Chapter I

INTRODUCTION

In the broader area of international economics, exchange rate economics has gained much importance in the literature, particularly after the collapse of the Bretton Woods System in 1973 and the shift from fixed exchange rate regime to flexible exchange rate regime. Increase in multinational business and its improved transactions, and opening up of economies for world trade also add more and more to this grey area of research. Further, the study on the behavioural aspects of the foreign exchange market also assumed importance on account of the huge increase in the daily global foreign exchange transactions. For instance, it increased from US $0.1 trillion in 1977 to nearly US $2 trillion dollars in 1998 per day.

Exchange rates have shown much instability and uncertainty since 1973 owing to market activism. Researchers in this area are grappling with the reasons for these uncertainties in the foreign exchange market. What are the determinants of the exchange rate? Do exchange rates follow a specific pattern? Is there any measure that will resolve this uncertainty problem in the foreign exchange markets?

Many approaches to explain the volatility of exchange rates have been developed in the area of open economy macroeconomics. These include Purchasing Power Parity, Monetary approach, and Portfolio approach. However, these theories have had little success in explaining currency
movements in the medium and the long-term. But they have had no explanation on the short run exchange rate movements or the high volume of trading on the foreign exchange market which is the well-known phenomena. Frankel and Rose (1995) make following observation in their survey: "to repeat the central fact of life, there is remarkably little evidence that macro economic variables have consistent strong effects on floating exchange rates, except during extraordinary circumstances such as hyper inflation. Such negative findings have led the profession to a certain degree of pessimism vis-à-vis exchange rate research"

The present study questions the relevance of macro theories in explaining and predicting day-to-day transactions in the foreign exchange market. The general agreement in the area of exchange rate economics is that more than fundamentals, fads (speculative bubbles) are the most important aspects of day-to-day transactions in the foreign exchange markets (Sengupta, 1997). “The speculative agents’ role may be an important contributing factor in this framework, as the risk-taking attitude may tend to replace the risk aversion attitude”. Further, it was found that “the role of fundamentals is either insignificant or tending to be so in recent years. Problems of policy inconsistency and the so-called 'good news', 'bad news' effects or fads are playing more dynamic roles in the exchange market instability today” (Sengupta, 1997) in the case of four important bilateral exchange rates like Yen/Dollar, Mark/Dollar, Pound/Dollar and the
Frank/Dollar. This study also infers that fundamentals are much less important today in explaining the volatility of the real exchange rate process. One can observe from all the approaches that the existing theories consider only macro variables such as relative incomes, relative prices, relative interest rate differentials, relative cumulated current account balances etc. But in practice, do dealers consider only macro economic fundamentals such as these or any other variables that are micro in nature? Particularly, in the short run, where transactions occur in a very short span (within minutes), practitioners may not consider these macro variables while speculating. "... market participants do not in fact all use a common agreed-upon model for thinking about the foreign exchange market and do not all share the same expectations at any point of time." (Frankel & Froot, 683; 1996). They follow other variables that are micro in nature.

To support the above views, Frankel & Froot (1996) cite the example of dollar appreciation in 1984. "At times, however, the path of the dollar has departed from what would be expected on the basis of macroeconomic fundamentals. The most dramatic episode is the period from June 1984 to February 1985. The dollar appreciated another 20 percent over this interval, even though the real interest differential had already begun to fall. The observable factors that are suggested in standard macroeconomic models (like money growth rates, real growth rates, the trade deficit) at this time were also moving in the wrong direction to explain the dollar rise." Further,
they explain that “it is now widely accepted that standard observable macroeconomic variables are not capable of explaining, much less in predicting *ex ante*, the majority of short-term changes in the exchange rate” (p.695).

Another study by Goodhart (1996), also concluded that a typical spot trader does not buy and/or sell on the basis of any fundamental macroeconomic model, but rather trades on the basis of knowledge as to which other traders are offering what deals at a given point, and on the expectation of what could be their behaviour later in the day. Hence, the working of the market shifted from macroeconomic fundamentals to “technical analysis”. “This shift was a natural Bayesian response to the inferior forecasting record of the former group, as their forecasts of dollar depreciation continued to be proven wrong month after month” (Frankel & Froot: 702; 1996). To prove this theory there is some evidence from *Euromoney* magazine (August issues), which surveys the forecasting services, that is shown in appendix.

