

CHAPTER 1

INTRODUCTION

1.1. Exchange Rate Management in India since Independence - A Brief Review

India's foreign exchange market management after independence may be viewed in line with the paradigm shift in exchange rate regime – a *par value system* to a *basket-peg* and further to a *managed float exchange rate system*. In the early phase 1947 – 1971, India followed the *Par Value System* of exchange rate. Under this *Par Value System*, the external value of Indian rupee was fixed (at 4.15 grains of fine gold). Reserve Bank of India maintained the *Par Value* within the permitted margin $\pm 1\%$ with pound sterling as the intervention currency. However, the devaluation of Rupee in September, 1949 and June, 1966 in terms of gold resulted in the reduction of the par value of Rupee. But, during 1966 to 1971 the exchange rate of Rupee was remain unchanged.

After the breakdown of the *Bretton Woods System* in 1971, the most important events in the history of international economics was the replacement of *fixed exchange rate system* and the adoption of *flexible exchange rate system* instead. Since then world wide exchange rate policy posed a series challenge. In December 1971, the Indian rupee was linked to Pound Sterling. In this period, value of Starling was fixed in terms of US dollar under *Smithsonian Agreement* of 1971 and, therefore, the value of rupee was also stable against dollar. However, Reserve Bank authority had realized weaknesses associated with 'single currency peg'. In September 1975, value of rupee was pegged to a basket of currencies. Selections of currencies in the basket as well as their relative weights were kept confidential in order to remove speculation of exchange rate.

The regime of the *Pegged Exchange Rate System* was closed in the year 1991 with a two-dose depreciation of exchange rate in July 1st and 3rd, 1991. India moved towards the *Market Determined Exchange Rate System* following the recommendations of the committee on

Balance of Payments (Chairman, Dr. C. Rangarajan). *Liberalized Exchange Rate Management System (LERMS)* was put in place (of Pegged Exchange Rate System) in March 1992. Under LERMS, initially a dual exchange rate system was followed. Under this system, all foreign exchange receipts of current account transactions were required to be surrendered to the Authorized Dealers for conversion into domestic currency. 60% of the proceeds of these transactions were converted at the market rate quoted by the Authorized Dealers. Remaining 40% of the proceeds were converted at the Reserve Bank's official rate. The Authorized Dealers, in turn, were required to surrender these 40% of their purchase of the foreign currencies to the Reserve Bank. They were free to retain the balance 60% of foreign exchange for selling in the free market for permissible transactions.

The *Dual Exchange Rate System* was replaced by a *Unified Exchange Rate System* in March 1993. Restrictions on current account transactions were relaxed. The unification of the exchange rate of the Indian Rupee was an important step towards current account convertibility, which was finally achieved finally in August 1994. With the rupee becoming fully convertible on all current transactions, the risk-bearing capacity of banks increased and foreign exchange trading volumes started rising.

The main objective of exchange rate policy in the post-reform period has been widening and deepening the foreign exchange market and liberalization of exchange control regime. It was aimed that, exchange rate policies together with trade policies and industrial policies should form as an integrated policy framework to improve the overall productivity, competitiveness and efficiency of the economic system, in general, and the external sector, in particular.

1.2 Phenomenon of Excess Variability of Rupee/Dollar Exchange Rate

India has been experiencing, since the early phase of 1970's, spell of depreciation of Rupee against major currencies like Dollar. The rate of depreciation, however, displayed variation over the period. However, such depreciation became spectacular since recent past, when India went through many changes in financial system. Since 1991, there have been significant changes in the exchange rate policy. After having devaluation of rupee twice in 1991 the economy gradually moved to a floating exchange rate system in 1993. The current

account convertibility made Rupee/Dollar exchange rate more flexible. These can be shown in terms of the following tables.

