An Analysis of Exchange Rate Determination and Factors Affecting Its Volatility in India: A Time Series Analysis

DISSERTATION

SUBMITTED TO

BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY
(A CENTRAL UNIVERSITY)
LUCKNOW

BABASAHEB
BHIMRAO
AMBEDKAR
UNIVERSITY
LUCKNOW
प्रज्ञा शील करूणा
ESTABLISHED 1996

FOR THE AWARD OF DEGREE OF

Master of Philosophy

IN

ECONOMICS

Under the Supervision of

PROF. NMP VERMA

Submitted by

SHANU KUMAR

DEPARTMENT OF ECONOMICS
SCHOOL OF ECONOMICS AND COMMERCE
BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY
(A CENTRAL UNIVERSITY)
VidyaVihar, Raebareli Road Lucknow-226025(U.P.), India

Enrollment No. 703/18 **Year 2019**

DECLARATION

I hereby declare that the work embodied in the dissertation entitled, **"An Analysis of Exchange Rate Determination and Factors Affecting Its Volatility in India: A Time Series Analysis"** submitted in the partial fulfilment for the award of the degree of **Masters of Philosophy** in Economics is an authentic record of original work carried out by me under the guidance of **Prof. N.M.P Verma,** Department of Economics, Babasaheb Bhimrao Ambedkar University. I further declare that this is the original work and has not been submitted in any University or Institution for the award of any degree. I also want to declare that this dissertation is free from all kind of plagiarism.p

Place: Lucknow
Date:

Shanu Kumar
Enrollment No. 703/18)
Department of Economics
BBAU Lucknow, Uttar Pradesh

CERTIFICATE

This is to certify that the Dissertation titled "**An Analysis of Exchange Rate Determination and Factors Affecting Its Volatility in India: A Time Series Analysis**" submitted by **Mr Shanu Kumar** is an original research work has not been previously submitted in part or full for the award of any other degree or diploma to this or any other university.

The Dissertation submitted to Babasaheb Bhimrao Ambedkar University, Lucknow satisfies all the requirements as stipulated in the Master of Philosophy (M.Phil.) Regulations amended in 2017 incorporating the provisions of the University Grants Commission Regulations, 2016 and it is fit for submission and evaluation for the award of the degree of Master of Philosophy of the University.

Date: **Supervisor**

Head of the Department

Acknowledgement

I express my deepest gratitude for the help and support extended by all the persons who directly or indirectly contributed to the completion of my Dissertation. I take this opportunity to express my gratitude to each of them.

First and foremost, I would like to express my sincere gratitude to my supervisor, **Prof. N.M.P Verma** for his continuous support and encouragement in the realization of this work. This undertaking could have never been completed without the unconditional support of my supervisor.

I am grateful to **Prof. Sanatan Nayak**, Head of Department of Economics, BBA University for their valuable comments and suggestions with respect to my research work.

I express my profound gratitude to the members of DRC **Dr Devendra Kumar Yadav, Dr Surendra Meher, Dr LC Mallaiah** and **Dr Pranav Anand** for their encouragement, generous attitude and friendly behaviour throughout my research work.

I must also express my appreciation for my close friends and seniors for their continuous encouragement and support during my research. I am extremely thankful to **Ms Pratinidhi, Ms Deepanjali, Mr Pawan Kumar Gupta, Mr Altaf Ahmed, Mr Ravindra, Ms Kanti, Mr Firdous, Ms Pragya Sharma, Ms Ruchi Bhalla, Ms Priti Jha, Ms Alka, and Ms Soma** for their advice and support.

My sincere thanks to all the staff members of the Department of Economics for their help and support. I am very thankful to **Mr Atul Sahu** for their assistance throughout my research work.

Finally, I would like to express my gratitude to my parents **Mr P.K Singh and Lata Singh** for supporting me in the completion of my work. I am also thankful to my sister **Shalini Singh** and brother **Bhanu Singh** for supporting me in every stage and completion of my work.

I also place on record, my sense of gratitude to one and all who directly or indirectly, have lent their helping hand in the completion of my work.

Shanu Kumar
(M.Phil. Scholar)

CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

RBI	Reserve Bank of India
IMF	International Monetary Fund
OECD	Organisation for Economic Co-operation and Development
REER	Real Effective Exchange Rate
NEER	Nominal Effective Exchange Rate
ADF	Augmented Dicky Fuller
VAR	Vector Auto Regression
VECM	Vector Error Correction Model
ECT	Error Correction Term
FII	Foreign Institutional Investment

Chapter 1

Introduction

CHAPTER – I

INTRODUCTION

1.1 Introduction and Background of the Study:

The exchange rate acts as an economic barometer for any economy as it plays a critical role in facilitating international trade, investment, and financial transactions. It measures the economic strength and competitiveness of a nation. So a stable exchange rate is very important for an economy for its efficient economic growth. It is a key economic variable that can affect the decisions of foreign exchange investors, exporters, importers, business houses, financial institutions, and policymakers. It also affects the decisions of students who wish to study abroad and tourists. The exchange rate fluctuations bring a significant impact on the value of international investment portfolios, the competitiveness of exports and imports and the value of international reserves. So, Movements in the exchange rate have important implications for the economy's business cycle, trade and capital flows. Indian Foreign Exchange Market has gone through a significant change due to the gradual process of liberalization in the last two decades. It has transited from different regimes of foreign exchange management and capital market reforms. With the adoption of market-determined exchange rate system and India's growing international trade and financial integration with the world economy it has experienced excessive fluctuations and volatility in the exchange market

Exchange Rate Management in India since Independence

The conduct of exchange rate policy in any economy is a very complex process. in recent years the new emerging economies are exposed to various exchange rate risk, increase in capital mobility, increased openness to international trade and a major shift in the composition of exports from primary goods to manufacturing goods and services. so by looking at all the above external factors, the choice of an appropriate exchange rate regime

has been a difficult task for policymakers. So, there is no consensus regarding an ideal exchange rate regime that has been achieved so far. It varies according to time and circumstances. India has experienced a paradigm shift in its exchange rate regime- a par value system to a pegged regime and later to managed float exchange rate system. In the initial phase of 1947-71 India followed the par value system of IMF under which the external value of rupee was fixed at 4.15 grains of fine gold. The RBI had regulated the par value with the permitted margin of plus-minus 1 % with pound sterling as an intervening currency. However, the devaluation of rupee in 1949 and 1966 in terms of gold has resulted in the reduction in the par value of rupee in terms of gold to 2.88 and 1.83 grains of fine gold, respectively but during 1966 to 1971 the exchange rate of rupee remains unchanged. After the breakdown of the Bretton Woods System the flexible exchange rate system was adopted in the place of the fixed exchange rate system. In 1971 India pegged its currency to the US dollar from Aug 1971 to Dec 1991 and the pound sterling from Dec 1971 to Sep 1975. In this period, under Smithsonian agreement, the value of pound sterling was fixed in terms of the US dollar, so the value of rupee was stable against the dollar. On 24th Sep 1975, the association between the Indian rupee and pound sterling was disengaged and later the value of rupee was pegged to a basket of currencies. However, the selection of currency in the basket was kept secret to remove any speculation of the exchange rate. The year 1991-92 shows a major break in policy when India adopted various reforms measures following the balance of payment crisis. After the closure of the pegged exchange rate system, India switched over to the market-determined exchange rate system following the recommendation of the Rangarajan committee on the BOP. Later the Finance Minister of India announced the adoption of the Liberalized Exchange Rate Management System (LERMS) in the budget of 1992-93 in place of the pegged regime. Under the LERMS, a dual exchange rate system was followed under which all foreign exchange receipts of current account were required to be

surrendered to the authorized dealers for conversion into domestic currency. Out of the total proceeds, 60% of them were converted at the market rate quoted by authorized dealers and the remaining 40% of the proceeds were converted at the rate decided by RBI. The Authorized Dealers were required to surrender 40% of the purchase of their foreign currency to RBI and they retain the remaining 60 % for selling in the free market. This dual exchange rate system was later replaced by the Unified Exchange Rate system in March 1993. With the adoption of a market-determined exchange rate system in 1993, the rupee has experienced various episodes of heightened volatility

A falling currency is always a matter of concern for a country. Last year every political and economic discussion was revolving around the subject of upsetting news of depreciation of Indian rupee against the dollar. The Indian rupee has experienced a significant amount of depreciation in its value. So against this backdrop, this study is an attempt to examine the major factors which make this fluctuation to occur in the Foreign exchange market. So this study will contribute to the existing knowledge and simultaneously it will explain the exchange rate behaviour under changing macroeconomic fundamentals.

1.2 Literature Review:

A considerable amount of research has been conducted to examine the factors affecting exchange rate volatility. The literature observes the relationship between exchange rate and various macroeconomic variables which are contributing to the changing behaviour of the exchange rate.

Dabos &Ramón (2000) in his study showed that there is a long-run relationship between the real exchange rate and capital inflows, terms of trade, and productivity in the manufacturing sector in Mexico.

Hau & Rey (2003) in his study found that exchange rates are almost as volatile as equity prices when the forex liquidity supply does not infinitely price elastic, he also finds that higher returns in the home equity market relative to the foreign equity market are associated with a home currency depreciation, lastly he concludes that net equity flows into the foreign market are positively correlated with a foreign currency appreciation.

Magda Kandil 2004 studied the impact of exchange rate fluctuations on real output growth and price inflation in a sample of 22 developing countries and found that there is negative impact of currency depreciation on the economic performance of developing countries.

Tomoe Moore (2006) in his paper "the sources of real exchange rate fluctuations in India" examined the impact of real and nominal shocks on the exchange rate of Indian rupee against USdollar and using structural VAR Model technique and found that real shocks have a permanent effect on exchange rate.

Dua and Sen (2006) studied the relationship between the real exchange rate, level of capital flows, volatility of the flows, fiscal and monetary policy indicators and the current account surplus for the Indian economy and estimated that the variables are cointegrated and each granger causes the exchange rate.

Sundaram (2009) investigated the relationship between exchange rate and foreign institutional investment using the cointegration test found that there is not a long run relationship between stock returns and exchange rate.

Ghosh & Herwadkar (2009) Studied the effect of portfolio flows on various sectors of Indian financial markets over the decade preceding the global financial crisis. Using correlation analysis and the Granger causality test the result suggest that portfolio flows have an impact on equity prices and exchange rates in India.

Combes, Plane & Kinda (2011) analyzed the impact of capital inflows and exchange rate flexibility on the real exchange rate in developing countries. His analysis was based on panel cointegration techniques. The result obtained showed that a public and private flow leads to real exchange rate appreciation.

Li and Wong (2011) in his study titled "The Exchange Rate and Interest Rate Differential Relationship" examined the relationship between real exchange rate and real interest rate differential in the two financial crises of 1997 and 2008. The empirical result obtained shows that there is a negative relationship exists between real exchange rate and real interest rate differential in most countries.

Dhasmana (2011) studied the relationship between India's real exchange rate and its trade balance with its major trading partners. The study found that there is a positive relationship between real exchange rate and the trade balance in the long run. He also found that real exchange rate volatility is negatively correlated with India's trade balance in the long run.

T.O. Akinbobola(2012) in his study using cointegration and VECM method found that there exists a causal linkage between inflation, money supply and exchange rate in Nigeria.

Mirchandani (2013) in his research investigated various macroeconomic variables leading to variations in the exchange rate of a currency. The variables studied are the interest rate, inflation rate, GDP, current account, foreign direct investment, and USD-INR. The major findings of his study indicated that there was a strong correlation between the exchange rate and variables such as interest rate, inflation rate, and foreign direct investment and GDP Growth rate.

Kamble & Honrao (2014) in his research empirically investigated the nature of exchange rate volatility. The study used monthly data on the Rupee-US Dollar bilateral exchange rate.

The empirical analysis was carried out for the period between Jan 2011 and Sep 2013. The foreign exchange rate volatility was investigated using the GARCH (1, 1) model. The result shows that there is a significant impact of increase in capital flows on the exchange rate.

Sahu et al (2014) in his study investigated the dynamic relationships between oil price, exchange rate and Indian stock market from 1993 to 2013. Using Co-Integration Test, Vector Error Correction Model (VECM), Variance Decomposition Test and Impulse Response analysis he indicated that there exists a long run co-integrating relation between crude oil price, exchange rate, and Indian stock market, but crude oil price or exchange rate is not observed to affect the Indian stock prices significantly.

Renu Kohli (2015) in his study highlighted the importance of reserves which helps in reducing exchange rate volatility in an environment of financial globalization, market-determined exchange rate and macroeconomic imbalances. He finds that adequate reserve holdings significantly reduce exchange rate volatility irrespective of the exchange rate regime.

