Monetary Policy Response to Global Financial Crisis in India: An Econometric Analysis

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ABSTRACT

MONETARY POLICY RESPONSE TO GLOBAL FINANCIAL CRISIS

IN INDIA: AN ECONOMETRIC ANALYSIS

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This study has examined India's monetary policy response to global financial crisis by applying Taylor's rule with the aid of Autoregressive Distributed Lag model. It also investigates monetary policy response during pre global financial crisis period. The study has used quarterly data for pre-crisis (2001Q1 to 2008Q1) and post-crisis periods (2008Q2 to 2012Q4). All in all, it was revealed that Taylor's rule is more responsive to industrial output, exchange rate and inflation in short run as compared to long-run. However, monetary policy is responsive to inflation in industrial commodities in long-run. During post crisis period, it is responsive to output, inflation and exchange rate in short run whereas it has turned out to be non-responsive in the long-run. In addition to this, trends and perspectives of monetary policy in India were also analysed during the period 1970-71 to 2012-13.

(Biswabhusan Bhuyan)   (Dr. Kulwinder Singh)   (Dr. A.S. Kahlon)

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Dedicated

to

My *Mother*

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List of Abbreviations

Abbreviation	Word
QTM	Quantity Theory of Money
FII	Foreign Institutional Investor
BOP	Balance of Payment
CRR	Cash Reserve Ratio
SLR	Statutory Liquidity Ratio
ARDL	Autoregressive Distributed Lag
IIP	Industrial Index of Production
WPI	Wholesale Price Index
CPI_{ag}	Consumer Price Index for agriculture
CPI_{iw}	Consumer Price Index for Industrial Worker

CHAPTER- I

INTRODUCTION

1.1- Introduction

From the viewpoint of enhancing social welfare, economics as a science guides us not only towards optimization of production and consumption (of goods and services), but if economic system fails to do so, it also regulates the proper redistribution of benefits of production among the various groups of the society through economic policy. The science of economics has a long history but the formalized version was introduced by Adam Smith (1776) in his book entitled "An Enquiry into the Nature and Causes of Wealth of Nations" (Smith, 2006). His great contribution famed him as the father of Economics. Specifically, the branch of monetary economics studies the relationship between monetary aggregates, interest rate, output and price. The origin of monetary thinking in terms of linking money and prices can be traced back to the straightforward work of French writer Jean Budin. He attempted to put in plain words the price revolution that swept Europe for almost a century through import of large quantities of gold and silver from American colonies in the sixteenth century. Subsequently, this idea was refined and formalized by classical economists in the form of quantity theory of money (QTM) advocating a direct relationship between money supply and general prices, and laid down the formal foundation of monetary policy. However, the ideology of 'classical dichotomy' ignored the influence of monetary variables to real variables and recommends laissez fair attitude of the state towards economic activities.

Notwithstanding the explanation on fiscal policy measures, Keynes had emphasized the ability of monetary expansion to raise investment spending through declining real interest rate and thus criticized the concept of money neutrality. However, a special twist in terms of liquidity trap in Keynesian literature implied importance of monetary policy to promote economic activities. Afterwards, monetary school under the leadership of Milton Friedman viewed fluctuations of money supply is the only way to eliminate disequilibrium and had advocated rule based monetary growth as against 'discretionary' practice. The basic thrust of

monetarist school lays in its faith that money neutrality without ignoring the ability of money to influence output in the long run.

In India, RBI acts as the apex of monetary system and controls money supply through the various monetary policy instruments such as Cash Reserve Ratio (CRR), Statutory Liquidity Ratio (SLR) and Bank rate etc. Monetary policy has been frequently changing since independence which led changes in levels of income and output. The broad analytical aspect of current international practices of monetary policy has evolved as a nice blend of synthesis incorporating elements of Classical, Keynesians and monetarist thinking. Presently, there is a broad consensus with the view – "monetary policy also matters". The question is not whether monetary policy affects output and prices, but how to use it for economic stabilization. Over the years, monetary policy has been increasingly receiving considerable attention in the overall economic literature. Usually, the formulation and implementation of monetary policy lies in the hands of the central bank of a country with either active or implicit guidance of the government. The formulation of monetary policy mainly involves preparing a precise plan aimed at pursuing various objectives namely price stability, output expansion, maintaining orderly conditions in the financial markets etc. and setting appropriate intermediate and operating targets. The implementation of this plan is undertaken by using various direct and indirect operating instruments such as reserve requirements, open market operations; refinance facilities, etc. to regulate the operating and intermediate targets.

In India, the responsibility of conducting monetary policy is entrusted to the Reserve Bank of India (RBI). In the Annual Monetary and Credit Policy of RBI, the Governor publicly announces the medium to long-term stance of the monetary policy and changes in the relevant policy measures in the month of April every year. This is followed by a mid-term review in the month of October. In the planning era, monetary policy in India was characterized by credit planning. The basis objective of monetary policy was to ensure flow of credit to the particular sectors as desired in the planning exercise and provide credit to government to undertake development activities. The constitution of a high level committee to review the working of monetary system in India and to shape the future monetary policy framework under the chairmanship of Prof. Sukhamoy Chakravarty

Committee in 1982 was an important landmark in the history of monetary policy in India. Chakravarty Committee recommendations have significant influence in guiding the subsequent transformation in conduct of monetary policy in India. (Chakravarty et al., 1985) Finally, the process of economic reforms initiated in the early 1990s and the following institutional changes towards creation of a conductive atmosphere for operation of market forces have affected radical changes in the overall monetary policy framework in India.