Table 1.1
Variability Indicators
Sample Period 1975(I) – 2006(IV)

Variability Indicators	Exchange Rate	Money Supply M ₁ (‘00 Billions of Rs.)
SD	15.236	20.857
CV (%)	60.87	113.69
Skewness	0.270	1.424
Kourtosis	1.403	4.256
JB	15.153	51.683

Source: Author's Calculation Based on RBI Dataset

Table 1.2
Variability Indicators

Regimes	Regime of Basket Peg 1975(I) - 1991(I)		Regime of Market Determined 1991(II) – 2006(IV)	
	Exchange Rate	Money Supply M ₁ (‘00 Billions of Rs.)	Exchange Rate	Money Supply M ₁ (‘00 Billions of Rs.)
SD	3.189	2.292	7.833	20.388
CV (%)	28.53	66.55	20.07	61.16
Skewness	0.904	0.815	-0.614	0.887
Kourtosis	2.786	2.614	2.225	2.907
JB	8.986	7.613	5.633	8.429

Source: Author's Calculation Based on RBI Dataset

Table 1.1 depicts exchange rate variability measured in terms of *Coefficient of Variation (CV)* during the period 1975(I) – 2006(IV), which was 60.87%. At the same time, the variability of monetary base in India, the M₁ money supply, was 113.69%. These observations revealed the fact that the monetary base was more variable compared to the variability of exchange rate.

Table 1.2, shows the variability of the series concerned, measured in terms of the parameters such as standard deviation, CV, Skewness, Kurtosis, etc. for the two exchange rate regimes that India has been following, namely the *Basket Peg System of Exchange Rate* ranging from

the period 1975 to April, 1991 and *Market determined System of Exchange Rate* thereafter. From the Table 1.2 it is clear that during the period of *Basket Peg Exchange Rate System in India*, variability of Rupee/Dollar exchange rate and monetary base were respectively 28.53% and 66.55%. It indicates that, the variability of M_1 money supply was higher in the *Basket Peg Exchange Rate* regime of exchange rate.

However, since April, 1991 when India has been following the fully flexible market determined exchange rate, the variability of the exchange rate reduced from 28.53% to 20.07% measured in terms of CV. Several reasons can be posed in favor of this exchange rate stabilization in the post 1991 period. The replacement of **FERA** by **FEMA** and opening up of the economy attracted huge inflow of foreign capital, both in terms of **FDI** and **FII** which helped the exchange rate to stabilize. The adaptation of fully flexible exchange rate regime in the nineties and the integration of financial markets with world financial market during 1990s have made the exchange rates an important formation for understanding financial aggregates in India. The volatility of Rupee/Dollar exchange rate has excited the imagination of the economists. They have sought to explain several features of the variation in Rupee/Dollar exchange rate.

First, it has become a matter of interest to enquire how far depreciation of Indian currency is due to variation in money supply. Money supply in India has also been found to describe a steady increase over the last three decades since 1970. Again exchange rate depreciation has also been experienced in 1970's. This leads to an ipso facto correlation between increase in money supply and depreciation of Rupee. It, therefore, becomes pertinent to consider if there is any causal relationship between variation in Rupee/Dollar exchange rate and that in money supply.

Second, there is a confusion regarding the nature of variation in Rupee/Dollar exchange rates. One may wonder if such steady spell of depreciation of Rupee exhibits a dynamic path of adjustment to long-run equilibrium. Some economists hold that this spell of depreciation basically exhibits a movement towards equilibrium. However, some other economists are skeptical about such interest equilibrium movement. They, on the other hand, hold that volatility of Rupee/Dollar exchange rate displays the existence of disequilibrium. They hold such volatility in Rupee/Dollar exchange rate basically exhibits a continuous movement

everyday from the long-run equilibrium i.e., the *Purchasing Power Parity Level*. So the Rupee/Dollar exchange rate variations, according to them, display a long persisting case of disequilibrium.

The second issue has been termed as '*Overshooting or Undershooting*' phenomenon in International Economics. Variations of exchange rate have been found to conform to long-run equilibrium if such variations entail '*Overshooting*'. On the other hand, '*Undershooting*' variety of exchange rate variation is found to display movements away from disequilibrium. So the immediate concern for the volatility in Rupee/Dollar exchange rate is whether such variations display '*Overshooting*' or '*Undershooting*'.

