Inflation and Money Supply in India: An Empirical Evidence

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DECLARATION

I hereby declare that research work embodied in this dissertation entitled "**Inflation and Money Supply in India: An Empirical Evidence."** has been carried out by me at the Department of Economics, Central University of Haryana for the partial fulfilment of the requirement of award of the degree of Master of Philosophy in Economics, is a record of original research work done by me under the supervision of Dr. Ajeet Kumar Sahoo, Assistant Professor, Department of Economics, Central University of Haryana. The manuscript has been subjected to plagiarism check and the work is submitted to consideration of award of M. Phil Economics. The content of this dissertation has not been submitted so far in part or in full for any degree of diploma in other institution.

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(Subrat Kumar Nishanka)

CONTENTS

List of Tables

Table No. **Page No.**

List of Figures

Figure No. **Page No.**

List of Abbreviation

CDB : Current Deposit with Banks

CEMA : Currency Equivalent Monetary Aggregate

FEUD : Fixed Error Variance Decomposition

FDB : Fixed Deposit with Banks

GDP deflator: Gross Domestic Product deflator

IS : Industrial Share

INR : Indian National Rupee

IRF : Impulse Response Function

MSI : Monetary Service Indices

MRTP : Monopolistic Restrictive Trade Practices

NSCs : National Savings Certificates

OMO : Open Market Operation

0DR : Other Deposite with RBI

ODPO : Other Deposite with Post office

PPP : Purchasing Power parity

RPFD : Relative Price Inflation of Food

RPIF : Relative Price Inflation of Fuel.

SDB : Saving Deposite with Banks

SDPOSB : Saving Deposite with Post Office Savings Banks

TDPO : Time Deposite with Post office

VECM : Vector Error Correction Model

VAR : Vector Auto regression

UCL : Unutilized Credit limits

WNEI : World Non-fuel Commodities Inflation

WPI : Wholesale Price Index

CHAPTER-1

INTRODUCTION

1.1 Introduction

Inflation is always and everywhere a monetary phenomenon (Milton Friedman, 1970). Inflation is a rise in the general price level of goods and services in an economy over a period of time. Stimulus of changes in money supply over price level is an area of controversy. Despite several decades of research in understanding the precise nature of relationship between money supply and prices, there seems to be no final conclusion that can be relied upon for policy formulation. Change in inflation may stimulate unpredictable policy responses monetary authorities, which may lead to more uncertainty about the future inflation (Friedman, 1977). Inflation uncertainty leads to in-efficiencies in resources allocation and the misrepresent the price mechanisms. It reduces the level of investment and influences the nominal contracts that cause the costly real effects. Inflation imposes significant economic costs on society through increased inflation uncertainty (Evans, 1991). Higher inflation in current period itself is a driving factor for greater un-certainty about the future path of inflation rates (Okuns, 1971). Ball (1992) using the game theoretic frame work, provide a formal justification to Friedman's insight. Higher inflation uncertainty leads to an increase in the inflation rate as it provides an incentive to the policy makers to create an inflation surprise to stimulate output growth and hence the direction of causality runs from inflation uncertainty to inflation. Coulborn states that "too much money chasing too few goods".

1.2 Sense of Inflation in India

Inflation is a permanent characteristic of Indian economy. After the second world war, there has been a strong inflationary pressure on the economy due to high demand of goods and services and low supply, Because of the rapid growing of Indian population, rising money incomes, expansion in money supply and liquidity in the country, using volume of black money

and continuous rise in demand for goods and services caused by rapid economic development, inflation in India became inevitable.

1.3 Post war Inflation in India

The post war period saw the political crisis, partition of the country, social up heals and huge massacres, cause an inflationary trend which has remained repressed during this period From (1949 to1969).This phase marks the nationalization of 14 commercial banks. This period inherited a strong inflationary pressure because of the wars and the devaluation of Indian rupee. The situation of the inflation was further aggregated by the Korean War in the year 1950-51 but was stabilized in the coming years because of the bumper agriculture production in the country thus the period experienced a moderate inflation rate during the period, From (1969-1991).This was the period of inflation and economy landing into the balance of payment crisis and forced to adopt for reaching economic reforms covering various sectors of the economy .The four years period from 1971-72 and 1974-75 was the period of hyperinflation in the country with inflation rate touching at 15.25% but government measures brought back the high inflation on track but again in the year 1970 inflation was 9 percent due to poor agriculture output and crude oil prices .The decade 1980 also experienced the period of inflation compared to the last decade more or less it was approx. 7.5 percent but the next decade moved a step further in this direction and rate of inflation in 1990-91 was 10 percent. From (1991-2009). Liberalization of the imports, adoption of the flexible exchange rate system, convertibility of the rupee, deregulation of the interest rate, assistance of the public sector, abolition of the industrial licensing and the restrictive provision of the MRTP Act reduction in fiscal and revenues deficit etc were some of the important reforms introduced since 1990s and they have changed the entire Indian economy. Because of the various measures taken during the period, in the initial years the inflation rate was 10 percent. The second half of the 1990s saw a

significant outcome of the average inflation rate during this period declined from 10% in the first half to 5.08%.

The factors responsible for this were.

1) RBI policy

2) Cooling of global inflation

3) Depreciation of rupee slowed down

4) Large buffer of food grains Inflation after 2009.

Inflation rate in India is reported by the Ministry of Commerce and Industry of India. The wholesale price index (WPI) is the main measure of inflation .The WPI measures the price of a representative basket of wholesale goods.

1.4 Inflation as a Monetary Phenomenon (The Monetary View)

In the long-run the relationship between inflation and money growth depends on the demand for money and money supply. Central banks affect the money supply through their policy actions such as buying and selling government securities, changing reserve requirements, or changing the interest rate at which the central bank provides reserves to financial intermediaries. The public's demand for money is another important part of the relationship between money growth and inflation. If M is the nominal quantity of money and P is the price level, the real quantity of money is M/P. The price level commonly is measured by general price indexes such as the consumer price index and the gross domestic product deflator. Monetarism has three essential features Firstly monetarism is the reincarnation of classical macroeconomics, with its focus on the long-run properties of the economy rather than short-run dynamics. Second, monetarism focuses less on the structure of the economy and this is related to the attitude towards doubting the truth about our ability to understand or to adequately

quantify the structural linkages and dynamics. Third, monetarists are skeptical of the ability to use monetary policy for short-run stabilization, despite the fact that they believe short-run variations in money growth do affect aggregate demand and hence output. As a result, they favor rules that focus on achieving a rate of money growth consistent with price stability in the long run (Meyer, 2001). Noted economist A.Meltzer (1998) said most working economists, most central bank staffs, and market practitioners do not use money growth to predict inflation. Many rely on the Phillips' curve or theoretical relations. Although in the long-run there is strong correlation between money growth and inflation, monetary policy makers do not use long-run relationship because this relationship disappears in the short-run.

1.5 Measurement of Inflation in India

Percentage change in year to year in the general level which is effect in the several types of price is called as inflation, and the persistent component of inflation is termed as "Core Inflation". It has a combined of short to medium-run effect and long-run effect. Assignment of weights for constructing the general price index normally reflects the relative importance of WPI, consumer price index, and implicit GDP deflator. Headline inflation declined to significantly low levels during 2016-17, and projected in the October 2016 MPR.

1.6 Calculation of Inflation in India

The inflation in India is calculated by the Wholesale Price Index (WPI), out of 676 commodities chosen and divided in three categories like primary articles, fuel and power and manufactured products. The drafting of inflation in India is the variation of demand and supply. The inflation is caused by, when an increase in demand is not matched with the increase in supply in the economy.

1.7 Causes of Inflation in India

- **Population growth: -** According the 2011 census of India has been 17.64 %. The essential commodities and goods like food, oil and land etc., are not matching our population growth, which is caused by increase in the cost of productions in the country, and thats cause of inflation at some point of time.

- **Increase money supply growth:-** In last some few years the rate of increase in the money supply is varies between 15 to 18 percent and the national output is increased just as the annually average of the rate of 4 percent. Since the rate of increase in the output has not been sufficient to covered the increasing quantity of money in the economy and which is caused as the inflation.

- **Deficit Financing:** When the Govt. is unable to raise the adequate revenue for full filling its expenditure, it caused a deficit financing. In the sixth and seventh plan period there is a massive deficit financing had been occurred, it was Rs.15,684 Cr in 6^{th} and Rs.36,000 Cr in 7^{th} plan. So it increase the inflation in this time.

- **Increase government expenditure:** In India Government expenditure is rising during some of the recent years very firstly. There is more distributing activities proportion of non-development expenditure is being increased about 40 per cent of total government expenditure. Non-development expenditure does not create any real goods; it only creates purchasing power and which creates inflation in the economy. Not only the Demand side create inflation, but also the Supply side creates inflation.

- **Inadequate agricultural and industrial growth:** Agricultural and industrial growth in our country is below what we have targeted for. Over the four decades period, food grains output has increased of 3.2 per cent per annum. Some of the years of crop is failure due to droughts, scarcity of food grains not only the prices of food articles

increased, but also the general price level rise. Failure of crops always encouraged big wholesale dealers to inculcate the experience of hoarding which is created the scarcity conditions and increased up the price level of the economy.

- **Rise in administered prices:** In our economy a large part of the market is organized by the government. So number of important commodities, both agricultural and industrial, for which the price level is fixed by the government. The government manage the price from time to time to cover up losses in the public sector. Which leads to cost-push inflation. The upward increased of managed prices of coal, iron, steel, electricity and fertilizers are made at regular intervals. Once the administered prices are raised, it is a signal for other price to go up.
- **Rising import prices:** Inflation has a global phenomenon. International trade gets imported into the other country through major commodities like fertilizers, edible oil, steel, cement, chemicals, and machinery. Increase in the import price of petroleum which has been caused as a spectacular and its contribution to domestic price rise is very high.
- **Rising Taxes:** To increase the additional financial resources, the government is depending up on more and more on indirect taxes like excise duties and sales tax. Which tentatively increase the taxes and that taxes increased the price level high ultimately.
- **Unbalanced of economic growth:-** The Indian economy is vastly growing day by day in last few years. But the economic growth has not been balanced. The contribution of economic growth from primary (agriculture), secondary (industry), tertiary (services) are 17.2%, 26.4% and 56.4% respectively. The primary part has been less than the average .Due to this we are required to import a good quantity of basic goods and commodities for consumption. The weak of India national rupee has not helped in this regard. The prices of imported goods and commodities also to rise due to a weak INR.

- **Increase in spending capacity:-** The spending power of the people is also increasing usually. People employed in private sectors are large and their earnings are more, so it indicates that the standard of living of the people advanced, but which not matched with their increase in output prices.

The unlike matured economies, do not need to maintain the high growth rates, which is require the infusion of money in to the economy and leads the increase in the money supply. There would always be some inflation.

1.8 Money Supply in India.

M1 money supply in India is increasing in India, which shows the different sources of money are coming from different level. Money Supply M1 in India increased to 21060.20 INR Billion in January from 20004.60 INR Billion in December of 2016. Money Supply M1 in India averaged 5207.55 INR Billion from 1972 until 2017, reaching an all-time high of 28420.20 INR Billion in September of 2016 and a record low of 80.15 INR Billion in January of 1972.There is some money supply growth in India in recent most year showing in the given table no -1.

Table No 1.1.1 Money Supply and Growth of Money Supply

SL.No	Years	Money Supply in(Billion)	Growth in Money Supply in (%)
1	2016	28420.2	24.01
2	2015	22916.8	11.53
3	2014	20547	8.28
4	2013	18975.3	9.22

5	2012	17373.9	6.05
6	2011	16383.5	10.01

Source: Database on Indian Economy: RBI
https://dbie.rbi.org.in/DBIE/dbie.rbi?site=statistics

1.9 Money Supply M2.

Money Supply M2 in India increased to 24161.72 INR Billion in March from 22546.50 INR Billion in February of 2017. Money Supply M2 in India averaged 9246.46 INR Billion from 1991 until 2017, reaching an all-time high of 29134.50 INR Billion in September of 2016 and a record low of 1127.49 INR Billion in November of 1991.

1.10 Money Supply M3

Money Supply M3 in India increased to 124308.20 INR Billion in March from 122993.39 INR Billion in February of 2017. Money Supply M3 in India averaged 21448.13 INR Billion from 1972 until 2017, reaching an all-time high of 124308.20 INR Billion in March of 2017 and a record low of 123.52 INR Billion in January of 1972 due to Interest rate in Indian money market.

1.11 Indian Central Bank Balance Sheet.

Central Bank Balance Sheet in India decreased to 20766.24 INR Billions in February from 22648.03 INR Billions in January of 2017. Central Bank Balance Sheet in India averaged 7357.03 INR Billions from 2001 until 2017, reaching an all-time high of 23419.03 INR Billions in December of 2016 and a record low of 1624.31 INR Billions in August of 2001.

1.12 Money Supply and Inflation Relationship

The key is the relative relationship between money supply growth and economic growth. The reason for rapid price increases in the last decades of years is the same as the one for price increases in the 1970's. Central banks have been faces up the money supply in the face of a declining economy. So even though money supply growth hasn't been huge, it has been excessive relative to the underlying economy and has led to price inflation. In monetary inflation is a situation increase in the country depending up on the factors like public expectations, and the state development of the economy and the transmission mechanism which is caused monetary inflation.. How much of the velocity of money affect the relationship which is the best target and tools in the monetary policy.J.M.Keynes belived that the central bank can assess the economic variables and circumstances in real time in order to control the monetary policy. By the Monetary School think that Keynesian monetary policy is lot of overshooting, time lag errors and un-wanted affects .By Austrian School of economics defines that either the return of free markets in money, free banking or a 100% gold standard and abolition of central banks. In modern monetary theory, the supply of money is largely depend up on the endogenous one and the exogenous is like the Govt. surpluses and deficits play a important role to allow the Govt. settings the inflation targets in the economy.

1.13 The Positive of Money

The power of money is to be used for the public interest, in a democratic, transparent and accountable path, rather than by the same banks that cause financial crisis. There is a popular conception of money which is created from nothing by commercial bank but also money is created by the banking system (Mervyn King wrote in his book "In the United Kingdom").Then the Bank of England published a paper clearly mention that how the private banks create the money, in wrongly that the deposited money first and then banks lend it out. Those money

movement for a country in the banking system that works for the society and not the against of it.

1.14 The Link between Money Supply and Inflation

The basic thing is that the velocity of circulation of money or change with the hand with the time, the state of the economy and the growth in productivity capacity in the long run aggregate supply.

- **Growth of real output: -** Suppose the money supply increased 4% which would lead the aggregate demand in the same percentage. If the aggregate supply is just static there would be no increase in real output only the inflation will arise. If the increase in aggregate demand of 4% is matched with the increase in aggregate supply, there would be no inflation but just an increase in real output. In the words of money supply which can grow at the same as real output to maintain the price level. If the money supply grows at faster than the real output, it will cause inflation in the economy, but in the real world there would be different reason why an increase in the money supply does not lead to an increase in inflation.

- **Hard to measure Money supply: -** The money supply is taking a hard task to calculate only for the constantly is changing. So much increase in the money supply are often to changes in the way of people hold money, for an increase in credit card use may cause an increase in broad money M4.

- **Velocity of money circulation: -** MV =PY .The quantity theory of money shows that an increase in M causes an increase in P and this assumes that the V is constant and Y is constant. Since there is always a variations in the velocity of circulation.

- **Keynesian View with the liquidity trap:-**The theory says that in the recession time the money supply is increased which cause inflation. In a liquidity trap, interest rate fall

to zero which does not prevail the people to saving, in this situation which is sharp decrease in the velocity of circulation and an caused of deflation. As far as concerned is that there is increasing the money supply will not cause inflation.

In normal economic situation in the economy the money supply grows faster than the real output it will cause inflation in the economy. In the depressed situation of the economy this correlation breaks down the fall in the velocity of circulation of money. The central banks can increase the money supply without causing the inflation.

1.15 Rationale of the Study

Money supply is the complex result of the instruction of central bank, banks and financial institutions. This study will assess the relationship between the money supply and inflation in India from two different perspectives, viz., main stream and Post-Keynesian. It will analyze the different components of money supply and inflation functions. The present study will be based on the monetary aggregates in India because it analyzes the interest rate has increased over the years, which measures of money components within each monetary aggregates and that will be helpful for monetary conditions than the current aggregates in the country. Empirical data shows the disposable high powered money is a major contributor to the change in both the monetary aggregates and there is no significant relationship between the structural break even after the post-liberalization period. This study will focus both present and also future because it has a strong impact on foreign exchange intervention, claims on Govt. fund and more powerful to influence the reserve money. Money supply is not only fully control over the RBI, expansion of financial system, effective requirement of monetary management; more focus on Open Market Operation (OMO), effective monetary policy tool, high fluctuation in Govt. balance with RBI avoided the sound public expenditure management, losing control on money supply. RBI needs to think about the monetary policy framework, currently based on monetary aggregates into interest rate targeting. In this context, the present study will

provide a clear picture of the trend, pattern and relationship between money supply and inflation in India which will be helpful for the researchers, experts and policy makers.

1.16 Statement of the Problems:

Indian economy is going towards inflation in some of the years, which have a greater obstacle in the growth path if it is not bearable. Government and economists should have focus to give a better policies for a new built of a nation in recent most.

1.17 Objectives of the Study

1. To examine variation in money supply, prices, interest rate and GDP at market price in India.

2. To analyze the relationship between money supply and inflation in India.

1.18 Major Hypotheses:

H0: There is a no statistical significant relationship between money supply and inflation.

H0: There is a statistical significant relationship between money supply and inflation.

1.19 Data and Methodology

This paper involves the secondary data. Data source are the publication of RBI bulletin(2014-15 edition), IMF report, Monetary Policy Committee report, Ministry of finance report, hand book of India in different years as per the requirement of the dissertation work. The sample period ranges from 1970-71 to 2015-16. As the marginal increase in the money supply in previous year, it has a good linkage to the market and the industrial output as well as the price level of the economy. The estimation procedure elaborate in the research methodology chapter.

1.20 Expected outcome of the study

We construct the monetary aggregates in India with each component M1, M3, WPI, income velocity of money, and GDP at MP with a large panel data set, weighting each type deposited according to the transaction services offered by them. A measure of money appears to have some leading indicators properties for predicting both nominal output and inflation. So it is a better measure of money than the other monetary aggregates. It will give a light on the extent of the implementation of money supply and its actual condition in India. It will focus on the transformation of technology, electronic payment and a greater move in the digital concern, providing a quite satisfactory background of money supply and inflation in India. Indian rupee will be the number one position to tackle the dollar in some of the period that is our target.

1.21 Chapter layout

Organized the chapterization in detail**.**

1. The first is introduction chapter.

2. The second is brief review of literature.

3. Research methodology.

4. To examine the variation in money supply, prices and GDP at market price in India.

5. The relationship between money supply and inflation in India.

6. Findings, Conclusions, Policy implications and Limitation of the study.

CHAPTER-2

REVIEW OF LITERATURE

2.1 Introduction:

For a monetarists inflation is purely a monetary phenomenon. They defined that an increase in aggregate prices in an economy is caused by the large expansion of money supply. On the other part of the structuralist of school of thought argued that "inflation is monetary phenomenon and large rate of money supply is a consequence rather than cause of inflation in developing countries. The direction of causality between money supply and inflation, try to solve these controversies by different researcher in their own point of view. The study is to take some relevant review to solution for the topic, whether it is money supply influence the inflation or any other factor is responsible.

2.2 Framework of Review of Literature

Denbel et.al. (2016) this study which is totally based on the causal relationship between inflation and money supply and between inflation and economic growth in Ethiopia for the period of 1970 to2011. The techniques used in this analysis is Johansen co integration test and VECM that there is long run bi-directional causality between inflation and money supply and unidirectional causality from economic growth to inflation. In the short period there is one way causality were found from money supply and economic growth to inflation. The result in this study is that the inflation is negatively and significantly affected the economic growth**.**

Barnett (2015) this paper is now casting the biggest economy in the world's fastest growing economies with an annual GDP growth rate exceeding 10% between 1978 and 2008.But in 2015 the Chinese GDP grew at 7%, the lowest rate in five years. The borrowing cost of capital is too high. This paper constructs the Chinese monetary aggregates M1 and M2 and for the first time constructs the broader Chinese monetary aggregates M3 and M4.GDP data are published only quarterly data and with a substantial lag, while many monetary and financial decisions are made at a higher frequency. The factor model, incorporating as indicators the divisia aggregates

indexes, Divisia M1 and M2 along with additional information from a large panel of other relevant time series data. We find that the Chinese money supply declined at the beginning of 2010 after which is the growth of Divisia M1, M2, M3 and M4 all steadily decreased, reflecting the tightened borrowing conditions in Chinese model.

Barnett (1984) this paper explained the currently available capacity to use formal statistical index number theory to measure the economy's money supply accurately. This paper is firstly illustrated the tightness of money in the monetarist Federal Reserve policy. The rate of growth of the money supply is found to have been lower and more volatile than when measured by the official simple sum aggregates have induced a tighter and more volatile policy than was intended. The growth of Divisia and simple sum M2 and M3 from Nov 1979 to 1982 (M1 contain currency, travelers checks,, demand deposits and others checkable deposits,M2 contains M1 overnight repurchase agreement and Euro dollars money a market a mutual funds balances money a market deposit accounts and saving and small time deposits,M3 contains M2 a large time deposits term repurchase agreements and institution only money market mutual fund balances. The Divisia and simple sum aggregation are same estimators of the same economic quantity aggregates Q (q_t). The Divisia quantity index is known to possess very small error. The officially simple sum M2 and M3 monetary aggregates were upwardly biased during the sample period and provided a deceptively high measure of the rate of growth of the corresponding exact monetary growth. He also solution about the concern of stock and flows. The Divisia monetary aggregates measure the flow of services produced by the component assets. The officially simple sum aggregates measure the accounting stock. The nominal economic stock often treated as proportional to the service flow, is the discounted present value of expenditure on the expected service flow from the current period through the lifetime of the component assets. The CPI is the Laspeyres index, which is known to be up worldly biased, and the IPD is a Paasche index, which is known to be downwardly biased. He also stressed that

the sign of the error with Fisher ideal or divisia index is not always the same but it is magnitude is third order.

Singh et. al. (2015) the study investigated that there is a casual relationship between money, output and prices for the post liberalization period in India. They found that the variable is relevant in the understanding of relationship between money, output, and prices. Narrow money (M1) is found to be a better policy variable than reserve money (M0) or Broad money (M3). They also the test of Johansen test for co-integration test and granger causality test which give some result of the WPI prices have along run relationship with money supply however CPI prices have no relation with money supply. The relationship between quarterly money supply and output is unidirectional. M1 granger causes output. M0 and M3 do not Granger Cause output. Monthly M0 has bidirectional relationship with output, while M1 shows unidirectional relationship with. M3 has no relationship with output. Monetary variables have a causal relationship between with prices. In another case it is interesting one the food prices are having a causal relationship with monthly growth in base money.

