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Analysis of Macroeconomic Determinants of Exchange Rate Volatility in India

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ABSTRACT: The Foreign Exchange Market in India has undergone substantial changes over last decade. It is imperative by the excessive volatility of Indian Rupee causing its depreciation against major dominating currencies in international market. This research has been carried out in order to investigate various macroeconomic variables leading to acute variations in the exchange rate of a currency. An attempt has been made to review the probable reasons for the depreciation of the Rupee and analyse different macroeconomic determinants that have impact on the volatility of exchange rate and their extent of correlation with the same.

Keywords: Exchange Rate; Inflation; Interest Rate; Foreign Exchange Market; Current Account; Exchange Rate Volatility; International Trade.
JEL Classifications: F31; F41

1. Introduction

India has witnessed recent episode of excessive volatility leading to sudden and sharp depreciation of Indian Rupee against US Dollar. In June 2012, the Indian Rupee breached the 57 per Dollar mark & reached to 57.25- its all-time low against Dollar. International trade and investment decisions become more difficult due to volatile exchange rate because volatility increases exchange rate risk. If the participants in international trade are aware about exchange rate risks, they may prefer to switch to domestic activities where profits are relatively less uncertain rather than continuing trading in foreign markets. Alternatively, international traders may attempt to use forward foreign exchange markets in order to hedge against any possible losses.

India has embarked on a series of structural reforms in the foreign exchange market since 1990s. Exchange rate policy has been evolved over time in line with the gradual opening up of the economy as a part of the broader strategy of macroeconomic reforms. One of the important reforms was two step downward adjustment of Indian Rupee in order to install investors' confidence & boost domestic competitiveness. Indian Rupee was devalued two times in July 1991 in order to stabilize the foreign exchange market. These were decisive steps to end pegged exchange rate regime. During this era most of the academia & economists argued for establishment of Flexible Exchange Rate regime.
There were two arguments in the favour of Flexible Exchange Rate System. The first argument is related to the competitive position of a country in the international market. For e.g. if a price level in a country rises, it will make its products & services uncompetitive in international market and the balance of payments will suffer from a deficit. In order to keep equilibrium in the balance of payments, the country may use various macroeconomic policies to reduce the price level, and because prices are sticky-downwards this may lead to painful adjustment and may result in welfare losses. Therefore it is better, to leave the exchange rate to depreciate to compensate for the rise in price level and to keep the competitive position of the country without a need to undergo such long and painful adjustment.

The second argument of the proponents of flexible exchange rates is built upon the assumption that the stabilizing behaviour of speculators will make exchange rates relatively stable compared to fixed rates. For instance, if a currency depreciates from its long run value, speculators would know that the move is temporary, hence, would buy the currency since it is expected to appreciate in the future. Therefore, they stabilize the exchange rates' actual movements.

The flexible exchange rate system also protects a country from adverse external shocks. Under the Bretton Woods system a decrease in the demand for the exports of a country would cause a domestic contraction in this country. However, under a flexible exchange rate system the exchange rate would adjust to compensate for the shock, maintaining equilibrium in the current account and competitiveness and subsequently the level of demand. This merit of a floating exchange rate regime also gives the country the opportunity to exert an independent monetary policy.

However one of the most controversial features of Flexible Exchange Rate system is the high volatility of Exchange rate. Volatility represents the degree or the extent to which one variable changes over a time period. The larger the magnitude of a variable change, or the more quickly it changes over time, the more volatile it is. This paper reviews the probable reasons for this depreciation of the Rupee and the outlook for the same. The study has been divided into two parts. The first part describes major economic variables that have direct or indirect impact on exchange rate volatility while second part analyses the correlation of various macroeconomic variables with the exchange rate of a country.

2. Literature Review

Most previous researches about the behaviour of exchange rates have been devoted to explain and forecast exchange rate levels and not their volatility. Several structural models have been suggested to capture the pattern of exchange rates, such as monetary exchange rate models and portfolio balance models. However, none of these models was able to outperform a naive random walk model in forecasting in sample exchange rate (see, for instance, Meese and Rogoff, 1983).

Simon (1997) found that exchange rate and current account have direct and positive relationship with inflation and both exchange rate and current account are the key factors that badly affect the small economies.

