

## Theories of Exchange rate determination

### INTRODUCTION

By definition, the Foreign Exchange Market is a market<sup>1</sup> in which different currencies can be exchanged at a specific rate called the *foreign exchange rate*. We can anticipate the huge importance of the foreign exchange rate if we can just consider the influence of it on the imports and exports of a country.

For example, let's assume a currency appreciation<sup>2</sup> - the euro against the US dollar. Firstly, the exports of the European Union (E.U) nations will become 'expensive' for the United States of America (USA), which among other things means that E.U product will lose in terms of competitiveness. Secondly, such a currency appreciation will be to the benefit of E.U imports, should those be payable in US dollars. Conversely, a depreciation<sup>3</sup> of the euro against the US dollar will cause an opposite impact.

On the other hand, the rapid growth of international trade (both the import penetration<sup>4</sup> and the export ratio<sup>5</sup>) during the last decades, which was mainly due to the increase of the open economies, enhances the significance of the foreign exchange rates.

### FOREIGN EXCHANGE REGIMES

Undoubtedly, governments have always paid very serious attention to the exchange rate of a country's currency, utilizing any available 'means' at hand, in order to stabilize the 'desirable' range of rate.

Historically, there were periods that governments through the central banks intervened in the foreign exchange market in order to affect the fluctuation of the exchange rate that otherwise would be determined by market forces. There were also periods with no intervention when the exchange rate, *just like a price* (Parkin M. and King D. 1992) was determined by supply and demand.

On 22<sup>nd</sup> July, 1944, at Bretton Woods in the United States of America, 44 countries agreed that a broad international action was necessary to maintain an international monetary system, which would promote foreign trade<sup>6</sup>. In this respect, it established a worldwide system of **fixed exchange rates** between currencies. Actually, the 'tool' was gold, with the following quota: one ounce of gold was to be worth US dollars 35. After the establishment of the fixed rate of exchange, all other currencies were pegged to the US dollar at a fixed exchange rate.

As stated in the article<sup>7</sup> 'The End Of the "Fixed" Dollar', by the beginning of the 1960s, the US dollar 35 = 1 oz. gold ratio was becoming more and more difficult to sustain. Gold demand was rising and the U.S. Gold reserves were declining.

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<sup>1</sup> A worldwide 'net' that operates almost 24 hours per day because of different time zones.

<sup>2</sup> The rise in the value of a currency in terms of another

<sup>3</sup> The fall in the value of a currency in terms of another

<sup>4</sup> Shows the proportion of domestic demand satisfied by imports

<sup>5</sup> Shows the proportion of the GDP that is exported

<sup>6</sup> <http://www.ibiblio.org> (Conference at Bretton Woods)

<sup>7</sup> <http://www.the-privateer.com>

On 15<sup>th</sup> August, 1971, President Nixon, repudiated the international obligation of the U.S. to redeem its dollar in gold.

By the end of 1974, gold had soared from \$35 to \$195 an ounce.

Since the collapse of the Bretton Woods agreement (February 1973), the world's currencies have "**floated**" with respect to the US dollar.

Thus, the foreign exchange rate regime changed from a '**fixed exchange rate**' to a '**flexible or floating exchange rate**'. A system in which, exchange rates are determined by supply and demand that is called 'clean float' or where governments through central banks intervene (buy and sell currencies) in the markets, which is called 'dirty float'.

## VOLATILITY AND RISK

Undoubtedly, dramatic movements in the value of currencies can occur where the forces of supply and demand freely determine the price. Consequently, such a system increases the exchange rate risk associated with but not limited to international transactions.

The cross-border financial activity differs from the domestic activity in respect to related risk due to the fact that when investing in a foreign country you have to consider many other factors, such as:

- Tax system - differences related to the specific country's system.
- Political risk - a democratic country is preferable to a non-democratic one.
- Government intervention - it is also preferable to deal with a country without government intervention.
- Business risk - unforeseen changes in the general economic environment.

In addition, the likely volatility in the exchange rate can drastically affect the cost, profits and return on investments of international firms, thus, resulting in the following levels of risk:

- **Economic exposure**
  - **Transaction exposure** is related to those activities that trade internationally. For example, a EU company imports bicycle components from the United States with 2 months' credit. Possible US dollar depreciation will be for the benefit of the EU organization because it will pay fewer euros. On the contrary, if the US dollar appreciates, the company will suffer a loss, due to the fact that it will pay more euros. The transaction exposure (the risk of adverse movements in the exchange rate) can be eliminated using hedging instruments. An example of this would be forward rate contracts.
  - **Operational exposure**. Although a company may not trade globally, due to competitiveness, it may suffer the exchange rate risk. For example, a US bicycle producer will have a competitive advantage compared to a EU producer of a similar type of bicycle if the euro depreciates against the US dollar. The price of the US bicycle if converted into euros will fall, and consequently will attract EU members to buy it.