Lodha (2017) in his study examined the long- run and short-run interdependence between USD-INR exchange rates, gold prices, and crude oil prices. He employed Johansen Cointegration test for a long-run relationship. However, the results indicated that there was no long-run relationship between the variables. The study also examined the short-run relationship using the Granger causality test and the VAR model. The results reveal that there is bidirectional Granger causality exists between crude oil and USD/INR exchange rate, whereas unidirectional Granger causality runs from crude oil to gold price series.

India Ratings and Research (Ind-Ra,2018) argues that the global developments such as the strengthening of the US dollar, high commodity prices especially of crude oil, tighter monetary conditions in the US, coupled with domestic factors such as expanding

trade/current account deficit, inflationary pressures, and likely fiscal slippage are together impacting the rupee.

Akshay & Vidhi(2018) in his study proved that Crude oil price, Interest rate differential and Net investment inflows to India have an impact on the exchange rate in the short term.. Also, he analysed that there is no relationship between the trade deficit and the exchange rate. it was also found that during the financial crisis of 2008 the variables Crude oil price, Interest rate differential and net investment inflows to India had lesser importance in determining the exchange rate.

1.3 Rationale of the study and research gap

With increased global economic activity and trade the importance of the exchange market has grown significantly, so excess volatility in it is a major concern for any economy. As recently we have seen that the fluctuations in the exchange rate is a matter of serious discussion in all political and economic circles. It can impose real costs on the economy through its impact on international trade and investment. Sometimes, it may also impact on the conduct of monetary policy. So this study aims to identify all the macroeconomic fundamentals which can impact exchange rate fluctuations in the short run and long run. As the earlier studies suggest that there is greater interest among the policymakers and academia in exploring the factors impacting fluctuations in the exchange rate but most of the study is confined to limited no of variables. This study will discuss the short run and long run factors of exchange rate determination. Apart from this the study also covers the current period in which very limited no of literature is available.

1.4 Objectives of the Study:

The present study will address the following objectives:-

1. To analyze the factors affecting the exchange rate in the short run.

2. To analyze the factors affecting the exchange rate in the long run.

1.5 Hypotheses of the study:

From the factors affecting the exchange rate in short run and long run the null hypothesis formed will be:

H_0 There is no significant impact of interest rate differential, crude oil prices and net FII's on the exchange rate in short run.

H_0 There is no any significant impact of inflation differential, terms of trade and worker's remittances on exchange rate in the long run.

1.6 Research Methodology:

Time period of the study

The study employs annual data from the period 1993-2108 of India and US of selected variables.

Sources of data

To obtain reliable information which will help to ensure the effectiveness of the study, the data have been collected from only secondary sources such as from Reserve Bank of India database, Federal Reserve Bank of St. Louis, Organization for Economic Co-operation and Development (OECD), International Monetary Fund Financial Statistics, and World Bank.

Variables of the study

Out of the various factors impacting the exchange rate behaviour, the following factors were selected for the statistical testing in the research study. They are as follows:-Terms of trade, interest rate differential, net capital inflows, inflation differential, worker's remittances and crude oil prices in the short and long run.

Tools & techniques

The data are time series in nature so to test the stationarity of the data unit root test will be used. It is followed by the Johansen co-integration test to show the long run relationship. Vector Error Correction Model will be conducted to check the short run and long run causal relationship between the variables. The Impulse Response Function have also been employed.

1.7 Limitations of the study

This study will come up with some important findings regarding the fluctuations in the exchange rate in the short run and long run. There are large numbers of variables which affect the exchange rate but this study has employed a limited number of variables to understand the changing behaviour of exchange rate. While carrying out the research a no of other constraints was also experienced. The data used in social science research are generally non-experimental in nature so it is not subjected to control of the researcher. The problem of gathering information from various databases also possessed a major challenge to the researcher. Apart from this time constraint is also a major limitation to this study.

1.8 Outline of the study

The study is organized as follows:-

Chapter 1: Introduction and Review of literature

This chapter deals with the introduction of the topic as well as earlier studies related to the determinants of exchange rate.

Chapter2: Conceptual and Theoretical Framework

This chapter deals with the theoretical and Conceptual understanding of the topic which comprises all the preliminary information and terminologies required for the understanding of

exchange rate behaviour. It also deals with various theories on exchange rate determination in the short run and long run.

Chapter 3: Short run determinants of exchange rate

This chapter deals with the short-run determinants of the exchange rate. This chapter will give a detailed analysis of factors affecting exchange rate behavior in the short run.

Chapter 4: Long run determinants of exchange rate

This chapter is devoted to long-run determinants of the exchange rate. It will focus on those factors which affect the exchange rate in the long run.

Chapter 5: Findings and conclusions

This chapter will discuss the major findings and conclusion of the study.

Chapter 2

Conceptual and Theoretical Framework

CHAPTER – II

A. CONCEPTUAL FRAMEWORK

2.1 Introduction

The terminologies used in the foreign exchange market is sometimes, confusing to understand so this chapter will give a brief introduction of all the terminologies for the better understanding of exchange rate dynamics.

2.1.1Exchange Rate

The exchange rate is the value of one currency in terms of another currency. It is also known as Exchange-Rate or Forex Rate. In other words, the forex rate between two currencies can be defined as the rate at which one currency will be exchanged for another. The foreign currency market includes brokers, students, commercial banks, central banks, individual firms, foreign exchange brokers, etc. The major functions of the foreign exchange include:-

I. One can transfer currency from one market to another where it is needed for transactions.

II.it also Provides short-term credit to the importers and thereby it facilitating the smooth flow of goods and services between the countries.

III. It also performs stabilizing function in the foreign exchange rate through spot and forward market.

2.1.2 Kinds of Foreign Exchange Market in India:

A. Spot market: It is a type of market in which the sale and purchase of foreign currency take place within two days of the deal. The spot sale and purchase of foreign exchange comprise spot market. The rate at which the foreign currency is bought and sold is termed as the spot exchange rate.

B. Forward Market: It is also a type of market, where deals in the sale and purchase of foreign currency take place at some future date at a pre-determined exchange rate. When buyers and sellers are involved in an agreement to buy and sell a foreign currency after 90

days of the deal, it is called forward transaction. The exchange rate determined between buyer and seller for forwarding sale and purchase of currency is called forward exchange rate.

2.1.3 Types of exchange rate management

A. Fixed Exchange Rate

B. Flexible Exchange Rate

A. **The Fixed Exchange Rate**

When the exchange rate between the domestic and foreign currencies is determined by the monetary authority of a country and is not allowed to fluctuate beyond a certain limit, it is called a fixed exchange rate. According to the IMF system, the monetary authority of a member nation fixes the official value of its currency in terms of a reserve currency or a basket of key currencies. The exchange rate determined by the above method is known as the currency's par value system. It is also called the 'pegged' exchange rate system. However, the flexibility is allowed within the upper and lower limits fixed by the IMF, under the normal conditions it is usually 1% up and down.

The main motive of adopting a fixed exchange rate system is to maintain stability in foreign trade and capital movements in the country. Under the fixed exchange rate system, the government is responsible for the stability of the exchange rate. so, the government handles the buying and selling of the foreign currency- it buys when it becomes weaker and sells when it becomes stronger. Under this system, Private sale and purchase of foreign currency are suspended and any change in the official exchange rate is undertaken by the monetary authority of the country in consultation with the IMF. But nowadays most of the countries adopt a dual exchange rate system: a fixed exchange rate is followed for all official transactions and a market-determined rate for private transactions.

Arguments in Favour of Fixed Exchange Rate:

First, it provides stability in the exchange market about the future course of actions and it eliminates the risk and uncertainty from the market

Second, it creates a system for a smooth exchange of foreign capital between the nations, as it assures of a fixed return on investment.

Third, it also eliminates the possibility of speculative transactions in foreign exchange markets.

Lastly, it reduces the possibility of any exchange depreciation and devaluation of currencies.

B. **Flexible Exchange Rate**

When the exchange rate is determined by the market forces it is called the flexible exchange rate. It is often argued that flexible exchange rate bears uncertainty, risk and speculation in the currency market. The supporter of the flexible exchange rate has not only refuted these charges but also placed strong arguments in favour of flexible exchange rate.

Arguments in favour of Flexible Exchange Rate:

First, the flexible exchange rate provides autonomy in formulating domestic policies for any economy.

.Second, flexible exchange rate is self-adjusting in nature so it does not require any government intervention to maintain an adequate foreign exchange reserves to stabilize the exchange rate.

Third, since flexible exchange rate is based on various theoretical frameworks, so it provides great advantage in predicting the value of exchange rate.

Fourth, flexible exchange rate acts as a barometer for any economy as it measures the actual purchasing power of a currency in the foreign exchange market.

2.1.4 Foreign exchange market

A foreign exchange market is a place where mutual exchange of foreign currencies take place. In the foreign exchange market, investors buy foreign currencies with domestic currencies and sell foreign currencies for domestic currencies. In the words of Ellsworth a foreign exchange market comprises all those individuals and institutions who involve in transactions of foreign money results in inflow and outflow of foreign exchange. It covers all the banks, commercial companies, investment management firms, hedge funds and retail forex brokers and investors. So exchange market is regarded as the biggest financial market in the world.

2.1.5 Exchange Rate measure used in India

The USD-INR is the widely used currency in all the international transactions and other calculations with the rest of the world. Exchange rate in nominal terms is not a good measure of competitiveness. The main disadvantage of the use of single currency is that it cannot measure the difference in price and cost change in relation to other trading partners. To overcome this issue the effective measurement came into existence.

Nominal and Real Effective Exchange Rate

India uses two methods of exchange Rate namely Nominal Effective Exchange Rate (NEER) and Real Effective Exchange Rate (REER). These indicators are used for measuring the external competitiveness of the country. NEER can be defined as the weighted average of the bilateral Nominal Exchange Rate of home currency in terms of foreign currencies. Similarly, REER can be defined as the weighted average of the nominal exchange rate adjusted for the relative price differential between the home country and foreign countries. RBI provides two indices of Effective Exchange Rate, one is 6-currency based and other is 36-currency based. WPI is used as a proxy for Indian price of goods and services whereas CPI is used as a proxy for Foreign partner countries.

B. THEORETICAL FRAMEWORK

2.2 Introduction

In the literature, various theoretical models are given to analyse exchange rate determination and its behaviour. Theories of exchange rates determination have seen a significant change since the exchange rate system shifted from a fixed rate system to the floating exchange-rate system. The modern exchange rate theories are based on the monetary approach and the asset market or portfolio balance approach to the balance of payments that have been developed since late 1960s. These theories consider exchange rate, for the most part, as a purely financial phenomenon. The traditional exchange rate theories are based on trade flows and help explain exchange rate movements only in the long run. But, since the advent of floating exchange rates in 1973, international financial flows have increased tremendously which are far larger than trade flows (**Salvatore**). Therefore, now the interest has shifted towards monetary theory of exchange rate determination. However, the traditional theories are still important in explaining exchange rate in the long run.

2.3Exchange Rate Models

2.3.1 Purchasing-Power Parity Theory

The earliest and simplest model of exchange rate determination is known as purchasing power parity theory given by Swedish economist Gustav Cassel in 1918 to correct the large differentials in inflation rates experienced by the countries after the world war ended. The theory of PPP states that the exchange rate between the two countries is determined on the basis of ratio of price level between the two nations. The equilibrium is attained when purchasing power is same in both the countries. So when a nation's price level rises, it's goods become expensive, export declines and import rises which creates downward pressure on the

value of a currency and hence the currency depreciates till it goes back to equilibrium. The theory is based on the application of 'Law of One Price' which states that a given commodity should have the same price in both the countries when expressed in terms of the same currency given that there are no transportation costs, no trade barriers and competitive market. There are two versions of PPP theory:-

Absolute Purchasing-Power Parity Theory: - the absolute form of PPP postulates that the price of a fixed basket of goods and services will be equal in different countries when measured in one currency i.e. E=P / P* where E is spot exchange rate and P and P* are general price level in home and foreign nation respectively. Any deviation from the equilibrium exchange rate will result in arbitrage process bringing the price same in both the nations.

Relative Purchasing-Power Parity Theory: - the relative version of PPP states that the rate of change in prices of a basket of goods should be same in both the nations. The change in exchange rate is equal to the relative change in the price level of the basket of goods in the two nations over a period of time. Over the long run, a country with a relatively high rate of inflation tends to have a depreciating currency whereas the country having a lower rate of inflation tends to have an appreciating currency. It is considered as more flexible and dynamic version of absolute PPP.

Initially, it was observed that there were deviations in PPP only in short run and in long run PPP holds in equilibrium. But many of the recent studies show the deviation in PPP theory even in the long run (Dua **& Ranjan**). The problems like heterogeneity in the consumption basket of goods due to difference in tastes and consumption behaviour, presence of transportation cost and trade barriers, imperfect competition in the goods market and increase in the volume of capital flows internationally led to the sharp deviation from the PPP theory.