Kiganda (2014) this study specifically sought to the theory of monetarist theory of money supply in Kenya using the annual data from the period of 1984 to 2012. This study involved testing for stationary of the variables, using Augmented Dickey Fuller test, correlation coefficients, Vector error correction Model (VECM) and pairwise Granger causality test. There is no relationship between inflation money supply in Kenya. The data indicated that there is a weak significant positive correlation, are integrated of order 1, I (1) are co integrated. There exist a positive long run relationship between inflation and money supply in Kenya. The inflation is fundamentally derived from the growth rate of money supply and that a rapid increase in money supply leads to a rapid increase in inflation.

Khainga (2014) the study of this paper is to construct Divisia monetary aggregates and compare them with simple sum aggregations. They used the monetary aggregates for M1, M2, M3 and M3 XT are different from their counter parts, especially for M1, M2. It is found out that the currency and bank deposits are imperfect substitutes. Divisia aggregates perform equally as well as traditional monetary aggregates. Divisia monetary aggregates suggest that the different sub components of monetary assets are not highly substitutable and long run relationships based on demand for money, changes of stocks of financial assets as economic condition change. This includes user costs and expenditure shares for the monetary aggregates. Relative performance of the Divisia and simple sum aggregates by assessing the existence of plausible long-run relationship between the monetary aggregates and output and interest rate. Also used the method of co-integration test for analyzing the monetary aggregates, national income, and interest rate. The income elasticity based on Divisia monetary aggregates is lower, while the interest rate elasticities are marginally higher expect for Divisia M1.

Paul's (2015) the role of money in explaining in India through Philips curve approach against P-star model in forecasting inflation. It is the model which is the alternative measures of money such as simple sum and Divisia M3, to examine the relevance of inflation. The short run fluctuations in inflation are attributed to the determinants of long run equilibrium price. The long run equilibrium price (p*) is determined by current money supply, potential income and the equilibrium velocity. The benchmark asset that provides no liquidity services and is used to transfer wealth from one period to another and proxied by the rate of return on a least liquid asset/ long maturity assets or maximum rate of return among arrange of assets. As study mention that the IIP (Index Industrial Production) is considered an imperfect measure of demand pressure. They also used the Augmented Dickey fuller and Philip-Perron (pp) unit root test to observe the process. The result suggest that there is a coefficient associated with real money gap also turns out to be significantly different from zero and suggest that monetary

dynamics does have a crucial role in explaining the inflation. P-star model estimated with Divisia real money gap measure performs better than the model with simple sum real money gap measure in forecasting inflation. Inflation is affected by the three structural innovations at different forecast horizons. First is to shocks in money gap measures seem to have long term impact inflation as the impulse response coefficients rise till 12 months. This shows that the shocks in real money gap play a predominant role in explaining the inflation. Divisia real money gap and the five alternative measures of supply shocks include: world non fuel commodity inflation(WNEI), relative price inflation of food(RPFD), relative price inflation of fuel(RPFU), relative price inflation of food and fuel(RPFF) and movements in international crude oil inflation(OI). Each supply shocks on inflation have transitory in nature. It is used the period from April 1993 to August 2014.

Ahmed et.al. (2007) the study purposed that the money-out nexus in a multi-variety settings with impulse response function and variance decompositions analyses based on four variables VECM. Monetary policy effectiveness in the money. Money had little impact on price level. A variety of diagnostic test used in this theory to obtain the information regarding the money and fixed to flexible exchange rate regime during the period of study**.** The important implication of this study to use the monetary targeting as an important part of its macroeconomic policy to achieve a sustained rate of economic growth without endangering price stability. Money supply accounted for variance in output which is significantly less and expansionary monetary policy had no significant impact on prices. The persistent of inflation can be better examined by structural factors such as rising food prices, rising imports, and rising Govt. expenditure. GNP was compared for the middle –income countries on the purchasing power parity (PPP) basis and also given the financial sector development with financial liberalization may explain greater relevance of M2 than M1.

Javed et. al. (2011) the study revealed that the cost –push and monetary factors on GDP deflator through empirical analysis using annual data from 1971 to 2006-07. Here the study is tested by the model of OLS the stationary and Augmented Dickey Fuller test which is influenced both the cost push and monetary factors are influenced on whole sale price index. The prices of imported raw material have impact on GDP deflator and its positive sign suggest that as the prices of raw materials increase in the international markets the domestic price level also increases. Real GDP has positive sign but insignificant relationship with GDP deflator. There is positive relationship of the dummy variable with GDP deflator is that when the natural calamities occurs the productions of various commodities fall and there shortage leads to higher prices of these commodities. Lag value of broad money supply M and value of GDP deflator regression are stastically significant and the M1 and M2 are not significant. There is a positive relationship between narrow money supply and GDP deflator. The broad money supply M2 has positive insignificant relationship with GDP deflator. In this study there is dominant role increasing inflation as revealed by the sign of LCPI.

Sharma et. al. (2010) in this paper we have to investigate whether the money supply Granger cause the output or prices or both. Granger causes money supply or not .Since the test is required in the process of money supply, seasonal unit root test results are reported in all the M3, IIP, and WPI. The study found out that there is an effect of money supply on output has remained a short run phenomenon in the post liberalization period. On the other hand effect of money supply on prices gets reflected only at business cycle frequency in the form of Indian context. The causality is unidirectional in both the cases running from money supply too output and prices. In the bidirectional causality between money supply output and money supply-price indicates that money supply can be consider as exogenous in our bivariate frame work. This shows that the supply of money (M3) can be considered as an effective control variable.

The period of the study was from April 1991 to March 2009 which is mostly the post liberalization period.

Basu (2011) in this study the inflation management is one of the hardest tasks an economic policy maker has to undertake but there is a cardinal mistake of entirely economy. Inflation require judgments and intuition, and using the statistical information and understanding of economic theory. The period is taken from the year 1972 to 2011 from all the commodity and combined the food prices. The inflationary has begun in December 2009 when the WPI inflation climbed to 7.15 percent it continued to rise peaked in April 2010 at just short of 11percent, there was a small pickup in inflation in December 2011 and also because the down word or slow. When WPI inflation something in an uncertain manner in and around 10 percent and now India had very little inflation for the dozen years. There were occasional months when the inflation would exceed 8 percent and not a single month when it was in double digits these twelve years of price stability. India government does not control interest rates, excepting a few, such as the basis savings account interest rate for bank deposits. In adjusting the repo rate and reverse repo rate it is expected that these changes influence the behavior of banks and cause the free market interest rates, instances, on mortgages fixed deposits and other lending plans to move in similar directions. Thus in turn will influence and through that inflation. Another problem arising standard macro –economic demand management for controlling inflation because we are on the stage of globalization, the world is flat, there is need to worry about the neighbor's money in a way that we never had to in the past. The land scape of growth and inflation across in the nations, which the world is suffering from stagflation. In virtually all industrialized nations one sees inflation on high and emerging market economies in the nations which is called 'salad bowl inflation'.

Kohli (2001) this paper reveals that domestic monetary management of a capital surge in the economy also led to the fiscal expansion in India which raises the aggregate demand and

aggravate the inflationary impact of capital inflows. This only for the macroeconomic management as the only variable that can be varied in this scenario to control inflation or adhere to monetary target is domestic private sector credit. The period of the study in the year on 1985 to 1999 which is envisaged the impact of foreign currency inflows up on domestic money supply, and associated with the sterilization policies like the interest rate, exchange of foreign currency assets, OMO is another channel of sterilization. Sterilization leads to an increase in public debt, and these costs termed as quasi- fiscal costs. The substantial rise in commercial banks holdings of government securities by the system in 1990s, the quasi fiscal cost could be high. Heavy dependence upon reserve requirements as a policy tool for management and substantial amount of funds in India are still intermediated through the banking sector, its share in the total financial assets of the economy is steadily falling. Low rates of return on the bear which distorts the share of intermediation by the banking sector with the sterilization is the interest differential between the interest rate on purchase of foreign exchange securities and the interest rate paid on external debt servicing.

Samantarya et. al. (2006) the study investigated that the inflation increased from the 1970s onwards before moderating in the mid-1990s. Supply shocks both due to a setback in agricultural production and international oil prices and monetary expansion due to automatic monetization of the fiscal deficit were major contributory factors to higher inflation. The broad based financial market, particularly the activation of the government securities and forex markets coupled with improved monetary fiscal deficit interface enabled better monetary management since the second half of the 1990s. Monetary management was effective in ensuring a reduction in inflation and lowering expectation. The expansionary effect emanating from massive capital flows to India since 1993-94 has been sterilized through a variety of instrument. Including OMO and repo operations under LAF.

Bhole (1987) The study postulates that there has been a growing tendency both in India and abroad to conduct monetary analysis and policy in terms of empirically defined broad money and multiple measures of money in monetary system also has held that multiple M3 is the appropriate definition of money and that the money multiplier frame work is dependable for money supply analysis and control. The paper was totally focusing on the major issues relating the concept, measure, and determination of money supply. The possible assets used in the in the context of currency(C), other deposits with RBI(ODR), current deposits with banks(CDB), saving deposits with bank(SDB), saving deposits with post office saving banks(SDPOSB), fixed deposits with banks(FDB), time deposits with post office(TDPO), other deposits with post office(ODPO), national saving certificates(NSCS), other certificates with post offices(OCPO), treasury bills(TBs), government bonds(GBs), Industrial bonds(IBs) fixed deposits with non-banking companies(FDCOs), trade credit(TC), unutilized credit limits and industrial limits(UCL) and industrial shares(IS) . The study period of this paper was 1950-51 to 1981-82 this paper clearly show that it would not be the interests of the effectiveness of monetary policy to depend on the narrow money multiplier frame work for controlling money supply variations in India the regulations of government market borrowings, deficit financing, foreign exchange assets and availability of bank credit by fiscal and monetary authorities would have a high degree of success in controlling money supply.

Jha et. al. (1999) this paper investigated that there is a monetary asset grouping of monetary aggregate of the RBI estimated on the three monetary assets namely, currency with public, demand deposit and time deposits. The separaility tests to use for the construction of monetary assets lead us to reject any independent grouping of two assets out of the rest and take the data of monthly to roust the result. He told that the choices of proxies for benchmark rate and yield other assets plays a crucial role. The asset groups are neither equivalent to each other nor constant and to know the relative performance of the monetary assets over the period. This

paper is has pointed out that the separability is not satisfied, the divisia would be the better index to use than the simple sum. The separaility theory in M1 is a weekly part in this paper. The separailty theory shown in this segment is to provides the fundamental linkage between aggregation of goods and the maximization principles in economic theory, partitioning the economic structure in to two sectors and the theoretical hypothesis can produce power-full parameter restriction's, permitting great simplification in estimation of large demand systems. They also talk about the divisia model to evolving the user costs of monetary assets as the exogenous variables and the shares of got the monetary in assets in the total expenditure as the endogenous variables estimated y the using of non-linear seemingly unrelated method.

Serletis et. al. (2011) this paper build on the work of relationship between money growth uncertainty and the level of economic activity in the United States. They used the data of MSI (Monetary service indices) in the period of 1967:1 to 2011:3, in the context of bivariate VARMA,GARCH-in-Mean,assymetric BEKK model and increased Divisia money growth volatility is associated with a lower average growth rate of real economic activity. There are no effects of simple sum M1 and perhaps sum M2M aggregates. The relationship is not the roust to alternative methods of aggregating monetary assets .In the new Keynesian approach to monetary policy under the sticky prices, central banks use a short-term nominal interest rate as their operating instruments, but the effects of monetary policy on economic activity stem from how long-term real interest rates respond to the short-term nominal interest rate . They also said that there is a stable relationship in financial markets and decoupling of long-term interest rates from short-term interest rates has significant implications for monetary policy. The federal funds rate has reached the zero lower bound and lost its usual ability to signal policy changes with the change of federal funds rate. The subprime of financial crisis and the great recession time the central banks throughout the world departed from the traditional interest rate and targeting monetary policy and focusing on their balance sheet instead of using

the quantitative easing. The US economy in an environment with the federal funds rate at the zero lower bound and the level of excess reserves in the trillions of dollars, no one is sure how this will unfold. The federal funds rate unusually low for a long period introduces un-certainty about the future path of money growth and inflation. This un-certainty can be especially damaging to the economy, as it amplifies the negative response of the economy to un-favorable shocks and dampens the positive response to favorable shocks. The most of the puzzles and paradoxes that have evolved in the monetary economics literature were produced by the simple-sum monetary aggregates, provided officially by most central banks and are resolved by use of aggregation- theoretic monetary aggregates.

Binner et.al. (1999) this paper shows that there is a comparison to the performance of the Divisia M4 monetary index with the standard simple sum measure of broad money in the context of composite leading indicator of inflation in the United king dom. There is a principal component analysis as a more sophisticated weighted mechanism for the constituent components. Indicators constructed using a Divisia index measure of money were found to be more closely related to the inflation reference cycle than indicators using their simple sum counterparts when a principal components weighting mechanism was used. This paper constructs both shorter and longer composite leading indicators of inflation which reflect monetary factors and both cost and excess demand influences, as well as international pressures on UK inflation.M4 were found to provide longer average leads times over future movements in inflation in the majority of cases. The component analysis proved to be a useful alternative to the current practice of simple averaging. The resulting series were smooth, not dominated by regular or non-cyclical movements and stable over the time period under study. The Govt. commitment to base monetary policy on a target for inflation may best be achieved by use of Divisia index measure. It is good indicator to monitoring the movements of inflation.

Singh (2006) this paper found that the inflation targeting framework has been success fully implemented in several developed and developing countries. This system requires equal commitment from the Govt. and the central bank. In Indian context the targeting inflation is politically sustainable given the overwhelming preferences of the population for lower headline inflation. Taking in to account the measurement errors, the price stability means an inflation level of the order 2 to 3 percent. in the case of India ,McKibbin and Singh(2003) have shown that the nominal income targeting does better than both monetary targeting and inflationary targeting, while inflation targeting performs better than monetary targeting.

Schunk (2001) this paper provides direct evidence on the fore casting performance of the Divisia monetary aggregates relative to traditional simple sum monetary aggregates relative to the traditional simple sum monetary aggregates. It is shown that forecasts of US real GDP from a four variable vector auto-regression are most accurate when a divisia aggregate is included rather than a simple sum-aggregate, particularly at broad levels of aggregation. Further, the two M1 aggregates, relative to the broader aggregates, are superior predictors of the GDP deflator, with a slight edge going to Divisia M1 over simple sum M1.He studied that the simple summation would provide valid indices of the stock of nominal monetary wealth, as required in national accounting, or indices of bank liability, as required in bank accounting, but not valid structural economic variables. The eight VARs have been estimated in this study using 120 observation,1962:1-1991:4.The divergence between the simple sum and the Divisia aggregates relatively small. The M1 aggregates were particularly successful in fore casting the GDP deflator. This shows that the broad divisia monetary aggregates contain valuable information for forecasting future real economic activity. Since the narrowest Divisia aggregate is most useful for forecasting future prices.

Patnaik (2010) this paper persistent inflationary pressure experienced in the post liberalization era in India .The causes of inflation in India have undergone changes. This study is based on

the method of Co integrated Vectors Auto regression (VAR) framework, the empirical estimation is carried out. The Error Correction Mechanism (ECM) of the cointigrated variables is also carried out .The impulse response Function (IRF) of the cointigrated VAR system shows that there is lag in the response of inflation to the changes in the other variables in the VAR system. The Fixed Error Variance Decomposition (FEVD) shows that the inflation India is a mix of demand and supply side factors. The stabilization policies should therefore focus on both demand control as well as supply management. Also considering the lag in the impact of the explanatory variables the stabilization policies should become more pro -active. The existence of co-integrating relationship between the variables reveals along run relation between them. This implies that CPI is influenced by the IIP, RM and IMP (Index of Industrial, Reserve Money, Import index). The ECM is highly significant this implies that the CPI adjusts to past period trend and lags in other variables. So also it responds to past policy fundamentals. The IRF is the response to shock by the CPI adjusts after around 12 months and it is totally lag situation. The FEVD of CPI throws very crucial light on the determinants of inflation in India. Money supply does influences the inflation, but the impact is short lived. It is due to the external sector is also very immediate and it comes via the IIP.

Cysne (2003) this is postulates that the adequate measures of the welfare costs of inflation and money pay the interest-bearing asset held by the household .Each monetary asset is supposed to have, at the margin, a different degree of moneyness.The house hold is endowed with one unit of time that can be used to transact or to produce the consumption good, so that Y + S = 1, the GDP is normalized to one when the shopping time is equal to zero. For homogeneity there is used for Euler's theorem. Divisia quantity indices and consumers surplus measures of welfare losses and it is monetary services with the welfare costs of inflation. How the nominal prices used in their construction are normalized or deflated. The economy is a fisher one where the benchmark interest rate is determined by the rate of inflation, which is endogenous in the

model, and by the rate of the monetary assets are exogenously determined by the Govt.the interest rate wedges are directly linked to the inflation rate. We have also shown that financial innovations have negative impact on the welfare cost of inflation. How to take non-neutral financial innovations into considerations in the welfare measurement. The divisia methodology using to know the welfare cost of inflation only the knowledge of the demand for the monetary base.

Acharya (2007) this paper examines that the properties of a new weighted monetary aggregate, currency equivalent monetary aggregate for India using the components of a broad monetary aggregates NM3 recommended by the working group on money supply. Pure substitution effects occurring due to a relative price change in financial innovations. In this paper the attempt has been made to construct a new weighted monetary aggregate (CEMA), the new simple sum money definition of the RBI, NM3 for aggregation purpose. The empirical performance of this aggregate is compared with its simple sum counterpart NM3 by employing a money demand function. The money demand function is estimated using the ARDL approach to cointegration. The weighted monetary aggregate, CEMA is found to dominate the simple sum one in terms of expected properties in a money demand equation.

Chona (1976) this paper proves that the stock of money available to the community can be exogenously determined by the monetary authorities. It also covering the period 1951-52 to 1974-75 and to see whether the Reserve Bank can control and predict the effects of changes in its monetary liabilities on total money supply. The focus is on identifying the factors affecting money supply in terms of primary money created by the Reserve Bank of India and secondary money created by commercial banks. The Value of money multiplier has shown variations, particularly in the short period. The L has far exceeded the k effect on money supply Control on money supply has to be exercised changes through changes in the monetary liabilities of the reserve bank. There is another thing is to the net bank credit to Govt.has the major factor

causing changes in monetary liabilities of the Reserve Bank. The allocation of changes in money supply to policy actions and to behavioral variables, an allocation that is not possible in terms of the conventional presentation of data on money supply on the basis of the balance sheets of the banking system should facilitate the task of the reserve bank in making an early assessment of the probable response to monetary measures that it may wish to contemplate.

Thornton (2006) this study analyzed the GARCH model to finds a positive and significant relationship between the level and variability of monthly inflation in India from the period of 1957-2005. The running inflation to uncertainty about future inflation by Friedman. The inflation has a negative output effects, this strengthens the case for the central bank to focus on price stability as one of the prime objective of monetary policy.

Balakrishnan (1993) this paper is claimed that the neutrality of anticipated money growth under rational expectations is acceptable in the Indian context. They re-capitulate that fluctuations about the natural level of output are driven by money surprises is rejected for two categories of output in the Indian economy. One is aggregate output and another is industrial productions. In Indian context there would be wrongly advised that it can be certain of containing inflation solely by implementing a pre-announced reduction in money growth rate, leave alone doing so costless.

Jadhhav and Singh (1990) this study nexus that the inflation in India is due to chronic and time accelerating, the short-term dynamics of budget deficit, money supply and economic growth. They argued that causation between money and prices may not be the uni-direction as postulated by monetarist model. Money supply may not be independent of the price level and the causation may more appropriately be viewed as running both ways. Government expenditure adjusts more rapidly than receipts to a given change in price level and as a result, inflation widens the fiscal deficits leading, through the central bank financing, to larger money

supply increasing the inflation further. It takes closer look at the model for capturing inter relationship among budget deficit, money supply, inflation, and economic growth and their effect on the which conspicuous by their absence. The data covering from Indian from the period of 1970 to 1988.Static and dynamic simulations to conduct to assess the overall tracking ability of the model.

Vasuvedan (1979) this study emphasized that there is two important influences on the demand for money are income and interest rate. Money rates are generally administered a particularly serious problem is specifying an appropriate rate of interest, all the quantity variables are expressed in nominal, essentially because any deflation in to real terms either by whole sale price index or by national income deflator, would introduce an elements of arbitrariness apart from suggesting total absence of money illusion.

2.3 Research Gap

Every research has its own limitations. It has been found that mostly study is under taken by the WPI and CPI inflation, influence the inflation in the country, ignoring the GDP deflator because in Indian level official calculation is not so correct. So the different study is cannot possible to under taken for new theory. This the measurement errors of the price stability means an inflation level of the order 2 to 3 percent, in the case of India is the nominal income targeting does better than both the monetary targeting and inflationary targeting, while inflation targeting performs better than the monetary targeting. It shows that there is a gap between the money supply and inflation calculation in India.

CHAPTER –III

RESEARCH METHODOLOGY

3.1 Research Design

The study is empirical and causal in nature which provides insights into and an understanding of the various concepts related to inflation and money supply growth in India and attempts to reveals the interaction amongst them.

3.2 Data Description and Model Formulation

The study is based on secondary data. There is no comprehensive source of entire data used in the study. The data used in this study was therefore obtain from multiple sources. The fouth chapter is used only the growth variation, average, correlation and standard deviation for using the panel data from1970 to 2016. In the fifth chapter will analyse the study of vector error correction model with separate sheet and e-views 9.5 software is used to analyse the data. Four models are formulated on the basis of a wide range of literature of review. The time series data are used for the period of 46 years from 1970-71 to 2015-16 respectively for the analysing the contribution of money supply and inflation growth in India.

INFL = f (M1, M3, R, V1, V3, YG)

The above function provides information that, inflation is determined by growth rate of Narrow and Broad Money, rate of Interest, Velocity of money based on Narrow and Broad Money Supply and GDPat Market Price.

Table 3.1 Description of Variables

Variables	Definitions
INFL	Inflation Rate based on WPI
M1	Growth rate of M1- Narrow Money Supply
M3	Growth rate of M3- Broad Money Supply

R	Rate of Interest on Medium Term Deposit
V1	Velocity of Money base on Narrow Money
V3	Velocity of Money base on Broad Money
Y	GDP at Market Price

Considering the function following equations have been framed to test the relations between the rate of inflation and the host of the explanatory variables. Various model specifications are experimented as below.

$INFL = \beta_1 M1 + \beta_2 R + \beta_3 YG + \varepsilon$ …….. (1)

$INFL = \beta_1 M3 + \beta_2 R + \beta_3 YG + \varepsilon$ …….. (2)

$INFL = \beta_1 V1 + \beta_2 R + \beta_3 YG + \varepsilon$ …… (3)

$INFL = \beta_1 V3 + \beta_2 R + \beta_3 YG + \varepsilon$ …… (4)

Table 3.2 Money Demand Specifications

Sr. No.	Dependent Variable	Independent Variables
1.	INFL	M1, R, YG
2.	INFL	M3, R, YG
3.	INFL	V1, R, YG
4.	INFL	V3, R, YG
5.	β, β2, β3	The Parameter of the study
6.	E	The Error Term

3.3 Unit Root test

The prime assumption of time series technique is to examine the stationary of the data for the variables taken in the study. The stationary of data has been characterized by a time variant mean and variance. If mean and variance of a data are constant then the data is called stationary. To avoid the problems of spurious regression, it is necessary to confirm whether a stationary co-integration relationship among the variables.. All these models are used for the examination of unit root.