- **Translation exposure**

Assuming a company that has a subsidiary outside the EU and expects profits in one year's time. Based on the current exchange rate between foreign and domestic currency, the company has converted the amount of profits in its local currency. If the euro appreciates against the local currency, then the amount of profits when converted into euros will be less.

## DETERMINANTS OF EXCHANGE RATE

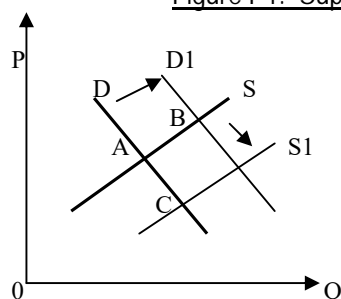
Many theories there have been written in respect to the main determinant of future exchange rates. Although the majority of these theories give adequate reasons in order to explain what actually determines the rates between the currencies, we can argue that there are many factors that may cause a currency fluctuation. Consequently, there is little that can be alleged in respect to the theory that better answers the question of what finally determines the exchange rates.

Here below, we will refer to the main theories regarding the determinants of the exchange rates.

### 1. Supply and Demand

As stated earlier, the exchange rate, just like commodities, determines its price responding to the forces of supply and demand<sup>8</sup>. Therefore, if for some reason people increase their demand<sup>9</sup> (shift of the curve from D to D1) for a specific currency, then the price will rise from A to B, provided the supply remains stable. On the contrary, if the supply<sup>10</sup> is increased (shift of the curve from S to S1), the price will decline from A to C, provided the demand remains stable (figure P1).

Figure P1. Supply and Demand for foreign currency



P: shows the exchange rate, Q: shows the amount of currency demanded and supplied  
A, B, C: Show the equilibrium exchange rate

<sup>8</sup> Although, one could assume that the international trade, investments and finance (when transactions in different currencies are needed) are the major reasons for change in the supply and demand of currencies, it is currency speculation that mainly causes the change of the market forces.

<sup>9</sup> The 'derived demand' for a foreign currency arises because of goods and services imported, international investments in assets, and international finance.

<sup>10</sup> We assume that the curve has the traditional upward slope.

Any excess supply (above the equilibrium point) or excess demand (below the equilibrium point) will increase or decrease temporarily foreign currency reserves accordingly. Finally, such disequilibrium situations will be eliminated through the pricing, e.g. the market itself.

## 2. Purchasing Power Parity (PPP)

By definition the PPP states that using a unit of a currency, let us say one euro, which is the purchasing power that can purchase the same goods worldwide. The theory is based on the ‘law of one price’, which argues that should a euro price of a good be multiplied by the exchange rate (€ /US\$) then it will result in an equal price of the good in US dollars. In other words, if we assume that the exchange rate between the € and US \$ states at 1/1.2, then goods that cost € 10 in the EU should cost US\$ 12 in the United States. Otherwise, arbitrage<sup>11</sup> profits will occur.

However, it is finally the market that through supply and demand will force accordingly the euro and US dollar prices to the equilibrium point. Thus, the law of one price will be reinstated, as well as the purchase power parity between the euro and US dollar.

Inflation differentials between countries will also be eliminated in terms of their effect on the prices of the goods because the PPP will adjust to equal the ratio of their price levels<sup>12</sup>. More specifically, as stated in their book (Lumby S. & Jones C. 1999) “*the currency of the country with the higher rate of inflation will depreciate against the other country’s currency by approximately the inflation differential*”.

In conclusion, it can be argued that the theory, although it describes in a sufficient way the determination of the exchange rates, is not of good value, mainly because of the following two disadvantages. Firstly, not all goods are traded internationally (for example, buildings) and secondly, the transportation cost should represent a small amount of the good’s worth.

## 3. The Balance of Payments (BOP) Approach

The balance of payments approach is another method that explains what the factors are that determine the supply and demand curves of a country’s currency.

As it is known from macroeconomics, the balance of payments is a method of recording all the international monetary transactions of a country during a specific period of time. The transactions recorded are divided into three categories: the current account transactions<sup>13</sup>, the capital account transactions<sup>14</sup>, and the central bank transactions<sup>15</sup>.