2.3.2 International Fisher Effect Theory

This theory makes use of interest rate differentials rather than inflation differentials in determining the exchange rate. It was developed by Irving Fisher in the 1930s and it is also called a fisher theory. This theory suggests that a higher interest rate will result in higher inflation rates hence; the theory estimates that the country having a higher interest rate will have a depreciating exchange rate which would help in equalizing returns in both the nation. It is very similar to the PPP theory because the Fisher effect depicts the relationship between inflation and interest rate. IFE assigns changes in the exchange rate to interest rate differentials, rather than inflation rate differentials among nations.

2.3.3 The Asset Approach

Prior to the monetary approach, it was common to emphasize international trade flows as major determinants of exchange rate because of the fact that the government has maintained tight restrictions on international flows of financial capital. But after financial liberalization we see that the volume of international trade in financial assets surpassed the trade in goods and services. The modern exchange rate models adjust to equilibrate international trade in financial assets rather than the traditional models of the exchange rate which focuses on equilibrating international trade in goods and services. The shift in emphasis from goods market to financial market has important implications. As goods prices adjust slowly relative to the financial asset prices so exchange rate will be much more variable than goods prices. The model assumes perfect capital mobility between the nations.

2.3.4 Monetary Approach

In the monetary approach, the exchange rate between two currencies is determined by the relative demand and supply between the countries. The basic premise of the monetary

approach is that the balance of payment is a monetary phenomenon. The monetary approach to BOP explains the correction in payments disequilibrium in terms of factors which bring the supply and demand for money into equality.

Under the fixed exchange rate system a country has no control over its money supply in the long run. The nation's BOP surplus or deficit is temporary and self-correcting in the long run i.e. the excess demand for or supply of money is eliminated through the inflow and outflow of funds. Hence, the BOP surplus and deficit are corrected and the international flow of money stops.

Whereas under flexible exchange rate system BOP disequilibrium is immediately corrected by automatic changes in exchange rates without any international flow of money. So we can say under a flexible exchange rate system a country has dominant control over its money supply and its monetary policy.

Thus according to the monetary approach, depreciation of currency results from excessive money growth in the nation while currency results from inadequate growth of money in the nation. In other words, we can say a nation facing greater inflationary pressure than other nations will find its exchange rate rising. On the other hand, a country facing lower inflationary pressure with respect to rest of the nations will find its exchange rate decreasing. Under the managed floating exchange rate the nation's monetary authority intervene in the foreign exchange market to contain volatility through accumulated international reserves.

2.3.5Expectations, Interest rate differentials, and exchange rates

Exchange rates not only depend upon the relative growth of money supply and real income in many nations but also on inflation expectations and expected change in exchange rates.

Other prominent monetary models are flexible and sticky price monetary models of exchange rate. The flexible price monetary model was proposed by Frenkel in 1976. It assumes that prices are perfectly flexible. The model explains changes in the nominal interest rate cause change in the expected inflation rate. Similarly, a relative increase in the interest rate of the domestic country with respect to foreign country implies that domestic currency will depreciate through the effect of inflation, which will result in the fall of demand for domestic currency compared to the foreign currency. In addition to flexible price the model further assumes that purchasing power parity (PPP) holds continuously, so does the international Fisher effect and uncovered interest rate parity.

The model also assumes that an increase in money supply in the domestic country would lead to a rise in domestic price and hence depreciation of the domestic currency in order to maintain PPP. Further an increase in domestic output will bring an appreciation to the domestic currency because an increase in real income will create excess demand for money.

In the sticky price model proposed by Dornbusch in 1976 introduced the concept of exchange rate overshooting which provided an explanation about exchange rate volatility and misalignment from purchasing power parity. An exchange rate is said to overshoot when its short term response is greater than the long run response to a change in market fundamental. The model explains that changes in the nominal interest rate reflect the changes in the tightness of monetary policy.

Hooper and Morton extended the sticky price model by incorporating the changes in the long-run real exchange rate. The change in the long run exchange rate is assumed to be directly linked with an unanticipated change in trade balance. So we can say that a domestic trade balance surplus indicates appreciation of exchange rate and similarly, trade balance deficit indicates depreciation of exchange rate.

2.3.6 Portfolio Balance Model

Monetary approaches to exchange rate determination, including the flexible price monetary model and sticky price monetary model assume that uncovered interest rate parity holds which implies that domestic and foreign assets are perfect substitutes of each other, while the portfolio balance approach regards that they are an imperfect substitute of each other. The deviation arises because of different risk attitudes towards foreign financial assets in relation to domestic financial assets or we can say that there exists a risk premium on holding foreign financial assets relative to holding domestic financial assets. Moreover and in contrast to the monetary models, foreign exchange rates are not expected to change with the portfolio balance approach. While purchasing power parity (PPP) holds in the flexible price monetary model and in the long run it holds in the sticky price monetary model of Dornbusch so there is no need for PPP to hold in the portfolio balance model. This implies that goods need not be perfect substitutes.

2.3.7 Theory of Capital Flows and Forward Premium

With the financial liberalization and opening up of capital accounts all over the world, capital flows have become very important in determining the exchange rate fluctuations. The relation between capital flows and the exchange rate is said to be negative because capital inflow means the purchase of a domestic asset by foreigners and capital outflow means the purchase of foreign assets by residents of our country. Sine exchange rate is determined by the demand and supply of domestic and foreign assets, so the purchase of foreign assets leads to the rise in the value of the foreign currency, similarly, the purchase of domestic assets leads to the rise in the value of the domestic currency.

Dua and sen (2009) developed a model which established the relationship between real exchange-rate, level of capital flows, volatility of the flows, fiscal and monetary policy

indicators and current account surplus and found that an increase in capital inflows and volatility leads to the appreciation of exchange rate.

If the forward exchange rate is above the present spot rate then the difference measured between the two is called forward premium, which is a good indicator of the future exchange rate. According to covered interest parity, the premium on the forward contract is equal to the interest rate differential between the two countries. So if the domestic interest rate rises the forward premium on the foreign currency will rise which leads to the appreciation of foreign currency

2.3.8 Microstructure Framework

The determinants of exchange rate discussed so far deals with the fundamentals which cause changes in exchange rates, but the microstructure theory provides an alternative view to the determination of exchange rate. Unlike the macroeconomic models which are based on public information or news which affects the entire economy, the microstructure theory deals with the access of private information which is known to some of the traders about the current state of the market.

2.4 Conclusion

Traditional theories which have been developed during the period of fixed exchange rates, such as the elasticity approach and the absorption approach, focused mainly on the real sector. However, in the current period of flexible exchange rates, the monetary sector is another important factor determining the exchange rate.

The two traditional theories: the elasticity approach and the absorption approach were concerned with the effects of devaluation on the trade balance. The elasticity approach focuses on the domestic goods market and the foreign goods market, while the absorption

approach focuses on the expenditures of economy as a whole. However, none of the above approaches considered the monetary sector explicitly. So a new model called the Mundell-Fleming model came into existence where the exchange rate is determined by the interaction between the real sector and the monetary sector

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 the exchange rate. Similarly, Dornbusch Model is considered to be the most appropriate one for explaining 'excess variability' or 'overshooting' of exchange rates. Nowadays microstructure theory of exchange rate is also an important measure of exchange rate determination. Apart from this intervention by the Government also impact the exchange rate.

Chapter 3

Short Run Determinants of Real Exchange Rate

CHAPTER 3

SHORT RUN DETERMINANTS OF REAL EXCHANGE RATE

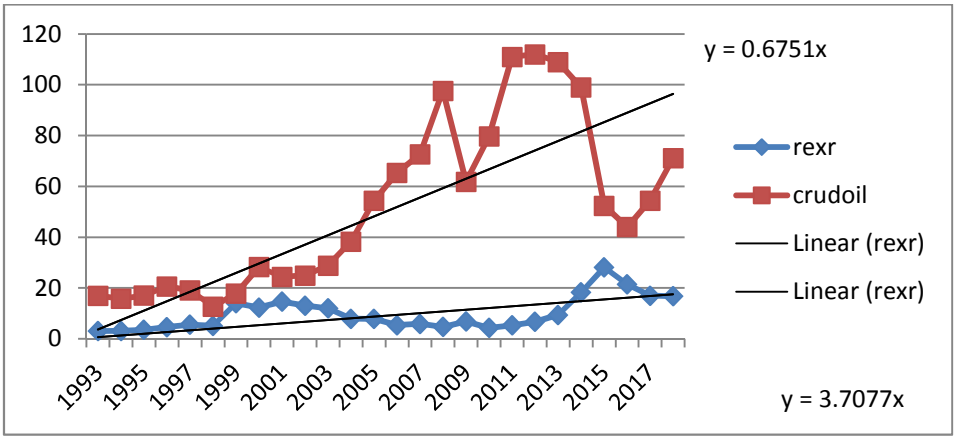
3.1 Introduction

The previous chapter sets the conceptual and theoretical framework of the determination of exchange rate and factors causing fluctuations in it. This chapter will discuss the short-run determinants of the exchange rate by applying the analytical technique on the annual data of India from 1993 to 2018. The result of this chapter will provide an answer to the first objective of the study.

Crude Oil prices and exchange rate

Coal and crude oil are India's largest primary sources of energy. The US Energy Information Administration overview of India illustrated that India was the fourth largest consumer of oil and petroleum products following the United States, China, and Japan. It was also considered as the fourth largest net importer of crude oil and petroleum products in the world. The demand for oil in India increased to about 3.727 million barrels per day while the country's production was about 894 thousand barrels per day. It imports nearly 80% of its total required needs. Thus, we can conclude that the widening gap between the demand for oil and the supply of oil in India must be met through an increase in import. This is one of India's main concerns; the huge outflows of US dollar worsens the current account deficit. This, in turn, increases the inflation rate and external debt burden, and as the demand for US dollar rises, the Indian rupee depreciates.

Figure 3.1 trends of crude oil and real exchange rate



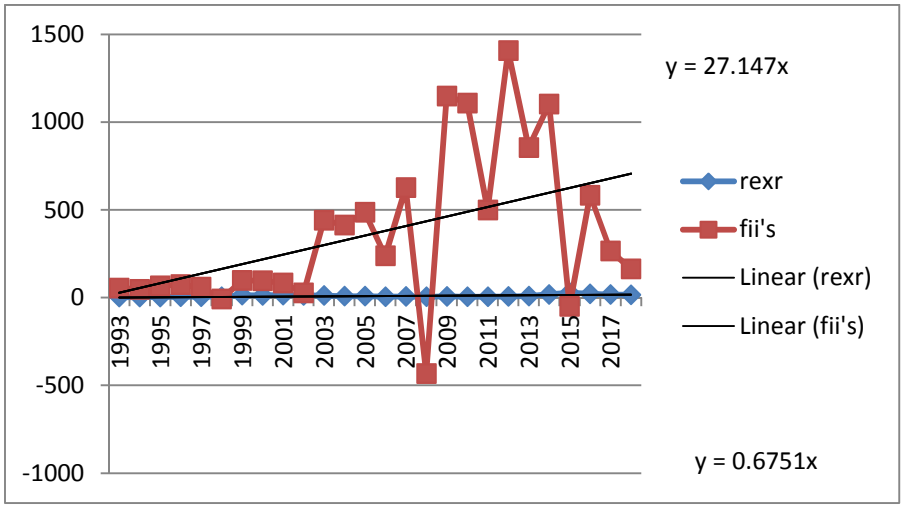
Data source: Reserve Bank of India database

The above figure shows the trends of crude oil prices and exchange rate from the year 1993 to 2018. The Y-axis represents crude oil price and exchange rate and the X-axis represents the time period. The graph shows both the variables crude oil price and the exchange rate was fluctuating in different time period.

FII's and Exchange rate

The growth of FII's in India has seen consistent growth since liberalization. It refers to the companies who invest in the financial market of the other country. In other words, it can be defined as investors residing outside India but investing in debt and equity markets of the country. The movement in the value of rupee is very highly correlated with the stock price movements in India. This can be explained by the fact that foreign institutional investors are making the largest investment in the Indian stock market. FII inflows create demand for rupee so it appreciates with respect to dollar similarly, outflow leads to depreciation of the currency. In another way, we can say that our current account deficit is mainly financed through foreign portfolio flows and our foreign reserves mainly contain or built through FII inflows.