From the second half of 2007 in the United States a financial crisis started with a burst of housing bubble which led to widespread mortgage defaults and hence large losses to banks and other financial institutions. This crisis occurred due to sub-prime housing loans given on a large scale by the American banks in the past several years. The Information Technology (IT) bubble burst in 2000 throwing the American economy into recession. To get the economy out of recession the US Federal Reserve cut interest rates for bringing large increase in liquidity or money supply with the banks. With cheap availability of credit, the household even with poor credit worthiness borrowed funds from the banks to buy cars and houses. Americans went on a home buying spree. Price of houses and real estate were rising rapidly. This rise in housing price made both households and banks believe that their prices would continue rising. In view of low interest rates and excess liquidity with them, lending for houses by banks was found to be quite attractive. As a result, banks provided housing finance even to sub-prime households, that is, households that had no capacity to pay back the loans.

One irresponsible financial behavior on the parts of banks was to provide Ninja Loans, which stand for providing loans to households or persons which had no income and no assets. All this went on well as long as housing prices were rising. The building of houses in excess during the boom period led to their excess supply in the market which caused house prices to decline in 2006. But, like the IT bubbles, housing bubble burst in the second half of 2007. With fall in prices of houses, the sub-prime households started defaulting on a large scale in making their installments. This caused heavy losses to the banks. With this sub-prime housing market which had expanded on a large scale when there were soft interest rates and huge amount of liquidity with the banks tumbled.

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Since Indian economy was closely integrated to world economy due to ongoing intensive phase of globalization of trade and finance. Thereby, having economic integration with US, European and other countries to greater degree than before, she was greatly under the influences of foreign trade and finance from these economies. Therefore, when financial crisis started in US market, India could not remain isolated. In broadly, global financial crisis influenced Indian Stock markets through depreciation of Indian Rupee, and liquidity crunch in the banking sector. Further, it also had an adverse impact on export growth and Balance of Payments (BOP). Following the eruption of financial crisis when the Wall Street of the US and the stock market of the European Countries crashed, its effect spilled over to India and our Stock market (Dalal Street) was also badly hit. To meet the liquidity requirements or liabilities of their parent companies foreign institutional investors (FIIs) started selling shares of the Indian companies held by them. The selling pressures by FIIs brought about a crash in Dalal Street. In the last few years, FIIs had invested on a massive scale in the equity shares of several Indian companies operating in various industries from consumer goods to infrastructure industries. As a result of the buying spree of shares of Indian companies by FIIs, share price rose to new heights. The Sensex which was around 6000 in 2004 rose to 8000 in Aug.-Sept. 2005 and went on rising further crossing 10000 mark in 2006, 13000 mark in 2007 and reached the peak of around 21,000 mark in January 2008. At this time the share prices in US and Europe started falling sharply and it affects share prices in Indian markets. Hence, this led to FII to sell shares held by them in the Indian Stock market to pull out capital from India. This was done to fulfill the needs of redemption pressures on their parent companies that were facing liquidity problem. Consequently, Sensex of Bombay Stock Market started trembling and fell from around 21000 in January 2008 to 11000 in September 2008 that is 60 per cent fall since January 2008. This caused huge losses to the Indian Companies and investors whose huge wealth was wiped out in a couple of months in 2008. This selling also led to the decline in foreign exchange reserves held by RBI.

As Rupee-Dollar exchange rates are determined by forces of demand for and supply of currencies in foreign exchange market, the increase in demand for dollars resulted appreciation of US dollar, that is, rupee depreciated against US

dollar. Demanded for dollars has enhanced for compensating ever-increasing import bill. This further raised the demand for dollars causing first depreciation of rupee in the months of September, October and November 2008. The Indian Rupee whose value appreciated to Rs. 39.4 for a dollar in Dec. 2007 depreciated to Rs. 49.3 for a dollar in end-oct.2008 and further to Rs.50.6 for a dollar in mid-November 2008. To prevent rapid depreciation of rupees and maintain relative exchange rate stability, RBI intervened and supplied dollars from its foreign exchange reserves. As a consequence, depreciation of rupee was prevented, but in this process of supplying more dollars in the foreign exchange market raise the quantity of rupees with the banking system which further created liquidity problem in the Indian banking system.

To tackle global financial crisis, there are both monetary as well as fiscal stimuli played vital role. The RBI was continuously rising interest rates to fight against inflation and reversed its monetary policy since October 2008.The RBI took several measures to prevent rupee depreciation by selling Dollars in market from its reserve. This tightening monetary policy affects the credit markets and adversely affect to industries. Therefore to increases the liquidity in banking system RBI cuts Cash Reserve Ratio (CRR) four times in October 2008 to January 2009 by 400 basis points from 9 per cent to 5 per cent. Besides this, RBI also reduced Statutory Liquidity Ratio (SLR) from 25 per cent to 24 per cent. However, reducing CRR and SLR were not adequate measure because injecting liquidity into market by keeping interest rate remains unchanged led to higher cost. Hence, to achieve the objectives, RBI reduced and revised five times its Repo rate by 400 basis points from 9 per cent to 5 per cent in October 2008. As a result, Indian banks reduce their prime lending rates. However, response from banks reveals that many banks have sited on surplus cash. Due to the adverse impact of global meltdown on various sectors of Indian economy, Indian banks become risk-averse and were not willing to lend for fear of having defaults by borrowers.

On the fiscal side, At G-20 Submit held in Washington DC in October 2008, Prime Minister Dr. Manmohan Singh emphasized giving a fiscal stimulus to overcome slowdown in economic growth. This fiscal stimulus is in keeping with Keynesian macroeconomics as Keynes emphasized increase in government

expenditure to get rid of depression in the nineteen thirties. The Indian government announced the first fiscal stimulus package on December 6, 2008 to stimulate growth so as to ensure 7 per cent growth rate in 2008-09. This fiscal package involves both government expenditure and tax cut to increase both consumption demand and investment in the economy. This fiscal package was expected to help the growth of infrastructure projects, growth of exports, textiles, housing, automobiles and small and medium enterprises.