Edwards (2000) investigated the dynamic association between exchange rate regimes, capital flows and currency crises in emerging economies. The study draws on lessons learned during the 1990s, and deals with some of the most important policy controversies that emerged after the Mexican, East Asian, Russian and Brazilian crises. He concludes that under the appropriate conditions and policies, floating exchange rates can be effective and efficient.

Taylor (2001) discusses the failure of liberalised policies in Argentina. He says that Argentina has failed in maintaining the liberalised policies about capital flows and a firm currency. Argentina had anti-inflation program based on freezing the exchange rate in the early 1990s. This means that the money supply within the country and the supply of credit to firms are tied directly to international reserves. So if the country gets capital inflows, the supply of money and credit increases, leading to a substantial increase in domestic prices.

Harberger (2003) studied the impact of economic growth on real exchange rate. He found that there is no systematic connection between economic growth and real exchange rate.

Husain et al. (2004) found in their study that little access to international capital is available for the weaker and less developed countries, so low rate of inflation and higher level of durability is associated with fixed exchange rate regime in those countries. However, they found no robust relationship between economic performance and exchange rate regime in the developing economies. They also found that advanced economies may experience durable and slightly higher level of growth rate without higher level of inflation in flexible exchange rate regime.

Due and Sen (2006) examine the interactions between the real exchange rate, level of capital flows, volatility of flows, fiscal and monetary policy indicators and the current account surplus for Indian economy for the period 1993Q2 to 2004Q1. The estimations indicate that the variables are cointegrated and each Granger causes to the real exchange rate.

3. Research Methods

This research has been carried out in order to investigate the impact of various macroeconomic variables on the volatility of foreign exchange rate. The research is based on secondary data, to compile the report with some variables twenty years annual data for the period of 1991 to 2010 were collected. The relationship between Exchange rate and Macro-economic variables such as, interest rate, Balance of trade, Inflation rate, Foreign Direct Investment, GDP etc. have been analyzed with the help of statistical tool.

3.1 Hypothesis

H0: Exchange rate has no correlation with any of the macroeconomic variables like Inflation, Interest Rate, Foreign Investment, GDP Growth & Current Account Balance.
H1: High inflation leads to appreciation of Exchange Rate of a currency.
H2: High interest rate results in depreciation in the Exchange rate of currency.
H3: Exchange rate has positive correlation with GDP growth rate & current account balance.

3.2 Data Collection & Analysis

Since last decade Indian foreign exchange market has undergone significant changes and has been subjected to few shocks. It is imperative by the fluctuation in Indian Rupee exchange rate against US Dollar. Table 1 summarizes various macroeconomic variables in India for the period of 1991 to 2010.

Table 1. Various Macroeconomic Indicators in India (1991-2010)

Year	Exchange Rate (against $)	Inflation (CPI)	Interest Rate (Lending Rate)	External Debt (Current US$)	GDP (Current US$)	FDI (Current US$)
1991	22.3	13.9	17.9	86.86	267.52	74
1992	25.9	11.8	18.9	89.66	245.55	277
1993	30.35	6.4	16.3	93.06	276.04	550
1994	31.37	10.2	14.8	99.61	323.51	973
1995	32.36	10.2	15.5	95.17	356.3	2144
1996	35.42	9	16	94.91	388.34	2426
1997	36.29	7.2	13.8	94.7	410.92	3577
1998	41.2	13.2	13.5	98.77	416.25	2635
1999	43.05	4.7	12.5	99.13	450.48	2169
2000	44.91	4	12.3	100.24	460.18	3584
2001	47.18	3.7	12.1	98.64	477.85	5472
2002	48.63	4.4	11.9	104.82	507.19	5626
2003	46.56	3.8	11.5	117.87	599.46	4323
2004	45.3	3.8	10.9	122.59	721.57	5771
2005	44.09	4.2	10.8	120.22	834.04	7606
2006	45.29	6.1	11.2	158.5	951.34	20336
2007	41.27	6.4	13	202.93	1242.43	25483
2008	43.24	8.4	13.3	225.99	1215.99	43406
2009	48.36	10.9	12.2	249.99	1377.26	35596
2010	42.6	12	10.2	290.28	1727.11	24159

