# THE INSTITUTE OF FINANCE MANAGEMENT

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## LECTURE NOTES

## EFFICIENT MARKET, EXCHANGE RATE FORECASTING AND DETERMINATION

## EFFICIENT MARKETS

### The Concept of Market Efficiency

There are several definitions of market efficiency but the general definition is that, in an efficient market price reflect all available information such that it is not possible to make abnormal profit. The concept of market efficiency was initially developed for the stock market, but it applies equally to the foreign exchange market and indeed to markets in general, financial or otherwise. In an efficient market, exchange rates reflect all available information.

### Implication of Market Efficiency

The implication of this definition is that it is not possible to predict price movements from available information because this information is already reflected in exchange rates. Since the arrival of information is random, and given that new information is reflected in exchange rates very quickly, the period-to-period changes in exchange rates tend to be random. Another implication is that it is not possible to earn abnormal (i.e. higher) returns via active trading as compared to what can be obtained from a passive buy-and hold strategy.

### Levels of Efficiency

There are three levels of efficiency that are defined with reference to the contents of the underlying information set. The three levels are: Weak Efficiency, Semi-strong Efficiency, and Strong Efficiency.

### *Weak Efficiency Level*
In a weak efficient market, exchange rates reflect all the information contained in the past behavior of exchange rates. This is obviously a limited set of information as it excludes the

effect of other relevant variables that, in the case of the foreign exchange market, affect the exchange rates. If the foreign exchange market is weakly efficient, this means that the future behaviors of exchange rates cannot be predicted from their past behavior.

### Semi-Strong Efficiency

In this case, the information set contains not only the pat behavior of exchange rates, but also all publicly available information. Publicly available information pertains to information on variables that affect exchange rates, economic and otherwise. Economic news as released by the central bank is publicly available, since it is reported by the media as soon as it is released. This information includes statistics and analysis pertaining to inflation, growth, and unemployment, the balance of payment, the money supply, public debt, and any other economic variable that may cause shifts in the supply and demand forces in the foreign exchange market. Non-economic factors include such things as cabinet reshuffles and changes in government. If the foreign exchange market is efficient in this sense then even research into the fundamental factors affecting the exchange rate will not help us predict its future behavior.

### Strong Efficiency

In this case, exchange rates reflect all available information, including private and insider information. Insider information may be obtained by having dinner with an official of the Reserve Bank who (privately) transmits knowledge of plans for intervention in the foreign exchange market, or plans to change the exchange rate arrangement. Insider information can also be transmitted by Treasury officials who are aware of hitherto unreleased information pertaining to changes in economic policy that are bound to affect the exchange rate. Private information may arise when, for example, an analyst develops a profitable trading rule that is not revealed as public information. If the foreign exchange market is efficient in this sense, then not even insider and private information can help us predict the future behavior of exchange rates or to make abnormal profit.

## Spot Market and Forward Market Efficiency

### Spot Market Efficiency

The efficiency of the spot foreign exchange market implies that spot exchange rates move a random and unpredictable way, reflecting the random arrival of new information. This means that one cannot make profit by speculating in the spot foreign exchange market by buying and selling currencies actively. It also means that the exchange rate follows a random walk – that is, period-to period changes in exchange rates are random and do not follow any pattern – and hence they are unpredictable.

### Forward Market Efficiency

This concept of efficiency encompasses both the spot and forward markets, and so it is also called foreign exchange market efficiency. In this sense, the market is efficiency if it reflects all available information, where the information is embodied in the forward rate. If a speculator believes that the period forward exchange rate will be lower than the spot rate prevailing, it will be profitable to buy forward and sell spot at the maturity of the forward contract.

## EXCHANGE RATE FORECASTING AND DETERMINATION

### Exchange Rate Forecasting

Exchange rate forecasting is a formal process of generating expectations about exchange rates. Expectations themselves are implicit forecasts, used as an input in the decision-making process. Exchange rate forecasting is a crucial element of the decision-making process of international business firms under a system of floating exchange rates. The importance of exchange rate forecasting stems from the fact that the outcome of decision taken now is contingent upon the value of the exchange rate prevailing sometime in the future.

### The Need for Exchange Rate Forecasting

Exchange Rate Forecasting is needed in the following cases

*Speculators*
Speculators need exchange rate forecasts for speculative purposes. There are various types of speculative activities including:
- Spot Speculation
- Forward Speculation
- Currency Option Speculation
- Currency Futures Speculation
- Currency Swap Speculation
- Uncovered Interest Arbitrage

*Multinational Companies*
Exchange rate forecasts are needed by multinationals in making various business decisions including:

- Hedging Decisions
- Investment and Capital Budgeting Decisions
- Financing and Pricing Decisions
- Strategic Planning

*Central Banks*
The Central Bank needs exchange rate forecasts for foreign exchange market intervention.