The stationary point is the unit root stochastic process that we discussed in the following way

$\Delta Yt = (Yt - Yt\text{-}1) = \mu t$……………………….(1)

$(-1 \leq p \geq 1)$

T= time or trend variable, μt is the error term. Null hypothesis is that $\delta = 0$, there is a unit root we can say the time series is stationary whereas alternative hypothesis is that $\delta \leq 0$ that is the time series is stationary.

3.4 ADF (Augmented Dickey Fuller) Test

This study has applied Augmented Dickey Fuller (ADF) test to check the stationary of the variables. The stationary test has been carried out at the level as well as at their first and second difference. There are three models of ADF test which are intercept, trend and intercept and no trend and no intercept.

The ADF for the non- stationary of a series is done for the following three forms of data series

$\Delta Yt = \alpha Yt\text{-}1 + Ut$……………………………... (2)

$\Delta Yt = \beta 1 + \delta Yt\text{-}1 + Ut$…………………….. (3)

$\Delta Yt = \beta 1 + \beta 2t + \alpha Yt\text{-}1 + Ut$……………………………………………………… (4)

$\alpha Yt = \alpha Yt\text{-}1 + \alpha i \sum \alpha Yt\text{-}i + \varepsilon t$……..... (5)

$\alpha Yt = \beta 1 + \delta Yt\text{-}1 + \delta i \sum \alpha \Delta Yt\text{-}1 + \varepsilon t$……..... (6)

$\alpha Yt = \beta 1 + \beta 2t + \delta Yt\text{-}1 + \alpha i \sum \alpha \Delta Yt\text{-}I + \varepsilon t$……... (7)

Where

ΔYt is the first difference of the series Yt, αi, $\beta 1$, $\beta 2$ are the parameters to be estimated.t is the time or trend variable, εt is the noise term.

The ADF test the null hypothesis (H0) against the alternative (H1) hypothesis;

H0: Each variable has a unit root, $\delta = 0$

H1: Each variable does not have a unit root, $\delta \neq 0$

3.5 Johansen co-integration test

It deals with long run relationship between the variables of the study. To examine the long run relationship between money supply and inflation Johansen co-integration test has been utilized in this study. This test is based on Trace statistics and max statistics. When there are more than two variables in a model, the number of co-integrating vectors can be more than one. In fact for number of variables there can be up to n-1 co-integrating vectors. This problem cannot be resolved by the Engel- granger single equation. Since we have five variables in this model, Johansen approach for multiple equations in adopted here. Considering in the variables all are to be endogenous, a vector auto regression model with higher order. Which is written in order below.

$Xt = A1Xt\text{-}1 + A2Xt\text{-}2 + \ldots\ldots\ldots\ldots + ApXt\text{-}p + et$…… (8)

$Xt = (n \times 1)$ vector (X1t, X2t,…….Xnt)

εt = independently and identically distribute dimensional vector with zero mean and variance matrix $\sum \varepsilon$. This equation can be reformulated in a vector error correction model (VECM).

$\Delta Xt = \prod Xt\text{-}1 + \sum_{i=1}^{p-1} \prod i \Delta Xt\text{-}1 + \varepsilon t$…….. (9)

Where $\prod = -(1 - \sum_{i=1}^{p-1} Ai)$ and $\prod i = -\sum_{j=i+1}^{p-1} Aj$

This shows the rank of the matrix ∏, the rank of ∏ is equal to the number of independent co- integrating vectors. Clearly it rank of (∏) = 0, the matrix is null hypothesis is the usual VAR model in first difference. If ∏ is of rank n, the vector process is stationary. Intermediate class, if rank (∏) =1, there is single co-integration vector and the expression ∏ Xt-1 is the vector correction model. For the other cases in which 1< rank (∏<n, there are multiple co integrating vectors, Johansen (1988) and Johansen and Juselius (1990) suggest two tests for determining the number co-integrating vectors. In practice only estimates of ∏ and its characteristics roots can be obtained.

$\lambda trace\ (r) = -T\sum_{i=r+1}^{n} Ln(1 - \lambda)$ … … … … … … … … … . (10)

And

$\lambda max\ (r, r+1) = -T\ Ln\ (1 - \lambda\ r + 1)$…… (11)

Where λi = the estimated values of the characteristic roots (Eigen values) obtained from the estimated ∏ matrix, T =number of observations.

The first statistics tests the null hypothesis that the number of distinct co-integrating vectors is less than or equal to r against the alternative hypothesis that co-integrating vectors is greater than r. the second statistics tests the null hypothesis that the number of co-integrating vectors is r against the alternative of r+1 co integrating vectors.

3.6 Granger Causality Test

It deals with the causal relationship between the variables of the study. It does not only examine the causality but also it checks the direction of the causality. In this study causality has been examined between money supply and inflation. Two time series variable of x and

y. X is said to Granger cause Y. If Y can be better predicted using the histories of both X and Y then it can by using the history of Y alone.

Yt =a0 + a1Yt-1 +……. + apYt-p+b1Xt-1 +……. + bpXt-p + Ut ……..(12)

Xt =C0 + C1 Xt-1+……..+ CpXt-p+d1Yt-1 +……..+ dpYt-p + Ut……... (13)

H0: b1 = b2 =……..= bp = 0

Ha: Not H0 is a test that x does not granger cause of Y.

Ho: d1 = d2=……. = dp =0

Ha: Not H0 is a test does not granger cause X.

Rejection of the null hypothesis in each cause implies there is granger causality. Granger causality test helps to finding the forecasting ability of variables. Evaluating past values of a variables help in predicting the future values of another variables under the null hypothesis is not having Granger causality. In Granger Causality test for a VAR model in R computes the long run causality between the variables as also intentions causality between them. In VAR model there is a lags of money supply and inflation.M3 to WPI and GDP at MP. A bivariate Grange causality test is also done to check the Granger causality between each of the pairs of these three variables.

3.7 Lagrange Multiplier (LM) test for auto correlation

Once the causality test is completed it is necessary to examine the robustness of the model taken in this study. For this purpose it is necessary to check the presence of auto correlation and normality test of disturbance terms Lagrange multiplier (LM) test and Jarque – Bera test are applied respectively.

The Lagrange Multiplier test for auto correlation was developed by Brewch (1978) and Godfrey (1978). It investigates the auto –correlation among the variables. It became a

slandered tool in applied econometrics. In this test the null hypothesis is there is no auto correlation and it can be rejected if the probability values is less than 5% level of significant.

3.8 Jarque –Bera test for normally distributed disturbances

It was developed to test normality, Heteroscedasticity and serial correlation or auto correlation of regression residuals (Jarque and Bera 1980). The statistics is this test is computed from Skewness and Kurtosis. It follows the Chi –Squared distribution with two degree of freedom. Here the null hypothesis is residuals are normally distributed which can be rejected if the probability value is less than 5%.

$$JB = \frac{n-k+k}{6}(S2 + 1/4(C - 3)2 \ldots \ldots \qquad (14)$$

n = Number of Observations (degree of freedom in general)

JB= Jarque Bera Test, S = Sample of Skewness,C =Kurtosis, k = Is the number of regressor.

3.9 Error Correction Model

The error correction mechanism used by the Sargan and popularized by the Engel and Granger corrects for disequilibrium. An important theory which is represented by the Granger representation that if two variables x and y are co-integrated then the relationship between the two can be expressed as ECM method. It is used for the specified variables, the short run dynamics is examined using the ECM. This model also used the long run equilibrium after the short run. The ECMt-1 past error term will explore the feedback relationship among variables. It will shows the long run relationship between money supply and other variables like WPI, GDP at MP, Broad money ,Narrow money and Other demand deposits. Some error correction model are directly implied y the Granger theorem. ADL91,1) model:

$Yt = \alpha 0 + \alpha 1 Yt\text{-}1 + \beta 0 Xt\text{-}1 + \varepsilon t$…….(15)

$Yt = \alpha 0 + \alpha 1 Yt\text{-}1 + \beta 0 Xt\text{-}1 + \varepsilon t + Yt\text{-}1 + Xt\text{-}1 + \beta 0 Xt\text{-}1 - \beta 0 Xt\text{-}1 - \beta Xt\text{-}1 + \alpha Xt\text{-}1 - \alpha 1 Xt1$…….(16).

Rearrange this ECM model as

$$\Delta Yt = (\alpha 1\text{-}1)\,(Yt\text{-}1) - \frac{\alpha 0 - \beta 0 + \beta 1\, Xt\,(Xt\text{-}1) + \beta 0 \Delta Xt + \varepsilon t}{(1-\alpha 1)(1-\alpha 1)}$$

…….(17)

Estimation the cointegration relationship with using different variables and lagged residuals from the co integrating relationship. When $(\alpha 1\text{-}1) < 0.> 0$ is the disequilibrium expands.= 0 no error correction.

(-1;0) error correction close to 0:slow, close to 1.

-1 is the full error correction in 1 period.

< -1 is the overshooting, oscillory, adjustment of the variables.

This above models are coming from different literature study and the books. The total model is fit for the study of money supply and inflation in India: An Empirical Evidence.

CHAPTER –IV

VARIATION OF MONEY SUPPLY

AND

INFLATION

4.1 Introduction

Money supply operates in India as a global opportunity and global challenges. Globalisation has expanded economic interdependence and interaction countries greatly. Milton Friedman, the father of monetarism, said that inflation is always and everywhere a monetary phenomenon and argued that the changes in overall price level and with the change of monetary stock or money supply. This chapter is to make an attempt to study the inter relationship between the rate of inflation and the rate of monetary growth in money supply in India with a simplistic approach, which is rely on the use of simple statistical tools like growth rate ,averages, correlation etc. With taking of econometrics. In previous studies carried out only the econometrics model in the context of inter-relationship between money, output and prices. In this portion the study to attempt is based on the econometric analysis of inflation rather than the analysis of descriptive.

Firstly a brief notation of quantity theory of money is attempted, which is mainly the part of Indian data pertaining to the rate growth in money supply and rate of inflation as measured the WPI data.

4.2 The Relationship between Money Supply and Price Level in Theory:

The relationship between money supply and the general price level which is implied in the refined the quantity theory of money that associated with Milton Friedman in his equation.

$$MV = PY$$

Where,

M = Money supply/Quantity of money

V = Velocity of circulation of money

P = General Price level

Y = Real national income

The equation is called the equation of exchange and the total value of payments in the form of quantity of money times the velocity, MV, equals the money value of national output (output times price, PY). It is meaningful theory which explains the impact of changes in money supply on the price level. If V is assumed to constant, then every change in M will produce a equal change in the price level or the real national income. If the economy is full of employment or close to full employment level of output, then change in the Y are too difficult with every change in M will cause only the P changes. On the other hand, if the economy operates at less than full employment level of output, then a change in M will reflected more in Y than in P. Money supply always produce changes in either P or Y. According to Friedman, money does matters and it appears when the excessive increase in P (inflation), it is primarily because of the increase in the money supply. In the version of quantity theory of money is proportionality hypothesis due to the V and Y in the equation is remain constant. In the general price level would vary proportionately with the changes in money supply which is actually a rise in 10 % in quantity theory of money will bring the 10 % rise in general price level.

The velocity of money is remain to be constant which is shows that the relationship between the money supply, general price level and real national income as per the velocity of money remain stable. In the state of the economy, only the velocity of money does not change to neutralize the growth in money supply. The example of our vision is that during the depression of U.S. economy in 1930's showed the narrow money stock is increased 35% and the consumer prices registered the decline of 20% was due to velocity of money. So it indicates that a given change in quantity of money on price level and real national income changes with the behaviour of velocity of money. A given change in stock of money will have widely differing effects on the price level and real national income in the economy that's depending up on the movement in the velocity of money.

Stability of the velocity of money alternatively means the demand for money is stable, both are inversely related. If the demand for money goes up then the people wish to hold more money in terms of cash, and they will spend less and ultimately the rate of money (velocity of money) goes down. So in this way the demand for money changes, velocity of money will also change in the opposite direction and in the later will also stable. It interprets the two type of velocity like transaction velocity and income velocity. The income velocity of money is denoting with Y/M where Y refers to national income at current prices and for a period and M refers to the average money stock in the economy during the same period.

The monetarist version of the quantity theory of money which is an attempt to establish the relationship between the money supply in terms of both narrow money(M2) and broad money(M3) measure and the growth in price level(inflation rate) .

4.3 Money Supply and price level in India:

It has been shown that the different literature pertaining to study which is reflected the excessive growth in money supply is one of the Important and prime reason behind the inflationary price experienced in the past. The monetary expansion or increase in money stock which has been directly consequence of borrowings of the central Govt. from the Reserve Bank or deficit financing by the Govt.

In the link between growth in money supply and price is well establish whether the link is positive and stable or not. In this portion we have to study historical base of data and later the portion of inflation rate based on WPI and money supply relationship.

4.4 Income velocity of Money in India:

The velocity of money assumes the main part of the relationship between money supply, price level and real national income. There is a full impact of growth in money supply, in the broad money (M3), which has not covered the price level and real national income. This is really a true fact that decline the income velocity of money only for the broad measures of money supply. The calculation of Velocity of Money Income -

$$V1 = \frac{\text{GDP at Market price}}{M}$$

The data contains on GDP at MP, Narrow money (M1), Broad money (M3), Interest rate with their income velocity shown in the following table.

Table No. 4.1 Growth Rate of Money Supply, Inflation, Income, Interest Rate and Their Variation.

Year	GDP at MP (YG)	M1	M3	WPI INFl	R(interest rate)	V1	V3
1970-1971	4.90	11.36	12.53	4.2	6.25	87.39	58.47
1971-1972	1.62	11.40	13.18	5.6	6	78.69	51.60
1972-1973	-0.56	14.20	15.45	10	6	67.15	43.39
1973-1974	3.19	13.39	14.82	20.2	6	60.07	38.18
1974-1975	1.17	6.47	9.85	25.2	7.375	56.85	34.82
1975-1976	8.38	10.13	13.04	-1.1	8	55.77	33.06
1976-1977	1.64	16.84	19.08	2.1	8	47.14	27.19
1977-1978	6.76	-11.37	15.57	5.2	3	56.31	24.62
1978-1979	5.40	16.79	17.96	0	6	49.53	21.35
1979-1980	-5.53	13.54	15.06	17.1	7	40.58	17.19
1980-1981	6.31	14.62	15.33	18.2	9	36.99	15.53
1981-1982	5.67	6.07	11.12	9.3	10	36.83	14.63
1982-1983	3.36	12.61	14.25	4.9	10.25	33.30	12.98

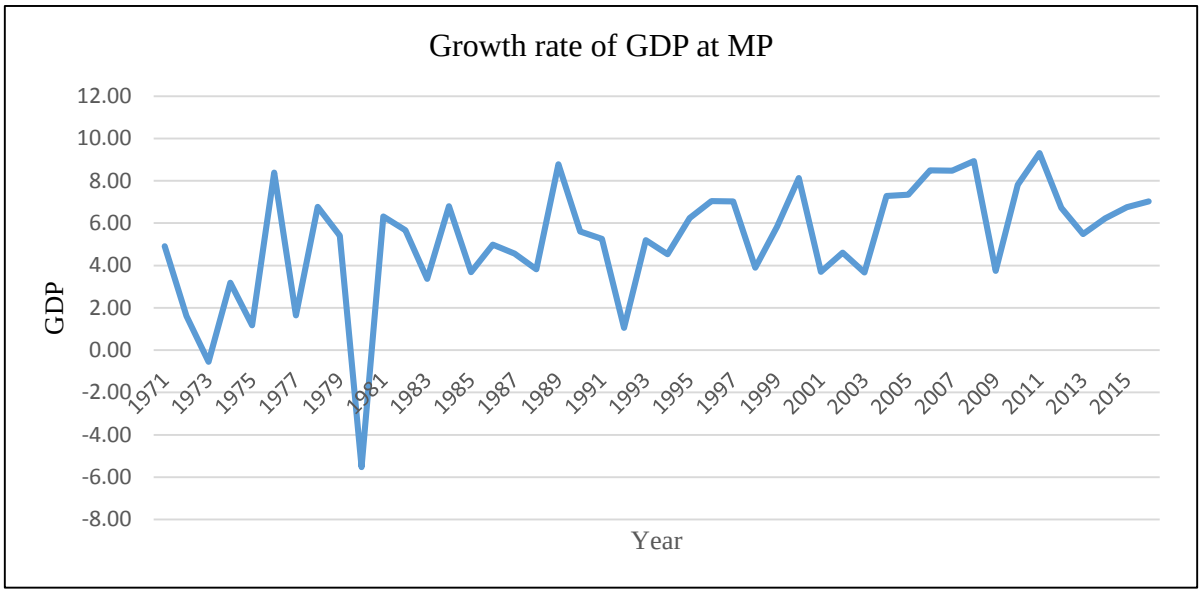
1983-1984	6.79	14.56	15.42	7.5	11.5	30.53	11.78
1984-1985	3.68	16.33	15.94	6.5	12	26.52	10.28
1985-1986	4.99	9.48	13.79	4.4	11	25.27	9.33
1986-1987	4.56	14.41	15.70	5.8	10	22.66	8.24
1987-1988	3.81	12.02	13.78	8.1	11	20.73	7.39
1988-1989	8.78	12.32	15.10	7.5	12	19.92	6.88
1989-1990	5.60	17.61	16.22	7.5	9.5	17.39	6.10
1990-1991	5.26	12.74	13.12	10.3	9.5	16.01	5.60
1991-1992	1.05	18.80	16.16	13.7	9.5	13.14	4.74
1992-1993	5.20	7.79	12.90	10.1	9.5	12.78	4.36
1993-1994	4.54	17.72	15.56	8.4	8.75	11.02	3.85
1994-1995	6.24	21.58	18.29	12.6	8.75	9.22	3.36
1995-1996	7.04	10.51	11.95	8.0	8.5	8.87	3.18
1996-1997	7.02	10.71	13.91	4.6	8.5	8.52	2.95
1997-1998	3.89	10.17	15.26	4.4	8.5	7.96	2.60
1998-1999	5.82	13.34	16.27	5.9	8.5	7.33	2.31
1999-2000	8.13	9.58	12.74	3.3	9	7.21	2.19
2000-2001	3.70	9.92	14.39	7.2	8	6.75	1.95
2001-2002	4.60	10.26	12.36	3.6	5.125	6.35	1.79
2002-2003	3.66	10.71	12.78	3.4	4.625	5.88	1.62
2003-2004	7.29	18.17	14.35	5.5	5.5	5.19	1.50
2004-2005	7.34	10.94	10.69	6.5	6.5	5.01	1.44
2005-2006	8.50	21.37	17.42	4.4	7.625	4.29	1.30
2006-2007	8.48	14.62	17.84	6.6	8.5	4.00	1.17
2007-2008	8.93	16.26	17.62	4.7	8.5	3.68	1.06
2008-2009	3.75	8.25	16.20	8.1	6.5	3.51	0.92
2009-2010	7.82	15.42	14.42	3.8	8.625	3.22	0.86
2010-2011	9.31	9.10	13.86	9.6	9.25	3.22	0.81
2011-2012	6.72	5.70	11.93	8.9	8.875	3.24	0.76

2012-2013	5.48	8.44	11.98	7.5	9	4.86	1.10
2013-2014	6.23	7.88	11.85	5.9	8.625	4.78	1.03
2014-2015	6.75	10.15	9.79	1.9	7.375	4.60	1.00
2015-2016	7.03	11.92	9.19	-2.5	7.35	4.35	0.97
Averages	5.22	12.06	14.26	7.27	8.23	22.71	11.03
St. Deviation	2.7	5.2	2.3	5.1	1.9	22.75	14.57
Correlation	M1&GDPatMP	M3&GDPatMP		M1&WPI		M3&WPI	
	-0.0634	-0.07011		0.01387		0.001974	

Source: Calculation of RBI data 2015-16 Hand book

In the above table shows all the pertinent growth of the money supply, WPI price inflation, income, interest rate and their inter-state variation of income velocity of GDP at MP with m1 and m3 of money supply in the economy as per the data of the year from 1970 to 2016. Over the entire period of combined growth in WPI inflation and real GDP at market price comes to 7.27 percent in averages where 5.22 percent in GDP at market price, that's why there is a close to the growth rate. Thus the growth of GDP at market price and WPI Price inflation together influence the growth of money supply in India. The variation of M1 (22.71percent) is increase heavily than the M2 (11.03percent), they together influence the inflation in India. In Indian context it shows that growth on money supply is the most part of the increase in price level and real GDP. In Long period there is a proportional relationship between the growth of money supply and combined growth in price level and real GDP.

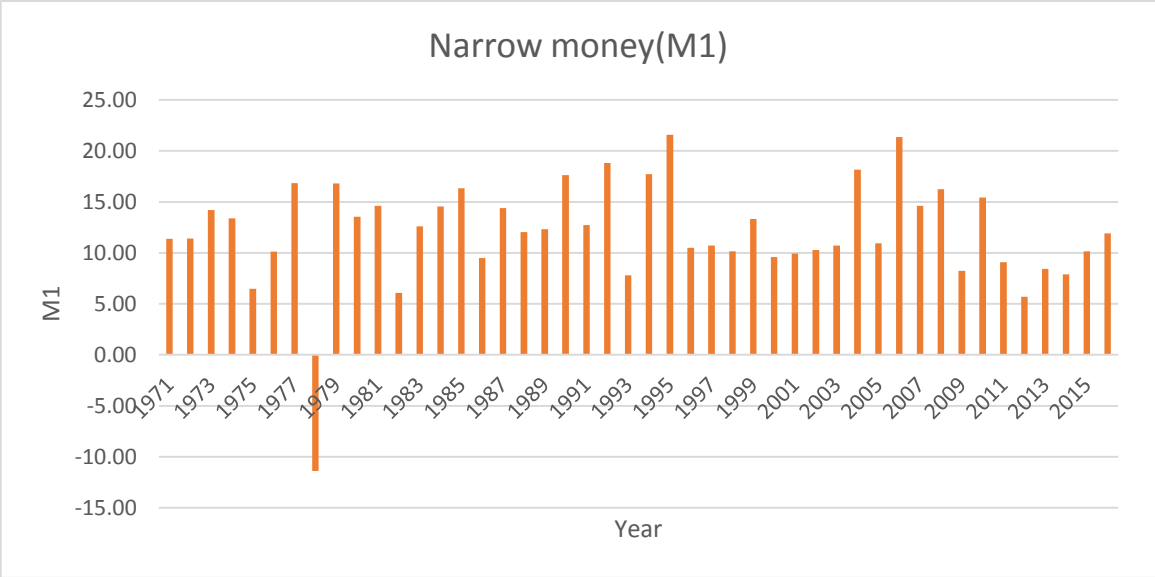
Figure No: 4.1.1Growth rate GDP at MP



Source : Own calculation

In the above figure the GDP at MP in constant prices at the period from 1970-71 to 2015-16 with analyzing of others.During the period 1978-80(-5.53), M3 was (15.06) and WPI inflation is zero, positive in M3 and negative in M1 and the real GDP was close to 7 percent. In that year there was a close relationship between M1 measure of money supply and price level and real national income. In the year 2015-16 there is a drastic change in the GDP at MP(7.3), M1 is (11.92),M3 is (9.19), WPI is (-2.5) it is due to WPI inflation carried out of the growth of money supply M1 and real national income. It has been argued that in case of India the over all inflation is due to increase in the price of food , which in turn shortage of food resulting droughts, floods, low agricultural productivity, heavy population pressure etc.In that contrary the inflation can go up.