Source: RBI Publications (World Development Indicators)

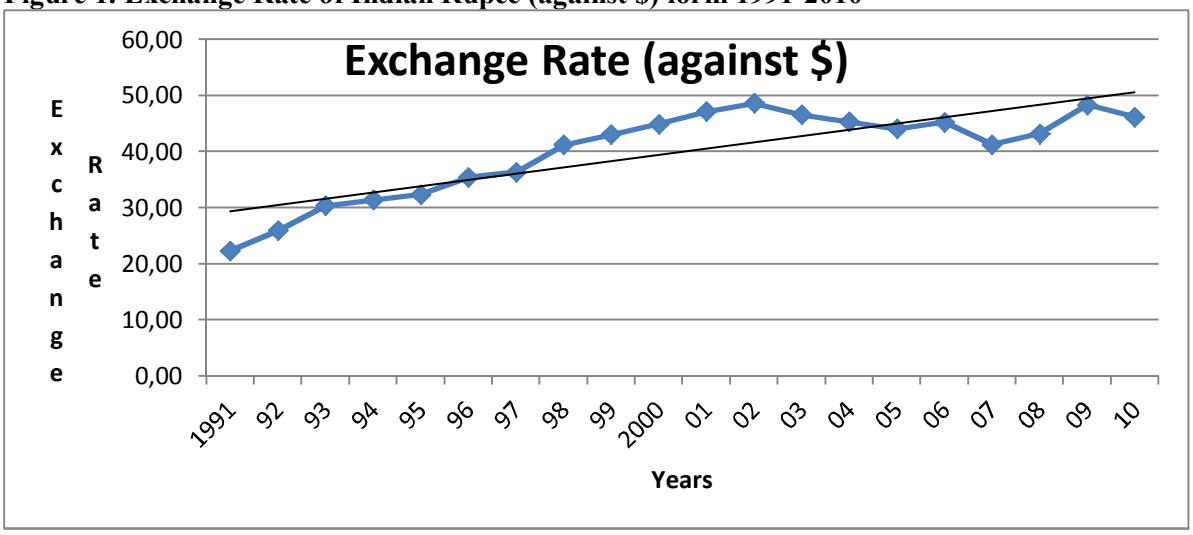
3.3 Determinants of Exchange Rate Volatility

There are many variables that have direct or indirect impact on the exchange rate of currency. The main determinants of Exchange rate are as follows:

3.3.A) Inflation Rate

By and large a country with a consistently lower inflation rate faces a rising currency value and high purchasing power as compared to other currencies. Figure 1 shows volatility in Indian Rupee exchange rate in last two decades.

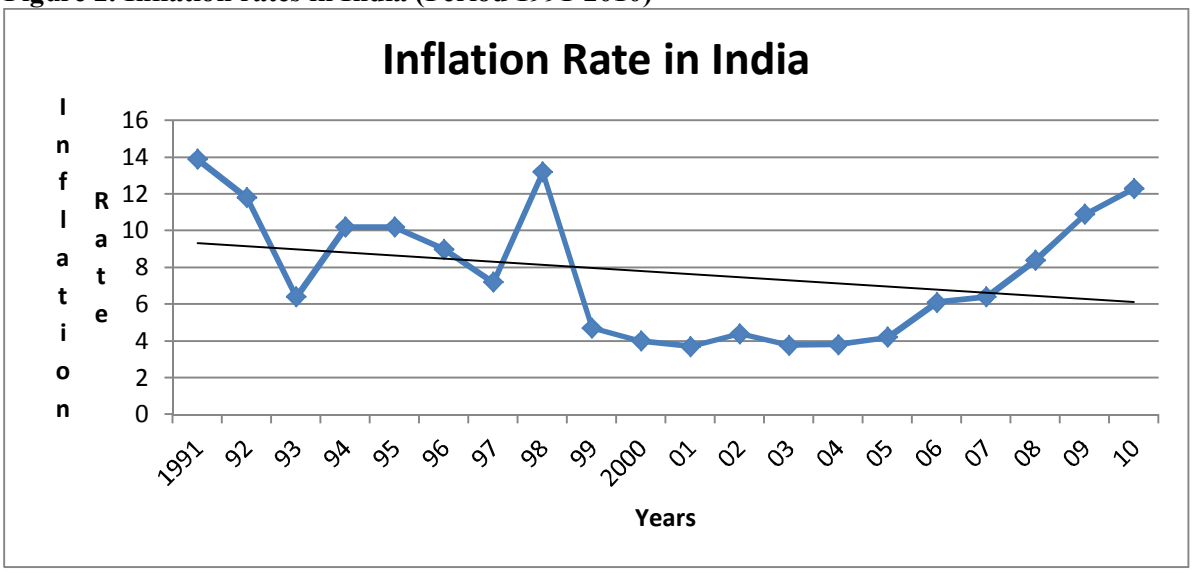
Figure 1. Exchange Rate of Indian Rupee (against $) form 1991-2010