1.3 Theoretical Developments of Exchange Rate Since 1970s

Flexible exchange rate system replaced the fixed exchange rate system in 1970s. Consequently, attention of economists was diverted from Balance of Payments to Exchange Rate. Variability of the major world currencies in the early seventies initiated the economists with the determination of exchange rate and explanation of the variations in it. Consequently, international economics, over the last three decades, saw the growth of plethora of economic theories on exchange rate. On the other hand, the consideration about the dynamic adjustment of balance of payments has been relegated to the background.

Several economic theories of exchange rate like *Purchasing Power Parity Theory*, *Covered Interest Arbitrage Theory*, and *Portfolio Balance Approach*, *Asset Market Model*, *Currency Substitution Theory*, and *Monetary Approaches to Exchange Rate (MAER) Theory* have gained Currency of late. Renewed interest in *Purchasing Power Parity* theory has provoked serious attention of economists in determining the effects of monetary shock on exchange rate variation.

However, MAER Theory has emerged as the most popular one among the economists for explaining the 'transmission' mechanism of money supply leading to variation in exchange rate. Similarly, Dornbush Model is considered to be the most appropriate one for explaining 'excess variability' or 'overshooting' of exchange rates. These two theories are being considered below.

1.4 Monetary Approach to Exchange Rate (MAER) Determination

Let us consider an open economy where the demand for money is

$$L = kPY \quad (1.1)$$

where, L = Demand for money

P = Domestic price level

Y = Real income

k = Constant Function indicating how money demand will change given a change in P or Y .

Equation (1.1) is often stated as '*money demand is a function of price and income*'.

A strong assumption of the monetary approach is that there is a stable demand for money. This means that the relationship among money demand, income and prices does not change significantly over time.

Now the money supply relationship can be written as

$$M = R + D \quad (1.2)$$

where, M = money supply

R = international reserves

D = domestic credit

$$\text{The law of one price indicates that } P = E P_f \quad (1.3)$$

Where, P = domestic price level

E = domestic currency price of foreign currency

P_f = foreign price level.

Equilibrium in the money market is obtained when money demand equals money supply

$$L = M \quad (1.4)$$

Now substituting equation (1.3) into (1.1) we get

$$L = kE P_f Y \quad (1.5)$$

Substituting equations (1.2) and (1.5) into equation (1.4) we obtain

$$kE P_f Y = R + D \quad (1.6)$$

Now differentiating with respect to 'time' we have

$$\dot{E} + \dot{P}_f + \dot{Y} = \dot{R} + \dot{D} \quad (1.7)$$

where dot (•) over a variable indicates percentage change.

From equation (1.7), by rearranging, we get

$$\dot{R} - \dot{E} = \dot{P}_f + \dot{Y} - \dot{D} \quad (1.8)$$

This indicates that percentage change in reserves (the balance of payments) minus the percentage change in exchange rate is equal to the foreign inflation rate plus the percentage growth of real income minus the percentage change in domestic credit.

Under Fixed Exchange Rate System

With fixed exchange rate, $\dot{E} = 0$, and we have the Monetary Approach Balance of Payments (MABP).

$$\dot{R} = \dot{P}_f + \dot{Y} - \dot{D} \quad (1.9)$$

Therefore, with fixed exchange rate, a percentage increase in domestic credit, given constant prices and income, will lead to a percentage decrease in international reserves. This means that, following central bank's expansion of domestic credit and creation of an excess supply of money, there will be a bigger balance of payments deficit. Conversely, a decrease in domestic credit would lead to an excess demand for money as money demand is unchanged

for a given \dot{P}_f and \dot{Y} . Here \dot{D} is falling so that \dot{R} will increase as to bring money supply equal to money demand.