But now-a-days, the reserve bank of India (RBI) has followed a pragmatic approach to monetary policy. Much like the US Federal Reserve, the RBI has responded to the state of the economy in a seemingly discretionary manner. Former Deputy Governor of RBI described their approach as follows, "Thus the overall objective has had to be approached in a flexible and time variant manner with a continuous rebalancing of priority between growth and price stability, depending on underlying macroeconomic and financial conditions" (Mohan, 2006). As monetary policy operates with a lag-time after market information available, central banks are more concerned about future policy key rates such as interest rate and many of central banks are facing problem to determine policy rates during slowdown of an economy. In the light of this current problem that arises in future, is if economy would badly hit by another Global financial crisis, how can it be solved? How policy rates would be determined? Whether Exchange Rate Taylors Type Rule is sufficient to solve the forthcoming Economic Meltdown. In this backdrop, there is need to analysis whether Taylors-Type exchange rate augmented rule is satisfying to implement monetary policy during the time of economic slowdown particularly in case of India's monetary policy.

1.2- Relevance of the Study

There is a widespread controversy regarding policy rate, output and inflation. The view on effectiveness of monetary policy on real sector has been changing over the time. Classical viewed that there is no impact of monetary policy rate on real sector. Whereas Keynes suggested that monetary policy has a little role on controlling economic activities. Monetarists argued that the importance of money is more. Lucas also argued that asymmetric information can affect real variable. But-now-a-days, two modern formulations have emerged in

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monetary policy literature known as McCallum rule and Taylor rule. These two rules are widespread used for the policy formulation. McCallum Rule uses Base money as the reaction variable but Taylors Rule uses interest rate as policy reaction variable. In Indian context, central bank is more concerning about interest rates rather than base money. In this backdrop, it is necessary to know the usefulness of Taylor's rule and to examine whether exchange rate augmented Taylor's type rule is capable to explaining monetary policy behaviour during the time of economic slowdown in Indian context. Therefore, an attempt in this study has made to examine the behavior of India's monetary policy using Taylor type Rules. The relevance of the study is further enhanced keeping in view the lack of works done previously in this direction.

1.3- Objectives of the Study

This study is based on following objectives:

1. To analyze trends of India's monetary policy.
2. To examine India's monetary policy response to global financial crisis.
3. To analysis short run and long run responsiveness of India's monetary policy using Taylor's-Type Rule during pre and post global financial crisis.
4. To explore necessities of exchange rate augmented Taylors-Type rule for open economy to form monetary policy during pre and post global financial crisis.
5. To highlight major implications of India's monetary policy and suggest appropriate policy measures.

1.4- Hypotheses

Important hypothesis formulated in present study to be tested are as under:

1. RBI got more autonomy in formulation and execution of monetary policy in India during post reforms period..
2. RBI monetary policy responds quickly to changing internal and external economic environment.
3. Short run Taylor's-type rule is more effective than long run Taylor's type rule during pre and post global financial crisis.
4. Exchange rate is more important for implementing monetary policy for open economy during pre and post crisis period.

1.5- Organization of the Study

This study includes six chapters of varied length. Chapter I presents the introductory theoretical and empirical frameworks of monetary policy generally as well as particularly for India and formulate the research problem to be analyzed.

Chapter II deals with reviewing relevant literature available in the context of research topic chosen, covering theoretical and empirical frameworks accordingly. This chapter elaborates the view of eminent economist on Global financial crisis.

Chapter III specifies the model used to estimate the behavior of India's monetary policy. It also outlines some important methodological issues that have been used in subsequent chapters. Data transformation procedures required for regression analysis as per the need of study for econometric analysis have also been discussed. Moreover, it deals with identification of important variables for analysis and enlists various data sources.

Looking beyond the present scenario regarding the monetary policy changes during global financial crisis, Chapter IV also presents empirical analysis of changing perspectives on monetary policy in India accompanied by the analysis of monetary policy trends in India. Besides the analysis of trends in monetary policy, it also looks into how monetary authority plays an important role to maintain price stability with ensuring output growth during various economic situations.

Econometric analysis of monetary policy response to global financial crisis has been undertaken in Chapter V. In this chapter, Taylors Rule has used to analysis the behaviour of India's monetary policy. It also presents a comparison view of monetary policy response during pre and post financial crisis. Accompanied by estimation of Taylor's rules, this chapter also outlines brief historical journeying of the money, price level and output and effects of monetary policy.

Finally, Chapter VI presents summary and conclusions based on the results and findings of study and also draws essential policy implications. The details of methodology and graphs are presented in Appendix at the end of the study.

1.6- Limitations of the Study

Though this study analyzed monetary policy response to global financial crisis through the application of Taylor's rule, it has two major limitations. During the Global financial crisis, there was occurrence of another crisis that is known European Debt in late 2009. This study assumes that there is no impact of euro crisis on Indian economy. To prevent this, exchange rate in terms of US$ Dollar has been utilized as one of the main indicator among others. Secondly, responsiveness of monetary policy to global crisis has been analyzed thoroughly, but this study is limited in its scope as effectiveness of monetary policy to influence levels of income and output has not been examined.