The aforementioned categories can show a deficit or a surplus, but theoretically the overall payments (the BOP as a whole) should be zero – which rarely happens.

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<sup>11</sup> Financial transaction involving the simultaneous purchase in one market and sale in a different market with a profitable price (Barron’s 1994).

<sup>12</sup> University College Dublin, prepared for *Encyclopedia of World Trade*.

<sup>13</sup> The current account includes the inflow and outflow of goods, services, and transfers.

<sup>14</sup> The Capital account includes the portfolio and the direct investments.

<sup>15</sup> Central bank’s transactions are related to the increase or decrease of foreign exchange reserves.

As stated earlier, a currency's price depreciation or appreciation (the change in the value of money), directly affects the volume of a country's imports and exports and, consequently, a likely fluctuation in the exchange rates can add to BOP discrepancies. For example, a likely depreciation will increase the value of exports in home currency terms (the larger the exports demand elasticity the greater the increase).

Conversely, the imports will become 'more expensive' and their value will be reduced in home currency (the larger the imports demand elasticity the greater the decrease).

Consequently, we can argue that unless the value of exports increases less than the value of imports, the depreciation will improve the current account. More specifically, we can finally assess the impact of the currency's depreciation on the current account only by considering the price sensitivity of imports and exports.

The **Marshall Lerner** Condition shows that if the sum of the price elasticity of demand for imports and exports is greater than one, then a fall in the exchange rate will improve the current account of BOP.

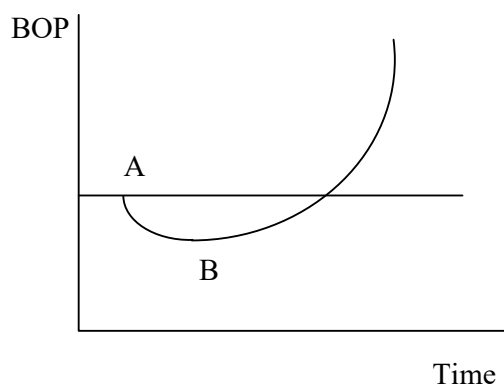
$$|H_x| + |H_m| > 1$$

*H<sub>x</sub>*: Price elasticity of exports volumes

*H<sub>m</sub>*: Price elasticity of import volumes

The **J curve effect** illustrates that in the short-term a depreciation of the currency can initially worsen (from A to B) the current account balance before it improves its position (figure P2). This is due to the low price elasticity of demand for imports and exports in the immediate outcome of an exchange rate change.

Figure P2. The J curve effect



#### 4. The Monetary Approach

In this approach attention is given to the stock of currencies in comparison to the willingness of people to hold these stocks.

According to the monetary theory, exchange rates adjust to ensure that the quantity of money in each currency supplied is equal to the quantity demanded (Parkin M. & King D. 1992).

Both **Quantity Theory of Money (QTM)** and **Purchasing Power Parity (PPP)** have been used in support of the aforementioned theory.

The **QTM** states that there is a direct relationship between the quantity of money and the level of prices of goods and services sold (Investopedia.com). In other words, *more money equals more inflation*.

In a domestic framework, the following equation has been formulated<sup>16</sup>.

$$MV = PY$$

*M: Money supply/demand*

*V: Velocity of circulation (the number of times money change hands)*

*P: Average price levels*

*Y: GDP*

Finally, we can conclude that an increase in the money supply leads to inflation, which in turn results in the decrease in the value of money or purchasing power.

Consequently, if we also consider this in an international context, we will appreciate the following implications:

Firstly, a rapid increase in the money supply (in the home currency), which as stated earlier means inflation, will put into effect the **PPP** resulting in the depreciation of the currency's exchange rate.

Secondly, a higher interest rate will also result in the currency's depreciation because of the positive relationship between interest rates and money circulation.

Finally, if the GDP grows faster than overseas GDP, the demand for money will increase. Assuming there is a given supply of money, the exchanged rate will decrease, which is in direct contrast to the PPP approach.