Under Flexible Exchange Rate System

In case of flexible exchange rates with no Central bank intervention, reserve flows \dot{R} equal zero, where exchange rate changes are non zero. The general equation (1.8) is now written for the Monetary Approach to Exchange Rate as

$$\dot{E} = \dot{P}_f + \dot{Y} - \dot{D} \quad (1.10)$$

With the MAER, an increase in domestic credit, given constant \dot{P}_f and \dot{Y} , will result in a depreciation of the domestic currency. \dot{D} and \dot{E} both have negative signs. Thus, if \dot{D} increases, \dot{E} will also increase. Since \dot{E} is domestic currency unit for foreign currency units, an increase in \dot{E} means that domestic currency is either appreciating at a slower rate or depreciating at a faster rate. Under the MAER, domestic monetary policy will not cause flow of money internationally but will lead to exchange rate changes.

1.5 Two Country Monetary Model for Exchange Rate

Importance of money supply in the determinations of exchange rate has been amply explained by the '*Two Country Monetary Model*'. In this model demand for money function is constituted by the Cambridge Quantity Equation such that

$$M^d = kPY, \quad k > 0 \quad (1.11)$$

For the domestic and foreign countries the equations are respectively

$$M_h^d = k_h P_h Y_h \quad (1.12)$$

and $M_f^d = k_f P_f Y_f \quad (1.13)$

Equilibrium in the money markets in both the countries required that

$$M_h^s = M_h^d \quad (1.14)$$

$$\text{and } M_f^s = M_f^d \quad (1.15)$$

Consequently, we have

$$M_h^s = k_h P_h Y_h \quad (1.16)$$

$$M_f^s = k_f P_f Y_f \quad (1.7)$$

From equation (1.19) and (1.20) we obtain

$$\frac{M_h^s}{M_f^s} = \frac{k_h P_h Y_h}{k_f P_f Y_f} \quad (1.18)$$

$$\frac{M_h^s}{M_f^s} = \frac{k_h E Y_f}{k_f Y_h} \quad (1.19)$$

$$\therefore E = \frac{k_f M_h^s Y_f}{k_h M_f^s Y_h} \quad (1.20)$$

where E is the home currency price of one unit of foreign currency.

Taking log on both sides, we get

$$\log E = \log k_f - \log k_h + \log M_h^s - \log M_f^s + \log Y_f - \log Y_h \quad (1.21)$$

Differentiating with respect to time, we have

$$\dot{E} = \dot{M}_h^s - \dot{M}_f^s + \dot{Y}_f - \dot{Y}_h \quad (1.22)$$

The equation (1.22) indicates that

- (i) a rise in the growth rate of domestic money supply leads a proportional rise in the depreciation rate of the domestic currency.

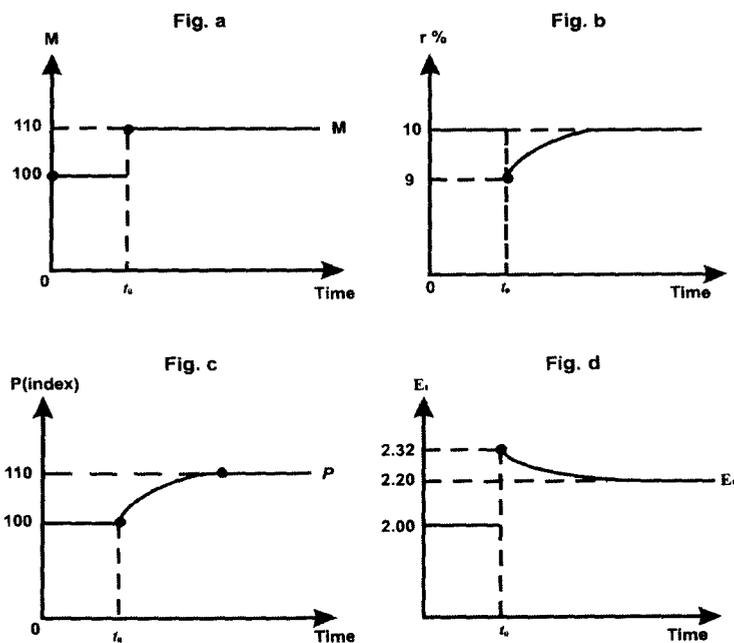
- (ii) rise in the growth rate of foreign money supply reduces depreciation rate of the domestic currency.