Figure 3.2 trends of FII's and Real Exchange Rate



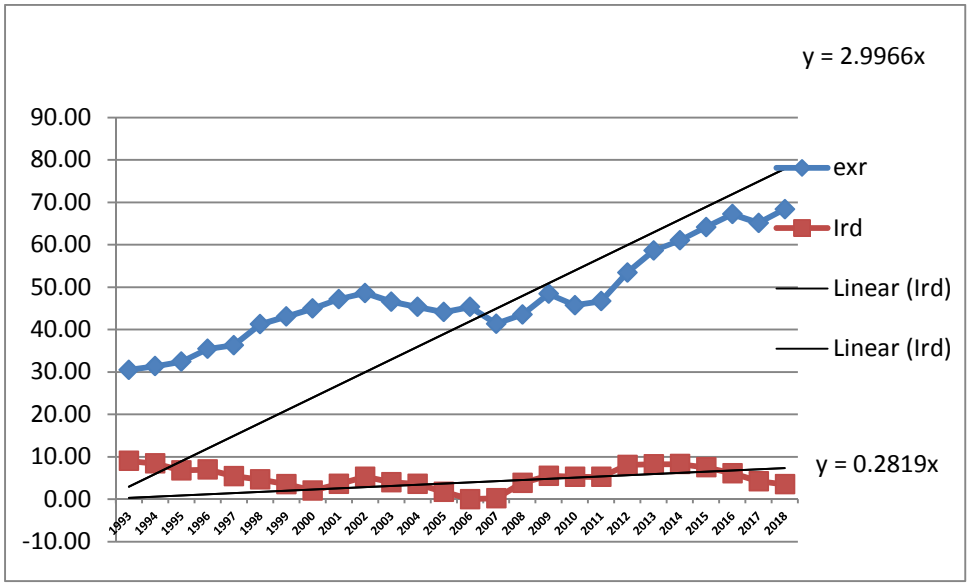
Data source: Reserve Bank of India database

Interest rate differential and exchange rate

Interest rate differential also plays an important role in exchange rate determination. As we know that higher interest rate attracts foreign investment to the country which helps in the economic growth of the economy. The interest arbitrage theory suggests that interest rate

differential causes international flow of short term liquid capital to earn higher returns abroad. The developed economies reduce their interest rates below zero to spur demand whereas emerging market economies raised their interest to restrict the capital outflows.

Figure 3.3 Trends of Exchange Rate and Interest Rate Differential



Data source: Federal Reserve Bank of St. Louis

3.2 Data and Methodology

The study used data on interest rate differential, crude oil prices and net foreign institutional investments (FII's) to examine its impact on exchange rate in the short run.

3.2.1 Model Specification

The theoretical analysis presented in chapter two suggests that exchange rate is determined by both short and long-run factors. However, this chapter deals with the short run determinants of exchange rate. These variables include interest rate differential, net inflow of FII's and crude oil prices. Based on the theoretical background and availability of data, this study estimates the following relationship:-

$$rer = \alpha + \beta_0\, inrd + \beta_1\, crudoil + \beta_2 fii + \mu$$

Where,

rer= real exchange rate

infd= interest-rate differential

crdoil= Brent crude oil prices

fii= net foreign institutional investment

α and $\beta's$ are intercept and slope coefficient and μ is the error term of the above real exchange rate model.

Table 3.1 Descriptive statistics of short-run determinants

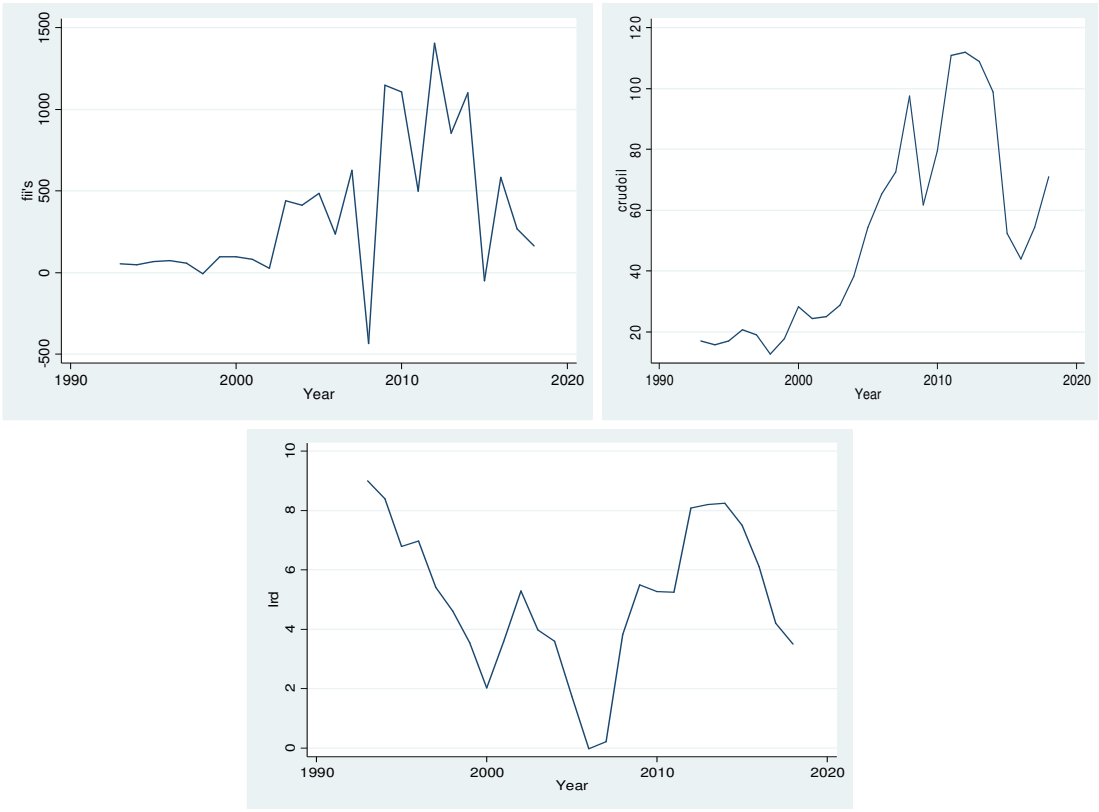
	CRUDOIL	FII_S	IRD	REXR
Mean	51.89375	363.5669	5.033942	9.915795
Median	48.20875	200.3100	5.260000	7.359836
Maximum	111.9650	1406.250	9.000000	28.14190
Minimum	12.71667	-433.3600	-0.020000	3.092067
Std. Dev.	33.34870	447.5072	2.467426	6.447132
Skewness	0.530611	0.778250	-0.263889	1.106442
Kurtosis	1.954944	2.860679	2.411441	3.603230
Jarque-Bera	2.403194	2.645613	0.677032	5.699136
Probability	0.300714	0.266387	0.712828	0.057869

The above table shows the descriptive statistics of all the short run determinants of real exchange rate. The results of Jarque-Bera test shows that residuals are normally distributed.

3.2.2 Stationary/ unit root test result

The first step in analysing the time series data is to determine the order of integration of the series. In this study Augmented Dicky Fuller unit root test have been employed to check the stationarity of data. But before employing ADF unit root test the graphical analysis of series has been presented. A visual plot of the series will give preliminary information about the trend and stationarity of data.

Fig3.4 Plots of the Real Exchange Rate and
Their shorts run Determinants during 1993-2018



Source: Reserve Bank of India and World Bank

So the above figure plots three variables of real exchange rate against time. The impression from the plots in the figure is that crude oil prices, Fii's and interest rate differential seem to have upward and downward trend in different time period which suggests that they are not stationary in their level form i.e. they have time-varying mean and covariance.

After this informal test, this study makes use of ADF test using stata to check the stationarity of data. The ADF unit root test checks the null hypothesis of a unit root. Therefore, a rejection of null hypothesis under the ADF test states that the series does not have unit root.

Table 3.2 ADF Unit root test results

Variables	Level form			1st difference		
	Intercept only	Intercept and trend	No intercept no trend	Intercept only	Intercept and trend	No intercept no trend
rexr	-1.537	-1.837	-0.229	-4.187**	-4.090**	-4.202**
Fii's	-3.754**	-4.476**	-2.596**	-9.787**	-9.678**	-10.00**
Crudoil	-1.38	-1.725	-0.189	-4.228**	-4.152**	-4.246**
Ird	-1.94	-1.915	-1.515	-3.344**	-3.24***	-3.37**

**5 per cent level significance, ***10 per cent level of significance

The result of the ADF test shows that the series is not stationary in their level form except Fii's. But variables become stationary at their 1st difference at 5% level of significance. Therefore it can be concluded that all the series are stationary at first difference.

Table- 3.3 Optimum Lag Length Criteria

lag	FPE	AIC	HQIC	SBIC
0	2.6e+10	35.3265	35.3732	35.5248
1	8.0e+08	31.8196	32.0532	32.8114
2	1.7e+09	32.4129	32.8335	34.1983
3	3.5e+09	32.6165	33.224	35.1953
4	3.2e+08*	28.8891*	29.6835*	32.2614*

To select the maximum lag length the optimal lag length criteria has been performed by selecting the above variables and the result shows that there are 4 no of lag in the model. The criterion like Final Prediction Error (FPE), Akaike Information Criterion(AIC), Hann Quinn Information Criterion (HQIC), Schwarz Criterion (SBIC or SIC) suggests optimal lag length. According to AIC and SBIC criteria lower the value better the model so in the above case all the criteria show similar result but in the case of contradicting results, more emphasis is given on AIC and FPE criteria.

3.2.3 Cointegration

Cointegration analysis is used to determine whether there is any long-run equilibrium relationship exists between real exchange rate and its determinants. Since the variables are integrated of the same order so this study employed Johansen cointegration test to find the cointegration among the variables.

Table- 3.4: Johansen Cointegration Rank Test Results

Null Hypothesis	Alternative Hypothesis	Statistics	0.05 Critical Value
Trace Statistics			
$r \leq 0$	$r \geq 1$	134.1151	47.21
$r \leq 1$	$r \geq 2$	58.0393	29.68
$r \leq 2$	$r \geq 3$	14.2119*	15.41

Maximum Eigenvalue statistic

Null Hypothesis	Alternative Hypothesis	Statistics	0.05 Critical Value
$r \leq 0$	$r \geq 1$	76.0758	27.07
$r \leq 1$	$r \geq 2$	43.8274	20.97
$r \leq 2$	$r \geq 3$	9.2181*	14.07

The above table presents Johansen Cointegration Test based on the trace statistics and the second part of the table presents the result of maximum eigenvalue statistics. The test has been performed on the level form not on their first difference. The Cointegration Test is necessary to establish a long run relationship between the variables. In the above test both the test statistics shows the same result i.e. there are two cointegrating equations. As according to decision criteria reject the null hypothesis if trace and max stats is greater than 5% value otherwise fail to reject null hypothesis. In the above result shown the null hypothesis suggests that there are two cointegrating eqn but trace stats and max stats is less than5% so the null hypothesis is accepted. So the series are cointegrated means that they exhibit a long run relationship. It implies that series are related and combined in a linear fashion. Now we estimate both short run and long run model and this will require the use of VECM model.

3.2.4 Vector Error Correction Model

The cointegration test result proves that we can use the Vector Error Correction Model for estimation. This model is used to separate the short run from long run relations. If results of the Johansen Cointegration Test found that the variables of interest are integrated in the long run the VECM must be used to find whether variables are cointegrated in the long run or not

Table- 3.5: Analysis of Vector Error correction model

Equation	R-Square	P-Value
Drexr	0.4784	0.9869
Dird	0.8247	0.0202**
Dcrudoil	0.916	0.0000**
DFii's	0.8265	0.0182**

It gives information about all the variables, as VECM model has taken 1st difference of all the variables. Further R-square of all the variables except real exchange rate is good enough to justify their causality and p-value close to zero also indicates its significance.

Table-3.6- Long-run causality results (Real Exchange Rate as dependent Variable)

cointegrating equation(Drexr)	Coefficient	P-value
Ce1	.8585602	0.158
Ce2	2.533313	0.154

This part of the result shows regression equation by taking drexr as dependent variable and lagged values of ird, crudoil, fii's as independent variables. Ce1 and Ce2 are called cointegrating equations in the model. The value of coefficient is error correction term in the model. To ascertain the long run causality between real exchange rate and all the independent variables the value of Error correction term of cointegrating equations has to show a negative coefficient and significant p-value. As the results show error correction term of cointegrating equation one is .8585602 and error correction term of the 2nd equation is 2.533313 which is a positive value and none of them has significant p-value. So all the conditions to show long-run causality is missing here this implies that the VECM do not show any long-run relationship between real exchange rate and all other independent variables. Thus it shows that there is no long-run causality running from crude oil prices, FII's and Interest rate differential to the real exchange rate.