CHAPTER-II

REVIEW OF LITERATURE

The existence of issues regarding the causes and effects of crisis is not a new phenomenon in economic literature. The global financial crisis which termed as the second biggest crisis to 1930s has a diversified cause and effect. Both monetary policy and fiscal stimulus has undertaken to solve this crisis. There have been various studies which focused on roots of crisis and its impact on Indian cases. Some of the past studies those are relevant to the topic are reviewed as under:

Ram Mohan (2009) deeply analyzed the effect of global financial crisis on Indian Economy. The crisis was reckoned to have started in August 2007 and impact of financial crisis was more than its initial forecast. The most vital turning point was Lehman Brothers cracked down on September 2008 and this resulted of cascading effect on other financial institution. The effect of the global financial crisis on emerging countries especially in India, were through three channels: the trade channel, the financial channel and the confidence channel. It was assumed that the primarily impact will be through trade channel, but at last found that three channels were responsible for adverse impact on Indian economy.

Reddy (2009) investigated various root of Global financial crisis. He mentioned that the most vital reason of crisis was inadequate regulatory framework rather than the regulator and irregular scrutiny of Federal Reserve in USA. The numerous views regarding root of financial crisis was inefficiency of regulator but it is useful to note that the most seriously affected financial institutions are those which were reputed for best capabilities in risk-assessment and risk-management. According to his findings, some lessons are drawn by him regarding causes and monetary policy regulatory framework. At last he mentioned that why Indian banking system did not hit too much as compare to developed nations. The lessons given by him are: "First, while the regulators focused their attention on the commercial banks, the crisis essentially originated from non-banks, especially investment banks, and in some ways the non-regulated parts of

commercial banks, as well as hedge funds or private-equity funds. But in India, The RBI retained its jurisdiction to regulate approximately 30,000 non-banking financial companies (NBFCs), but operationally it focused only on the deposit taking institutions, and systemically important ones, defined on the basis of the size of the balance sheet. Second, the relationships between banks and non-banks were not adequately regulated; with the result that the assurance of liquidity support from banks implicit in such relationships was not properly monitored. Third, while regulating the commercial banks, their excessive dependence on resources other than deposits was not monitored. Fourth, large corporate magnates have emerged as big players in financial markets, but financial regulators have failed to regulate them. Some of the players operated in a way that their operations became too big to fail. Fifth, the risk of individual financial institutions could have been assessed by each institution, to the satisfaction of the regulator. But the exposures of institutions to each other within the financial sector might have been largely ignored. It may be noted that this phenomenon is different from consolidated supervision of conglomerates, in the sense that it relates to exposures of conglomerates to each other collectively. Sixth, financial innovations appeared to spread the risk widely, and often away from regulated entities like banks and institutional companies. In reality however, such innovations removed the risks from regulators' radar, while substantively reverting to the banking system under stressful conditions. Correspondingly, the off-balance sheet obligations of financial institutions might have been seriously underestimated by the regulators."

Subbarao (2009) speech revealed regarding the satisfaction of Decoupling[1] Theory, during global meltdown. This Theory states that there is no longer dependence of emerging economy on USA demand. So, every emerging economy like India, China, Brazil have self-sufficient to create market for their own product. Hence, there is no dependence of growth of emerging economy on USA economy. "He also mentions that in a rapidly globalizing world, the 'decoupling theory' was never totally persuasive. Given the evidence of the last few months – capital flow reversals, sharp widening of spreads on sovereign and corporate debt

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[1] .Decoupling theory states that there is no longer correlation between Emerging and Developed Economies.

and abrupt currency depreciations - the 'decoupling theory' stands totally invalidated. Reinforcing the notion that in a globalized world no country can be an island, growth prospects of emerging economies have been undermined by the cascading financial crisis with, of course, considerable variation across countries."

Cukierman (2013) explained the monetary policy response to the global financial crisis of various central banks when the crisis hits the economy. His paper involves the comparison of policy before, during and after the global financial crisis. The paper documented the tradeoff between the lender-of-last resort function of the central bank and moral hazard. The advance knowledge of lender-of-last resort facilitated to create moral hazard and encouraged to buildup financial bubbles. At last the paper also suggested the controversial question like how and when a central bank should exit large scale monetary expansion.

Schneider and Kirchgassner (2009) analyzed the various causes that involves for the origin of the current financial crisis, and also deal with why the economists were became fail to provide suitable answer for the origin of the global financial crisis and the best possible solution to overcome it. The economics profession, in fact, unconscious of the alarming worldwide financial and economic crisis, and significantly underestimated its global magnitude and end result. They primarily focused on to explore various causes for this unconsciousness about the adverse effect of Global financial crisis on most of the emerging as well as developed nations. About the economic model they viewed that, models are applied to verify economic theory and these are based on historical data. Therefore, models applied to past data are representative-agent type and these models are served for only academic justification.

Melvin and Taylor (2009) emphasized on three dimension of global financial crisis, they are causes, threats and opportunities to global financial crisis. They analysis four important issue about four asset classes: the equity market, fixed income market, and emerging market. The paper was among the first to offer a inclusive view of what happened and why, along with full of meaning investigation of many significant issues raised by the crisis. Their analysis emphasized on equity market which covers the broad role of cause of Global financial crisis. All other classes such as fixed income market and emerging

market are played an auxiliary role supporting to equity market as the cause of crisis. But the conclusion shows both three are mutually affected and provided incentives to crisis.

EPW Research Foundation (2011) attempted to review cyclical response to monetary policy which is affected through changes in the repo rate, reverse repo rate, and the cash reserve ratio. They examined the response to changes in policy rates since 2001 in three different respects- the inflation rate, interest rate and the bench mark rates. And they found that the transition from the benchmark prime lending rate to the base rate has brought about better transmission of policy rate signals to the lending rates of banks. Suggestion to enhance transparency and improve the transmission channels of policy rates include setting a sunset date for BPLR, disclosing the methodologies in computing the BR, and resuming the practice of disseminating the actual lending rate structure of banks.