The equation (1.22) shows that at any definite period, when foreign money supply and growth rates in both the countries remain unchanged, exchange rate is directly related to domestic money supply.

1.6 Overshooting of Exchange Rate: Dornbusch's Approach

Dornbusch's model explaining exchange rate overshooting in response to a monetary shock and the time path of adjustment of exchange rate can be visualized with the precise sequence of following events.

Figure 1.1
Time Path of Adjustment of Monetary Expansion



Panel (a) shows that money supply in the home country increases unexpectedly by 10% at time t_0 . Panel (b) shows 10% unanticipated increase in money supply leads to an immediate decline in rate of interest from 10% to 9% (say). Panel (c) shows that 10% increase in money supply have no immediate effect on prices because prices are sticky in the short run for the inherent rigidities in the market for labor and goods. However prices will rise gradually over time until they are 10% higher than originally in the long run. Panel (d) shows that exchange rate increase because the investors shift from domestic bonds and money balances to foreign bonds and increase their demand for foreign currency. After initial rise, exchange rate (i.e., domestic currency price of foreign currency) declines over time until it reaches the PPP level. This demonstrates that exchange rate overshoots following a monetary impulse.

Most of the researches explaining the variation of exchange rate has focused upon industrialized countries, while similar evidence in the developing economies is neglected. Empirical tests on these models in the context of underdeveloped countries, with depressed financial sector and structural rigidities, can help the researchers understand the role of monetary and exchange rate policies in the developing world.

1.7 Objective of the Study

The objective of the present study is to investigate into the nature of Rupee/Dollar exchange rate variation over the period of the study and to examine if the volatility of Rupee/Dollar exchange rate had any link with the variation in money supply in Indian economy. More specifically, the objectives of the study are to examine

- (i) the 'stationarity' and 'integrability' of money supply and exchange rate series
- (ii) if any long-run relationship between these variables did exist.
- (iii) if the long-run relations, in the event of its existence, were 'stable'.
- (iv) the nature of the causal relationship between the variables.

- (v) the responses of these variables to different types of endogenous shocks.
- (vi) the nature of the causal relation under the 'Basket-Pegged' and 'Market Determination' regimes.
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- (vii) how far the causal relationships remain invariant under the 'frequency domain' study.

1.8 Chapter Specifications

The study consists of **fifteen** chapters as stated below.

Chapter 2 presents the survey of relevant literature, which provides the theoretical and empirical findings on the relationship between exchange rate and money supply.

Chapter 3 deals with nature and source of data set, period of the study and methodological issues.

Chapter 4 contains the enquiry into the *stationarity* of the relevant time series and their integrability.

Chapter 5 enquires into the '*Cointegration*' between Rupee/Dollar exchange rate and money supply. The '*Cointegration*' study enables us to examine if any long-run relationship between the variables did exist.

Chapter 6 presents our study on the dynamics of short-run shocks and the *stability* of the long-run relationship between the variables.

Chapter 7 is devoted to the study of the long-run relationship between Rupee/Dollar exchange rate and money supply through the 'system approach' (**unrestricted VAR Model**) when '*two way linkage*' between the endogenous variables (exchange rate and money supply) is ensured.

Chapter 8 presents the *Intervention Analysis* through the *Impulse Response Functions* of the endogenous variables in the VAR model.

Chapter 9 presents the *Intervention Analysis* through the *Variance Decomposition* of the endogenous variables concerned.

Chapter 10 is devoted to the study of the nature of *causality* between exchange rate and money supply through the **restricted VAR Model**.

Chapter 11 presents the Spectral Analysis for the confirmation of the nature of *Granger Causality* the variables concerned. *Time Domain analysis* is being supplemented through the *Frequency Domain* study.

Chapter 12 contains our study under the '*Pegged Exchange Rate Regime*'.

Chapter 13 presents our study under the '*Market Determined System*' of exchange rate.

Chapter 14 provides the theoretical explanations of the findings in Chapters 12 and 13.

Chapter 15 presents the Summary, Conclusions and Policy Implications of the study.