*Spot Speculation and Uncovered Interest Arbitrage*
A spot speculator buys (goes long on) a currency if a forecast indicates that it will appreciate, and sells or short sells a currency if the forecast indicates an impending depreciation. In both cases profit will be made if the expectation or forecast turns out to be correct.

*Options Speculation*
A long call or a short put position will be taken if the underlying currency is expected to appreciate, while a short call or a long put position will be taken if the currency is expected to

depreciate.  Thus, there is a need to forecast the level of the underlying exchange rate on the expiry date in the case of European option, and throughout the life of an American option.

*Spot-Forward Speculation and Uncovered Arbitrage*
If a forecast indicates that the spot exchange rate will be higher than the forward rate on the maturity date of the forward contract, a speculator buys forward and sells spot upon delivery.  If the forecast indicates that the spot exchange rate will be lower than the rate.  A speculator sells forward and buys spot.  If the forecast of the spot exchange rate on the maturity date of the forward contract is correct, profit will be made. In the case of uncovered arbitrage, exchange rate forecasting is also crucial.  If the forecast indicates that the foreign currency is expected to appreciate by more than the interest rate differential, the speculator will indulge in outward arbitrage, borrowing the domestic currency and investing in the foreign currency.

*Hedging*
The decision whether or not to hedge a foreign exchange exposure resulting from payables or receivables depends on the spot exchange rate expected to prevail when the payables and receivables are due. While hedging protects you from the bad outcome, it also deprives you of the good outcome.  In the case of receivables, a hedging decision will be taken if the foreign currency forward, for example, the hedger may regret the decision if the forecast is wrong.

*Investment and Capital Budgeting Decisions*
In the case of capital budgeting for foreign direct investment, such as the decision to establish a foreign subsidiary, the decision is normally based on a feasibility study involving the estimation of the cash flows of the subsidiary.  Since the operational currency of a foreign subsidiary is different from the currency of the parent company, exchange rate forecasting is needed in order to convert the estimated future cash flows into domestic currency.

*Financing Decisions*
A currency will be chosen for financing purposes if it is expected depreciate.  A long-term financing decision involves the choice of the currency to serve as the denomination of a bond issue, for example.  In both cases, exchange rate forecasting required.

*Pricing Decisions*
Exchange rate forecasting is important for international business firms selling their products in foreign countries.  The foreign currency price of a product could be anything in relation to the corresponding domestic currency price, depending on the level of the exchange rate. An appreciation of the domestic currency may make the foreign currency price of the product too high to achieve the market penetration objective.

*Strategic Planning*
Exchange rate forecasting is also important for strategic planning, such as the choice of the production location and the foreign markets.  Normally, international firms aim to incur costs in countries where currencies are expected to depreciate and earn revenue in countries where currencies are expected to appreciate.

*Central Bank Intervention*

Not only do business firms need exchange rate forecasting but so do central banks and economic decision-making authorities. For example, the central bank intervenes in the foreign exchange markets in order to make the expected path of the exchange rate converge on the desired path. Knowing what the expected path is requires exchange rate forecasting.

**Approaches to Forecasting Exchange Rates**

While forecasters use a wide variety of forecasting techniques, most can be classified into three distinct approaches:

- Efficient Market Approach
- Fundamental Approach
- Technical Approach

*Efficient Market Approach*

Financial markets are said to be efficient if the current exchange rates fully reflect all the available and relevant information. The efficient market hypothesis (EMH) has strong implications for forecasting. Suppose that foreign exchange markets are efficient. This means that the current exchange rate has already reflected all relevant information, such as money supplies, inflation rates, trade balances, and output growth. The exchange rate will then change only when the market receives new information. Since news by definition is unpredictable, the exchange rate will change randomly over time. In a word, incremental changes in the exchange rate will be independent of the past history of the exchange rate. If the exchange rate indeed follows random walk, the future exchange rate is expected to be the same as the current exchange rate. In a sense, the random walk hypothesis suggests that today's exchange rate is the best predictor of tomorrow's exchange rate. Predicting the exchange rates using the efficient market approach has one principal advantage. Since the efficient market hypothesis is based on market-determined exchange rates, it is costless to generate forecasts. Both the current spot and forward exchange rates are public information. As such, everyone has free access to it.

*Fundamental Approach*

The fundamental approach to exchange rate forecasting uses various models. For example the monetary approach to exchange rate determination suggests that the exchange rate is determined by three independent (explanatory) variables: I) relative money supplies ii) relative velocity of monies, and iii) relative national outputs. Generating forecasts using the fundamental approach would involve three steps:

- Estimation of structural model to determine the numerical values for the parameters.
- Estimation of future values of the independent variables
- Substituting the estimated values of the independent variables into the estimated structural model to generate the exchange rate forecasts.

The fundamental approach to exchange rate forecasting has three main difficulties. First, one has to forecast a set of independent variables to forecast the exchange rates. Forecasting the former will certainly be subject to errors and may not be necessarily easier than forecasting the latter. Second, the parameter values, that is the α and the *βs*, that are estimated using historical data may change over time because changes in government policies and/or the underlying structure of

the economy. Either difficulty can diminish the accuracy of forecasts even if the model is correct. Third, the model itself can be wrong. The forecasts generated by a wrong model cannot be very accurate.