Source: Compiled by Author based on data from Reserve Bank of India publications.

As a general rule the countries with higher inflation face depreciation in their currency in relation to the currencies of their trading partners (figure 2). This is also usually followed by the higher interest rates.

Figure 2. Inflation rates in India (Period 1991-2010)



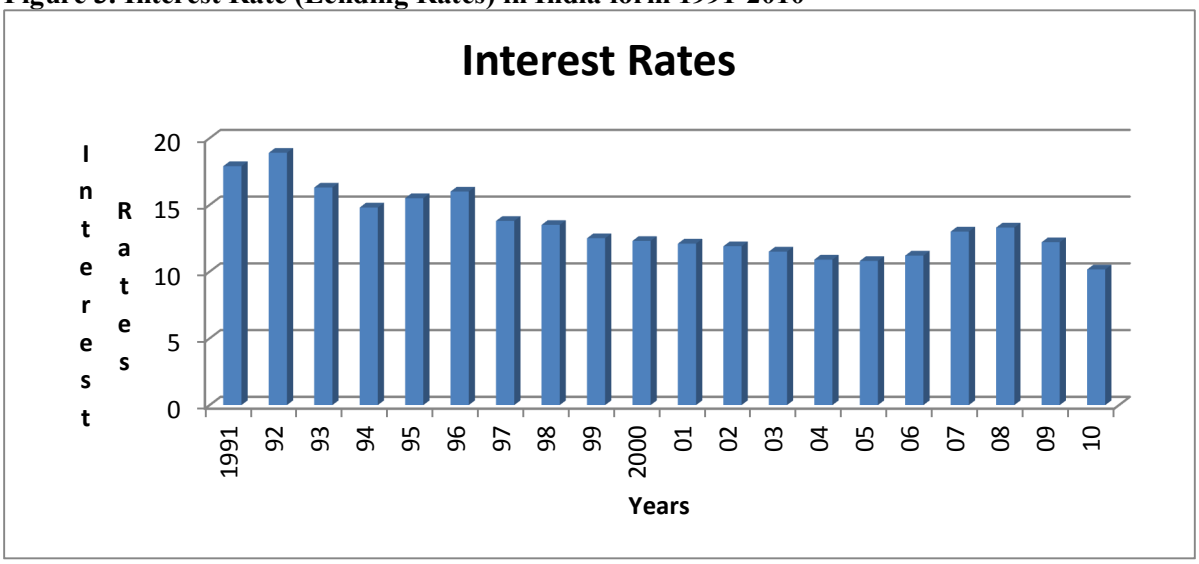
Source: Compiled by Author based on data from Reserve Bank of India

3.3B) Interest Rates

Over the years another important factor for movements in exchange rates has been interest differential i.e. the difference in interest rates between major countries. Currencies with higher interest rates attract large no. of investors seeking a better opportunities for their investment. This makes the currency more attractive as a form of investment and increases the demand for the currency. The opposite relationship exists for decreasing interest rates i.e. lower interest rates tend to decrease exchange rates.

The interest rate decisions are taken in India by the Reserve Bank of India's Central Board of Directors. The official interest rate is the benchmark repurchase rate. This rate was last reported at 8 percent. For last decade, from 2000 until 2010, India's average interest rate was 5.82 percent reaching to highest at 14.5 percent in August of 2000 and a record low at 3.25 percent in April of 2009 (figure 3).