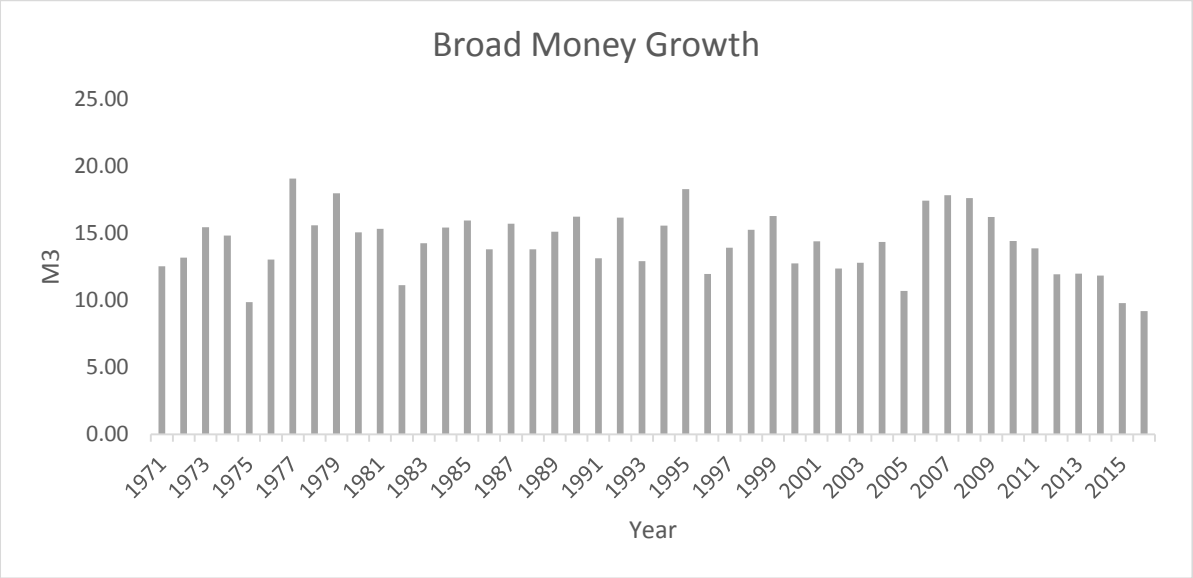
Figure No: 4.1.2 Growth Rate of Narrow Money



Source: Own calculation

In the above figure shows the M1 growth in the country in the year from 1970-71 to 2015-16. It includes only the liquid assets like currency in circulation, notes, and coins in the hands of public. There is proportional relationship between M1 growth and combined growth of WPI and real GDP. Now the position of M1 is 11.92 due to increase in the market needy , financial transaction, inter- national trade to rapid the economic growth one . It is increasing per year by year due to OMO,credit structure of the govt, balancing the situation, current deficit etc.

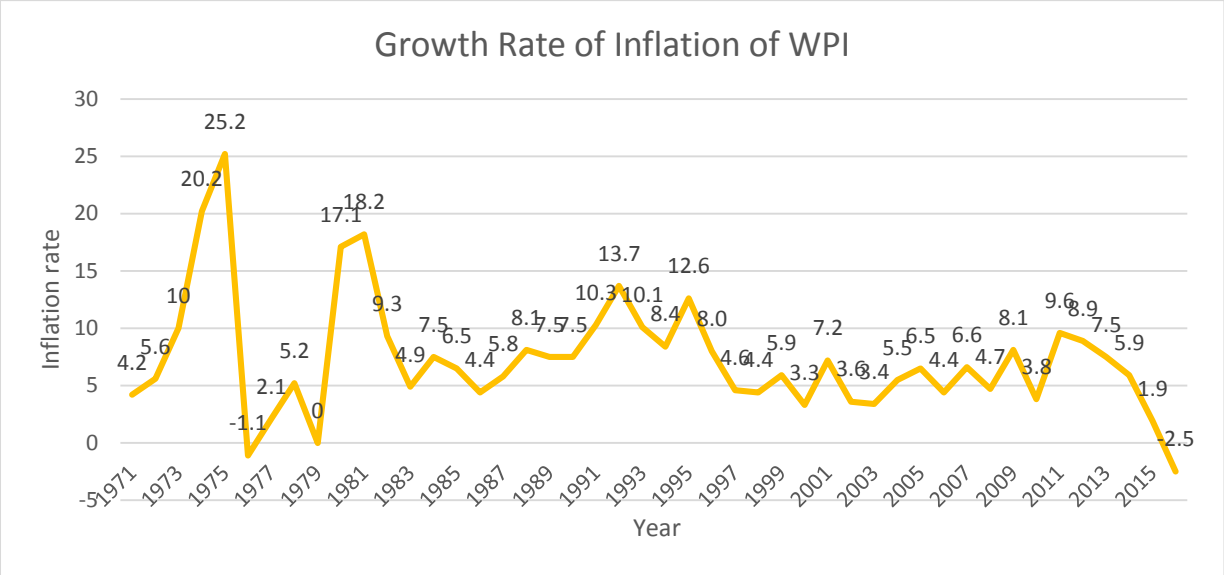
Figure No:4.1.3 Growth Rate of Broad Money



Source :Own calculation

In the above shown figure which indicates that the broad money includes a set of less liquid assets like term deposites with the banks. In the year 1978-79 witnessed an M3 growth was positive and considerable like 19.5 percent. In the same way the WPI inflation appears to have whole effect on increase in the money supply. It was true that due to oil price hikes and also saw a substantial increase in the money supply. Growth of money supply was very large, while the price level was half or one third of it. It is due to the deficit financing by the govt, during the post independence period,which was leading to substantial growth of money supply and price level in the economy. The money supply momentum continued, when the price level slowed down to 6.7 percent in annual averages in terms against 8.3 percent in previous.It shows there is positive association with inflation in India.

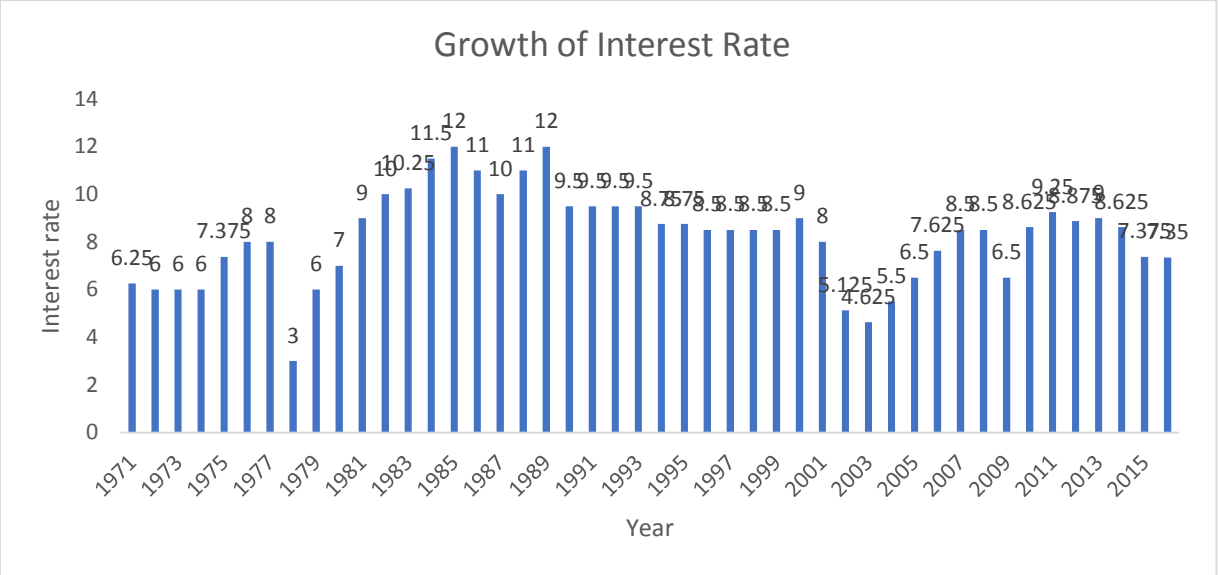
Figure No: 4.1.4 Growth Rate of WPI Inflation



Source:Own Calculation

In the above figure shows the WPI Price inflation rate of India is going to turn a great assessment of monetary policy, which shows that there has been large sucessful meeting of its key objectives in the post-reform period. Just as like as 1990s witnessed a fall has closed to the 5 percent per annum in the decade gone by, notably lower than that of 8 percent in the previous four decades. It shows there is a structural reforms with improved monetary–fiscal interface and reform in the govt securities markets with better monetary managemant as key role to stabilize the inflation, tolerance in the economy has come down. Another thing is that there is a huge international crude oil prices remains low and also the inflation remains stable.Since the inflation are a key determinant of actual inflation out come, the lags of monetary transmission is taking pre-emptive actions to keep the inflation expections stable. Some other factors are like increased competition, productivity gains, and strong corporate balance is also contributed to low and stable inflation environment, and the monetary measures take a substantial role to play in the same level.

Figure No:4.1.5 Growth Rate of Interest rate

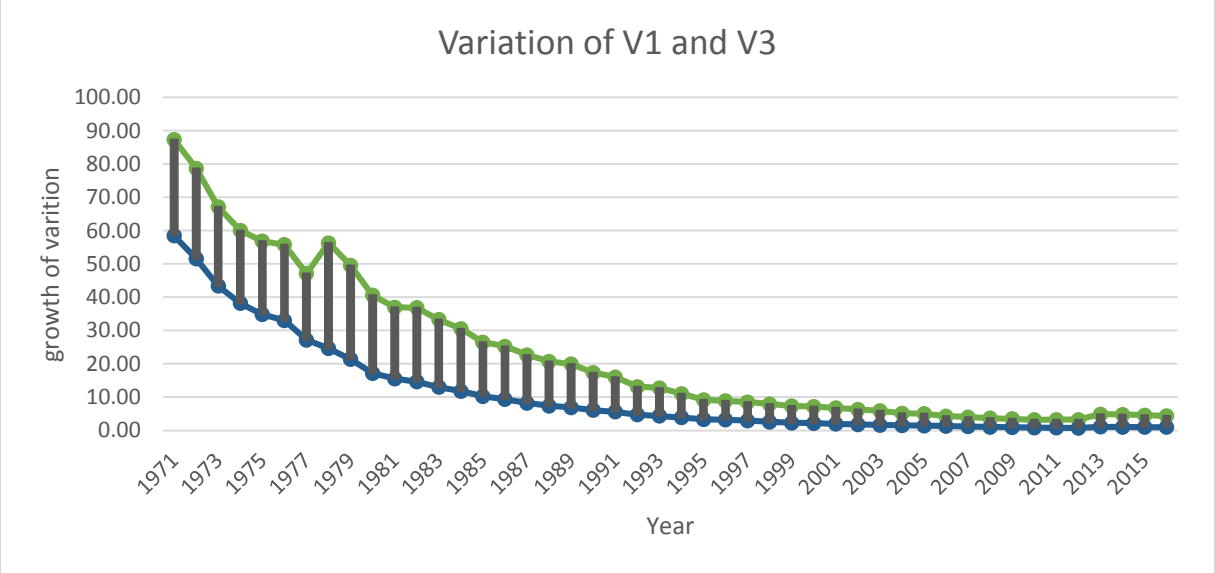


Source : Own Calculation

In the above figure shows the real growth of interest rate structure of banks is totally determined in the market, the major factor is that the interest rate influenced the decline the inflation rate in the recent period.In year to year it is fluctuations, which has been distincts downward in the inflation rate during the period of 1990s. The WPI on an average basis has declined from an about 10.5 percent per annum between 1990 to 1995 to about 5 percent per annum over the last year. In the same trend also happening in the context of interest rate that has to be decline. The yield on the rate of interest rate on the year 1980 to 1990 it was always 11.5 percent whare as in post reforms period it was drastically changed like always 8 to 9 percent. The banks have already reduced their deposite rates. The term deposite rates of public sector banks have declined their one year maturity from the range of 8-10 percent and now it is jost to 6-8 percent. The fall in the interest rate in the recent period is consonance with the monetary policy with the soft and flexible interest rate. It has a impact of both inflation and money supply in the economy.

The velocity of money is the central place in this theory, which is seek to influence the money supply, price level, and income. In past figure shown that not only the broad money(M3),narrow money(M1) influence the price level and real national income but also the reason is that the decline in the velocity of money for both the broad money and narrow money of money supply.

Figure No 4.1.6 Variation of Money



Source: Own calculation

It can be seen that there is sharp decline in the velocity of money in the year 1970-71 was V1 (87.39) where as V3(58.47) and in same consideration of the year 2015-16 it is V1(4.35) where as V3(0.97). The important factor of India is recognized that there is a decline in income velocity of money is due to increase in the degree of monetisation as a necessary part or result of progressive widening use of the money in the economy, which is influence for the negative on the velocity of money. It is actually true fact because of the post- bank nationalization period and rapid growth of branch expansion and deposit mobilization or active service in the economy

4.5 Money Supply and Alternative Indicators of Inflation

Now the manipulation of the relationship between the changes in money supply ,WPI inflation and GDP at MP and establish that there is a increase in the price level, defined the money supply in India**.**

Over the entire period of from 1970 to 2016 the annual average combined growth in WPI and GDP at market price is 7.8%. This table is showing all WPI and GDP at MP which is closely acquinted with the growth of money supply in the economy.

In case like India the growth of money supply is an important part of the growth of price level and real GDP. Over a long period there is a proportional relationship between the growth of money supply and combined growth in price level and real GDP. The larger part is the real GDP.To qoute by C.Rangarajan, the Former governer of RBI " Money has an impact on both prices and output. The process of money creation is a process of credit creation. Money comes in to existence because credit is given either to the Govt. or the private sector or the foreign sector, since credit facilities is the production process, it has favourable impact on output. But in the same manner , the increased in money supply raises the demand with an upward pressure on prices." The growth of money supply is due to the price level rather than the output. In the over the period of time, money supply and price level are positively co-related. How ever in the short run that is break down because on the account of the transmission of lags of changes in money supply, which can be long and variable. In Indian context the principal evidence shows that there is a full impact of changes in money supply on inflation rate can take long time, now it is increasing, the working group of Money supply (1998) set up by the RBI studied on this like inflation in India is reasonably influenced by money supply in the short run and prices effect in short run and deviate from long run on account of supply shocks .

CHAPTER- V

RESULTS AND DISSCUSSIONS

5.1 Results and Discussions

The VECM model of inflation rate in India measured by WPI Price inflation is being illustrated in following manner**.**

Model -1: $INFL = \beta_1 M1 + \beta_2 R + \beta_3 YG + \varepsilon$ …….. (1)

TABLE 5.1 – Descriptive Statistics

	INFL	M1	M3	R	V1	V3	YG
4 Mean	7.273913	12.06094	14.26130	8.235870	22.70865	11.03167	5.223950
Median	6.500000	11.96890	14.36992	8.500000	11.89917	4.104783	5.540870
Maximum	25.20000	21.57502	19.08139	12.00000	87.38663	58.47450	9.305246
Minimum	-2.500000	-11.37059	9.188179	3.000000	3.216914	0.762787	-5.527630
Std. Dev.	5.198694	5.206156	2.332289	1.928159	22.74536	14.56688	2.798301
Skewness	1.294952	-1.724849	-0.119998	-0.295475	1.198688	1.742997	-1.377007
Kurtosis	5.510459	10.19600	2.556104	3.105131	3.408408	5.182449	6.154124
Jarqu-Bera	24.93584	122.0588	0.488064	0.690528	11.33557	32.42088	33.60509
Probability	0.000004	0.000000	0.783463	0.708033	0.003456	0.000000	0.000000
Sum	334.6000	554.8033	656.0199	378.8500	1044.598	507.4567	240.3017
SumSq.De	1216.189	1219.683	244.7808	167.3008	23280.81	9548.731	352.3719
Obsern	46	46	46	46	46	46	46

Looking to this descriptive statistics table, it can be inferred that most of the variables considered for the analysis are normal as suggested by the Jarque-Bera test.

Table No. 5.2 Correlation Matrix

Covariance							
Prob	INFL	M1	M3	R	V1	V3	Y
INFL	26.43888						

M1	-10623.42**	49175434					
	0.0469	-----					
M3	-45653.45**	2.14E+08*	9.46E+08				
	0.0517	0.0000	-----				
R	0.775338	-1007.795	-4018.424	3.636974			
	0.6014	0.6187	0.6510	-----			
V1	23.80209	-86880.00*	-349715.8*	-11.50645	506.1045		
	0.1701	0.0001	0.0003	0.0715	-----		
V3	14.47946	-47447.95*	-190832.0*	-8.975085**	316.9340*	207.5811	
	0.1930	0.0010	0.0028	0.0267	0.0000	-----	
YG	-43804.48**	1.83E+08*	8.10E+08*	-2902.378	-333679.8*	-186068.5*	7.17E+08
	0.0312	0.0000	0.0000	0.7076	0.0001	0.0007	-----

***, ****Denotes 1% and 5% significant level respectively.

The above table deals with correlation matrix. Looking to the raw data, there is significant correlation among INFL, M1, M3 and YG while R is negatively correlated with V3. Growth rate of GDP is negatively correlated with INFL, V1 and V3 while positively correlated with M1 and M3. There isn't any significant correlation found between R and YG.

Table No. 5.3 Unit Root Test at Level

Variables	ADF Test at Level		PP Test at Level		KPSS Test at Level	
	C	C & T	C	C & T	C	C & T
INFL	-4.365840* (0.0011)	-5.349041* (0.0004)	-4.288609* (0.0014)	-4.568486* (0.0035)	0.370676* (3)	0.089474* (9)
M1	-7.724984* (0.0000)	-7.638131* (0.0000)	-7.663630* (0.0000)	-7.583549* (0.0000)	0.128245* (2)	0.122668* (2)
M3	-4.604086* (0.0005)	-4.828818* (0.0017)	-4.613702* (0.0005)	-4.802984* (0.0018)	0.222720* (2)	0.102685* (2)
R	-2.524809 (0.1165)	-2.473158 (0.3393)	-2.494553 (0.1235)	-2.400936 (0.3742)	0.129486* (5)	0.132308*(5)
V1	-3.505766** (0.0128)	-1.652321 (0.7545)	-8.109608* (0.0000)	-3.670073** (0.03491)	0.780953 (5)	0.232996 (5)
V3	-6.448097* (0.0000)	-5.591960* (0.0002)	-68.08073* (0.0001)	-39.31021* (0.0000)	0.701906*(5)	0.211954* (5)
YG	-5.908045* (0.0000)	-8.013172* (0.0000)	-6.016459* (0.0000)	-9.468926* (0.0000)	0.797212(4)	0.091049*(7)

Cointegration Analysis for first equation.

Following Engle and Granger (1987), the estimated co-integrating regression for the level series (growth rate of Wholesale Price Index) is given below. The following table provides results. The constant is significant at 5 % level. Only Growth rate of GDP –YG is significantly.

Table No. 5.4 Cointegration analysis

Dependent Variables	Independent Variables			
	CONSTANT	YG	R	M1
INFL	8.62593 ** (3.34185) (0.0134)	−0.870855* (0.259695) (0.0017)	0.487888 (0.392914) (0.2212)	−0.0680623 (−0.4741) (0.6379)
	R^2 = 0.216 Adj. R^2 = 0.160 D.W. = 1.341			

***, ****Denotes 1% and 5% significant level respectively.

The ADF test for the residuals is stationary

The following table provides the possible lag length to be appropriate for the above mention equation. As per the all of the criteria, one lag is appropriate to estimate VAR for this model.

Table No 5.5 ADF Test In First Equation for residuals

VAR Lag Order Selection Criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-435.1841	NA	14215.02	20.91353	21.07902	20.97419
1	-397.4986	66.39820*	5084.313*	19.88089*	20.70835*	20.18418*
2	-383.9354	21.31354	5839.520	19.99693	21.48636	20.54286
3	-375.6137	11.49195	8910.689	20.36256	22.51396	21.15113
4	-363.4203	14.51596	11954.53	20.54382	23.35719	21.57503
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						

FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Following Johansen (1988), the Johansen test of co-integration for the level series of the growth rate of WPI has been given in the below table.

Johansen test Cointegration for Growth rate of WPI (Level Series)

Table No 5.6 Johansen test Cointegration

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.590176	82.91535	63.87610	0.0006
At most 1 *	0.413829	43.66617	42.91525	0.0420
At most 2	0.264450	20.16385	25.87211	0.2177
At most 3	0.140266	6.649819	12.51798	0.3825
Trace test indicates 2 cointegration eqn (s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The values of the trace test indicate that there are two cointegration vectors in this estimated VAR. While the below table provides information on λ Max Eigenvalue test for number of co-integration in the equation. It suggests only one co-integration equation. As there has been contradictory results been found for both of the tests, the thumb rule is applied and that is the test which suggests higher co-integration equation has to be considered.

Table No 5.7 Johansen test Co-integration for Growth rate of WPI (Level Series)

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.590176	39.24918	32.11832	0.0057
At most 1	0.413829	23.50231	25.82321	0.0983
At most 2	0.264450	13.51404	19.38704	0.2883
At most 3	0.140266	6.649819	12.51798	0.3825
Max-eigenvalue test indicates 1 cointegration eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Analysis of VECM for First Model Specification:

After having confirmed with the numbers of cointegration equation in the model, the estimates of VECM are discussed in the following four equations.