Pascha (2009) focused on the importance of regional cooperation to overcome from Global financial crisis. He termed the global financial crisis of 2008/09 can be considered as the worst economic downturn since economic depression in the late of 1920s and early of 1930s. According to his analysis the unregulated excessive spending and net capital inflows into the US was the main culprit of crisis. The article suggested that the stronger regional integration, regional monetary cooperation with stronger supervision and regulation of financial markets are necessary to stay away of such economic downturn.

Jeffery (2010) stressed the impact of global financial crisis on trade and the role of international institution, in particular the WTO. During the period between December 2009 and March 2010, more than 62 countries enacted new policy measures affecting foreign investors. In particularly, at least 23 economies (mostly G-20 countries) adopted state aid measures or stimulus packages. His article also focused on impact of the global financial crisis on Foreign Direct Investment flows.

Hutchison *et al.,* (2010) estimated monetary policy rule for Indian context by using Taylors-type rule. The paper estimated an exchange rate augmented Taylors rule for India for the period range from 1980Q1 to 2008Q4. They have used data such as overnight or money market rate as the policy rate, annual percentage change in WPI for inflation and percentage change in CPI because it

shows a great policy attention, for measuring output the paper involves IIP. All data are based on quarterly. For measurement of potential output they have used Hodrick-Prescott (HP) Filter. Their findings were, at 1% and 5% output gap is more typically significant where as at 10% it is sometimes shows significance. Hence, this consistence results show that policy made by RBI is responsive to output gap and this paper found that monetary policy is somewhat less responsive to output gap than earlier periods.

Sheel (2014) elaborated that the recent monetary policy has concentrated on two important aspects, such as external financial stability and domestic business cycle. In developed nations, where tightly regulated financial markets exists, are mainly concerned with developmental than regulatory. But emerging market economies are concerned with "Impossible trinity"[2] and Taylor Rule. The impossible trinity has no longer importance in case of developed nations. In advance economies the Taylor rule responds to the domestic business cycle. This article also suggested that emerging economies should follow a separate instrument as a part of the consistent framework instead of using single instruments, namely, the interest rate to target both external financial stability as well as domestic business cycle.

Ali and Islam (2010) examined the macroeconomic impact of global financial crisis on Bangladesh. The evidence suggested that the effect of crisis was mild in nature with modest slowdown of the economy. But the appropriate policy actions at the global level along with its own fiscal and monetary policy stimulus were helped to dominate adverse macroeconomic effect of global financial crisis. Further, his findings shows that the impact on Bangladesh much lower than both developed nations (such as the U.S. and EU countries) and emerging economies like India and China.

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[2] According to Mundell-Fleming a country can choose only two out of following three: a fixed exchange rate, monetary independence and free capital flows.

Concluding Remarks

To sum up, this chapter undertakes review of some of the past studies those are relevant to the topic. Most of the studies concluded that the basic root of the global financial crisis is improper transparency and lack of perfect accountability of mortgage loans which are provided at low interest rate. India's monetary policy played an important role to switch crisis. But all the past studies are free from empirical evidence of India's monetary policy during recent global financial crisis. In this backdrop, this chapter creates a new environment to review India's monetary policy and supported to draw up econometric analysis.

CHAPTER - III

METHODOLOGY AND DATA ISSUES

3.1-Introduction

In recent economic literature, monetary policy is considered as an important tool for maintaining macroeconomic stability with full employment. However there are some keen criticisms, particularly in the context of new classical school of economic thought. Global financial crisis since its outburst in July 2007 has adversely influenced entire world economy by various ways and Indian economy is not an exception. Vicissitudes of open economy especially during recession have been materialized all around. In India, frequent changes in monetary policy key rates have been made especially during previous decade and particularly after incidence of global crisis. These changes in key rates have primarily attributed to changes in rates of growth of GDP, inflation and currency exchange. These changes are initiated mainly to control inflation, raise GDP growth and also to maintain external balance of economy. Analysis of monetary policy response by changing key interest rate is an important area of research in monetary economics now-a-days. Henceforth, model and methodology to analyze India's monetary policy behaviour to different economic conditions has been examined using following model. This chapter also includes issues related to methodology, variable selection and data sources.

3.2-The Model

In present study, keeping in mind casualties among above mentioned macroeconomic variables, both simple and exchange rate augmented Taylor-type rules are used to analysis India's monetary policy response during pre and post global crisis period. The following Taylors rule specification (Taylor, 2001) is used to estimate causality among variables through ARDL approach to Co-integration:

$$IR_t = \beta_0 + \sum_{i=1}^{n} \beta_1 I_{t-i} + \sum_{i=1}^{n} \beta_2 IG_{t-i} + \sum_{i=1}^{n} \beta_3 ER_{t-i} + u_i$$

Where

IR= Interest Rate (Based on the Importance, see Appendix C)

I= Inflation Gap (Includes Consumer Price Index for agriculture, Consumer Price Index for Industrial Workers, Wholesale Price Index   )

IG= Output gap (Index of Industrial Production)

ER= Exchange rate (Exchange Rate Rupee to One Dollar)

For closed economy, exchange rate to be excluded from equation.