The survey showed that in 1978, out of 23 forecasting services, 18 were depending on macroeconomic fundamentals and only two on technical analysis. But by 1988, out of 31 firms, 18 were depending on the technical analysis and only 7 on the macro economic fundamentals. From this survey, it is clear that the importance of “fundamentals” in the day-to-day transactions of the foreign exchange markets is declining “and that large
exchange rate movements may take place with little basis in macro economic fundamentals" (p. 703). Perhaps in the long-run, there is scope for considering macro variables' influence on exchange rate changes. But in the foreign exchange market, the short-run forecasters will dominate.

To further substantiate the case for studying micro behaviour in the market, a recent study by National Bureau of Economic Research (working paper-7524), on "How Do UK-Based Foreign Exchange Dealers Think Their Market Operates?" comes out with interesting results. The study conducted a primary survey of 110 UK-based foreign exchange dealers in March/April 1998. The study addresses three issues: a) the microeconomic operation of the foreign exchange market like trading techniques and trading mechanisms; b) the traders' views on the relevance of fundamentals in explaining the changes in exchange rate determination and its strengths in predicting future exchange rate movements; c) the importance of microstructure factors in studying the rate changes.

The results are very interesting and, hopefully, will influence the theoreticians in exchange rate economics to meet the present-day demands of the field. The study finds that among the traders, over a period of time, there is a huge and significant shift from fundamentals to non-fundamental factors. The traders unanimously believe that fundamentals are irrelevant in intra-day trading. They believe that news (32.8% out of 110 respondents),
bandwagon effects (29.3%) and speculative effects (25.3%) are more important in the intra-day market. Only 0.6% of the respondents felt that fundamentals are useful in the intra-day trading. But, as academicians view, fundamentals are found to be an important element in explaining changes in medium and long-term horizons. In other words, as the horizon lengthens, the attraction towards fundamentals rises but so do risks. It was also found that speculative forces, which traders measure from the order flows (synonym of effective demand) through the market, were highly ranked in the intra-day and are the only factor perceived to have a significant role in both intra-day and medium term trading.

Given these results, it is intuitive that, in the intra-day and short-term trading, macro theories on exchange rate determination are of less use for dealers. Long-term predictions are also of not much use for them, as they perceive that they need to face more risk in long-run trading. Hence, it is a necessary to capture the speculative forces, which are important in the intra-day and short horizon business in the foreign exchange market.

Now the question is what are the variables that will be considered by the short-run forecasters? In the literature, micro variables are bid-ask spreads, trading volume, own volatility, nonsynchronous trading, information inventory cost, etc. In the financial market literature, to study the behaviour of prices, participants and uncertainties the researchers mostly
used the *microstructure theory*, which is the only theory that considers all the micro variables specified above, but in the case of stock markets only.

As in the stock market, in the foreign exchange market also there may be possibility of applying the *MicroStructure Theory*, which considers the micro aspects of the market. Market microstructure refers to the study of trading activity in organised asset markets, with particular attention to the information and the institutional features of trading processes. It deals with the behaviour of participants in financial markets, including the foreign exchange market, and the effects of information and institutional variables on the performance of the market. Here institutional factors include the technological, traditional and regulation factors. Since all the traditional models give much weightage to the long-run behaviour of the exchange rates and are less essential to the day-to-day transactions of the foreign exchange market, microstructure theory assumes much importance from the side of participants in the market, particularly in the short run. This theory concentrates on the institutional factors such as price information, the matching of buyers and sellers optimal dealer pricing policies, “news’ and transactions costs, and nonsynchronous trading.

But the question is whether the foreign exchange market can satisfy the basic features of the microstructure theory so that this theory can be applied as is applied in the security market, i.e., the theory is by nature
market specific. This specificity has the advantage of realism, but makes the immediate applicability of microstructure theory to the foreign exchange market questionable. The first test would be to identify some of the concepts of the foreign exchange market that fit into the theory. Since one of the fundamental lessons of the microstructure theory is that institutional differences can affect market efficiency and allocation this point will be studied extensively in this research.