Table No 5.8 VECM for First equation Model

Dependent Variables	Independent Variables						
	ECT-1	ECT-2	Δ(INFL(-1))	Δ (M1(-1))	Δ (R(-1))	Δ(YG(-1))	CONSTANT
ΔINFL	-0.955229* (0.0000)	0.218624** (0.0212)	0.355247** (0.0240)	0.153979 (0.2113)	0.152382 (0.7918)	0.183148 (0.5247)	-0.172863 (0.7851)
	R^2 = 0.577989 Adj. R^2 = 0.509555 D.W. = 2.004537						
Dependent Variables	Independent Variables						
	ECT-1	ECT-2	Δ(INFL(-1))	Δ (M1(-1))	Δ (R(-1))	Δ(YG(-1))	CONSTANT

ΔM1	0.060415 (0.8443)	-0.066986 (0.6397)	-0.345832 (0.1464)	-0.561871** (0.0031)	-0.71175 (0.4180)	-0.155133 (0.7230)	0.002810 (0.9977)
	R^2 = 0.468640 Adj. R^2 = 0.382474 D.W. = 2.141063						
Dependent Variables	Independent Variables						
	ECT-1	ECT-2	Δ(INFL(-1))	Δ (M1(-1))	Δ (R(-1))	Δ(YG(-1))	CONSTANT
ΔR	0.056555 (0.3991)	-0.005994 (0.8475)	0.012431 (0.8100)	-0.005588 (0.8908)	-0.070682 (0.7117)	0.077556 (0.4164)	0.029723 (0.8874)
	R^2 = 0.099063 Adj. R^2 = -0.047035 D.W. = 2.003659						
Dependent Variables	Independent Variables						
	ECT-1	ECT-2	Δ(INFL(-1))	Δ (M1(-1))	Δ (R(-1))	Δ (YG(-1))	CONSTANT
ΔYG	-0.005139 (0.9615)	0.200851* (0.0001)	0.004323 (0.9580)	-0.211783* (0.0013)	0.156571 (0.6066)	0.144109 (0.3423)	0.107383 (0.7477)
	R^2 = 0.709055 Adj. R^2 = 0.661875D.W. = 1.979418						

***, ****Denotes 1% and 5% significant level respectively.

The above table contains both of the co-integrated estimated equations. In first equation growth of the WPI in the current period is associated with its previous period that is its first lag. Along with the first period lag of other variables like M1, R and YG are also estimated. Both of the error terms in the equations are significant but only first error term with negative sign is considered for analysis. Thus it took 95 % adjustment within one year to adjust the error. Lag of the INFL is positively and significantly associated with the dependent variable. In equation two, current period of growth rate of M1 is negatively and significantly associated with its lagged value while other variables in the system are insignificant with no error correction mechanism in the equation.

The third equation is with interest rate as the dependent variable and found no variable significantly associated in the system. The last equation shows the growth rate of GDP as

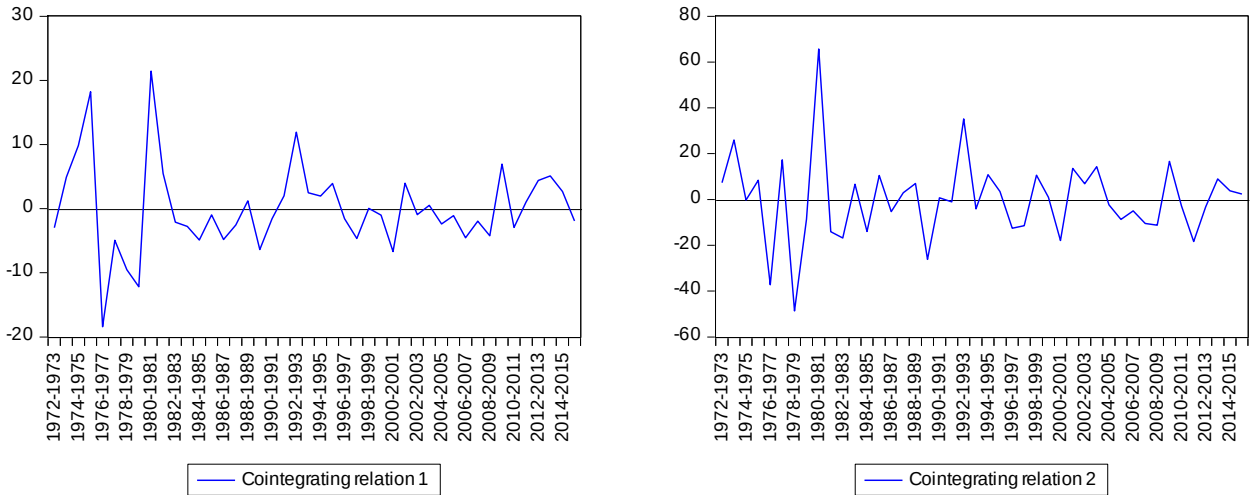
dependent variable and having only negative and significant association with lagged value of M1 with no error correction mechanism.

Though, there have been two co-integrating equations, but only single equations shows appropriate error correction mechanism in the system.

Figure No- 5.1.1: First Equation VECM First Model

The above estimated residuals graph provide enough indication that most of the estimated residuals are approaching to zero except in the case of INFL.

Figure No 5.1.2 Cointegration



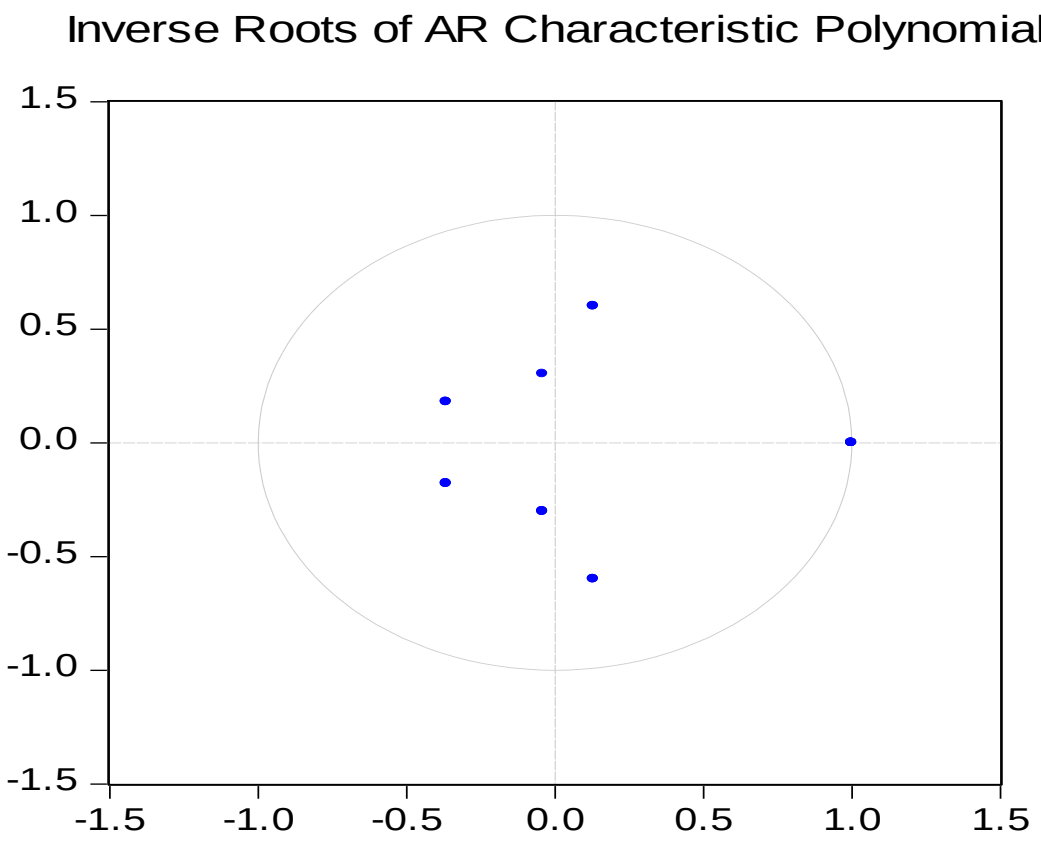
Both of the cointegration relationship showed equilibrium approach with quite stable relations.

Table No 5.9 First Equation Polynomial Test Model

Roots of Characteristic Polynomial	
Endogenous variables: INFL M1 R YG	
Root	Modulus
1.000000	1.000000
1.000000	1.000000
0.130314 - 0.599434i	0.613436
0.130314 + 0.599434i	0.613436
-0.364912 - 0.178621i	0.406284
-0.364912 + 0.178621i	0.406284
-0.040181 - 0.302191i	0.304850
-0.040181 + 0.302191i	0.304850
VEC specification imposes 2 unit root(s).	

The above table provides the roots of characteristic polynomial of the variables of the level series are given where it confirmed 2 cointegration relations and others are less than on and all lie inside the circle which is plotted in following figure.

Figure No -5.1.3: Inverse Roots of AR Characteristic polynomial



All the roots lay inside the circle and 2 roots are equal to 1 and others are less than one, therefore, variables are co-integrated in the order of CI (2,2).

Diagnostic Testing

Table no- 5.10 First Equation Autocorrelation Model (X^2 Distribution):

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	Df
1	1.703965	NA*	1.743592	NA*	NA*
2	11.91422	0.9916	12.44005	0.9884	26

3	27.50871	0.9588	29.17560	0.9331	42
4	35.06408	0.9926	37.48650	0.9833	58
5	52.57836	0.9720	57.24621	0.9253	74
6	63.33085	0.9852	69.69646	0.9446	90
7	77.88937	0.9816	87.00930	0.9107	106
8	84.52277	0.9961	95.11678	0.9659	122
9	89.77535	0.9995	101.7200	0.9911	138
10	104.4913	0.9992	120.7643	0.9779	154

The above table provides diagnostic test –autocorrelation for the residual. It deals with Q statistics and Adjusted Q- statistics with their respective probabilities. And it shows that residuals are not suffering from the problem of the autocorrelation as the Ho = NO residual autocorrelation up to lag h cannot be rejected as per the VEC residual Portmanteau test.

Table No 5.11 First Equation VECM Residual Serial Correlation LM Test

Lags	LM-Stat	Prob
1	9.128473	0.9080
2	13.85990	0.6092
3	20.30596	0.2068
4	9.041435	0.9117
5	16.99197	0.3861
6	11.19127	0.7975
7	17.40909	0.3596
8	6.957486	0.9741
9	5.352296	0.9937

10	14.77641	0.5411

The table above is the serial correlation LM test showed the values of LM statistics for Lags 1 to 10 and all are insignificant. Thus the null hypothesis Ho= No serial Correlation cannot be rejected. Thus residuals are free from the serial correlation.

Table no 5.12 first Equation Normality Test of Skewness

Component	Skewness	Chi-sq	Df	Prob.
1	0.151735	0.213006	1	0.6444
2	-0.415215	1.525186	1	0.2168
3	-1.066252	8.086511	1	0.0045
4	0.005528	0.000285	1	0.9865
Joint		9.824989	4	0.0435

Table no 5.13 first Equation Normality of Kurtosis

Component	Kurtosis	Chi-sq	df	Prob.
1	3.840337	4.223126	1	0.0399
2	3.752802	2.075641	1	0.1497
3	4.212229	1.064290	1	0.3022
4	2.631003	0.008690	1	0.9257
Joint		7.371747	4	0.1175

Table No- 5.14 first Equation Jarque- Bera Test

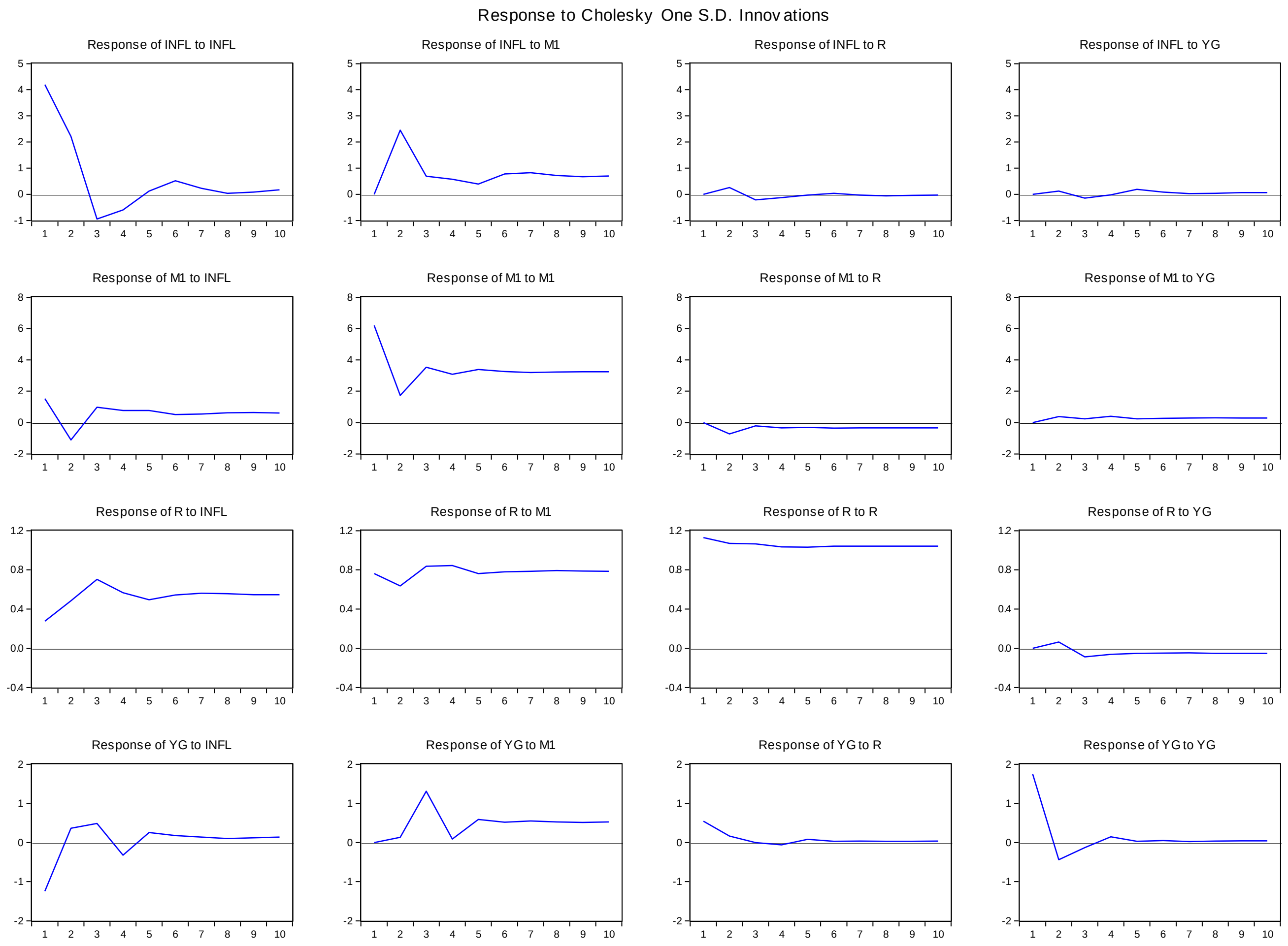
Component	Jarque-Bera	df	Prob.
1	4.436132	2	0.1088

2	3.600827	2	0.1652
3	9.150801	2	0.0103
4	0.008975	2	0.9955
Joint	17.19674	8	0.0281

The normality test has been performed using Orthogonalisation of Residual correlation (Doornik-Hansen). The orthohogonalised residuals are obtained by a principal component decomposition of the original residual correlation. The orthogonalised residuals are uncorrelated by construction and independent under the assumption of normality. The Skewness, Chi-square and Kurtosis with their joint probability have been tested. The null hypothesis H_o- Residuals are multivariate normal, cannot be rejected.

The impulse response functions are given in the below figure. There are stable as well as unstable functions can be seen in the figure. Those of the functions which are not coming to zero i.e. diverting from zero are termed as unstable. INFL to INFL, INFL to R, INFL to YG, M1 to INFL, M1 to R, M1 to YG, YG to INFL, YG to R and YG to YG are the stable impulse responses can be seen in the figure.

Figure No 5.1.4 The Impulse Response Function of first equation



5.2 Some Implications

Looking to the econometric techniques used and the results derived. It can be inferred based on that INFL in India is highly influenced by the growth rate of GDP along with Lagged value of inflation growth rate based on WPI.

Model 2: Second Equation Model

INFL= β_1 M3 + β_2 R + β_3 YG +ε …………………………………………….. (2)

Cointegration Analysis for Second equation.

Following Engle and Granger (1987), the estimated cointegration regression for the level series (growth rate of Wholesale Price Index) is given below.

Table No 5.15 Cointegration Analysis of second Equation

Dependent Variables	Independent Variables			
	CONSTANT	YG	R	M3
INFL	9.57056*** (1.814) (0.0769)	−0.863407* (−3.332) (0.0018)	0.443799 (1.178) (0.2453)	−0.101065 (−0.3288) (0.7439)
	R^2 = 0.214 Adj. R^2 = 0.157 D.W. = 1.386			

Lag Length Criteria.

The following table provides the possible lag length to be appropriate for the above mention equation. As per the all of the criteria, one lag is appropriate to estimate VAR for this model.

Table No 5.16 Equation of Second Lag length Selection in

VAR Lag Order Selection Criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-403.3250	NA	3118.027	19.39643	19.56192	19.45709
1	-370.7056	57.47233*	1419.495*	18.60503*	19.43249*	18.90832*
2	-358.0987	19.81074	1706.303	18.76661	20.25604	19.31254
3	-347.0790	15.21774	2289.782	19.00376	21.15516	19.79233
4	-336.3281	12.79867	3290.392	19.25372	22.06709	20.28493
* indicates lag order selected by the criterion						

LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Johansen test Cointegration for Growth rate of WPI (Level Series) Trace Statistics

Table No 5.17 Model Second Equation

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.564320	78.30439	63.87610	0.0019
At most 1	0.432069	41.74706	42.91525	0.0652
At most 2	0.186614	16.85383	25.87211	0.4260
At most 3	0.161795	7.765654	12.51798	0.2714
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Johansen test Cointegration for Growth rate of WPI (Level Series) Maximum Eigenvalue

Table No.5.18 Statistics Second equation model

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**

None *	0.564320	36.55733	32.11832	0.0134
At most 1	0.432069	24.89323	25.82321	0.0660
At most 2	0.186614	9.088172	19.38704	0.7154
At most 3	0.161795	7.765654	12.51798	0.2714
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Analysis of VECM for Second Model Specification:

After having confirmed with the numbers of cointegration equation in the model, the estimates of VECM are discussed in the following four equations.

Table No 5.19 Second Equation Model Specification

Dependent Variables	Independent Variables					
	ECT-1	Δ(INFL(-1))	Δ (M3(-1))	Δ (R(-1))	Δ (YG(-1))	CONSTANT
ΔINFL	- 0.204940*** (0.0806)	-0.248926 (0.1276)	0.478495 (0.1756)	0.428136 (0.5028)	0.331077 (0.3953)	-0.192146 (0.8184)
	R^2 = 0.245603 Adj. R^2 = 0.146341 D.W. = 2.086294					
Dependent Variables	Independent Variables					
	ECT-1	Δ(INFL(-1))	Δ (M3(-1))	Δ (R(-1))	Δ (YG(-1))	CONSTANT
ΔM3	0.054127 (0.2498)	-0.236832* (0.0004)	-- 0.401373* (0.0051)	0.031960 (0.9009)	-0.293145*** (0.0624)	-0.116623 (0.7289)
	R^2 = 0.434765 Adj. R^2 = 0.360392 D.W. = 2.286489					
Dependent Variables	Independent Variables					
	ECT-1	Δ(INFL(-1))	Δ (M1(-1))	Δ (R(-1))	Δ (YG(-1))	CONSTANT

ΔR	-0.017227 (0.5460)	0.037417 (0.3474)	-0.137257 (0.1122)	-0.021942 (0.8881)	0.113136 (0.2350)	0.019887 (0.9225)
	R^2 = 0.124133 Adj. R^2 = 0.008888 D.W. = 2.112057					
Dependent Variables	Independent Variables					
	ECT-1	Δ(INFL(-1))	Δ (M1(-1))	Δ (R(-1))	Δ (YG(-1))	CONSTANT
ΔYG	-0.164078* (0.0067)	0.181525** (0.0307)	-0.297192 (0.1009)	0.091272 (0.7802)	0.049592 (0.8034)	0.109618 (0.7981)
	R^2 = 0.508098 Adj. R^2 = 0.443375 D.W. = 2.023646					

***, ****Denotes 1% and 5% significant level respectively.

Figure No. 5.1.5 Graphs of Residuals

Figure No. 5.1.6 Cointegration Graph

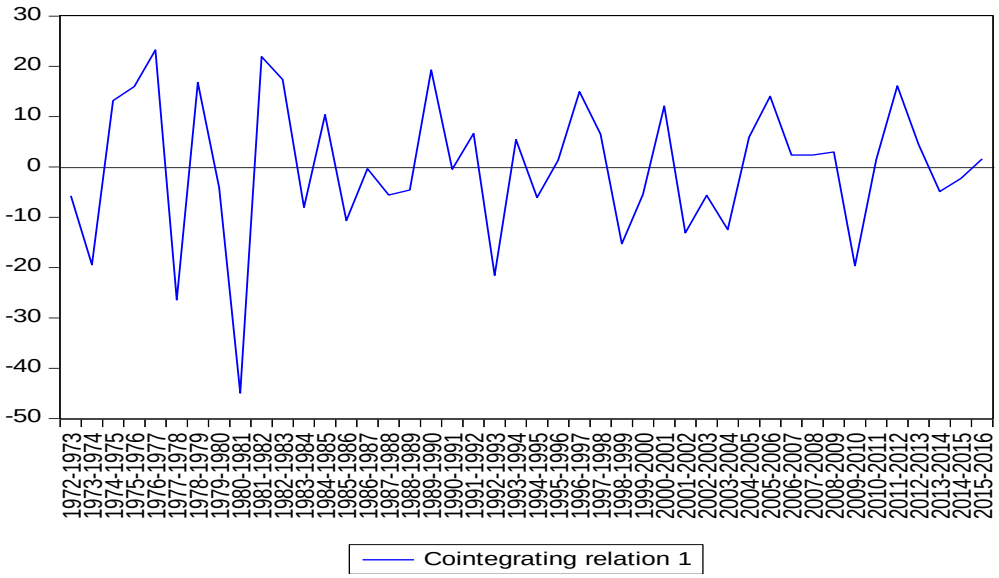
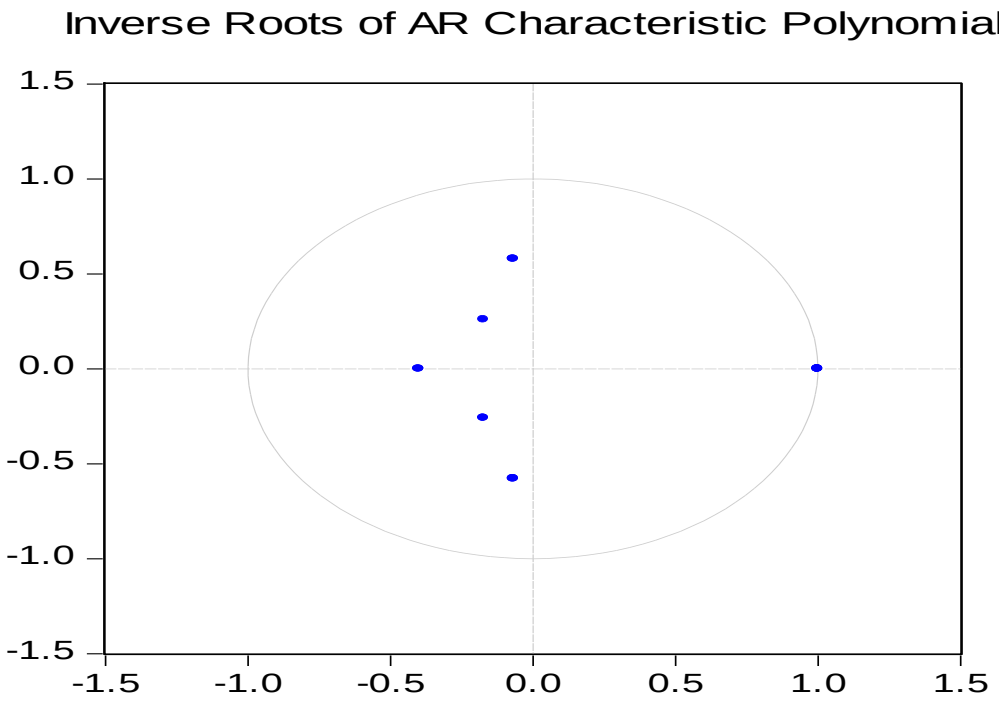


Table No. 5.20 Second Equation polynomial characteristics

Roots of Characteristic Polynomial	
Root	Modulus
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
-0.068643 - 0.578747i	0.582803
-0.068643 + 0.578747i	0.582803
-0.399743	0.399743
-0.172461 - 0.258937i	0.311112
-0.172461 + 0.258937i	0.311112
VEC specification imposes 3 unit root(s).	