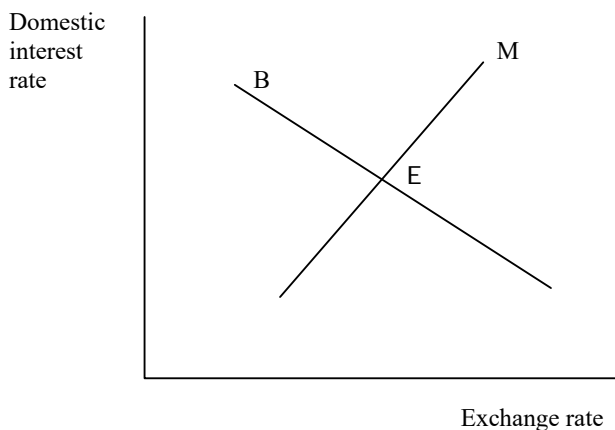
### 5. The Portfolio Balance Approach

The portfolio balance approach takes into consideration the diversification of investors' portfolio assets.

Diversification is a technique that attempts to reduce risk by investing both among various financial instruments and across national borders, to mention just a few.

For example, here below we consider a combination of domestic and foreign money and domestic and foreign bonds, the implications of which are illustrated in the following figure P3.

Figure P3. Portfolio balance approach



<sup>16</sup> Firstly by Irving Fisher and later by Milton Friedman.

Both the M and the B lines show combinations of domestic interest rates and exchange rates. The upward line M is in agreement with the equilibrium in the money market and the downward line B is in agreement with the equilibrium in the bond market. Point E, which is the intersection of M with B, represents the combination of interest rate with the exchange rate that gives equilibrium to both the money and bond markets.

What the theory argues is that an increase in the money supply will lead to a depreciation of the exchange rate. The extent of the depreciation depends upon the slope of the curves M and B.

For example, if we consider an increase in the domestic money supply, we will anticipate that a lower interest rate and /or a higher exchange rate can only absorb the excess supply, which in turn will result in the reduction of bonds. To this end, line M will move to the right and line B will move to the left.

## EXCHANGE RATE FORECASTING

In the previous section we referred to various theories in respect to the main determinant of future exchange rates. However, it is actually an empirical topic to identify the most important factors.

As a result, we can argue that forecasting exchange rates is a difficult task because of so many factors that might be regarded as determinants. In addition, using formulas<sup>17</sup> (similar to the Interest Rate Parity Theorem) will result in only imprecise estimates of future currencies exchange, basically because the data related to inflation differentials and future spot rates are by themselves only estimates (Lumby S. & Jones C. 1999).

On the other hand, it remains doubtful whether or not the foreign exchange market is an efficient<sup>18</sup> one - since it seems that not all information but only the historical is incorporated in prices (weak form efficiency).

Although we share the opinion that there is no reliable method available to forecast exchange rates, we will refer here below to some of the main concepts.

### 1. The Unbiased Expectations Hypothesis

The concept of the Unbiased Expectations Hypothesis argues that the forward rate is an unbiased forecaster of the future spot rate. Thus, the forward rate at time  $t$  for maturity at time T must equal the markets expectation at time  $t$  for maturity at time T.

$$F_{tT} = E_t(S_T)$$

In addition, the forward price is the expected spot price minus a risk premium to cover likely interest rate differentials.

$$F_{tT} = E_t(S_T) - \pi. \quad \pi \text{ is the risk premium}$$

<sup>17</sup>  $\frac{\text{US inflation} - \text{UK inflation}}{1 + \text{UK inflation}}$  = percentage change in the \$, where +=depreciation and -=appreciation.

<sup>18</sup> All information is immediately incorporated in prices.

## 2. Unbiased or Biased Predictor

Finally, the UEH does not give a quite satisfactory reply as to whether or not a forward rate may be a biased predictor of a future spot rate.

In this respect, the following equation gives adequate answer to the aforementioned question.

$$S_T = b_0 + b_1 F_{t,T} + b_2 I$$

*S<sub>T</sub>*: represents the realized spot rate for the maturity date

*F<sub>T</sub>*: represents the forward rate

*I*: represents any available information that affects the exchange rate

*b<sub>2</sub>*: is a statistically significant that represents the market's efficiency if all the information is not incorporated in the forward rate (inefficient market)

Studying historical data, we can conclude that in the majority of instances the **b<sub>0</sub>** does not equal to zero and the **b<sub>1</sub>** does not equal to 1, which means that the forward rate is actually a **biased predictor** of the future spot rate. Contrarily, both the **b<sub>0</sub>** and the **b<sub>1</sub>** have a negative value, demonstrating that there is a risk premium (mentioned earlier) related to the forward rate.

## 3. Purchasing Power Parity

In accordance with the PPP concept, the inflation differentials between countries affect the exchange rate, and consequently the PPP could be of good value in order to forecast the exchange rate. In Cochran & Defina study (Cochran & Defina 1995), they show that the exchange rates, although they deviate from the PPP, they finally return to their PPP levels. However, during their deviation the possibility of the exchange rates moving backward from or forwards to the PPP remains the same, and consequently the PPP did not prove itself to be a consistent or reliable 'tool' for forecasting.