Table 3.7- Short run causality results (Real Exchange Rate as dependent Variable)

Drexr								
	rexr		**ird**		**crudoil**		**Fii's**	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
LD	-.357131	0.54	-2.76619	0.225	-0.021803	0.908	0.0319197	0.202
L2D	-.25937	0.65	-2.26605	0.212	.1348027	0.331	0.0207907	0.231
L3D	-.103391	0.87	1.033911	0.876	.2816646	0.124	0.0092786	0.297

To check the short run causality between the variables the lag coefficient and p value of each independent variable should be significant. Here real exchange rate is dependent variable. The above table shows that lagged value of each independent variable like interest rate differential, crude oil prices and FII's does not have significant value of short run coefficient and P-value. It means that the p-values are not significant to explain the dependent variable real exchange rate. So there is no short run causality running from interest rate differential, crude oil prices and FII's to real exchange rate.

Table-3.8- long run causality (Interest Rate as dependent Variable)

cointegrating equation(Dird)	**Coefficient**	**P-value**
Ce1	-.3593541	0.006*
Ce2	-.9824227	0.009*

This part of the result shows regression equation by taking interest rate as dependent variable. The result shows that error correction term has negative coefficient and significant P-value at 1% level of significance which shows that there exists long run causality running from real exchange rate, crude oil prices and FII's to interest rate differential.

Table 3.9-Short run causality (Interest Rate as dependent Variable)

Dird								
	rexr		**ird**		**crudoil**		**Fii's**	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
LD	.2783114	0.028**	.9605882	0.225	.0797628	0.047**	0.0087999	0.098
L2D	.3598384	0.004*	.7074422	0.212	.0480548	0.104	0.0058071	0.116
L3D	.4823661	0.001*	.327348	0.876	.0375668	0.335	0.0030207	0.111

The results from the above table show that only lagged values of real exchange has significant p-value at 1% and 5% level of significance. So it shows there is short run causality running from real exchange rate to interest rate differential. To check the short run causality from lagged values of real exchange rate, linear hypothesis test (wald test) is performed.

Table 3.10 Wald Test

```
( 1)  [D_ird]LD.rexr = 0
 ( 2)  [D_ird]L2D.rexr = 0
 ( 3)  [D_ird]L3D.rexr = 0
 ( 4)  [D_ird]LD.crudoil = 0

           chi2(  4) =   14.26
         Prob > chi2 =    0.0065*
```

The null hypothesis assumes they are jointly zero to explain interest rate differential.

The above result show that p-value is significant so null hypothesis is rejected and there is short-run causality running from real exchange rate to interest rate differential.

Table 3.11 long run causality test (crude oil price as dependent variable)

cointegrating equation(Dcrudoil)	**Coefficient**	**P-value**
Ce1	-4.218639	0.000*
Ce2	-12.55234	0.000*

This part of the result shows regression equation by taking crude oil price as dependent variable and lagged values of real exchange rate, interest rate differential, and FII's as independent variables. The result shows that error correction term has negative coefficient value for both cointegratin equation and it also have significant P-value, which shows that there exists long run causality from real exchange rate, interest rate differential, and FII's to crude oil prices.

Table 3.12 Short run causality test (crude oil price as dependent variable)

Dcrudoil(dependent variable)								
	rexr		**ird**		**crudoil**		**Fii's**	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
LD	.7592904	0.461	12.86921	0.001*	-.0041008	0.990	-.140096	0.001*
L2D	.7836717	0.435	7.719244	0.014*	-.5729236	0.017**	-.0724486	0.016 **
L3D	.7073659	0.536	-4.428065	0.091	-1.147389	0.000*	-.0343351	0.026 **

The above result shows that first and second lagged values of interest rate differential, second and third lagged value of crude oil prices and all the lagged values of FII's affect crude oil prices. It means that there is short run causality from lagged values of crude oil prices, interest rate differential and FII's to crude oil price.

Table 3.13 Wald Test

```
[D_crudoil]LD.ird = 0
 [D_crudoil]L2D.ird = 0
 [D_crudoil]L2D.crudoil = 0
 [D_crudoil]L3D.crudoil = 0
 [D_crudoil]LD.fiis = 0
 [D_crudoil]L2D.fiis = 0
 [D_crudoil]L3D.fiis = 0

       chi2(  7) =   23.66
       Prob > chi2 =    0.0013*
```

The result of the Wald test confirms the short run causality as p-value is significant. So the result suggests that there is short-run causality from lagged values of crude oil prices, interest rate differential and FII's to crude oil price.

Table 3.14 long run causality (FII's as dependent variable)

cointegrating equation(DFii's)	**Coefficient**	**P-value**
Ce1	-10.5274	0.831
Ce2	-11.28963	0.937

This part of the result shows regression equation by taking FII's as dependent variable and lagged values of real exchange rate, crude oil prices and interest rate differential as independent variables. The result shows that error correction term have negative coefficient

but insignificant P-value, which shows that there is no long run causality running from real exchange rate, crude oil prices and interest rate differential variable to FII's.

Table 3.15-Short run causality (FII's as dependent variable)

DFii's(dependent variable)								
	rexr		**ird**		**crudoil**		**Fii's**	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
LD	-36.99016	0.443	34.17818	0.853	-10.63036	0.485	-.0693881	0.973
L2D	14.86474	0.752	141.3495	0.336	3.214737	0.775	.1627429	0.908
L3D	-16.66558	0.755	-12.39637	0.919	-10.30015	0.487	.1421868	0.843

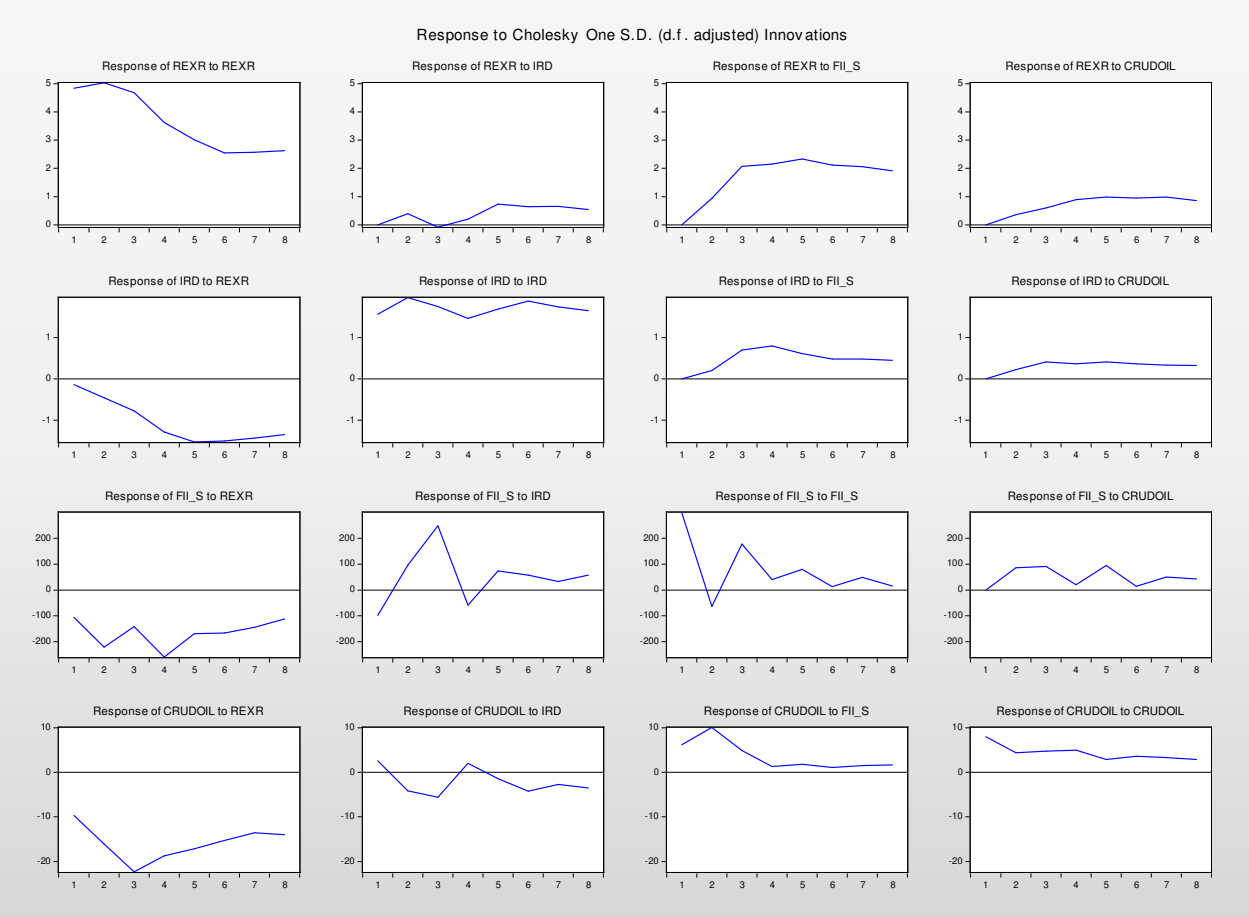
Here FII's is dependent variable. The above table shows that lagged value of each independent variable like real exchange rate, crude oil prices and interest rate differential does not have significant P-value, which shows that there is no short run causality running from exchange rate, crude oil prices and interest rate differential variable to FII's.

3.2.5 Impulse Response Function

The below figure shows the impulse response function which tells us about the responsiveness of dependent variable if there is one unit shock in the error term. As well as Impulse Response Functions: It identifies the responsiveness of the dependent variables in the VECM system when a shock is put to the error term such as U1, U2, U3, U4 and U5. A unit shock in U1 will bring a change in the crude oil prices. It has also impacted the FII's, interest rate differential and real exchange rate during the next eight years as shown in the figure.

Fig 3.5 Impulse Response Function

.



3.3 Conclusion

This chapter analyzed the short-run determinants of exchange rate. The chapter discusses the descriptive statistics of all the short run variables which shows that residuals are normally distributed. The trend of all short-run variables shows upward and downward trend in different time period. The chapter started by analyzing time series properties of data employing unit root test and informal test by plotting the figure of all short run determinants of exchange rate. The ADF test result shows that the series is stationary after 1st difference. After that Johansen cointegration test is used to check long run equilibrium relationship between the variables. The result shows there is long run association between the variables as result indicates two cointegrating equation in the model. Later VECM model is used to check

the short run and long run causality between the variables. The VECM result shows that there is no long run causality from crude oil prices, interest rate differential and FII's to real exchange rate. But long run causality exists from crude oil prices, real exchange rate, FII's to interest rate differential. The short run causality result shows that there is short run causality from real exchange rate and crude oil prices to interest rate differential. The long run causality exists from real exchange rate, interest rate differential, and FII's to crude oil prices. Lastly, the result of VECM also shows the short run causality from interest rate differential, FII's to crude oil. So in this chapter, we have observed the causal relationship between the variables based on VECM results.

Chapter 4

Long Run Determinants of Exchange rate

CHAPTER 4

LONG RUN DETERMINANTS OF EXCHANGE RATE

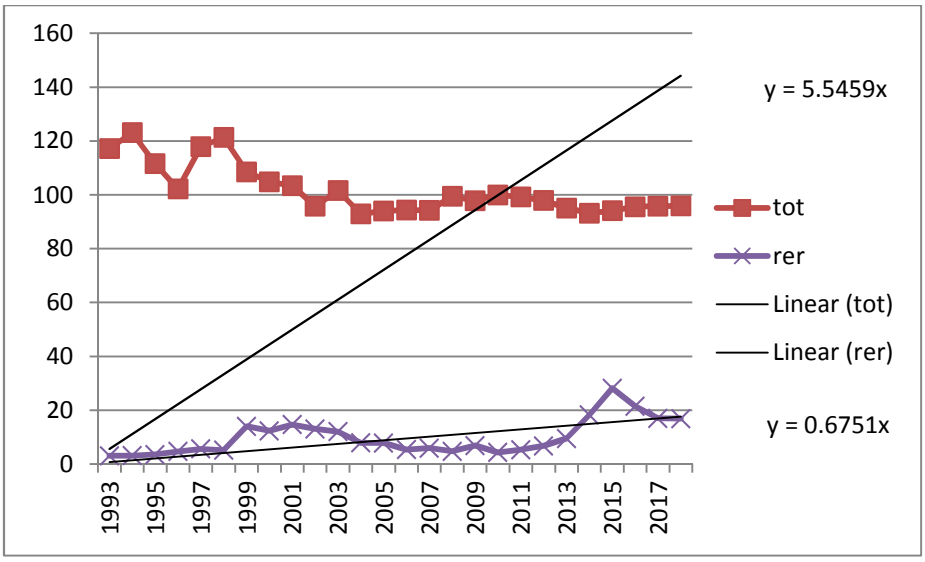
4.1 Introduction

The second chapter sets the conceptual and theoretical framework of the determination of exchange rate and factors causing fluctuations in it. This chapter will discuss the long run determinants of exchange rate by applying the analytical technique on the annual data of India from 1993 to 2018. The result of this chapter will provide an answer to the second objective of the study.