Figure 3. Interest Rate (Lending Rates) in India form 1991-2010



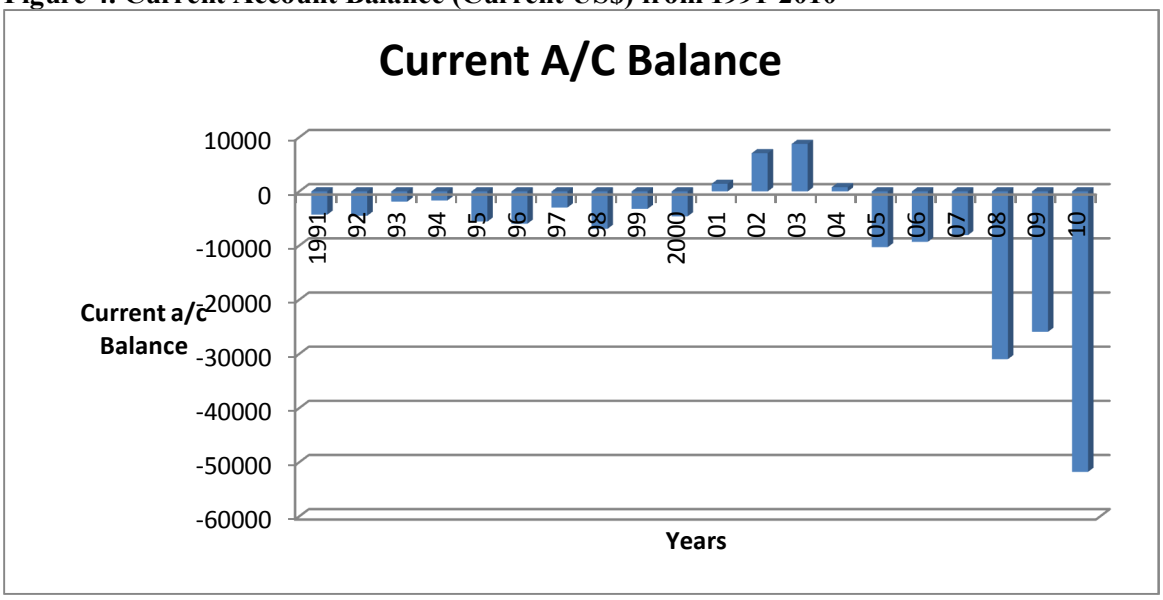
Source: Compiled by Author based on data from Reserve Bank of India publications.

3.3C) Current-Account Deficits

The current account is a record of the balance of trade between a country and its other partners all over the world. It reflects all payments & receipts between countries for purchase or sale of goods, services and payment / receipt of interest and dividends. The current account deficit indicates that the country is spending more on international trade than it is earning and in order to balance this deficit it is borrowing capital from foreign sources.

The Current Account balance in India was -2.7 percent of GDP in the fiscal year 2010-11. Since last three decades from the 1980 to 2010, the average Current Account as percent of GDP was -1.24 percent reaching to highest of 1.5 percent in December 2003 and a record low of -3.2 percent in December 2010 (figure 4).

Figure 4. Current Account Balance (Current US$) from 1991-2010



Source: Compiled by Author based on data from Reserve Bank of India publications.