Figure No .5.1.7



Diagnostic Testing

Table No. 5.21 Second Equation Autocorrelation (X^2 Distribution)

VEC Residual Portmanteau Tests for Autocorrelations					
Null Hypothesis: no residual autocorrelations up to lag h					
Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	Df
1	5.283087	NA*	5.405950	NA*	NA*
2	22.98032	0.7774	23.94591	0.7316	29
3	40.75742	0.6522	43.02377	0.5560	45
4	55.98323	0.6578	59.77216	0.5205	61
5	73.31397	0.5979	79.32480	0.4055	77
6	82.92405	0.7636	90.45226	0.5555	93
7	93.96586	0.8470	103.5831	0.6285	109
8	101.2883	0.9411	112.5327	0.7805	125
9	112.4836	0.9631	126.6067	0.8018	141
10	125.8277	0.9681	143.8756	0.7656	157
*The test is valid only for lags larger than the VAR lag order.					
df is degrees of freedom for (approximate) chi-square distribution					

Table NO. 5.22 Second Equation VECM Residual Serial Correlation LM Test

VEC Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order h		
Lags	LM-Stat	Prob
1	22.02215	0.1425
2	18.35130	0.3037
3	19.48372	0.2444
4	17.08290	0.3803
5	16.79411	0.3990
6	10.40129	0.8448
7	11.54609	0.7746
8	7.120935	0.9709
9	10.97175	0.8112
10	13.27225	0.6528
Probs from chi-square with 16 df.		

Table No. 5.23 Second Equation Normality Test for Skewness

Component	Skewness	Chi-sq	Df	Prob.
1	-0.651159	3.508255	1	0.0611
2	0.091283	.077449	1	0.7808
3	-0.921455	6.385168	1	0.0115
4	-1.053308	7.931352	1	0.0049
Joint		17.90222	4	0.0013

Table No. 5.24 Second Equation Normality Test for Kurtosis

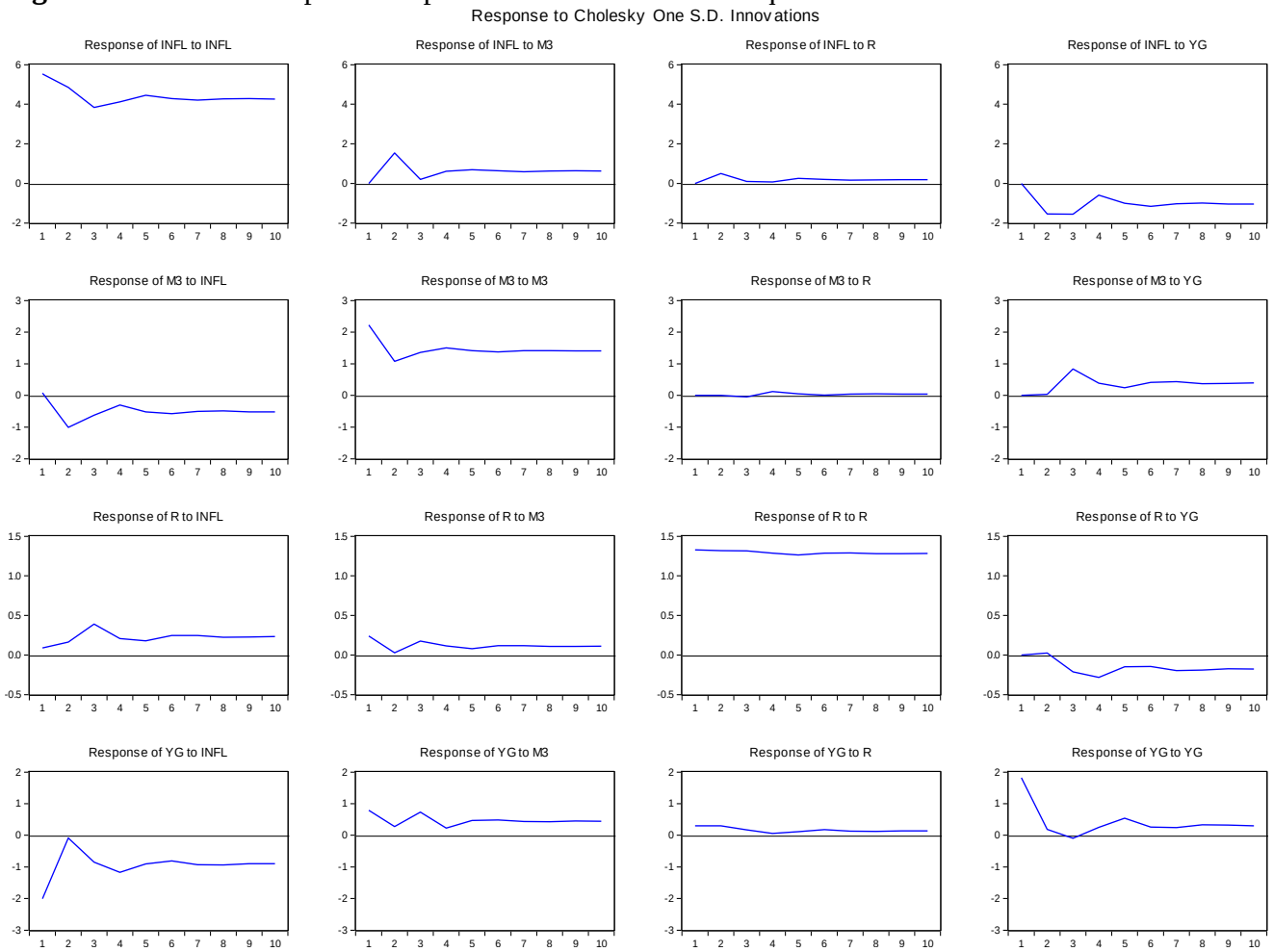
Component	Kurtosis	Chi-sq	Df	Prob.
1	4.774492	4.444069	1	0.0350
2	2.017859	1.974309	1	0.1600
3	4.368377	0.043780	1	0.8343
4	5.415725	0.986900	1	0.3205

Joint		7.449057	4	0.1140

Table No. 25 Second Equation Jarque-Bera Test

Component	Jarque-Bera	Df	Prob.
1	7.952324	2	0.0188
2	2.051757	2	0.3585
3	6.428947	2	0.0402
4	8.918252	2	0.0116
Joint	25.35128	8	0.0014

Figure No.5.1.7 The Impulse Response Function of second equation



Some Implications

Looking to the econometric techniques used and the results derived. It can be inferred based on that inflation in India is highly influenced by the growth rate of GDP along with Lagged value of inflation growth rate based on M3 and interest rate.

Model-3: Third Equation

$INFL = \beta_1 V1 + \beta_2 R + \beta_3 YG + \varepsilon$ …… (3)

Cointegration Analysis for third equation.

Following Engle and Granger (1987), the estimated cointegrating regression for the level series (growth rate of Wholesale Price Index) is given below.

Third equation Cointegration Analysis Table No.5.26

Dependent Variables	Independent Variables			
	CONSTANT	YG	R	V1
INFL	7.44665 *** (1.931) (0.0603)	−0.813430* (−2.856) (0.0066)	0.460129 (1.200) (0.2370)	0.0126389 (0.3529) (0.7259)
	$R^2 = 0.214$ Adj. $R^2 = 0.158$ D.W. = 1.395			

Lag Length Criteria

The following table provides the possible lag length to be appropriate for the above mention equation. As per the all of the criteria, one lag is appropriate to estimate VAR for this model.

Table No 5.27 Third Equation lag length Criteria

VAR Lag Order Selection Criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-482.2985	NA	134000.9	23.15707	23.32257	23.21773
1	-350.9631	231.4006	554.4280	17.66491	18.49237*	17.96820
2	-329.3554	33.95491*	434.1342*	17.39788	18.88731	17.94381*

3	-313.1489	22.38038	455.0894	17.38804	19.53944	18.17662
4	-295.7230	20.74517	475.8886	17.32014*	20.13351	18.35135
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

Table No. 5.28 Johansen test Cointegration for Growth rate of WPI (Level Series) Trace Statistics Third Equation

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.668212	102.1900	63.87610	0.0000
At most 1 *	0.487465	53.64653	42.91525	0.0031
At most 2	0.313588	24.23755	25.87211	0.0788
At most 3	0.160187	7.681364	12.51798	0.2788
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table No. 5.29 Johansen test Cointegration for Growth rate of WPI (Level Series) Maximum Eigenvalue Statistics Third Equation

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.668212	48.54344	32.11832	0.0002
At most 1 *	0.487465	29.40898	25.82321	0.0161
At most 2	0.313588	16.55619	19.38704	0.1230
At most 3	0.160187	7.681364	12.51798	0.2788
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Analysis of VECM for Third Model Specification:

After having confirmed with the numbers of cointegration equation in the model, the estimates of VECM are discussed in the following four equations

Table No. 5.30 Third Equation Model of Analysis of VECM

Dependent Variables	Independent Variables						
	ECT-1	ECT-2	Δ(INFL(-1))	Δ (V1(-1))	Δ (R(-1))	Δ (YG(-1))	CONSTANT
ΔINFL	-0.741130* (0.0000)	-0.157271* (0.0000)	0.094399 (0.5086)	-1.500785* (0.0000)	-0.613487 (0.3098)	0.381873 (0.1999)	-3.003170* (0.0008)
	R^2 = 0. 0.561589 Adj. R^2 = 0.490495 D.W. = 1.976344						
Dependent Variables	Independent Variables						

	ECT-1	ECT-2	Δ(INFL(-1))	Δ (V1(-1))	Δ (R(-1))	Δ (YG(-1))	CONSTANT
ΔV1	-0.125241 (0.2947)	-0.041219** (0.0425)	0.228093** (0.0236)	0.163879 (0.4647)	0.350519 (0.4067)	-0.227680 (0.2744)	-1.368838** (0.0269)
	R^2 = 00.254661 Adj. R^2 = 0.133796 D.W. = 1.866926						
Dependent Variables	Independent Variables						
	ECT-1	ECT-2	Δ(INFL(-1))	Δ (V1(-1))	Δ (R(-1))	Δ (YG(-1))	CONSTANT
ΔR	0.031007 (0.5508)	0.018485** (0.0367)	0.019798 (0.6490)	0.209757** (0.0328)	0.122522 (0.5052)	0.111286 (0.2202)	0.418550 (0.1186)
	R^2 = 0.208246 Adj. R^2 = 0.079854 D.W. = 1.978582						
Dependent Variables	Independent Variables						
	ECT-1	ECT-2	Δ(INFL(-1))	Δ (V1(-1))	Δ (R(-1))	Δ (YG(-1))	CONSTANT
ΔYG	-0.099364 (0.3277)	0.041190** (0.0173)	0.194294** (0.0232)	0.573543* (0.0030)	0.560203 (0.1197)	0.022917 (0.8968)	1.197031** (0.0228)
	R^2 = 0.614711 Adj. R^2 = 0.552232 D.W. = 1.872853						

***, ****Denotes 1% and 5% significant level respectively.

Figure No 5.1.8 Residual

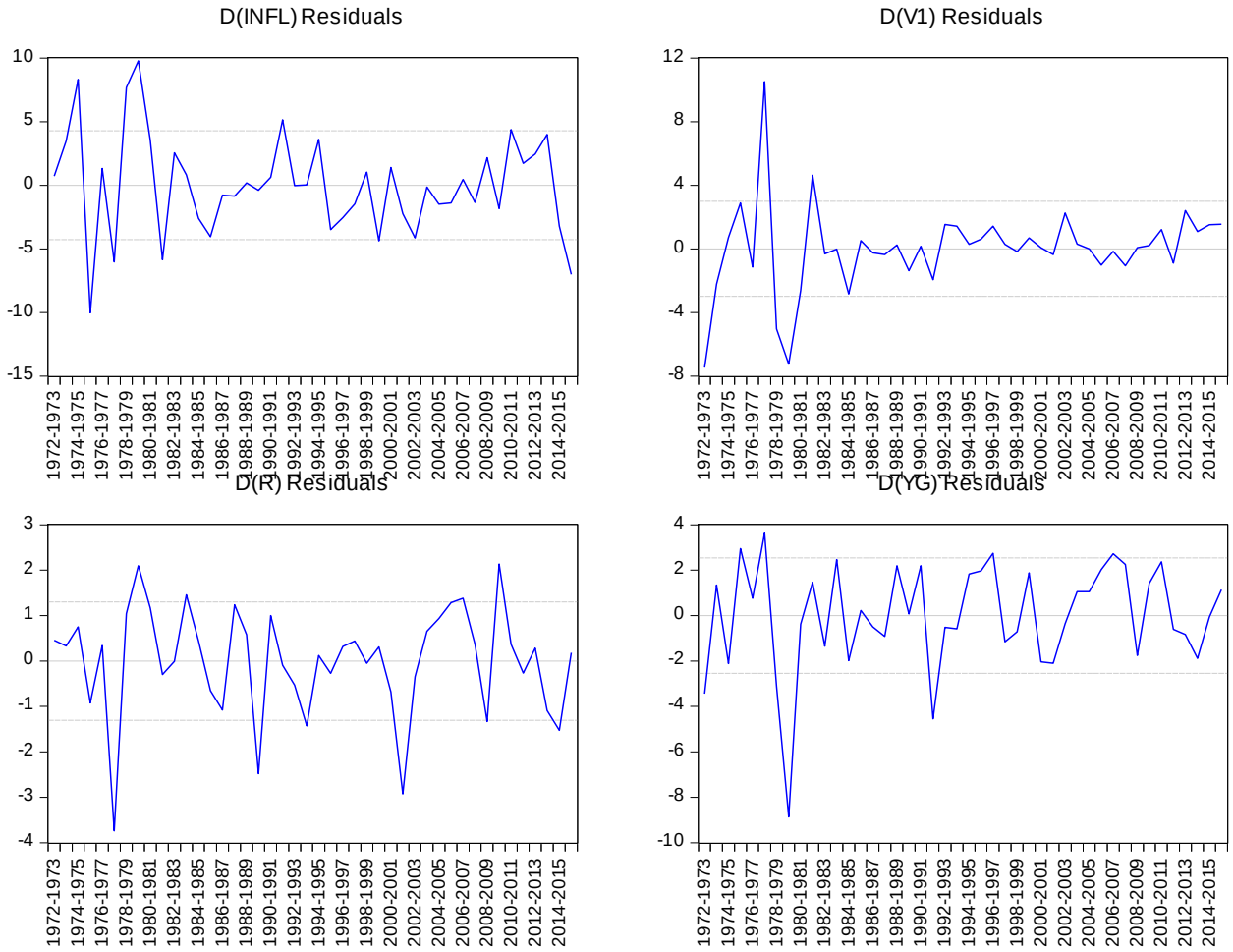


Figure No. 5.1.9 Cointegration Graph

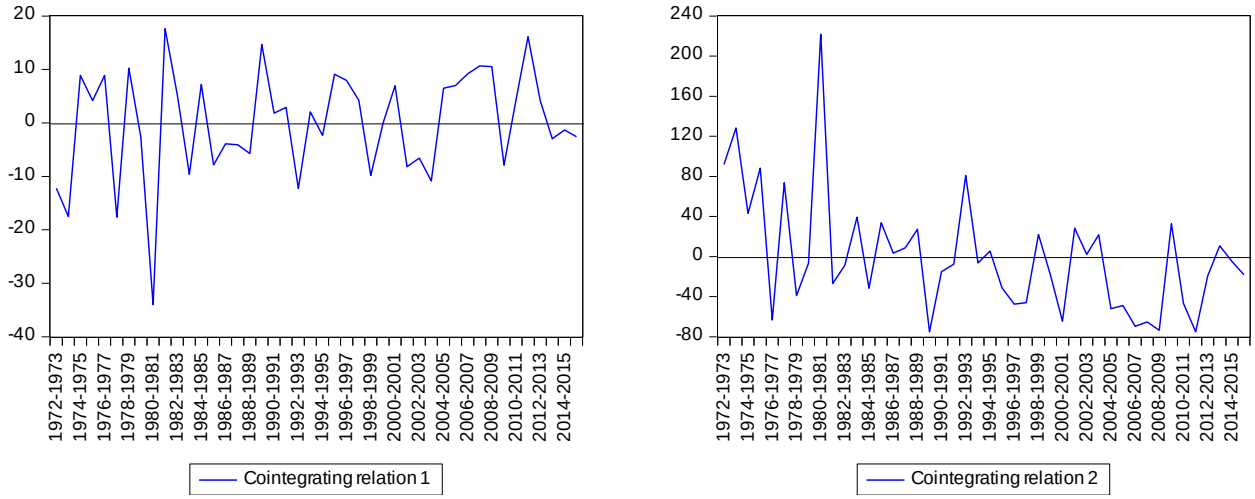


Table No. 5.31 Third Equation polynomial Test

Roots of Characteristic Polynomial	
Root	Modulus
1.000000	1.000000
1.000000	1.000000
0.791477	0.791477
0.112776 - 0.618669i	0.628864
0.112776 + 0.618669i	0.628864
-0.313386 - 0.416530i	0.521256
-0.313386 + 0.416530i	0.521256
-0.045076	0.045076
VEC specification imposes 2 unit root(s).	

Figure No .5.1.10

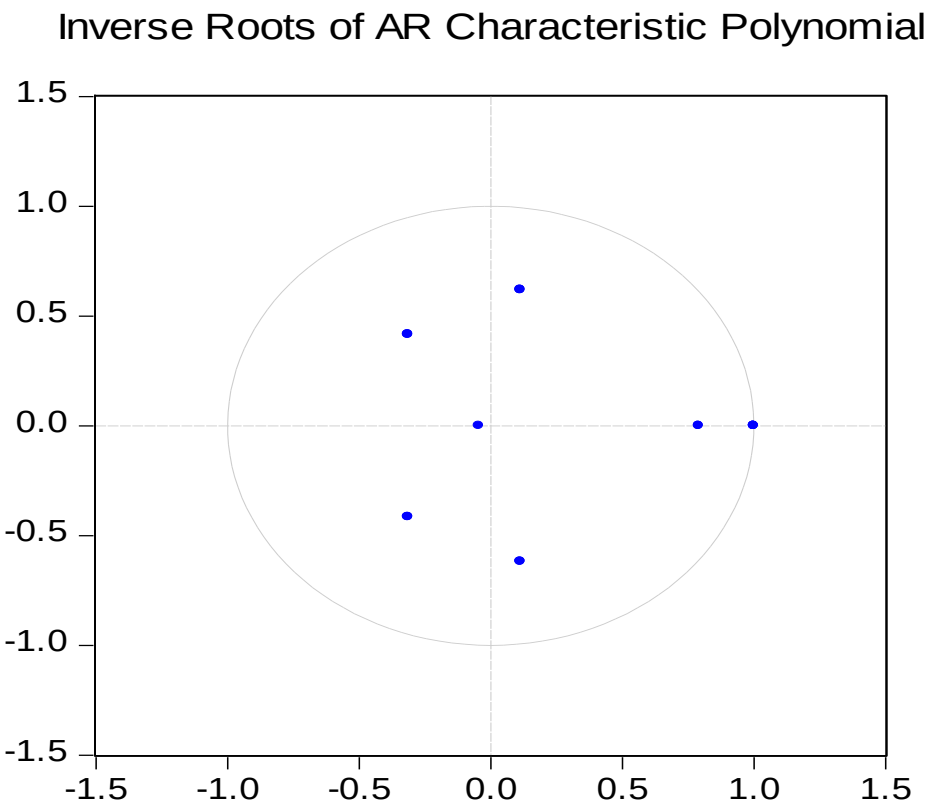


Table No. 5.32 Diagnostic Testing Third Equation Autocorrelation Test (X^2 Distribution)

VEC Residual Portmanteau Tests for Autocorrelations					
Null Hypothesis: no residual autocorrelations up to lag h					
Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	Df
1	3.944178	NA*	4.035903	NA*	NA*
2	14.64789	0.9634	15.24931	0.9526	26
3	27.21717	0.9624	28.73830	0.9407	42
4	38.89409	0.9746	41.58292	0.9489	58
5	58.78984	0.9018	64.02940	0.7893	74
6	68.39987	0.9563	75.15681	0.8694	90
7	82.18641	0.9582	91.55160	0.8401	106
8	93.84550	0.9726	105.8016	0.8517	122
9	99.61968	0.9942	113.0606	0.9408	138
10	117.5963	0.9870	136.3244	0.8438	154
*The test is valid only for lags larger than the VAR lag order.					
df is degrees of freedom for (approximate) chi-square distribution					

Table No 5.33 Third Equation VECM Residual Serial Correlation LM Test

VEC Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order h		
Lags	LM-Stat	Prob
1	17.81921	0.3346
2	12.39279	0.7165
3	16.94934	0.3889

4	11.82335	0.7560
5	23.63558	0.0978
6	9.464195	0.8931
7	18.06864	0.3199
8	13.82602	0.6117
9	5.978878	0.9883
10	18.33178	0.3048
Probs from chi-square with 16 df.		