Terms of trade and exchange rate

Terms of trade can be defined as the ratio of export prices to import prices, in other words, it measures how much can be obtained in imports per unit of exports. It is generally presented as an index based on a given base year and therefore it shows the proportional change in the price of exports and imports. If price index of India's exportable commodity will increase in relation to the price index of importable commodity, it will lead to better terms of trade. A country will get higher revenue and real exchange rate will appreciate. On the other hand, due to higher export price, exports of country may also decrease. This will lead to depreciation of currency. Finally, it can be concluded that terms of trade may cause the appreciation or depreciation of real exchange rate.

Fig 4.1 Trends of Terms of trade and exchange rate

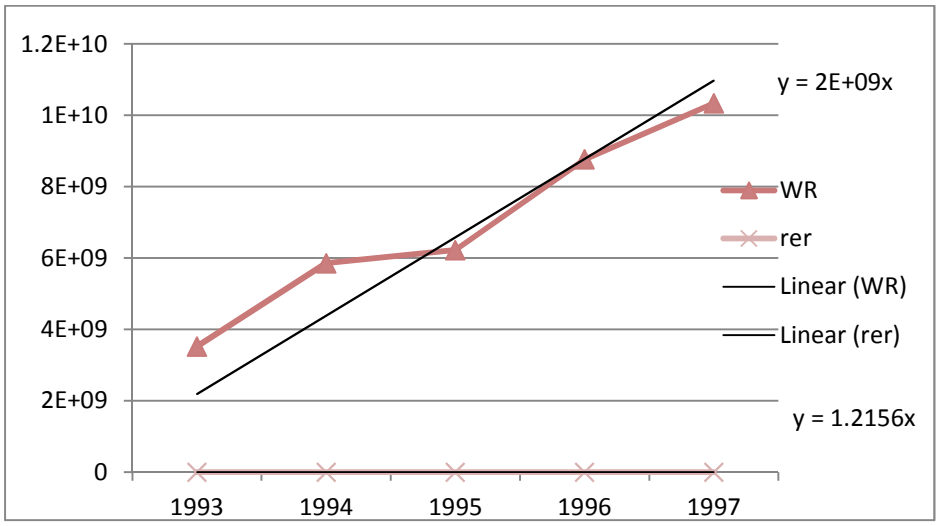


Source: OECD and RBI

Worker's remittances and exchange rate

In developing countries remittances from migrants are a significant source of externa finance. When migrants sent money back to their country it constitutes a sizeable share of GDP for emerging market economies. It has a substantial impact on exchange rate. Various studies reveal that inflow of remittances leads to appreciation of nominal exchange rate. While some of the studies suggest that remittances lead to depreciation of real exchange rate.

Fig. 4.2 Trends of Worker's remittances and exchange rate

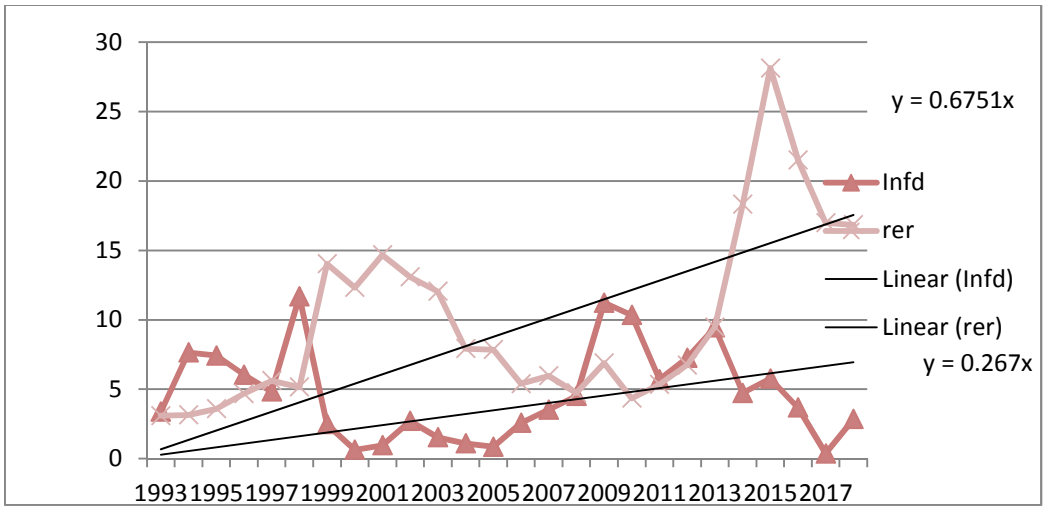


Source: World Bank

Inflation differential and exchange rate

The rate of inflation has a major impact on the value of currency and exchange rate with respect to the currencies of other country. It is one among the many factors that can influence country's exchange rate. As inflation is closely related to interest rate, it can influence exchange rate. Low-interest rate induces consumer spending and economic growth. But if it is increased beyond a point where demand exceeds supply it will lead to inflation which is not good for an economy

Fig. 4.3 Trends of Inflation differential and exchange rate



Source: IMF and RBI

4.1.2 Model Specification

The theoretical analysis presented in chapter two suggests that exchange rate is determined by both short and long-run factors. However, this chapter deals with the long run determinants of exchange rate. These variables include terms of trade, worker's remittances and inflation differential. Based on the theoretical background and availability of data, this study estimates the following relationship:-

$$lrer = \alpha + \beta_0\, ltot + \beta_1\, lwr + \beta_2\, linfd + \mu$$

Where

lrer = log of real exchange rate

ltot = log of terms of trade

lwr = log of worker's remittances

linfd= log of inflation differential between countries

α and β's are intercept and slope coefficient and μ is the error term of the above real exchange rate model.

4.1.3 Definition of variables

The variables used in the above real exchange rate model are briefly defined in this section.

Real exchange rate: - It can be defined as the nominal exchange rate of India which takes the inflation differentials among the countries into account for its calculation. It is also defined as the ratio of nominal exchange rate (Price of a US dollar in terms of Indian rupees) to the price level (GDP Deflator) of India. It is a very important indicator to measure the competitiveness in the foreign trade of India. Here, Real Exchange rate is used as dependent variable in the study.

Terms of trade:- It can be defined as the relative price index of exportable commodity to price index of importable commodity.

Worker's Remittances:- A remittance is a transfer of money by a worker in any other country to an individual in India. In other words, it is an act of sending money in payment or as gift.

Table 4.1 Descriptive statistics of long-run determinants

	LWR	LTOT	LRER	LINFD	LEXR
Mean	10.41495	2.006180	0.913760	0.532638	1.666254
Median	10.51152	1.993627	0.865925	0.610012	1.658209
Maximum	10.84750	2.090271	1.449353	1.067443	1.834989
Minimum	9.546887	1.967911	0.490249	-0.443697	1.484204
Std. Dev.	0.416890	0.037464	0.271897	0.406353	0.098788
Skewness	-0.449081	1.054992	0.216523	-0.748667	0.008578
Kurtosis	1.837410	2.844201	1.938976	2.740493	2.408276
Jarque-Bera	2.338171	4.849330	1.422742	2.501801	0.379635
Probability	0.310651	0.088508	0.490971	0.286247	0.827110

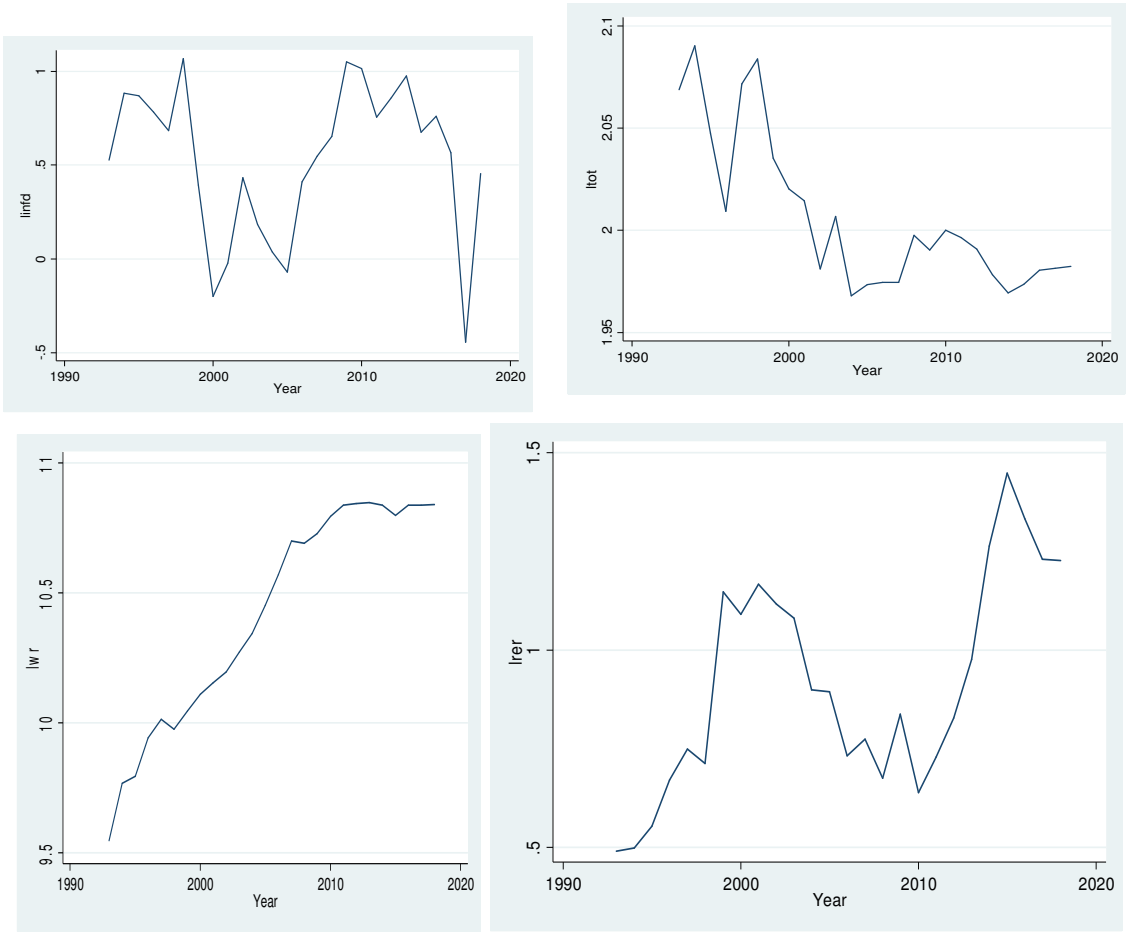
The above table shows the descriptive statistics of all the long run determinants of real exchange rate. The results of Jarque-Bera test shows that residuals are normally distributed.

4.1.4 Stationary/ unit root test result

Again the same procedure has been followed as discussed in previous chapter to determine the order of integration of the series. In this study ADF unit root test will be employed to check the stationarity of data. But before employing ADF unit root test the graphical analysis

of series will again be performed. A visual plot of the series will give the preliminary information about the trend and stationarity of data.

Fig4.4 Plots of the Real Exchange Rate and
Their long run Determinants during 1993-2018



Source: World Bank, Reserve bank of India, International Monetary Fund

So the above figure plots all variables of real exchange rate against time. The impression from the plots in the figure is that the log value of all the variables (terms of trade, worker's remittances and inflation differential) have upward and downward trend in different time period which suggests that they are not stationary in their level form i.e. they have time-varying mean and covariance. After this informal test, this study makes use of Augmented Dicky-Fuller (ADF) Test to check the stationarity of data. The ADF unit root test checks the

null hypothesis of a unit root. Therefore, a rejection of null hypothesis under the ADF test states that the series does not have a unit root.

Table 4.2 ADF Unit root test results

Variables	Level form			2nd difference		
	Intercept only	Intercept and trend	No intercept no trend	Intercept only	Intercept and trend	No intercept no trend
lrer	-1.609	-1.739	0.511	-9.945**	-9.716**	-10.771**
ltot	-2.106	-2.690	-0.741	-7.559**	-7.359**	-7.736**
lwr	-3.289**	-0.994	4.079	-9.034**	-8.736**	-9.223**
linfd	-2.666*	-2.612	-1.537	-5.678**	-5.495**	-5.872**

**1 per cent level, **5 per cent level significance, ***10 per cent level of significance*

The result of the ADF test shows that the series are not stationary in their level form. But variables become stationary at their 2nd difference at 5% level of significance. Therefore it can be concluded that all the series are stationary at second difference

Table- 4.3 Optimum Lag Length Criteria

lag	FPE	AIC	HQIC	SBIC
1	4.1e-09	-7.97197	-7.78505	-7.17849
2	7.3e-10	-9.8249	-9.45106	-8.23793
3	1.3e-09	-9.67462	-9.11386	-7.29417
4	5.8e-10*	-11.4894*	-10.7417*	-8.31542*

The criterion like Final Prediction Error (FPE), Akaike Information Criterion(AIC), Hann Quinn Information Criterion (HQIC), Schwarz Criterion (SBIC or SIC) suggests optimal lag length. To select the maximum lag length the above test has been performed by selecting the

long run variables and the result shows that there are four no of lags in the model. According to AIC and SBIC criteria lower the value better the model so in the above case all the criteria show similar result but in the case of contradicting results, more emphasis is given on AIC and FPE criteria.