ARDL representation of the above Taylors rule for long run co-integration as below:

$$IR_t = \beta_0 + \sum_{i=1}^{n} \beta_1 IR_{t-i} + \sum_{i=0}^{n} \beta_3 I_{t-i} + \sum_{i=0}^{n} \beta_3 IG_{t-i} + \sum_{i=0}^{n} \beta_4 ER_{t-i} + U_i$$

For short run, estimation of error correction equation using difference of variables is necessary. A general Error Correction specification of above Taylors rule is given below:

$$\Delta IR_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta IR_{t-i} + \sum_{i=0}^{n} \beta_3 \Delta I_{t-1} + \sum_{i=0}^{n} \beta_4 \Delta IG_{t-i} + \sum_{i=0}^{n} \beta_4 \Delta ER_{t-i} + ECM + U_i$$

According to Taylors rule, all coefficients are expected to be positively significant. This study has taken care of different levels of significance i.e. 1%, 5% and 10%. At 1%, 5% and 10% level, it is said to be highly significance, significance and less significance respectively. F-statics results are not appropriate due to different orders of integration. Therefore, bound test or t-statistics can able to determine significance of concerned variables. Most common t-statistics has been used to test the significant of results.

3.3-Methodological Issues

Before estimating above regression equations, there is need to de-seasonalise the IIP data, so this study employed X12-ARIMA procedure for de-seasonalise IIP. Another issue for time series data is, it suffers from stationary problem. To deal with this problem, Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test have utilized to examine order of Integration (Appendix B)

In India, there is no officially measurement of potential output. Virmani (2004) compared results obtained from an unobserved components models and Hodrick-Prescott (HP) filter. He found that there is a little difference between these two. Therefore, this study includes HP filter to determine potential output and output gap.

In the recent past years, inflation rate became a major concern in economic literature. As it is an important factor to bring change in output, the optimal rate of inflation should be decided. There is a variety of views on determining inflation threshold level (Chakravarti, 1985; Rangarajan, 1998; Vasudevan *et.al.*, 1998; Kannan and Joshi, 1998; Samantaray and Prasad, 2001; Singh, 2010; Mohanty*,* 2011). The recent study followed by the pattern of Mohanty (2011) accepts inflation should be in-between 4.0 to 5.5 percent. In this regard, 5 per cent has been considered as optimal inflation rate for calculating inflationary gap in this study.

There are different methods to test the long run relationship among the time series variables. The most commonly used methods include Engel and Granger (1987) test, fully modified OLS procedure of Phillips and Hansen's (1990), maximum likelihood Johansen (1988, 1991) and Johansen-Juselious (1990) tests. All these methods assumes that all time series variables are integrated of order one i.e. I(1). In addition, these methods suffer from low power and do not give good results in case of small sample properties (Hasan and Nasir, 2008). To mitigate this problem, this study employs ARDL approach to co-integration methodology proposed by Pesaran and Shin (1999) which has been commonly used in recent studies. This methodology is chosen because the variables, that are used to estimate Taylors rule, are mixed of different order of integration i.e. I(0) and I(1) (Appendix B).

Besides this, other tests are applied to detect higher order auto-correlation (LM test), heteroscedasticity and normality. The Null Hypothesis for autocorrelation and heteroscedasticity is "there is no autocorrelation or heteroscedasticity". Whereas Alternative Hypothesis is "there is presence of autocorrelation or heteroscedasticity. Normality test is another issue which purely depends on size of sample. If the P-value is less than assumed level of

significance, it is assured that there is a problem of autocorrelation or heteroscedasticity. On the contrary, if P-value is higher than assumed level of significance, it is assured that there is no problem of autocorrelation or heteroscedasticity in given data. For large sample, normality tests give desirable results rather than small sample. As estimation in this study is based on small sample, there is no importance for normality test. Therefore, our estimation does ignore the results of normality test. The optimal lag length is adopted on the basis of Schwartz Bayesian Criteria. Before estimating Taylors rule through ARDL approach to co-integration, model stability needs to be check out. For this purpose, plots of cumulative sum of Recursive residuals and Plot of Cumulative Sum of Squares of Recursive Residuals are applied accordingly (Appendix A).

3.4-Variable Selection and Data Sources

This study assumed that RBI reacts to various factors such as Output gap, Inflation rate at the time of fixing short term interest rate. In present study, repo rate as well as reverse repo rate have used as proxy of short term interest rate (i.e. policy rate) based on their importance during different time periods. Generally Repo rate is used as indicator of interest rate in majority of years, but in case repo rate data is data available, reverse repo rate has been utilized accordingly (Appendix C).

Monetary policy is implemented so as to influence level of output during different economic situations, but it is considered more sensible to industrial output than agricultural output because agricultural output is mainly depends on monsoon and economic policy has no role to control natural forces. Henceforth, Index of Industrial Production (IIP) is the best measure of out as compared to Gross Domestic Product (GDP) for analyzing monetary policy behaviour as GDP (absolute values in native currency) comprises final outputs of all sectors. In this point of view, index of IIP has been used as an indicator of output for data analysis so as to remove the impact of natural calamities and output gap has been calculated using IIP data instead of GDP data. Thus, IIP has been used as proxy of national output/income in this study.

Moreover, this study includes WPI gap, CPI_{ag} gap, CPI_{iw} as the indicators of inflation rate. The base year for WPI is 2004-05=100, for CPI_{ag} 1986-87=100, for

CPI$_{iw}$ 2001=100. All Data are Quarterly in nature and the data range is from 2001Q1 to 2012Q4. Third important variable in the equation is Exchange rate for which values of Indian rupee in terms of US Dollar during the period under study are utilized accordingly. The whole period is divided into two phases; they are pre-crisis period which covers period from 2001Q1 to 2008Q1, and post-crisis period from 2008Q2 to 2012Q4.

Data related to different variables has collected from different data sources. Data on monetary variables like interest rate and exchange rate, foreign exchange reserve, broad money as the money supply (M_3) has collected from Hand book of Statistics on Indian economy, Reserve Bank of India (RBI). Data of Industrial production index has collected from indiastat database and RBI. Data portal government of India and Labor Bureau has been utilized for collecting data related to Inflation. All quarterly data are converted into same base year.