Table No. 5.34 Normality Test in third Equation for Skewness

Component	Skewness	Chi-sq	Df	Prob.
1	-0.105791	0.103929	1	0.7472
2	0.256829	0.602174	1	0.4377
3	-0.823835	5.291585	1	0.0214
4	-0.814017	5.184575	1	0.0228
Joint		11.18226	4	0.0246

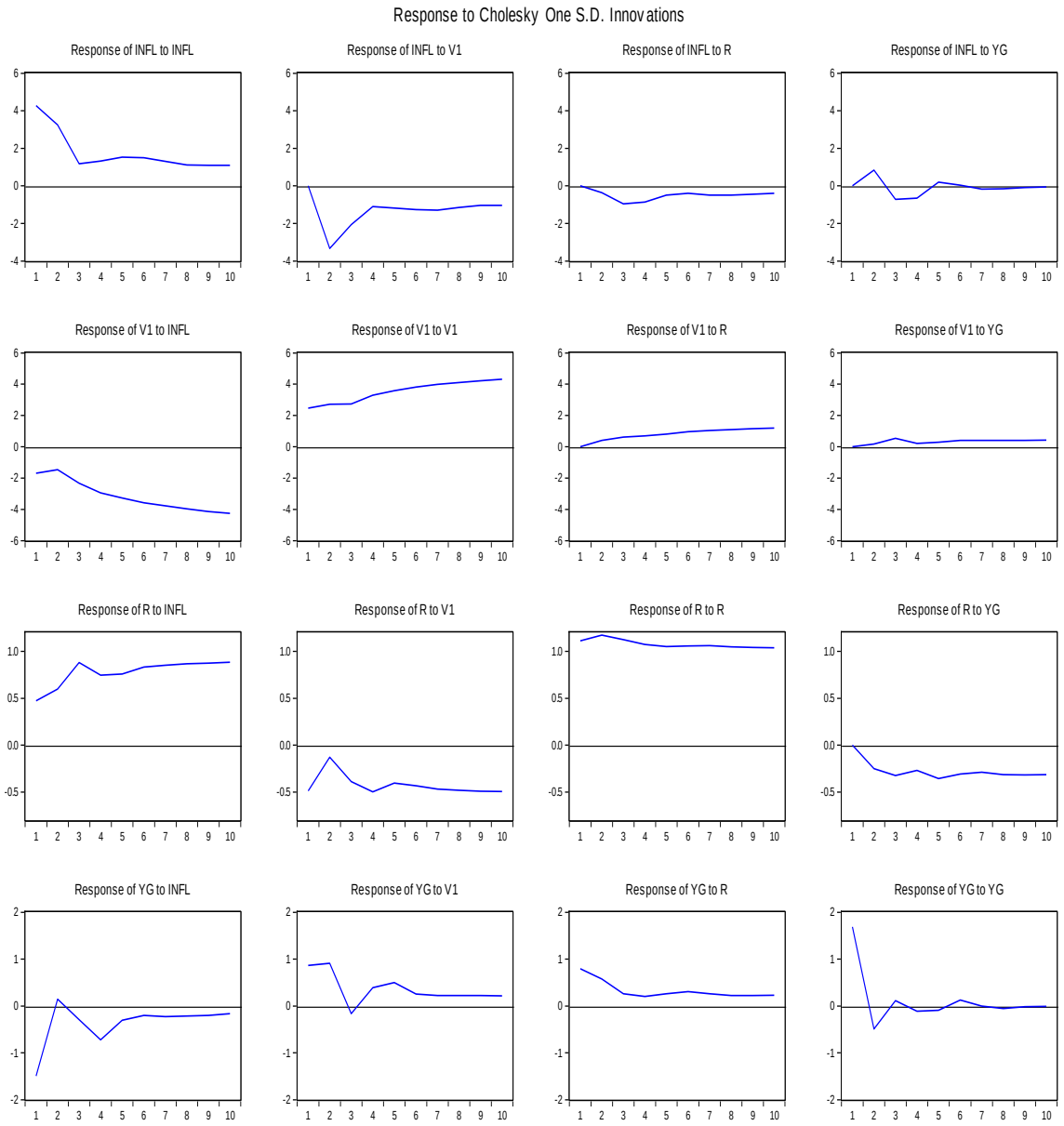
Table No. 5.35 Normality Test in third Equation for Kurtosis

Component	Kurtosis	Chi-sq	Df	Prob.
1	2.979648	0.518692	1	0.4714
2	6.087273	20.69735	1	0.0000
3	3.979545	0.014477	1	0.9042
4	4.692828	1.658498	1	0.1978
Joint		22.88902	4	0.0001

Table No.5.36 Third Equation for Jarque-Bera test

Component	Jarque-Bera	Df	Prob.
1	0.622621	2	0.7325
2	21.29952	2	0.0000
3	5.306062	2	0.0704
4	6.843073	2	0.0327
Joint	34.07128	8	0.0000

Figure No.5.1.11 Impulse response function Third equation



Some Implications

Looking to the econometric techniques used and the results derived. It can be inferred based on that inflation in India is highly influenced by the growth rate of GDP along with Lagged value of inflation growth rate based on the variation of money(V1) and with interest rate.

Model-4: Fourth Equation

$INFL = \beta_1 V3 + \beta_2 R + \beta_3 YG + \varepsilon$ …… (4)

Cointegration Analysis for Forth equation.

Following Engle and Granger (1987), the estimated cointegrating regression for the level series (growth rate of Wholesale Price Index) is given below.

Table No.5.37 Cointegration Analysis for Forth equation

Dependent Variables	Independent Variables			
	CONSTANT	YG	R	V3
INFL	7.28471***	−0.807839*	0.478595	0.0242632
	(1.893)	(−2.875)	(1.226)	(0.4316)
	(0.0653)	(0.0063)	(0.2269)	(0.6683)
	R^2 = 0.2154 Adj. R^2 = 0.1594 D.W. = 1.400			

Lag Length Criteria

The following table provides the possible lag length to be appropriate for the above mention equation. As per the all of the criteria, one lag is appropriate to estimate VAR for this model.

Table No. 5.38 Lag Length Criteria Fourth Equation

VAR Lag Order Selection Criteria					
Lag	LogL	LR	FPE	AIC	SC
0	-456.3592	NA	38963.99	21.92187	22.08736

1	-287.5364	297.4496	27.04822	14.64459	15.47205*
2	-265.3770	34.82190	20.63040	14.35129	15.84072
3	-243.9615	29.57385*	16.87536	14.09340	16.24480
4	-223.1660	24.75651	15.03065*	13.86505*	16.67842
* indicates lag order selected by the criterion					
LR: sequential modified LR test statistic (each test at 5% level)					
FPE: Final prediction error					
AIC: Akaike information criterion					
SC: Schwarz information criterion					
HQ: Hannan-Quinn information criterion					

Table No. 5.39 Johansen test Cointegration for Growth rate of WPI (Level Series) Trace Statistics fourth Equation

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.658812	74.93788	63.87610	0.0044
At most 1	0.293411	30.84966	42.91525	0.4526
At most 2	0.234543	16.61009	25.87211	0.4446
At most 3	0.128764	5.651547	12.51798	0.5058
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Johansen test Cointegration for Growth rate of WPI (Level Series) Maximum Eigenvalue Statistics Fourth Equation Table No.5.40

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.658812	44.08822	32.11832	0.0011
At most 1	0.293411	14.23957	25.82321	0.7018
At most 2	0.234543	10.95855	19.38704	0.5176
At most 3	0.128764	5.651547	12.51798	0.5058
Max-eigenvalue test indicates 1 cointegration eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Analysis of VECM for fourth Model Specification:

After having confirmed with the numbers of cointegration equation in the model, the estimates of VECM are discussed in the following four equations.

Table No. 5.41 Analysis of VECM for fourth Equation Model Specification

Dependent Variables	Independent Variables					
	ECT-1	Δ(INFL(-1))	Δ(INFL(-2)	Δ(INFL(-3)	Δ(INFL(-4)	Δ (R(-1))
ΔINFL	-0.800456* (0.0000)	-0.375808 (0.0806)	0.119349 (0.6529)	0.211460 (0.3456)	0.074427 (0.7022)	0.113074 (0.8562)
	Δ (R(-2))	Δ (R(-3))	Δ (R(-4))	Δ (V3(-1))	Δ (V3(-2))	Δ (V3(-3))
	-1.638688* (0.0087)	-0.858297 (0.1396)	0.124530 (0.8178)	-6.306609* (0.0005)	-4.508401** (0.0398)	-0.775758 (0.6927)

	Δ (V3(-4))	Δ (YG(-1))	Δ (YG(-2))	Δ (YG(-3))	Δ (YG(-4))	CONSTANT
	-2.509114 (0.2000)	-0.546352 (0.1843)	0.054010 (0.8841)	0.238810 (0.4873)	0.256722 (0.2349)	-15.55199* (0.0000)
	R^2 = 0.835741 Adj. R^2 = 0.714331 D.W. = 1.396276					
Dependent Variables	Independent Variables					
	ECT-1	Δ(INFL(-1))	Δ(INFL(-2)	Δ(INFL(-3)	Δ(INFL(-4)	Δ (R(-1))
ΔR	-0.095966 (0.1566)	0.020189 (0.8099)	-0.009692 (0.9260)	-0.051750 (0.5567)	0.029758 (0.6976)	0.249791 (0.3100)
	Δ (R(-2))	Δ (R(-3))	Δ (R(-4))	Δ (V3(-1))	Δ (V3(-2))	Δ (V3(-3))
	-0.457387*** (0.0601)	-0.066211 (0.7708)	-0.132961 (0.5321)	1.298508*** (0.0636)	-1.904970** (0.0275)	0.011180 (0.9884)
	Δ (V3(-4))	Δ (YG(-1))	Δ (YG(-2))	Δ (YG(-3))	Δ (YG(-4))	CONSTANT
	-0.860337 (0.2634)	-0.312688** (0.0546)	-0.007570 (0.9586)	-0.066643 (0.6219)	0.011538 (0.8916)	-1.912744 (0.1490)
	R^2 = 0.548306 Adj. R^2 = 0.214446 D.W. = 1.986003					

Dependent Variables	Independent Variables					
	ECT-1	Δ(INFL(-1))	Δ(INFL(-2)	Δ(INFL(-3)	Δ(INFL(-4)	Δ (R(-1))
ΔR	0.015199 (0.4851)	0.087922* (0.0016)	0.035521 (0.2929)	0.017510 (0.5378)	0.051176** (0.0405)	0.046791 (0.5549)
	Δ (R(-2))	Δ (R(-3))	Δ (R(-4))	Δ (V3(-1))	Δ (V3(-2))	Δ (V3(-3))
	0.061164 (0.4322)	0.118628 (0.1081)	-0.022104 (0.7474)	0.208721 (0.3520)	0.353638 (0.2006)	0.054537 (0.8267)
	Δ (V3(-4))	Δ (YG(-1))	Δ (YG(-2))	Δ (YG(-3))	Δ (YG(-4))	CONSTANT

	0.345056 (0.1653)	-0.020921 (0.6875)	-0.032203 (0.4939)	-0.060355 (0.1683)	-0.051689*** (0.0610)	0.320290 (0.4521)
	R^2 = 0.939382 Adj. R^2 = 0.894578 D.W. = 1.930895					
Dependent Variables	Independent Variables					
	ECT-1	Δ(INFL(-1))	Δ(INFL(-2)	Δ(INFL(-3)	Δ(INFL(-4)	Δ (R(-1))
ΔYG	0.223885 *** (0.0991)	0.105543 (0.5297)	-0.050495 (0.8088)	-0.019769 (0.9105)	0.131416 (0.3915)	0.593298 (0.2284)
	Δ (R(-2))	Δ (R(-3))	Δ (R(-4))	Δ (V3(-1))	Δ (V3(-2))	Δ (V3(-3))
	0.119945 (0.8034)	0.099129 (0.8273)	-0.216744 (0.6104)	1.267261 (0.3618)	0.517890 (0.7613)	1.845333 (0.2335)
	Δ (V3(-4))	Δ (YG(-1))	Δ (YG(-2))	Δ (YG(-3))	Δ (YG(-4))	CONSTANT
	0.102437 (0.9467)	-0.598375*** (0.0657)	-0.429919 (0.1423)	-0.511645*** (0.0606)	-0.291988*** (0.0872)	4.435399*** (0.0949)
	R^2 = 0.765878 Adj. R^2 = 0.592832 D.W. = 1.955204					

***, ****Denotes 1% and 5% significant level respectively.

FIGURE NO 5.1.12

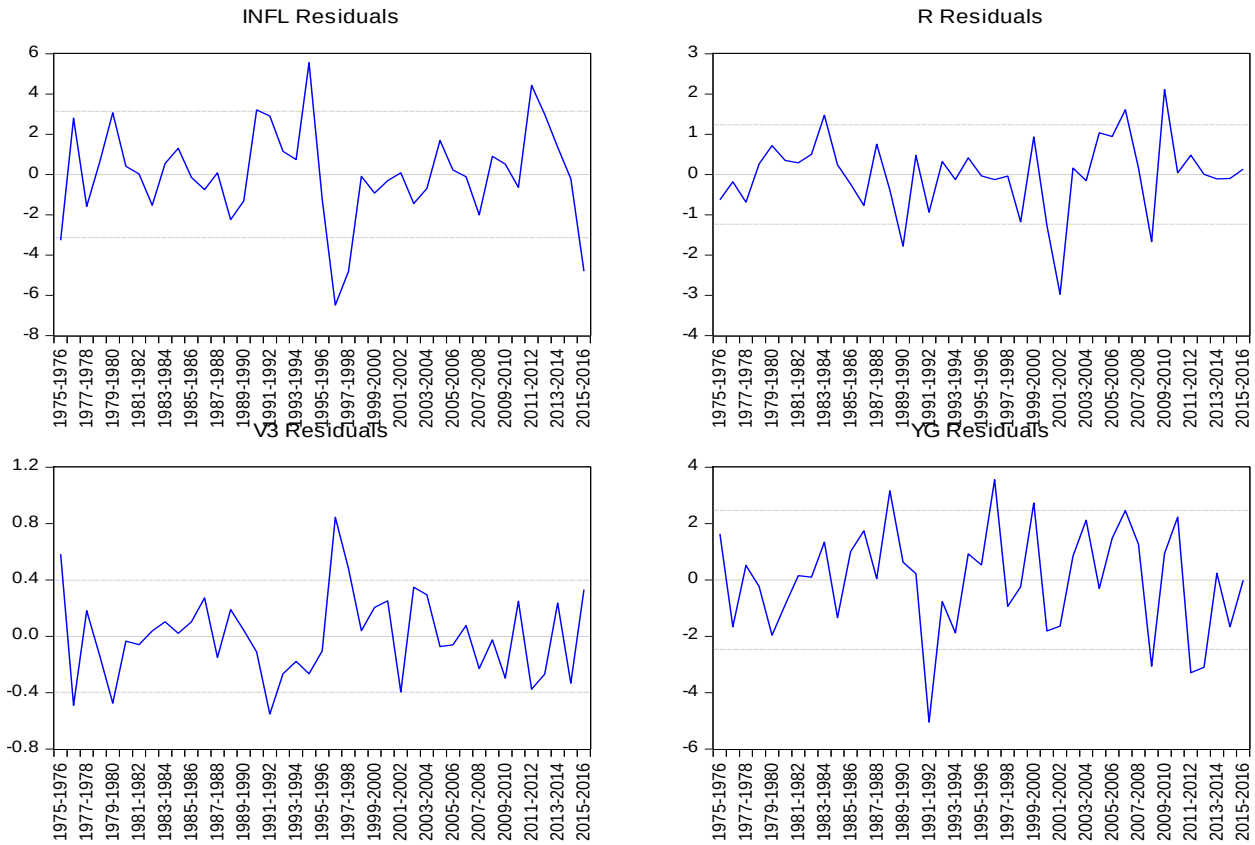


Figure no 5.1.13 Cointegration Graph

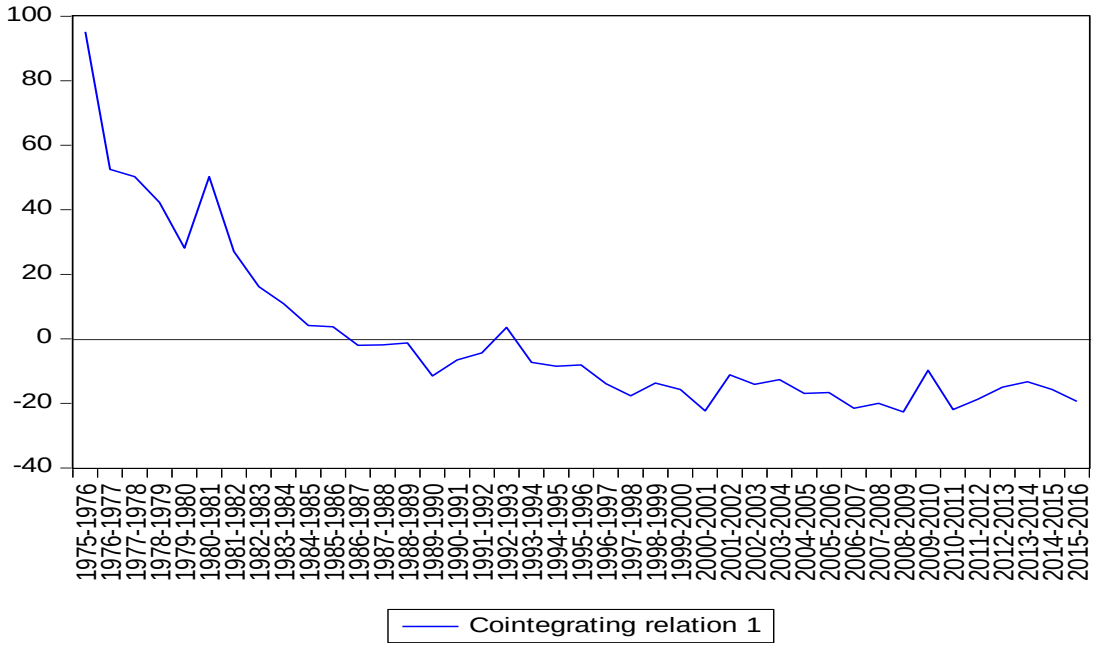


Table NO.5.42 Fourth Equation Polynomial Test

Roots of Characteristic Polynomial	
Root	Modulus
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
-0.896443	0.896443
0.869618	0.869618
0.546013 + 0.658081i	0.855103
0.546013 - 0.658081i	0.855103
0.024136 + 0.833019i	0.833368
0.024136 - 0.833019i	0.833368
-0.615277 - 0.466139i	0.771914
-0.615277 + 0.466139i	0.771914
0.315988 - 0.677770i	0.747810
0.315988 + 0.677770i	0.747810
-0.313709 - 0.650406i	0.722109
-0.313709 + 0.650406i	0.722109
-0.697260	0.697260
-0.262212 - 0.634664i	0.686697
-0.262212 + 0.634664i	0.686697
0.392114 + 0.191248i	0.436267
0.392114 - 0.191248i	0.436267

Figure No 5.1.14

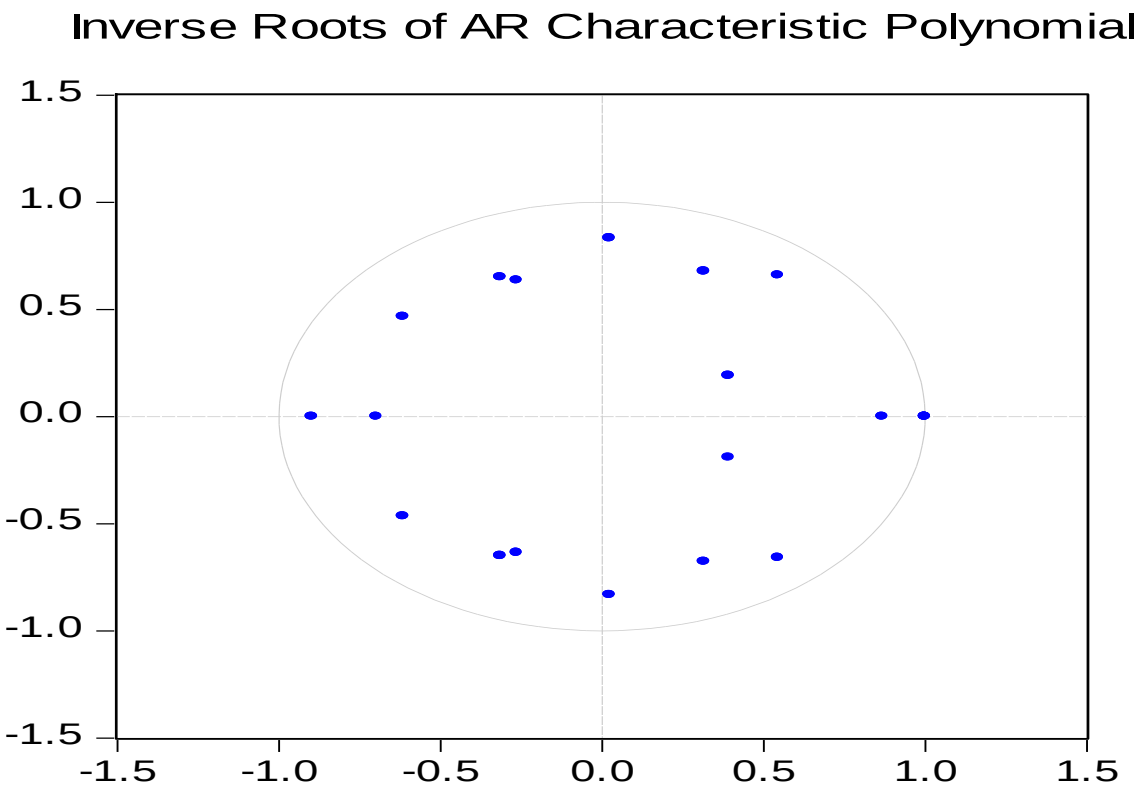


Table No. 5.43 Diagnostic Testing Fourth Equation Autocorrelation (X^2 Distribution)

VEC Residual Portmanteau Tests for Autocorrelations					
Null Hypothesis: no residual autocorrelations up to lag h					
Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	Df
1	10.19949	NA*	10.45448	NA*	NA*
2	18.14309	NA*	18.80544	NA*	NA*
3	28.59027	NA*	30.07740	NA*	NA*
4	38.94952	NA*	41.55657	NA*	NA*
5	58.20488	0.0010	63.48628	0.0002	29
6	73.70800	0.0044	81.64708	0.0007	45
7	90.52312	0.0084	101.9241	0.0008	61
8	105.0634	0.0185	119.9894	0.0012	77

9	115.3009	0.0584	133.1062	0.0041	93
10	133.5611	0.0551	157.2568	0.0017	109
*The test is valid only for lags larger than the VAR lag order.					
df is degrees of freedom for (approximate) chi-square distribution					

Table No. 5.44 Fourth Equation VECM Residual Serial Correlation LM Test

VEC Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order h		
Lags	LM-Stat	Prob
1	14.88770	0.5329
2	14.35795	0.5721
3	12.54209	0.7059
4	11.07600	0.8048
5	23.39987	0.1035
6	14.53258	0.5591
7	17.10168	0.3790
8	15.55504	0.4844
9	13.63588	0.6258
10	22.66843	0.1229
Probs from chi-square with 16 df.		