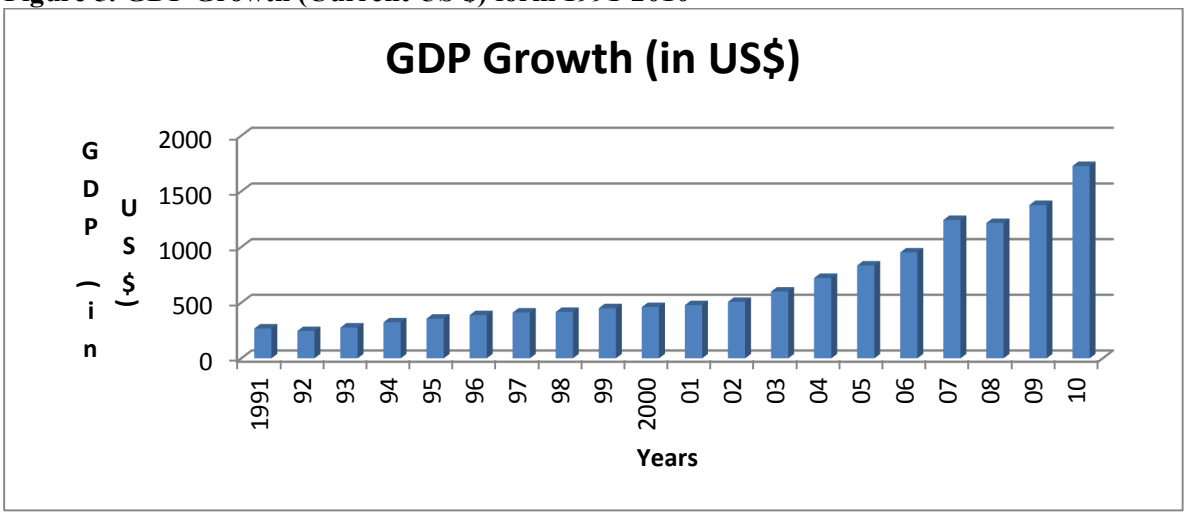
Exchange rate has a strong correlation with current account surplus or deficit in long term. But there may not be any causal relationship. In case of the floating exchange rate system, the status of current account affects exchange rate of a country to a certain extent. The current account surplus

mostly results in appreciation of domestic currency, while its deficits will lead to devaluation of the same.

3.3D) Growth in GDP

Indian economy encompasses diverse characteristics such as traditional village farming as well as modern agriculture, modern industries, handicrafts and a multitude of services. Services are the major source of economic growth, accounting for more than half of India's total national output with the employment of less than one third of its labor force in this sector.

Figure 5. GDP Growth (Current US $) form 1991-2010



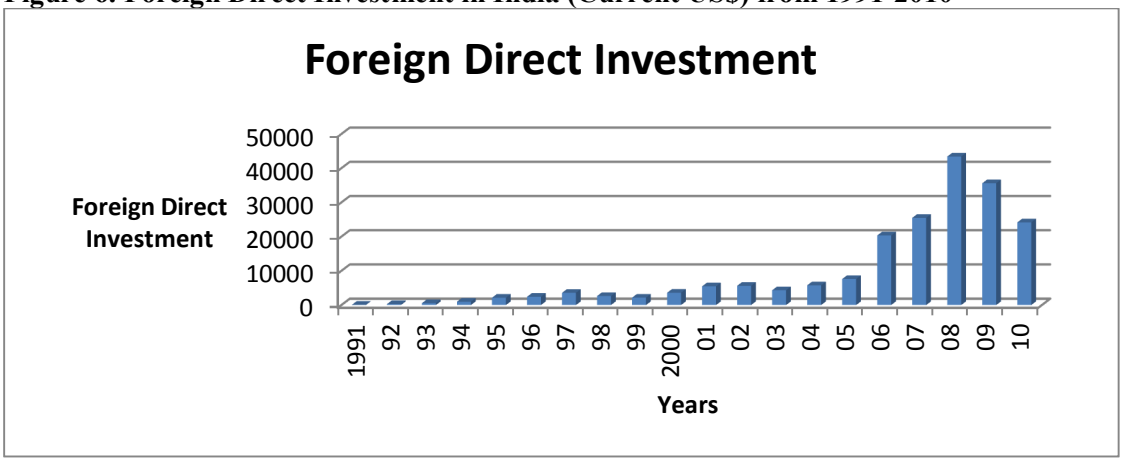
Source: Compiled by Author based on data from Reserve Bank of India publications.

The Gross Domestic Product (GDP) in India has increased by 6.1 percent in the last quarter of 2011 over the previous quarter. For a period of 2000 until 2011, average quarterly GDP Growth in India was 7.45 percent reaching to its peak at 11.8 percent in December 2003 and a record low of 1.60 percent in December 2002 (figure 5).

3.3E Foreign Investment & Capital flow

The Foreign Investment flow is increased in the country when it is growing rapidly such as India, China and Brazil etc. (figure 6).