4.1.5 Cointegration

Cointegration analysis is used to determine whether there is any long-run equilibrium relationship exists between real exchange rate and its determinants. This study employed Johansen Cointegration test to check the long run relationship among the variables like real exchange rate, terms of trade, inflation differential and worker's remittances.

Table- 4.4: Johansen Cointegration Rank Test Results

Null Hypothesis	Alternative Hypothesis	Statistics	0.05 Critical Value
Trace Statistics			
$r \leq 0$	$r \geq 1$	118.0467	47.21
$r \leq 1$	$r \geq 2$	48.5555	29.68
$r \leq 2$	$r \geq 3$	14.3421*	15.41

Maximum Eigenvalue statistic

Null Hypothesis	Alternative Hypothesis	Statistics	0.05 Critical Value
$r \leq 0$	$r \geq 1$	69.4912	27.07
$r \leq 1$	$r \geq 2$	34.2133	20.97
$r \leq 2$	$r \geq 3$	11.0825*	14.07

The above table presents Johansen cointegration test based on the trace statistics and the second part of the table presents the result of maximum eigenvalue statistics. The test has been performed on the level form not on their first difference. The cointegration test is

necessary to establish a long-run relationship between the variables. In the above test result shows that there are two cointegrating equations. As according to decision criteria reject the null hypothesis if trace and max stats is greater than 5% value otherwise fail to reject null hypothesis. In the above result, the null hypothesis suggests that there are two cointegrating eqn because trace stats and max stats is less than5% so null hypothesis is accepted. The value of trace statistics is14.3421 which is smaller than 15.41, again the Eigenvalue statistics is 11.0825 which is smaller than 14.07 so in both the cases null hypothesis can't be rejected. so the series are cointegrated means that they exhibit a long run relationship. It implies that series are related and combined in a linear fashion. Now we estimate both short run and long run model and this will require the use of VECM model.

4.1.6 Vector Error Correction Model

This model is used to separate the short run from long-run relations. If results of Johansen cointegration test found that the variables of interest are integrated in the long run the VECM must be used to find whether variables are really cointegrated in the long run or not.

Table- 4.5 Analysis of Vector Error correction model

Equation	R-Square	P-Value
Dlrer	0.8055	0.0520
Dltot	0.6709	0.6614
Dlwr	0.9290	0.0000*
Dlinfd	0.8521	0.0028*

It gives information about all the variables, as VECM has taken 1st difference of all the long run variables. Further R-square of all the variables is good enough to justify their causality and p-value close to zero of some of the variables also indicates its significance.

Table-4.6- Long-run causality results (real exchange rate as dependent variable)

cointegrating equation(Dlrer)	**Coefficient**	**P-value**
Ce1	-.5548227	0.138
Ce2	1.425014	0.562

This part of the result shows regression equation by taking log of real exchange rate as dependent variable and lagged and log values of terms of trade, worker's remittances, and inflation differential as independent variables. Ce1 and Ce2 are two cointegrating equation in the model. To ascertain the long run causality between real exchange rate and all the independent variables like log values of terms of trade, worker's remittances, and inflation differential the error correction term have to show a negative coefficient and significant p-value. As the result shows that the coefficient of first error correction terms have negative value while the coefficient of 2^{nd} error term have a positive value and none of them have significant p-value. So all the conditions to show long-run causality is missing here this implies that the VECM do not show any long-run relationship from independent variables to real exchange rate. So there is no long-run causality running from terms of trade, worker's remittances, and inflation differential to real exchange rate.

Table 4.7 Short run causality (real exchange rate as dependent variable)

Dlrer(dependent variable)								
	lrer		**ltot**		**lwr**		**linfd**	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
LD	.132364	0.723	-3.912877	0.081	-1.693117	0.077	-.4087834	0.143
L2D	.9552592	0.025**	-.0895131	0.965	.8503771	0.601	.1702283	0.431
L3D	-.0593484	0.876	-4.339595	0.161	2.155457	0.015**	-.2633791	0.105

To check the short run causality between the variables the lag coefficient and p value of each independent variable should be significant. Here log value of real exchange rate is dependent variable and log values of terms of trade, worker's remittances, and inflation differential as independent variables. The above table shows that lag value of real exchange rate and worker's remittances have significant p-value. It means that there exists short run causality from lag value of real exchange rate and worker's remittances to real exchange rate.

Table 4.8Wald test result

[(1) [D_lrer]L2D.lrer = 0

(2) [D_lrer]L3D.lwr = 0

chi2(2) = 8.17

Prob > chi2 = 0.0168**

The above result confirms short run causality as the result shows significant p value.

Table 4.9 Long run causality (terms of trade as dependent variable)

cointegrating equation(Dltot)	**Coefficient**	**P-value**
Ce1	.0966301	0.169
Ce2	-.86632	0.061

This part of the result shows regression equation by taking terms of trade as dependent variable and lagged values of real exchange rate, worker's remittances, and inflation differential as independent variables. The result shows that error correction term does not have significant coefficient value and P-value is also not significant, which shows that there is no any long run causality running from real exchange rate, worker's remittances, and inflation differential to terms of trade.

Table 4.10 Short run causality (terms of trade as dependent variable)

Dltot(dependent variable)								
	lrer		**ltot**		**lwr**		**Linfd**	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
LD	-.093317	0.183	-.1283611	0.760	.1512216	0.401	-.0807103	0.123
L2D	-.085667	0.286	-.1826738	0.631	.3680072	0.229	-.0468375	0.249
L3D	-.0326796	0.648	.168641	0.772	.0270252	0.871	-.0195087	0.523

To check the short run causality between the variables the lag coefficient and p value of each independent variable should be significant. Here terms of trade is dependent variable. The above table shows that lagged value of each independent variable like exchange rate, worker's remittances, and inflation differential does not have significant P-value. So there is no short run causality running from exchange rate, worker's remittances, and inflation differential to terms of trade.

Table 4.11 long run causality results (worker's remittances as dependent variable)

cointegrating equation(Dlwr)	**Coefficient**	**P-value**
Ce1	.0848586	0.344
Ce2	.220029	0.709

This part of the result again shows regression equation by taking worker's remittances as dependent variable and lagged values of real exchange rate, terms of trade and inflation differential as independent variable. The result shows that error correction term does not have a significant value of coefficient and P-value is also not significant, which shows that there is no long run causality from real exchange rate, terms of trade and inflation differential to worker's remittances.

Table 4.12 Short run causality (worker's remittances as dependent variable)

Dlwr(dependent variable)								
	lrer		**ltot**		**lwr**		**Linfd**	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
LD	-.0944051	0.291	.313136	0.560	.2732852	0.234	.1454682	0.030*
L2D	-.1339952	0.191	.4836335	0.319	-.5179181	0.184	-.0445659	0.390
L3D	-.1011572	0.268	.8151656	0.272	-.0848928	0.690	.076029	0.051

Here worker's remittances are dependent variable. The above table shows that lagged value of independent variables like real exchange rate, terms of trade and inflation differential does not have significant P-value except 1st lag value of inflation differential. So there is a short run causality running from inflation differential to worker's remittances.

Table 4.13 Wald test results

[D_lwr]LD.linfd = 0
chi2(1) = 4.74
Prob > chi2 = 0.0295**

The Wald test result confirms the short run causality that exists from inflation differential to worker's remittances.

Table 4.14 long run causality result (inflation differential as dependent variable)

cointegrating equation(Dlinfd)	**Coefficient**	**P-value**
Ce1	-.9403533	0.281
Ce2	5.463597	0.340

The result shows that error correction term does not have significant coefficient and P-value, which shows that there is no long run causality from independent variable like real exchange rate, worker's remittances and terms of trade to inflation differential.

Table 4.15 Short run causality result (inflation differential as dependent variable)

Dlinfd(dependent variable)								
	lrer		**ltot**		**lwr**		**Linfd**	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
LD	.6960044	0.423	-3.776165	0.469	-3.955421	0.076	.0857335	0.895
L2D	-1.099456	0.269	-11.7272	0.013**	.9144063	0.809	-.1286608	0.798
L3D	-.4569932	0.606	-4.686176	0.516	-.0344227	0.987	.0426136	0.910

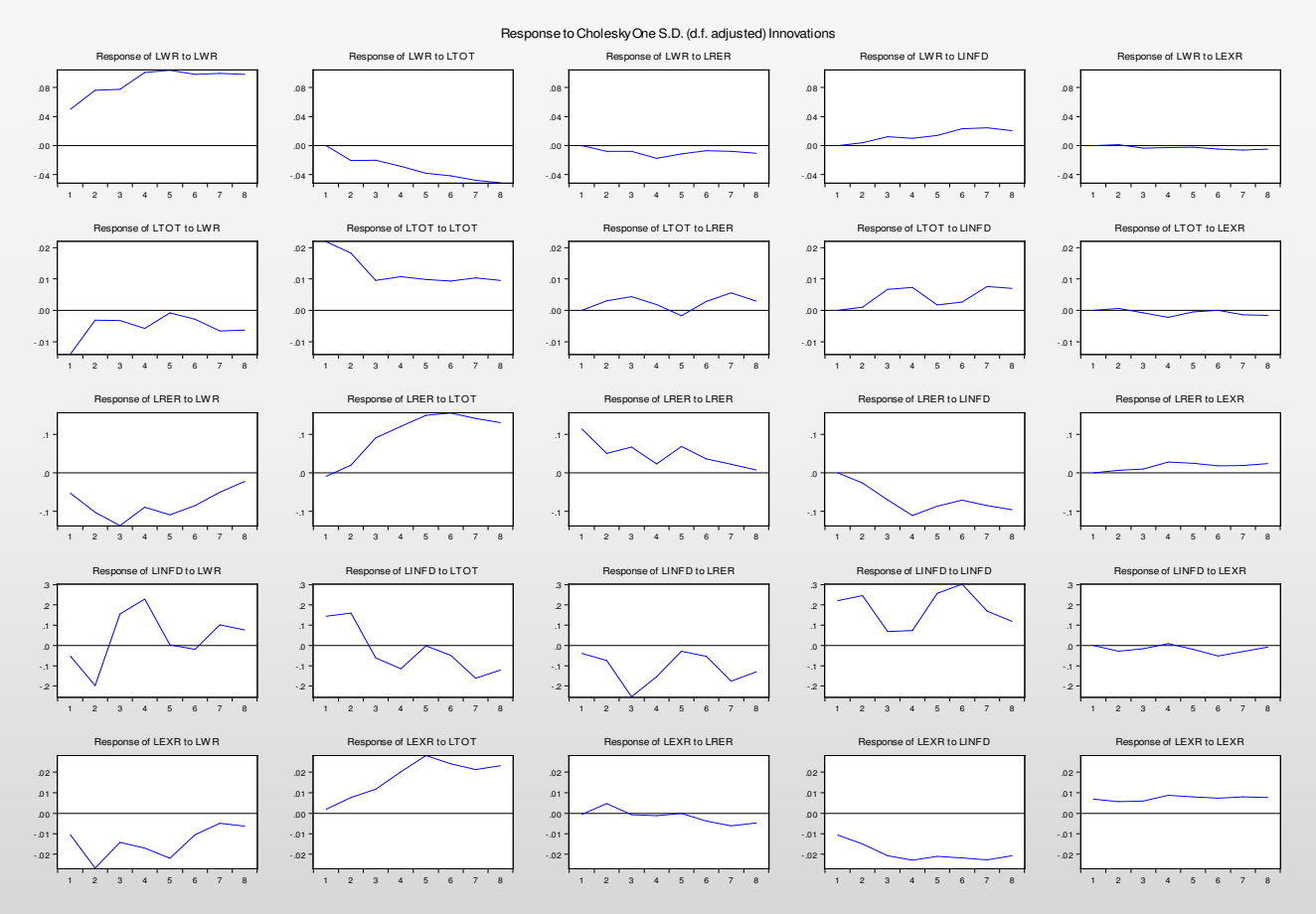
The result from the above table shows that the lagged value of independent variable like terms of trade has significant P-value. So there is a short run causality existing from lagged value of terms of trade to inflation differential.