Table No. 5.45 Normality Test of fourth for Skewness

Component	Skewness	Chi-sq	Df	Prob.
1	0.053407	0.025067	1	0.8742
2	-0.843291	5.219648	1	0.0223

3	-0.026815	0.006323	1	0.9366
4	-0.379237	1.212301	1	0.2709
Joint		6.463339	4	0.1671

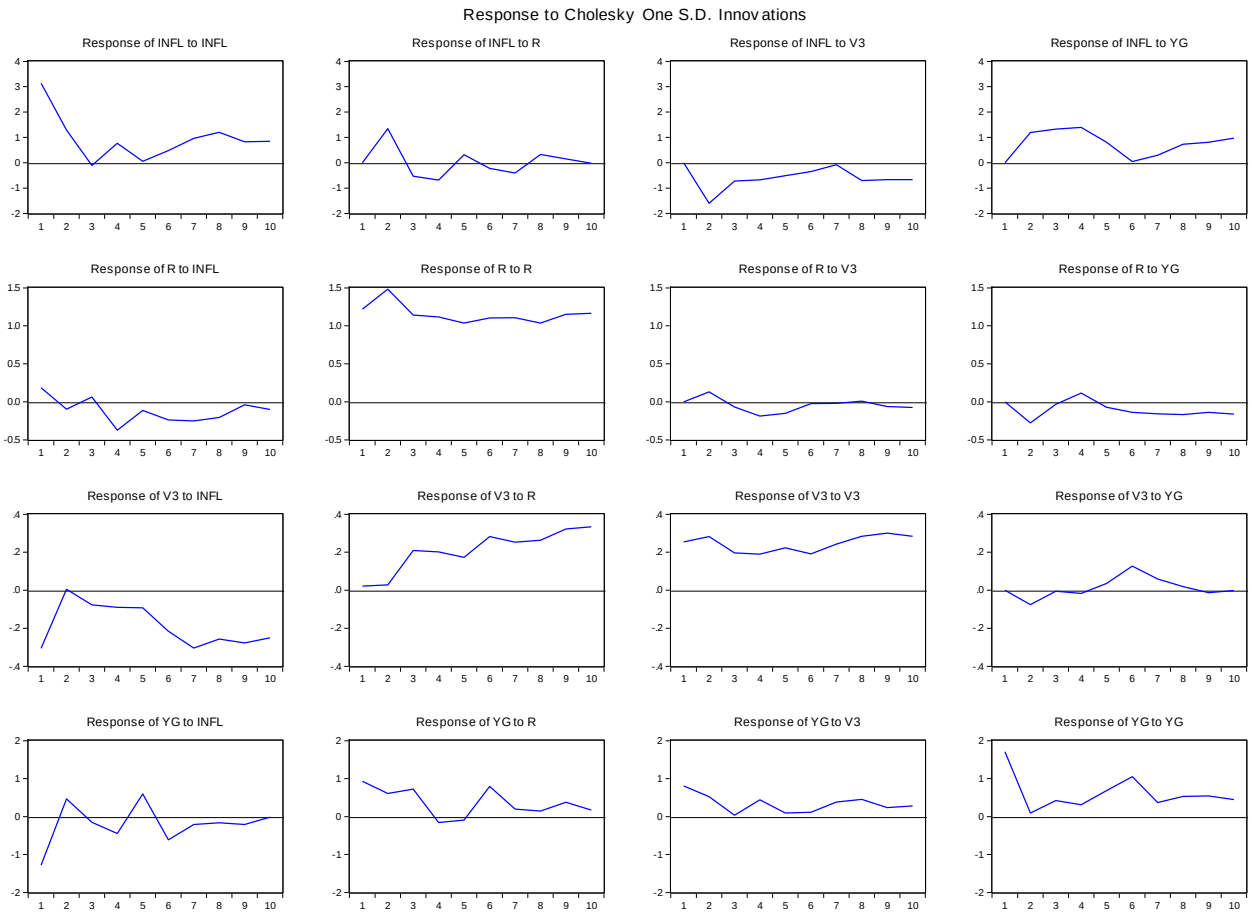
Table No.5.46 Normality Test of fourth for Kurtosis

Component	Kurtosis	Chi-sq	Df	Prob.
1	4.271564	7.249102	1	0.0071
2	4.952090	2.437636	1	0.1185
3	2.497985	0.020667	1	0.8857
4	2.511197	0.488867	1	0.4844
Joint		10.19627	4	0.0372

Table No. 5.47 Fourth Equation Jarque-Bera test

Component	Jarque-Bera	Df	Prob.
1	7.274169	2	0.0263
2	7.657283	2	0.0217
3	0.026991	2	0.9866
4	1.701168	2	0.4272
Joint	16.65961	8	0.0339

Figure No 5.1.15 Impulse response fourth equation function



Some Implications

Looking to the econometric techniques used and the results derived. It can be inferred based on that inflation in India is highly influenced by the growth rate of GDP along with Lagged value of inflation growth rate based on the interest rate with variation of money(V3).

Table No.5.48 Granger Causality Test for All equation

Pairwise Granger Causality Tests
Lags: 3

Null Hypothesis:	Obs	F-Statistic	Prob.
M1 does not Granger Cause INFL	43	3.95581	0.0155**
INFL does not Granger Cause M1		2.21793	0.1028
M3 does not Granger Cause INFL	43	2.34643	0.0890
INFL does not Granger Cause M3		3.38655	0.0284**
R does not Granger Cause INFL	43	2.00035	0.1313
INFL does not Granger Cause R		2.99997	0.0432**
V1 does not Granger Cause INFL	43	8.80861	0.0002*
INFL does not Granger Cause V1		5.22639	0.0042*
V3 does not Granger Cause INFL	43	6.47821	0.0013*
INFL does not Granger Cause V3		15.3661	1.E-06*
YG does not Granger Cause INFL	43	1.32211	0.2823
INFL does not Granger Cause YG		2.05729	0.1232
M3 does not Granger Cause M1	43	0.47061	0.7046
M1 does not Granger Cause M3		1.44562	0.2457
R does not Granger Cause M1	43	0.41242	0.7451
M1 does not Granger Cause R		0.70464	0.5555
V1 does not Granger Cause M1	43	0.83093	0.4856
M1 does not Granger Cause V1		0.26017	0.8536
V3 does not Granger Cause M1	43	2.02152	0.1282
M1 does not Granger Cause V3		1.70402	0.1835
YG does not Granger Cause M1	43	0.22331	0.8796
M1 does not Granger Cause YG		3.62399	0.0220**
R does not Granger Cause M3	43	0.15309	0.9270

M3 does not Granger Cause R		1.54871	0.2187
V1 does not Granger Cause M3	43	1.74776	0.1746
M3 does not Granger Cause V1		1.19376	0.3259
V3 does not Granger Cause M3	43	2.75661	0.0564**
M3 does not Granger Cause V3		1.22389	0.3151
YG does not Granger Cause M3	43	0.24672	0.8631
M3 does not Granger Cause YG		1.38843	0.2620
V1 does not Granger Cause R	43	2.14991	0.1110
R does not Granger Cause V1		0.47617	0.7008
V3 does not Granger Cause R	43	5.14843	0.0046*
R does not Granger Cause V3		1.38879	0.2619
YG does not Granger Cause R	43	1.03373	0.3893
R does not Granger Cause YG		2.25779	0.0983
V3 does not Granger Cause V1	43	4.93686	0.0057*
V1 does not Granger Cause V3		4.76569	0.0067*
YG does not Granger Cause V1	43	1.21488	0.3183
V1 does not Granger Cause YG		7.18561	0.0007*
YG does not Granger Cause V3	43	2.36341	0.0873
V3 does not Granger Cause YG		1.68879	0.1867

The above table deals with the Granger causality test. The Null hypothesis of X doesn't cause to Y has been tested and respective probabilities are given. Accordingly there is unidirectional causality being found between M1 and WPI inflation. Unidirectional causalities have been found from WPI inflation to M3, WPI inflation and interest rate, M1 to GDP at MP, V3 to M3, V3 to Interest rate and V1 to GDP at MP. Bi-directional causalities have been found from V1

to WPI inflation and WPI inflation to V1 as well with V3 to WPI inflation and WPI inflation to V3. Moreover bi-directional causality has also been found from V1 to V3 and V3 to V1. These results are well in accordance with the monetary theoretical foundation.

CHAPTER – VI

MAJORFINDINGS, CONCLUSION, POLICY IMPLICATIONS

6.1 Major Findings

Looking to the econometric techniques used and the results derived. It can be inferred based on that INFL in India is highly influenced by the growth rate of GDP along with Lagged value of inflation growth rate based on WPI.

VAR estimates that there is a weak association with the changes in money supply with the changes in WPI inflation. The exogenous factor are more responsible to raise the inflation than the endogenous one. There is a direction of relationship between variables to find out the results by using the Granger causality test. Impulse response function and error variance decomposition shows that the strength of these relations remains weak. Unidirectional causalities have been found from WPI inflation to M3, WPI inflation and Interest rate, M1 to GDP at MP, V3 to M3, and V3 to Interest rate and V1 to GDP at MP. Bi-directional causalities have been found from V1 to WPI inflation and WPI inflation to V1 as well with V3 to WPI inflation and WPI inflation to V3. Moreover bi-directional causality has also been found from V1 to V3 and V3 to V1. These results are well in accordance with the monetary theoretical foundation. The shock of GDP at MP has a positive impact and that of other has negative. The forecasts of WPI inflation steps and the comparisons of forecasted values with the other values, which provides a good framework for forecasting WPI in India. The model of VAR is appropriate to calculate and estimate the variables for forecasting the inflation in India.

6.2 Conclusion

The paper is considered that if there is any relationship between monetary components and inflation due to some reasons for modifying the current mode of policy analysis. The evidence between 1970 to 2016 shows there is no direct relationship between money supply and prices. In the consequence the marginal declines in money supply don’t specify to reduce in the inflation rate. Monetary policy has a lag effect and that there is a time lag between the policy

announcement and the economy. In the quantity theory of money predictions that there will be a long-run proportionate of the price level for the exogenous increase in the nominal money stock. The policy makers don't set the money growth rates exogenously for the quantity theory of empirical evidence. In the context of India the MV=PT and P =F (M) does not hold the theory of Friedman. The velocity of money and total output are to be constant in this theory in the short period of time for the functional relation of prices and money stock. The problem of measurement in the monetary aggregates and estimation in the procedure of policy formulation with exclude of money in the economy. Interest rate is the sole responsibility to influence the inflation but actually it is unobserved the natural interest rate in the Indian context. In the business cycle form both M and V are rise while in the recession there is fall, there is a inverse relationship between them. The theory is applicable in the full employment countries. In Indian context any increase in the money supply is appropriate for the fiscal and other policy measures, for the productivity activities, utilizing existing capacities, further expansion of resources, and the augmenting the supply side. This is the fact that, larger money supply don't cause inflation and reduce money supply don't cause inflation. As Friedman said that a counter revolution never restores the initial situation. It is the right time to go to the deep root study of the problem and solve at any point of view. It is highly required the projects management, increase the domestic productions, new generations reforms and augmenting the supply of goods and services. The inflation of India is increasing not only for money supply but also severe for the structural factors as like flood, bad monsoon, high crude oil prices, huge expenditure in defence sector, black money trade policy etc. Which are not taken in to account of this study. The revenue deficit is reduced further and further. Policies must be in the place of "crowding-in effect" of the fiscal deficit is larger than the "crowding- out" effect. Whatever is the effect to any inflation whether it is long-run and short-run is need to be re-consider.

6.3 Policy Implication

There is need a good policy to reduce the inflation through a proper committee set by the Govt. for periodically monitoring, matching the money supply of RBI at various level.

- Balance between aggregate demand and aggregate supply when the inflation situation is occurs in the economy.
- Artificial scarcity is created by the black marketeers and hoarders which has to be controlled.
- At any cost to eliminate the corruption and nepotism at various level.
- There is a direct physical controls of monetary policy.

6.4 Limitations of the study and Future study

The study is based on the inflation and money supply and inflation in India in the year from 1970 to 2016 as taken as short period, so it cannot rely the right result. Only taken the monetary components which don't influence the inflation. So it is a big gap between this studies. We have specially wants to study the money relation to inflation is justifying or not. I will further take this matter in near future**.**

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APPENDIX

Appendix 1

year	CC	CB	CP	ODRBI	BDRBI	DD	TD	M0	M1	M3	WPI	Y	INFl	r	V1	V3
1970-71									73.74	110.2		6443.89		6.25	87.39	58.47
1971-72									83.23	126.93		6549.76	5.6	6	78.69	51.60
1972-73									97	150.13		6513.52	10	6	67.15	43.39
1973-74									112	176.24		6728.18	20.2	6	60.07	38.18
1974-75									119.75	195.49		6807.93	25.2	7.375	56.85	34.82
1975-76									133.25	224.8		7430.85	-1.1	8	55.77	33.06
1976-77									160.24	277.81		7554.43	2.1	8	47.14	27.19
1977-78									143.88	329.06		8102.49	5.2	3	56.31	24.62
1978-79									172.92	401.12		8565.34	0	6	49.53	21.35
1979-80									200	472.26		8116.68	17.1	7	40.58	17.19
1980-1981	143.07	8.81	134.26	4.11	47.34	95.87	323.5	194.52	234.24	557.74	257.3	8663.4	18.2	9	36.99	15.53
1981-1982	154.11	9.31	144.74	1.68	54.19	102.95	378.15	209.98	249.37	627.52	281.3	9183.74	9.3	10	36.83	14.63
1982-1983	176.39	9.8	166.59	1.86	52.85	116.9	446.49	231.1	285.35	731.84	104.9	9502.94	4.9	10.25	33.30	12.98
1983-1984	206.43	10.4	196.03	2.91	80.6	135.04	531.27	289.94	333.98	865.25	112.8	10195.6	7.5	11.5	30.53	11.78
1984-1985	238.75	12.03	226.72	5.95	107.46	166.48	630.18	352.16	399.15	1029.33	120.1	10585.15	6.5	12	26.52	10.28
1985-1986	265.24	14.65	250.59	2.89	113.52	187.47	752.99	381.65	440.95	1193.94	125.4	11141.33	4.4	11	25.27	9.33
1986-1987	299.13	15.31	283.82	3.09	145.86	228.25	901.16	448.08	515.16	1416.32	132.7	11673.5	5.8	10	22.66	8.24
1987-1988	351.22	15.63	335.59	3.97	179.7	245.99	1057.2	534.89	585.55	1642.75	143.5	12136.39	8.1	11	20.73	7.39
1988-1989	401.19	17.9	383.29	6.94	221.45	277.63	1257.07	629.58	667.86	1934.93	154.2	13304.86	7.5	12	19.92	6.88
1989-1990	482.86	19.86	463	5.98	287.07	341.62	1498.9	775.91	810.6	2309.5	165.7	14094.15	7.5	9.5	17.39	6.10
1990-1991	552.82	22.34	530.48	6.74	318.23	391.7	1729.36	877.79	928.92	2658.28	182.7	14876.15	10.3	9.5	16.01	5.60
1991-1992	637.38	26.4	610.96	8.85	348.82	524.23	2026.43	995.05	1144.06	3170.49	207.8	15033.37	13.7	9.5	13.14	4.74
1992-1993	713.26	30.53	682.73	13.13	381.4	544.8	2399.5	1107.79	1240.66	3640.16	228.7	15857.55	10.1	9.5	12.78	4.36
1993-1994	853.96	30.95	823.01	25.25	507.51	659.52	2803.06	1386.72	1507.78	4310.84	247.8	16610.91	8.4	8.75	11.02	3.85
1994-1995	1046.81	40	1006.81	33.83	612.18	881.93	3353.38	1692.83	1922.57	5275.96	112.6	17717.02	12.6	8.75	9.22	3.36
1995-1996	1225.69	43.11	1182.58	33.44	685.44	932.33	3843.56	1944.57	2148.35	5991.91	121.6	19058.99	8.0	8.5	8.87	3.18
1996-1997	1372.17	51.3	1320.87	31.94	595.74	1053.34	4553.97	1999.85	2406.15	6960.12	127.2	20497.86	4.6	8.5	8.52	2.95
1997-1998	1610.56	54.77	1455.79	35.41	718.06	1187.25	5534.88	2264.02	2678.44	8213.32	132.8	21327.98	4.4	8.5	7.96	2.60
1998-1999	1758.46	60.02	1689.44	37.36	797.03	1363.88	6718.92	2592.86	3090.68	9809.6	140.7	22646.99	5.9	8.5	7.33	2.31
1999-2000	1970.61	79.79	1890.82	30.34	804.6	1496.81	7823.78	2805.55	3417.96	11241.74	145.3	24650.29	3.3	9	7.21	2.19
2000-2001	2182.06	86.54	2095.5	36.13	814.77	1662.7	9337.71	3032.95	3794.33	13132.04	155.7	25597.11	7.2	8	6.75	1.95
2001-2002	2509.74	101.79	2407.94	28.31	841.47	1791.99	10755.12	3379.52	4228.24	14983.36	161.3	26831.9	3.6	5.125	6.35	1.79
2002-2003	2824.73	108.92	2715.81	32.19	833.46	1987.57	12443.79	3690.38	4735.58	17179.36	166.8	27852.58	3.4	4.625	5.88	1.62
2003-2004	3270.28	120.57	3149.71	50.97	1043.65	2586.26	14269.6	4364.9	5786.94	20056.54	175.9	30041.9	5.5	5.5	5.19	1.50
2004-2005	3686.61	123.47	3563.14	68.43	1139.96	2869.98	15958.87	4891.11	6477.66	22456.53	187.3	32422.09	6.5	6.5	5.01	1.44
2005-2006	4295.78	174.54	4121.24	74.67	1355.11	4074.23	18931.04	5719.32	8263.89	27194.93	104.5	35432.44	4.4	7.625	4.29	1.30
2006-2007	5040.99	212.44	4828.54	90.27	1972.95	4776.04	23421.13	7088.61	9679.25	33100.38	111.4	38714.89	6.6	8.5	4.00	1.17
2007-2008	5908.01	223.9	5684.1	55.33	3284.47	5783.72	28620.46	9282.75	11558.1	40178.55	116.6	42509.47	4.7	8.5	3.68	1.06
2008-2009	6911.53	257.03	6654.5	38.06	2912.75	5886.88	35351.05	9879.61	12596.71	47947.75	126	44163.5	8.1	6.5	3.51	0.92
2009-2010	7995.49	320.56	7674.92	36.53	3522.99	7179.7	41134.3	11556.53	14892.68	56026.98	130.8	47908.47	3.8	8.625	3.22	0.86
2010-2011	9496.59	378.23	9118.36	28.22	4235.09	7228.56	48657.71	13768.21	16383.45	65041.16	143.3	52823.86	9.6	9.25	3.22	0.81
2011-2012	10672.3	436.6	10236.7	32.4	3562.91	7109.02	56474.37	14263.44	17373.94	73848.31	156.1	56330.5	8.9	8.875	3.24	0.76
2012-2013	11909.75	499.14	11410.61	19.65	3206.71	7532.25	64922.93	15148.86	18975.26	83898.19	167.6	92268.79	7.5	9	4.86	1.10
2013-2014	13010.74	552.55	12458.19	145.9	4297.03	8119.78	74576.24	17327.42	20597.62	95173.86	177.6	98394.34	5.9	8.625	4.78	1.03
2014-2015	14483.12	621.31	13861.82	154.51	4655.61	8916.32	82577.64	19264.63	22924.04	105501.7	181.2	105521.51	1.9	7.375	4.60	1.00
2015-2016	16634.63	653.68	15980.95	154.51	5018.26	9970.21	90437.73	21807.4	26105.67	116543.4	176.7	113502.49	-2.5	7.35	4.35	0.97

Appendix 2

Variance Decomposition of INFL:			
Period	S.E.	INFL	M1
1	4.420888	100.0000	0.000000
2	5.486215	90.12546	9.874536
3	5.539192	88.89953	11.10047
4	5.580525	88.37647	11.62353
5	5.585407	88.33895	11.66105
6	5.585468	88.33918	11.66082
7	5.585514	88.33835	11.66165
8	5.585533	88.33815	11.66185
9	5.585534	88.33814	11.66186
10	5.585534	88.33814	11.66186
11	5.585534	88.33814	11.66186
12	5.585534	88.33814	11.66186
13	5.585534	88.33814	11.66186
14	5.585534	88.33814	11.66186
15	5.585534	88.33814	11.66186
Variance Decomposition of M1:			
Period	S.E.	INFL	M1
1	5.377872	4.773435	95.22656
2	5.521103	8.379635	91.62037
3	5.577750	9.109418	90.89058
4	5.594183	9.403046	90.59695
5	5.595062	9.424091	90.57591
6	5.595079	9.424054	90.57595
7	5.595113	9.424538	90.57546
8	5.595119	9.424653	90.57535
9	5.595119	9.424658	90.57534
10	5.595119	9.424658	90.57534
11	5.595119	9.424658	90.57534
12	5.595119	9.424658	90.57534
13	5.595119	9.424658	90.57534
14	5.595119	9.424658	90.57534
15	5.595119	9.424658	90.57534

Cholesky Ordering: INFL M1			

Appendix 3

Null Hypothesis: M1 has a unit root				
Exogenous: Constant				
Lag Length: 8 (Automatic - based on SIC, maxlag=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			8.157023	1.0000
Test critical values:	1% level		-3.621023	
	5% level		-2.943427	
	10% level		-2.610263	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(M1)				
Method: Least Squares				
Date: 06/22/17 Time: 16:48				
Sample (adjusted): 10 46				
Included observations: 37 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
M1(-1)	0.851416	0.104378	8.157023	0.0000
D(M1(-1))	-0.924725	0.226158	-4.088851	0.0003
D(M1(-2))	-0.797425	0.248171	-3.213207	0.0034
D(M1(-3))	-0.747720	0.202698	-3.688839	0.0010
D(M1(-4))	-0.379393	0.124127	-3.056486	0.0050
D(M1(-5))	-1.799732	0.227369	-7.915472	0.0000
D(M1(-6))	-1.402993	0.276624	-5.071840	0.0000
D(M1(-7))	-1.149196	0.379491	-3.028256	0.0054
D(M1(-8))	-2.311184	0.495014	-4.668923	0.0001
C	40.70470	40.99335	0.992959	0.3295
R-squared	0.963419	Mean dependent var		700.8851
Adjusted R-squared	0.951226	S.D. dependent var		813.6649
S.E. of regression	179.6973	Akaike info criterion		13.44588
Sum squared resid	871859.9	Schwarz criterion		13.88127
Log likelihood	-238.7488	Hannan-Quinn criter.		13.59938
F-statistic	79.01028	Durbin-Watson stat		2.384922
Prob(F-statistic)	0.000000			

Appendix 4

Null Hypothesis: D(Y) has a unit root				
Exogenous: Constant				
Lag Length: 6 (Automatic - based on SIC, maxlag=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			3.930206	1.0000
Test critical values:	1% level		-3.615588	
	5% level		-2.941145	
	10% level		-2.609066	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(Y,2)				
Method: Least Squares				
Date: 06/22/17 Time: 16:51				
Sample (adjusted): 9 46				
Included observations: 38 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y(-1))	3.855161	0.980906	3.930206	0.0005
D(Y(-1),2)	-4.944819	1.095242	-4.514819	0.0001
D(Y(-2),2)	-4.831788	1.180873	-4.091708	0.0003
D(Y(-3),2)	-5.031700	1.182448	-4.255326	0.0002
D(Y(-4),2)	-9.582252	1.411426	-6.789057	0.0000
D(Y(-5),2)	-6.441193	1.933087	-3.332076	0.0023
D(Y(-6),2)	-3.043484	1.680013	-1.811584	0.0801
C	-1423.237	1016.940	-1.399529	0.1719
R-squared	0.785686	Mean dependent var		195.6032
Adjusted R-squared	0.735679	S.D. dependent var		7280.968
S.E. of regression	3743.302	Akaike info criterion		19.47799
Sum squared resid	4.20E+08	Schwarz criterion		19.82274
Log likelihood	-362.0818	Hannan-Quinn criter.		19.60065
F-statistic	15.71163	Durbin-Watson stat		2.099978
Prob(F-statistic)	0.000000			