Figure 6. Foreign Direct Investment in India (Current US$) from 1991-2010



Source: Compiled by Author based on data from Reserve Bank of India publications.

The demand for domestic currency will increase as foreign investors have to sell their currency in order to buy the local currency. This increased demand will result in the increase in value of the same.

Inherently investors make investment decisions based on two driving factors – "the level of risk" and corresponding "level of return". When the expected levels of risk-return ratio are high the

investors are attracted and demand for assets is increased. Central banks monitor and control the flow of money in and out the country. Therefore most of the countries hold significant forex reserves. For e.g. China and Russia alone hold well over a trillion U.S. dollars in their foreign currency reserves.

4. Statistical Variables Analysis

Impact of various macroeconomic variables on exchange arte has been studied with the help of Pearson's correlation analysis using SPSS (version 20). The result of this correlation analysis is as follows:

4.1 Interest Rate vs. Exchange Rate:

The interest rate and exchange rate highly correlated, and the statistical analysis shows that there is negative correlation between interest rate and exchange rate since the value of r is - 0.934. This correlation is significant at 0.01 level.

4.2 Inflation Rate vs. Exchange Rate

The inflation rate and exchange rate moderately correlated, and the statistical analysis shows that there is indirect correlation between inflation rate and exchange rate since the value of r is - 0.606. This correlation is significant at 0.01 level.

4.3 GDP VS. Exchange Rate

The analysis of correlation between these two variable shows that there is a moderate positive relationship between the GDP and Exchange rate as the value of r is 0.525 & this relationship is significant at 0.05 level.

The exchange rate and income may not drift apart in the long run, but in the short run they have weak and indirect relationship. The statistical results indicate that the relationship between the two variables is not very significant. However, they are indirectly linked through several channels including imports of goods & serivces, agricultural production and foreign aid.

4.4 Current Account VS. Exchange Rate

The analysis shows that there is no relationship between the Current Accounting and exchange rate since the value of r is only -0.120 and this relationship is not significant.

The value of any currency is expected to fall when the current account is in deficit, and *more likely* to rise when the current account is in surplus. Though this relationship is not extremely systematic, yet the data represent a moderate impact of the exchange rate on the balance of current account. The later reduces more often when the exchange rate is high, and increase mostly when the currency is depreciated. Also the statistical analysis indicates that the changes in the exchange rate account for an insignificant proportion (less than 4 percent) of the movement in the current account. (E. S. Hoffman, Ph.D. June 2005)

4.5 Foreign Direct Investment vs. Exchange Rate

The analysis of correlation between these two variable shows that there is a mild positive relationship between the FDI and Exchange rate as the value of r is 0.442 & this relationship is significant at 0.05 level.

5. Findings & Conclusions

The statistical analysis of various macroeconomic variables shows that:

H0 : This hypothesis is rejected as it has been found that Exchange rates is correlation with many variables such as interest rate, inflation rate & GDP Growth rate in either direct or indirect manner.

H1: This hypothesis is rejected as moderate indirect correlation has been found between two variables.

H2: This hypothesis is accepted as strong indirect correlation has been found between interest rate & exchange rate.

H3: This hypothesis is partially accepted as mild direct correlation has been found between exchange rate & GDP growth while between Current account balance & Exchange rate there is very weak correlation.

On the basis of above analysis it can be concluded that Indian Rupee has shown high volatility over the years. There are various probable reasons associated with it. India was receiving capital inflows even amidst continued global uncertainty in 2009-11 as its domestic outlook was positive. With domestic outlook also turning negative, Rupee depreciation was a natural outcome. Apart from lower capital inflows uncertainty over domestic economy has also made investors nervous over Indian economy which has further exaggerated depreciation pressures. Depreciation leads to

imports becoming costlier which is a worry for India as it meets most of its oil demand via imports. Apart from oil, prices of other imported commodities like metals, gold etc. will also rise pushing overall inflation higher. Even if prices of global oil and commodities decline, the Indian consumers might not benefit as depreciation will negate the impact. In present scenario without a more stable source of capital inflow, the Rupee is expected to remain highly volatile.

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