*Technical Approach*
The technical approach first analyses the past behavior of exchange rates for the purpose of identifying patterns and then projects them into the future to generate forecasts. The approach is based on the premise that history repeats itself. The technical approach is thus at odds with the efficient market approach. At the same time it differs from the fundamental approach in that it does not use the key economic variable such as money supplies or trade balances for te purpose of forecasting.

## Performance of the Forecasters

Because predicting exchange rates is difficult, many firms and investors subscribe to professional forecasting services for a fee. There three measures of performance of forecasters.

- Mean Absolute Error (MAE)
- Mean Square Error (MSE)
- Root Mean Square Error (RMSE)

### *Mean Absolute Error [MAE]*

It is the average of the absolute errors. It is given by:

$MAE = \dfrac{1}{n} \sum_{t=1}^{n} \left| \hat{S}_t - S_t \right|$ , where n is the number of forecasting periods; $\hat{S}_t$ is forecast exchange rate

and $S_t$ is actual exchange rate. The reason for using absolute values is to avoid the possibility of negative errors cancelling out positive errors and thus resulting into a very low or zero mean error although the forecaster may be far away from being accurate.

$(\hat{S}_t - S_t)$ is termed *forecasting error*. If $\hat{S}_t > S_t$ , we have a positive forecasting error while $\hat{S}_t < S_t$ signifies a negative forecasting error. The forecasting error can be expressed in percentage terms. It is then known as the *percentage forecasting error*. It is given by:

Percentage Forecasting Error $= \dfrac{\hat{S}_t - S_t}{S_t} \, x100\%$

### *Mean Square Error*

It is the average of squared forecasting errors. It is given by:

$MSE = \dfrac{1}{n} \sum_{t=1}^{n} (\hat{S}_t - S_t)^2$ Squaring the errors has the same advantage as using absolute values. It

solves the problem of negative errors cancelling out positive errors.

### *Root Mean Square Error*

It is the square root of the mean square error. It is given by:

$$RMSE = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(\hat{S}_t - S_t)^2}$$

## Purchasing Power Parity Approach

The most widely accepted theory of all exchange rate determination theories, the theory of *purchasing power parity* (PPP) states that the long-run equilibrium exchange rate is determined by the ratio of domestic exchange rates relative to foreign exchange rates. The theory attempts to explain changes in exchange rates by changes in inflation rates. According to this theory the value of the domestic currency depends on its purchasing power in its own domestic country as compared with the purchasing powe

*Forecasting Using the PPP*
Forecasts would first of all have to be made for the rate of inflation in the countries whose currencies are under review. Having established estimates of inflation rates, estimates of exchange rates could then be made.

*Problems and Weaknesses*
- The might be valid in the longer term, but it cannot account for short-term fluctuation in exchange rates.
- Even if the method is reliable over the long term, it would be difficult to predict the long term rate of inflation in various countries.
- The method considers inflation to be the only determinant of exchange rate movements and ignore other relevant variables that might affect exchange rates
- The method is based on market efficiency assumption. However markets are known to be inefficient.

## Balance of Payments (Flows) Approaches

After purchasing power parity, the most frequently used theoretical approach to exchange rate determination is probably *the balance of payments approach*, involving the supply and demand for currencies in the foreign exchange market. The basic balance of payment approach argues that the equilibrium exchange rate is found when the net inflow (outflow) of foreign exchange arising from current account activities matches the net outflow (inflow) of foreign exchange arising from financial account activities.

## Monetary Approach

The monetary approach in its simplest form stated that the exchange rate is determined by the supply and demand for national monetary stocks, as well as the expected future levels and rates of growth of monetary stocks. Other financial assets, such as bonds (covered later), are not considered relevant for exchange rate determination as both domestic and foreign bonds are viewed as perfect substitutes. Changes in the supply and demand for money are the primary determinants of inflation. Changes in relative inflation rates in turn alter exchange rates through an assumed purchasing power parity affect. The monetary approach also assumed that exchange

rates are flexible in the short run as well as the long run, so that the transaction mechanism is immediate in impact.

This theory attempts to explain changes in exchange rates by the movement of money between one country and another.  The movement of money raises from: (i) the balance of payments between a country and other countries; (ii) movement of capital; (iii) to a lesser extent, use of a country's official reserves.

*Forecasting Using the Monetary Theory*
In order to make exchange rate forecasts, forecasts would have to be made of the likely movements of money various countries.  Having made these estimates, forecasts of changes in exchange rate could be made, probably using an econometric model for the country's economy.  The major problem with exchange rate forecasting by this method is uncertainty about the economic conditions which cause the movement of money into and out of the country.  Long-term exchange forecasts, whatever prediction model is used, will therefore be very uncertain.