4.1.7 Impulse Response Function

The below figure shows the impulse response function which tells us about the responsiveness of dependent variable if there is one unit shock in the error term. As well as Impulse Response Functions: It identifies the responsiveness of the dependent variables in the VECM system when a shock is put to the error term such as U1, U2, U3, U4 and U5. A unit shock in U1 will bring a change in the Worker's Remittances. It has also impacted the terms of trade, inflation deferential and real exchange rate during the next eight years as shown in the figure. But before calculating the impulse response function, the ordering of variable is

important. There are many methods. We have chosen the Cholesky dof adjusted, response to Cholesky one standard deviation innovation, shock or residual (error term) + 2 standard error. In the next eight years, all variables in this entire function will be affected.

Figure 4.5 Impulse Response Function of all the variables



4.1.7 Conclusion

This chapter analyzed the long-run determinants of exchange rate. The chapter discusses the descriptive statistics of all the long run variables which shows that residuals are normally distributed. The trend of all long run variables shows upward and downward trend in different time period. The chapter started by analyzing time series properties of data employing unit root test and informal test by plotting the figure of all long run determinants

of exchange rate. The ADF test result shows that the series are stationary after 2nd difference. After that Johansen cointegration test is used to check long run equilibrium relationship between the variables. The result shows there is long run association between the variables as result indicates two cointegrating equation in the model. Later VECM model is used to check the short run and long causality between the variables. The VECM result shows that there is no long run causality from terms of trade, worker's remittances, and inflation differential to real exchange rate. But there is short run causality running from worker's remittance to real exchange rate. Similarly, there is short run causality exist from inflation differential to worker's remittances. The normality test has been performed for the diagnostic test. The impulse response function test have also been performed.

Chapter – 5

Findings and Conclusions

CHAPTER – 5

Findings and Conclusions

5.1 Introduction

The previous chapter presented the detailed analysis of short run and long run determinants of exchange rate. So in this chapter we will discuss the major findings attained by applying the analytical technique proposed on the annual data of India and US from the period 1993 to 2018 in the previous chapter. The results obtained will provide answers to the questions which were raised in the first chapter of this study.

5.2 Major Findings of the study

The third chapter is concerned with the short run determinants of exchange rate. The result shows that data are stationary at first difference and there exists a long run relationship between the variable taken for the study. The VECM result shows that short run factors like crude oil prices, interest rate differential and net FII's does not have any impact on real exchange rate in short run and long run. But real exchange rate impacts interest rate differential in short run as it shows short run causality. Similarly the result also shows that crude oil prices are impacted by FII's and interest rate differential in short run. The Jarque Bera Test shows that residuals are normally distributed. This chapter analyzed the short run determinants of exchange rate. The chapter discusses the descriptive statistics of all the short run variables which shows that residuals are normally distributed. The trend of all short run variables shows upward and downward trend in different time period. The chapter started by analyzing time series properties of data employing unit root test and informal test by plotting the figure of all long run determinants of exchange rate. The ADF test result shows that the series are stationary after 1st difference. After that johansen cointegration test is used to

check long run equilibrium relationship between the variables. The result shows there is long run association between the variables as result indicates two cointegrating equation in the model. Later VECM model is used to check the short run and long causality between the variables. The VECM result shows that there is no long run causality from crude oil prices, interest rate differential and FII's to real exchange rate. But long run causality exists from crude oil prices, real exchange rate, FII's to interest rate differential. The short run causality result shows that there is short run causality from real exchange rate and crude oil prices to interest rate differential. The long run causality exists from real exchange rate, interest rate differential, and FII's to crude oil prices. Lastly, the result of VECM also shows the short run causality from interest rate differential, FII's to crude oil. So in this chapter, we have observed the causal relationship between the variables based on VECM results.

The fourth chapter presents a detailed discussion about the long run determinants of exchange rate. The unit root test suggests that data are stationary at the 2^{nd} difference. Again the result of Johansen Cointegration test shows that there is long run relationship among the variables. The VECM model employed to check the short run and long run causality shows that the terms of trade, inflation differential and worker's remittances do not impact the real exchange rate in the long run but the lagged values of real exchange rate affect the real exchange rate in short run. Similarly, inflation has shown an impact on worker's remittances in short run. The Jarque Bera test reveals that residuals are normally distributed in the model. The VECM result shows that there is no long run causality from terms of trade, worker's remittances, and inflation differential to real exchange rate. But there is short run causality running from worker's remittance to real exchange rate. Similarly, there is short run causality exist from inflation differential to worker's remittances. The normality test has been performed for the diagnostic test.

5.3 Limitations and Directions for future

The study confines itself mainly to the monetary approach of exchange rate determination. There are other theories like microstructure framework, random walk approach, sterilized and unsterilized intervention by the Government, concept of forward premium are not considered for this study. Hence this opens scope for further follow up research in the future.

5.4 Conclusion

In sum, it can be said that several exchange rate models have been tested by different researchers to predict the behaviour of exchange rate in short run and long run but none of them seems to work best at all times. Monetary models which are based on fundamental variables works best in the long run. The volatility in the exchange rate is much higher than the volatility in macroeconomic fundamentals. So it can be said that there are many variables in the short and long run which impacts the exchange rate behaviour. It is very difficult to predict the more efficient variables which can explain the fluctuations in exchange rate.

References

Pami Dua, parth sen (2009). 'Capital Flow and Volatility and Exchange Rates: the case of India', in *Macroeconomic Management and Government Finances*, Asian Development Bank, New Delhi: Oxford university Press.

Maurice K. Shalishali, Johnny C. Ho (2002). 'Inflation, Interest Rate, and Exchange Rate: What Is the Relationship?' in *Journal of Economics and Economic Education Research*, Volume 3, Number 1.

Renu Kohli (2015). 'Capital Flows and Exchange Rate Volatility in India: How Crucial are Reserves?' in *Review of Development Economics*, Vol. 19, Issue 3, pp. 577-591.

Harald Hau, Hélène Rey (2003). 'Exchange Rate, Equity Prices, and Capital Flows' in *CEPR Discussion Paper* No.3735.

Maurice Obstfeld (2010). 'Capital Flows, the Current Account, and the Real Exchange Rate: Consequences of Liberalization and Stabilization' *NBER Working Paper* No. w1526

Basant K. Kapur (2005).' Capital Flows and Exchange Rate Volatility: Singapore's Experience' *NBER Working Paper* No. w11369

Jean-Louis Combes, Patrick Plane, Tidiane Kinda (2011), 'Capital Flows, Exchange Rate Flexibility, and the Real Exchange Rate' in *IMF Working Paper No. 11/9*

Tomoe Moore Eric J. Pentec(2006). 'The Sources of Real Exchange Rate Fluctuations in India' in *Indian Economic Review*, vol.41, No.1.

Marcelo Dabos, V. Hugo Juan-Ramón(2000) 'Real Exchange Rate Response to Capital Flows in Mexico: An Empirical Analysis' *IMF Working Paper* No. 00/108

T.O. Akinbobola(2012). 'The dynamics of money supply, exchange rate and inflation in Nigeria' in *Journal of Applied Finance & Banking*, vol.2, no.4, 2012, 117-141

Anubha Dhasmana (2011). 'India's Real Exchange Rate and Trade Balance: Fresh Empirical Evidence' in *working paper no: 373*. IIM Bangalore.

Saurabh Ghosh, Snehal Herwadkar(2009). 'Foreign Portfolio Flows and their Impact on Financial Markets in India' *Reserve Bank of India Occasional Papers* Vol. 30, No.3

Diebold, F. X., & Nerlove, M. (1989). The dynamics of exchange rate volatility: a multivariate latent factor ARCH model. *Journal of Applied econometrics*, 4(1), 1-21.

Kyereboah-Coleman, A., & Agyire-Tettey, K. F. (2008). Effect of exchange-rate volatility on foreign direct investment in Sub-Saharan Africa: The case of Ghana. *The Journal of Risk Finance*, 9(1), 52-70.

Frenkel, J. A. (1982). Flexible exchange rates, prices and the role of 'news': Lessons from the 1970s. In Exchange Rate Policy (pp. 48-100). Palgrave Macmillan, London.

Devereux, M. B., & Engel, C. (2002). Exchange rate pass-through, exchange rate volatility, and exchange rate disconnect. *Journal of Monetary economics*, 49(5), 913-940.

Cheung, Y. W., & Chinn, M. D. (2001). Currency traders and exchange rate dynamics: a survey of the US market. *Journal of international Money and Finance*, 20(4), 439-471.

Levich, R. M. (1985). Empirical studies of exchange rates: price behavior, rate determination and market efficiency. *Handbook of international economics*, 2, 979-1040.

Stockman, A. C. (1980). A theory of exchange rate determination. *Journal of Political Economy*, 88(4), 673-698.

Adubi, A. A., & Okunmadewa, F. (1999). Price, exchange rate volatility and Nigeria's agricultural trade flows: A dynamic analysis.

McKenzie, M. D. (1999). The impact of exchange rate volatility on international trade flows. *Journal of economic Surveys*, 13(1), 71-106.

Meese, R. (1990). Currency fluctuations in the post-Bretton Woods era. *Journal of Economic Perspectives*, 4(1), 117-134.

Mundell, R. (2000). Currency areas, volatility and intervention. Journal of Policy Modeling, 22(3), 281-299.

Kenen, P. B., & Rodrik, D. (1986). Measuring and analyzing the effects of short-term volatility in real exchange rates. *The Review of Economics and Statistics*, 311-315.

Meese, R. A., & Singleton, K. J. (1983). Rational expectations and the volatility of floating exchange rates. *International Economic Review*, 721-733.

Zhang, Y. J., Fan, Y., Tsai, H. T., & Wei, Y. M. (2008). Spillover effect of US dollar exchange rate on oil prices. *Journal of Policy Modeling*, 30(6), 973-991.

Anderson, R. W. (1985). Some determinants of the volatility of futures prices. Journal of Futures Markets, 5(3), 331-348.

Osinubi, T. S., & Amaghionyeodiwe, L. A. (2009). Foreign direct investment and exchange rate volatility in Nigeria. International Journal of Applied Econometrics and Quantitative Studies, 6(2), 83-116.

Parveen, S., Khan, A. Q., & Ismail, M. (2012). Analysis of the factors affecting exchange rate variability in Pakistan. *Academic Research International*, 2(3), 670.

Morana, C. (2009). On the macroeconomic causes of exchange rate volatility. *International Journal of Forecasting*, 25(2), 328-350.

Gavin, M., Hausmann, R., & Leiderman, L. (1995). Macroeconomics of capital flows to latin america: Experience and policy issues.

Mahmood, I., Ehsanullah, M., & Habib, A. (2011). Exchange rate volatility & macroeconomic variables in Pakistan. Business management dynamics, 1(2), 11.

Frenkel, M., Shimidt, G., Stadtmann, G., & Christiane, N. (2002). The effects of capital controls on exchange rate volatility and output. *International Economic Journal*, 16(4), 27-51.

Verma, N.M.P. and Dutta V. (2013),"Understanding Recession: Conceptual Arguments and US Adjustments, Recession and Its Aftermath: Adjustments in the United States," Australia and other Emerging Asia, N.M.P Verma (Ed.). Springer 287 pages.

Singh, D. and Verma, N.M.P. (2016), "Trade-off between Inflation and Unemployment in the short run: A case of the Indian Economy". *International Finance and Banking*, ISSN 2374-2089, vol. 3, No. 1.

Kumar, S. (2009). Investigating causal relationship between stock return with respect to exchange rate and FII: evidence from India.

Singh, B. (2005). Inter-relation between FII, inflation and exchange rate. Inflation and Exchange Rate (August 31, 2005).

Urkund Analysis Result

Analysed Document: final editeddissertation.docx (D54208395)
Submitted: 6/28/2019 12:37:00 PM
Submitted By: gbl.bbau@gmail.com
Significance: 7 %

Sources included in the report:

Dissertation.docx (D30185038)
https://www.va.gov/opa/pressrel/docs/Verdana.doc
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.660.2498&rep=rep1&type=pdf
https://www.researchgate.net/publication/323129673_An_Econometrics_Analysis_of_the_Determinants_of_Exchange_Rate_in_Nigeria_1980-2016
https://pdfs.semanticscholar.org/983e/2cc885620f8e26295b5d3da38f85bcebb693.pdf
https://pdfs.semanticscholar.org/d573/1694791760c81e112c5865090e8d8b6995ff.pdf
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1023.5776&rep=rep1&type=pdf
b14e733b-0129-47a1-b89a-afe3a063774f

Instances where selected sources appear:

13