**Market Microstructure theory:**

Market microstructure theory is the study of the process and outcomes of exchanging assets (i.e., currency, stock, etc.) under explicit trading rules. While much of economics abstracts from the mechanics of trading, the microstructure theory analyse the way in which specific trading mechanisms affect the price formation process in the financial markets. These trading mechanisms may differ between the markets. For example, in the stock market trading is centralised but in the foreign exchange market trading is decentralised. However, irrespective of the type of trading mechanism, prices emerge for the assets when buyers and sellers trade. But the question is whether the equilibrium price that emerged is based on the interaction of pure demand and supply factors, which comes out of the desires of the trading agents, as our simple microeconomics explains? Certainly not, and this is the beginning of the study of market microstructure theory.
Basically, microstructure theory consists of two models viz., the inventory model and the information model. The crux of the inventory model is the problem of optimisation as the dealers' objective is to maximise expected profit per unit of time. The model emphasises control if the inventory fluctuations through price adjustments to avoid bankruptcy and failure at the end of dealing. Failure arises in this model whenever the dealer runs out of either inventory or cash. This model also explains the relationship between the transaction cost and the bid-ask spreads.

Information models, which are based on the adverse selection problems, also explain the behaviour of market prices through information contents of the traders. Since there exists asymmetries of information between the dealers, their behaviour in making the price will be different. These information models explain how the equilibrium market price emerges in the presence of asymmetric information.

In microstructure theory there are two variables that play center stage which had no role in the macro approach. These variables are the hallmarks of the micro approach. They provide additional guidance for defining the microstructure. These variables are: (a) Order flows (b) Bid-ask spread. Both these variables are synonymous with the 'quantity' and 'price' in traditional microeconomics. Understanding of these two variables is
essential for appreciating how the microstructure approach to exchange rate behaviour departs from the earlier macro approaches.

Order flow, as used in microstructure theory, is a variant of a key term in microeconomics, "effective demand". Order flow measures the net buyer-initiated orders and seller-initiated orders. Here the word 'initiated' is very important in differentiating between order flows and the effective demand. In microstructure theory, orders are initiated against a dealer. The dealer stands ready to absorb imbalances between buyers and sellers. These 'uninitiated' trades of the dealer account for the wedge between the two concepts, net demand and order flow.

Spreads, the second hallmark variable of the micro approach, receive a lot of attention within the field of microstructure for three reasons: they are historical, scientific and practical. Historically, the field of microstructure is a response to an earlier rational expectations literature. A premise of the rational expectations approach is that trading mechanisms have little or no effect on the mapping from fundamentals to price. This oriented microstructure from the outset toward a single question: how does altering the trading mechanism alter price? This orientation leads naturally to a focus on the determination of transaction prices - i.e., spreads. The second reason the spreads receive so much attention is scientific. On the empirical side of the field, data on spreads are a core element of most data sets. As such, they
are a ready target for testable hypotheses, in contrast to other features of the trading environment that are important, but not as readily measurable (such as the flow of information, the dispersion of beliefs, and the flow of liquidity-motivated orders). The third reason spreads receive so much attention is practical. This concern, as the resources devoted to it, has naturally influenced the course of research within microstructure.

**Micro-Macro nexus:**

The core distinction between the microstructure approach and the asset approach is the role of trades. Under the asset approach, trades play no role, whereas in microstructure models they are the driving forces. We frame this distinction by considering structural models within these two approaches.

The equations of exchange rate determination within the asset approach are typically estimated at the monthly frequency, or lower, and take the form:

\[ \Delta P_t = f(i, m, \ldots) + \varepsilon_t \quad (1.1) \]

Where \( \Delta P_t \) is the change in the nominal exchange rate over the period. The driving variables in the function include current and past values of home and foreign interest rates 'i', money supply 'm', and other macro determinants like trade balance, fiscal deficits, etc. Here, changes in public information
variables drive price without any role for order flow. If any price effects from order flow should arise they would be subsumed in the residual $\varepsilon_t$. Though logically coherent and intuitively appealing, a long literature documents that these macro determinants account for only a small portion of the variation in floating exchange rates.