CHAPTER –IV

EMPIRICS OF MONETARY POLICY IN INDIA:
PERSPECTIVES AND TRENDS

4.1- Introduction

Very important actions of causes and effects that change the direction and path of development can be well known by studying its evolutionary process. This is more useful to know about past and to guide the future. Hence, this idea tempts to carry out intensive review of monetary policy trends for India. Over the six decades, the Indian monetary system has gone under rapid change followed by changing pattern of Indian economy. Moreover, the recent monetary policy has undergone frequent modifications with the respect of time change (Samantaray, 2003). This chapter intensively elaborates the successive path of monetary policy since independence. In genuine sense, the main objective of central bank is to maintain monetary stability by the appropriate setting of interest rate. The interest rate can be different types such as reverse repo rate or repo rate. When an economy is facing any downward movement (i.e. Output), central bank follows easing monetary policy to boost the economy, on the contrary when the economy is in above its equilibrium point (i.e. inflation) is prevailing in economy, central bank follows tightening policy by raising the rate of interest. So, it can be mention that equilibrating money market is the explicit goal where as equilibrating output market is the implicit goal of monetary authority. However, now-a- days controlling both the money market and output market became the prime object of monetary authority (Mohanty, 2011). It is important to know the changing pattern of monetary policy such as Objectives, policy targets and instruments, policy framework, which will be useful guide for empirical analysis of following chapter.

The discussion on the past developments of monetary policy trends in India since independence can be periodised on the basis of different aspects. But this chapter's method of periodisation is based on policy environment. Based on the policy environment, the whole policy can be classified broadly into two regimes. Beginning with 1950, first regime is extended up to the mid of 1980s and the second regime covers the period from mid 1980s to the recent. The initial or

formative period since independence up to mid 1980s is characterized by credit planning, banking expansion (1969), shifts towards tight regulated credit planning since the mid 1960s, increase the deficit financing by government etc. The first regime can further be divided into two sub regime, one is from independence to mid 1960s(i.e. 1964) which was based on credit planning and second sub regime started from mid 1964s to adoption of Chakravarty Committee report (1985). Second regime started with the recommendation of Chakravarty committee (RBI, 1984) which adopted money-multiplier framework. The economic reforms in 1991, divided second regime into two sub-regimes, first one is from 1984 to 1991 and second is since 1991. After economic reforms in 1991, there was a radical change from direct to indirect instruments to control deeply diversified financial market with the greater autonomy. However, both regimes have witnessed different situations and different policy frameworks adopted by RBI accordingly over the time.

Therefore, the whole monetary policy trends since independence are analyzed by dividing whole period into four sub-groups in this chapter. They are as follows:- (i) formative period (1947-1964), (ii) Period of banking expansion with social control (1964-1984),(iii) New regime of monetary policy with partially reforms(1984-1991), (iv) Post reforms with financial deepening (1992-2007), (v) Global financial crisis era (2007-2012).

4.2 - Historical Background of Monetary Policy in India

4.2.1- Initial Formative Periods (1947-1964)

Reserve Bank of India was set up in April, 1 1935 according to the provision of Reserve Bank of India Act 1934. Earlier to the independence, the main objective of RBI was (i) issue of notes, (ii) control of money supply on the behalf of the national interest, (iii) Public debt management, (iv) Maintaining the exchange value of rupee (RBI, 2008). After the independence, it faced a serious problem due to the partition of Reserve Bank Assert into two parts. Planning commission was set up in the year March 1950. The important objective was to ensure high growth by implementation of well regulated plan (GOI, 1951).

After establishment of planning commission, first five year plan was implemented in the year 1951. During this period India was faced severe food shortage and mounting inflation. As a planned development, macroeconomic policy in India moved from fiscal neutrality to fiscal activism (Reddy 2000). So this policy reflected full implication of Keynesian analysis and ignored classical view. India also had to recover its economy suffered from division of India and Pakistan. The growth to recover the economy was the prime objective of first five year plan. New investment requires credit. Hence, Central bank starts judicious credit with the anticipation of increase in production and savings (GOI, 1951). However, merely 10.3 percent growth of money shows a restrictive monetary policy. On the product market side Indian first five year plan was witnessed of actual 3.4 per cent of growth.

Monetary policy was faced unanticipated problem during the second five year plan as the degree of monopoly which was enjoyed by RBI during first five year plan was curtailed. At the initial period of second five year plan foreign exchange reserves were high and the motive was to ensure high growth rate. On this ground, second five year plan was implemented with the emphasis on heavy industrialization under the leadership of Prof. P.C. Mahalanobis (Mahalanobis, 1955). Although India achieved admirable expansion of output through industrialization but there was some drawbacks during second five year plan. Finance Minister T.T Krishnamachari emphasized to transfer balance to investment goods which declined foreign exchange reserve. This leads to the high pressure on monetary authority to formulate policy and to provide credit to government. The statistics shows that the money supply (M1) increased by 29.4 percent where as the real income and price level increased by 21.5 per cent and 35.0 per cent accordingly, resulting inflationary pressure in the economy. It was not possible to full credit control because there was fear of adverse impact on output. Therefore, RBI followed selective credit controls as the remedy to curtailed inflation. There was much need of expenditure for infrastructure development which was not immediately rise production, but could help in future production. It has further pressures to rise in consumer goods inflation in the economy. Central bank provided credit to private sector to boost further investment. Hence, RBI did

not follow any instruments to check general inflation rather than it follows selective credit control to some sector (Samantaray, 2003).