## 4. Econometric Models

The econometric models in their attempt to forecast the exchange rates take into consideration other factors that are regarded as determinants of the exchange rates. More specifically: inflation, the relative<sup>19</sup> GDP levels, the relative interest rates, and the relative money supply.

Although the econometric models perform well in general, we can argue that these models do not lead to reliable forecasts because they use in many cases 'past' data.

In addition, it can be argued that empirical studies indicate that the ability of such models to forecast is greater in the long term than in the short term.

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<sup>19</sup> For example, the relative price of a good is the price of that good in terms of another.



### 5. Technical Analysis Forecasting

In contrast to the fundamental analysis that considers financial data, the technical analysis analyses diagrams based on past data. More specifically, it accepts the following:

- The market is efficient (all information is incorporated into the prices).
- The prices are moved by trend.
- The history repeats itself.

The technical analysis takes into consideration indicators, such as moving averages and oscillators, the volume of transactions, trend lines, and time or price filters, and it combines their trend according to some charting rules.<sup>20</sup> Then in turn the technical analysis tries to identify the future price and anticipate the price patterns in the financial and commodity markets.

The applied chartist techniques, either on bar charts or on candlestick<sup>21</sup> charts, lead to more reliable forecasts when dealing with short-term periods.

### CONCLUDING REMARKS

In this assignment we initially analyzed the theories of exchange rate determination, and we concluded that the exchange rate of a currency, just like commodities, determine its price responding to the forces of supply and demand.

However, it remains difficult to evaluate the ‘weight’ of each factor that influences the supply and demand flows. In this respect, we can argue that in the long term fundamental forces drive the currency’s movements, e.g., inflation rates, interest rates, and GDP levels, to mention just a few, while in the short run, news and events drive the exchange rates movements. Moreover, we still remain unsure as to the ranking of the factors that finally determine the exchange rates.

We have further considered various concepts and models thought to be reliable forecasters of the exchange rates. We have concluded that the forward rates are not good predictors of the future spot rates. In other words, the forward rate does not provide an ‘unbiased’ estimate of the exchange rate movements.

Taking into consideration the time horizons, we come to the conclusion that fundamental economic forces, such as purchasing power parity and the balance of payments, did not automatically affect the exchange rates, but they require a considerable amount of time. As a result they are not reliable over short time periods. Conversely, we can argue that the technical analysis performs comparatively well in the short run since news and events are incorporated into the diagrams and trends.

We finally conclude the following: Firstly, the foreign exchange market is not an efficient one. Otherwise, it would be futile to beat or try to forecast the market. Secondly, because of so many determinants of the exchange rates, it is difficult to proceed to a reliable estimation for future rates. Thirdly, there is no unfailing method available to forecast exchange rates, and we have further determined that the forward

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<sup>20</sup> For example, if the 9 days moving average moves above the 30 days moving average – sign BUY.

<sup>21</sup> A very old Japanese technique for analysing and timing the stock and futures markets.

rate provides a biased estimate of the future spot rate. As a result, companies trading internationally face exposure to exchange rate risk.

In this respect, the mentioned ‘costly’ hedging<sup>22</sup> instruments in *Appendix 1* have been developed in order to manage the exposure related to unfavorable currency movements. More specifically, it can be argued that there is no ‘perfect’ hedge or in other words a hedge with 100 % efficiency. What in practice happens is that a small profit or loss is made. For example, when an importing company has a liability that is payable in six months, it can hedge its exposure to exchange rate risk by using a forward contract. e.g., the company can buy the due amount at the six months forward rate. The company having used the aforementioned hedging instrument has no ‘uncertainty’ about the exchange rate movements because it will pay a *specific* and *previously known* amount in its own currency. In other words, the company has ‘locked’ its exposure, and consequently, its cost irrespective of whether or not the after six months ‘spot’ rate proved to be in favour of or not in favour of his decision to hedge.

Finally, we wish to underline that as indicated earlier, there are no *unfailing* methods to forecast exchange rates; consequently, the companies face an exposure related to the currencies’ fluctuation. However, their exposure to exchange rates movements can be managed, controlled, and even more, eliminated by using hedging instruments.

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<sup>22</sup> When people decide to hedge, they are insuring themselves against a negative event. *Investopedia.com*