of the purchasing-power-parity condition stated in terms of levels of prices and levels of exchange rates, rather than in terms of inflation and changes in exchange rates.
- The law of one price means that prices of the same item in different currencies reflect the exchange rates between the currencies.
- Law of One Price assumes that transportation costs, barriers to trade (import-export levies, customs duty etc.) and other transaction costs (currency conversion fee) are insignificant. There must be competitive markets for the goods and services in both countries. Moreover, LOOP applies only to tradable goods. LOOP is not applicable to immobile goods such as houses, and many services that are local.
- The "Big Mac index[1]" published by Economist tries to find out what should have been the PPP governed exchange rate.
- The Big Mac Index is helpful to explain the Purchasing Power Parity.
- Starbucks Tall Latte index is also another index which compares the price of Starbucks Latte in different countries, exactly like the Big Max Index. But yet to enjoy the cult status likes Big Mac Index.
- Both interest rate and inflation rate affect exchange rate significantly.
- In an economy, the relationship between the real interest rate, nominal interest rate and inflation is known as "Fischer Effect".
- International Fisher's effect relates the nominal interest rate between two countries and the movement of exchange rate between the currencies of the two countries. It indicates that the country with lower nominal interest rate will appreciate in the future compared to other relative currency.

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