Equations of exchange rate determination within the microstructure approach are derived from the optimization problem faced by the actual price setters in the market, namely the dealers. These take the form of variations on the following specification:

$$\Delta P_t = g(Q, I, ...) + \varepsilon_t$$  \hspace{1cm} (1.2)

Where now $\Delta P_t$ is the change in the nominal exchange rate between two transactions. The driving variables in the function include order flow $(Q)$ signed so as to indicate direction, a measure of dealer net positions, or inventory $(I)$, and other micro determinants. It is interesting to note that the residual in this case is the mirror image of the residual in equation 1.1 in that it subsumes any price changes due to the public information variables of the asset approach.

To estimate the link between the micro and macro approaches, the study investigates equations with components from both approaches (see results in Chapter 6)

$$\Delta P_t = f(i, m, ...) + g(Q, I, ...) + \varepsilon_t$$  \hspace{1cm} (1.3)
Equation 1.3 is very important to establish the superiority of micro variables over the macro variables.

Given this theoretical flavour, the present study tries to examine the microstructural models on the Indian rupee/US dollar (henceforth INR/USD) Japanese Yen/US Dollar (henceforth YEN/USD), and US Dollar /Euro (henceforth USD/EURO) exchange rate behaviour with the help of high frequency data for the period August 1999, which were provided by Olsen & Associates, Switzerland.

OBJECTIVES AND IMPORTANCE OF THE STUDY:

The present study has the following objectives:

1. To test the volatility of the exchange rates,
2. To study the impact of information, both public and private information, on predicting the exchange rate,
3. To examine the importance of micro variables in comparison with the macro variables in predicting the exchange rate changes,
4. To draw conclusions that will help in policy makers in reducing the uncertainty in the market.

This kind of study has assumed importance in the Indian context particularly after 1991. With the introduction of economic reforms, volatility in exchange rates may be more intense especially due to opening up of markets, increasing business of multinational enterprises, increasing foreign
institutional investments, full convertibility on current account. (In the Indian market, the transactions amount to more than one billion dollars per day). Since full convertibility on capital account is on the cards, this type of study assumes more importance in the day-to-day transactions of the foreign exchange market.

LIMITATIONS OF THE STUDY

The major limitation of the study is the 'space' of the foreign exchange market. This is limited only to the inter-bank dealings of the market and excludes the customer services of the bank and the dealings between the brokers. The reason for this limited 'space' is that the data are be available only for those transactions that Reuters gives namely inter-bank transactions of the market. This limitation may not affect the final conclusions of the study as major transactions take place only between the banks, other transactions will form not more than two to three percent of the total transactions in the foreign exchange market.

DATA BASE:

The data for this study will be obtained from the Reuters D2000-2 Electronic Brooking System that provides 'tick-by-tick' data of all the transactions in the market and also provides some flash news that will affect
the exchange rate and the foreign exchange transactions. This is a system that caters only for dealers from the major banks, which are the main participants in the wholesale spot foreign exchange market. Limit orders input by some participants to D2000-2 are automatically matched with the market orders of others, yielding data on the best current bid and ask quotations, the inside spread and transaction prices and volume. For the present study, we take the data for the period August 2-31 (total 22 working days) in the case of INR/USD, August 5-6 in the case of YEN/USD and August 2 in the case of USD/EURO in the year 1999.

**Plan of the Study**

The present study is divided into six chapters including the present one. The next chapter presents an overview of the existing models in microstructure theory (basically the theories on information models). The third chapter presents a thorough review of the studies on the microstructures in foreign exchange markets and identifies the research gaps in the area. The fourth chapter explains the methodology and the database that will be followed in examining the objectives of the study that are presented in the present Chapter. The fifth chapter explains the nature and availability of high frequency data in the foreign exchange market. It explains the functioning and dealing mechanisms of the market. This chapter also explains, in detail, the data used in the study and the summary
statistics of the data, sources of data and difficulties in dealing with such data sets. In sixth chapter, the study concentrates on the estimation of the models and discusses the results, besides presenting the conclusions of the study and the policy recommendations, if any, of the study. Summary and conclusions follow at the end.