During the third five year plan India faced war with China in 1962 and war with Pakistan in1965 again put pressure on monetary authority to finance rapid increasing war and development of related fields needs. The defense expenditure rose from 2 per cent of Net National Product before 1962 to around 4 per cent between 1962 and 1972. (Joshi & little, 1987) Therefore, money supply (M1) increased by 57.9 percent while NNP increased by 11.8 percent and price by 32 percent during the third plan. Due to these two war India's growth rate rapidly decline. The government of India stopped five year planning and adopted three annual planning (1966-69) with the objective of ensuring a stable economic growth. To ensure more production, quota-cum-slab stipulating minimum interest rate was introduced in October 1960 (RBI, 2011).On the other hand it was pressured for monetary authority. Hence, target of monetary authority was shifted from price stability to greater economic growth during 1960s.

4.2.2- Period of Banking Expansion with Social Control (1964-1984)

After the two wars, RBI devaluated its currency for the first time to maintain stability in economy in 1966 (Balachandran, 1998). During 1965 to 1968, heavy draught distressed Indian economy. Food grains import rose significantly around one third of import bill. This shows that there was need for revolution in agriculture. Therefore selective credit was provided to agricultural sector under new agricultural strategy and a Green Revolution started in 1966. From 1966-71, cereal production was raised around 50 percent. All these incidents put pressure on monetary policy. For the second time, Rupee was devaluated in 1970. During this period, refinancing to different banks for more credit at lower interest rate to priority sector, deficit financing, external oil price shocks etc. brought constraints in monetary policy (Joshi and Little, 1987). More production was thought to be an important instrument for anti-inflationary measure. This shows that monetary policy was mainly controlled by political authority rather than monetary authority. There was no independent monetary policy rule to equilibrate money market. The Credit Authorization Scheme (CAS) was introduced in 1965 to ration bank credit (RBI, 2011). The aim of this scheme was to increase large credit and mobilization

of financial resources for the plan period. The further constraint was imposed when "Social Control" was introduced by the Government of India in December, 1967. The important provision of Social Control was to distribute credit to enhance flow of credit to priority sectors such as Agriculture and Small Scale Industries and exports (RBI, 2011). National Credit Council was set up on 22nd Dec 1967 to create forum for discussion and assessing credit to priority sectors on all India basic. This Council was also operating to bring co-ordination between Reserve bank of India and Government of India. Interest subsidy to certain economic activities was introduced to in the year 1968. Again Pre-shipment credit was introduced to promote export measure in 1969. This scheme helped banks to get refinance from Reserve Bank of India.

The year July 1969 was the most significant in the banking history because the major commercial banks in India became nationalized. This landmark event helps for expansion of banking sector and social control of bank credit. Fourteen banks got nationalization status. These nationalized banks were used non- food credit as instruments to developed economic status based on the needs. Reserve bank of India also starts credit planning to ensure large quantum and distribution of credit to achieve rural development. Due to the nationalization there was massive rise in branches all over the India which spreads banking facilities each and every corner of the county. This process helped rural people to achieve banking facilities. The number of commercial branches rose from 8,262 in 1969 to 13,622 in 1972 which rose to 45,332 by 1984. This shows that Indian Economy was fully financed deepening. During this period growth of output is lesser as compare to growth of financial asserts. "Volume of aggregate deposit of scheduled commercial banks increased from Rs 4,338 crore in march 1962 to Rs.60,596 crore in March 1984 and the volume of bank credit increased from Rs 3,396 crore to Rs. 41,294 crore in between the same period. Particularly, non-food credit increased from Rs. 3,915 crore in March 1970 to Rs. 37,272 crore in March 1984. The average annual growth rate of aggregate deposits markedly increased from 9.5 per cent for the period 1951-52 to 1968-69 to 19.3 percent for the period 1969-70 to 1983-84. In between the same period, bank credit increased from annual average of 10.9 percent to 18.2 per cent. This period also witnessed growing volume of priority sector lending, which had not received sufficient

attention by the commercial banks prior to nationalization. The share of priority sector advances in the total bank credit of scheduled commercial banks raised from 14 per cent in 1969 to 36 per cent in 1982.The share of medium and large industries in the bank credit had come down from 60.6 per cent in 1968 to 37.6 per cent in 1982". The main focus of monetary policy of RBI during this period (1964-84) was creation of bank credit, particularly on non-food credit. This was the main policy indicator during this period. Attention of RBI was based on the Scheduled banks because they had high proportion of bank credit and availability of data accordingly time. Reserve money was not used as the operational purpose. The main source of Reserve money was RBI's credit to Government which was beyond its control. Out of the policy instruments, SLR was mainly used for government plan expenditure from the banks. SLR was significantly increased from 25 percent in February 1970 to 36 percent in September 1984. RBI was providing funds to the banks through the 'general refinance' and 'export refinance'. CRR was used as the policy instruments to neutralize the inflationary impact of deficit financing. The CRR was raised from 3 per cent since September 1962 to 5 per cent in June 1973 and further it gradually rose to 9 percent in February 1984. There was no significant role of Bank rate in the policy operations (Samantray, 2003).

The year 1976 was the most important for the monetary thinking in India. There was a debate going on regarding monetary policy procedures of RBI. During this period, RBI's money supply analysis was based on the simple sum of its various components. Hence it was like an ex-post analysis. Gupta (1976) argued that money supply based on money supply theory like money-multiplier approach could provide better understanding than simple sum of various components of money supply. But unfortunately RBI economists rejected Gupta's view by saying unsatisfactory and unpracticed and they claim that there is a proper economic analysis of money supply of RBI's which is being carried out (Mujumdar, 1976).

During the period 1979-1982, Indian economy was hit not only by various macroeconomic problems, but also weather related problems. Adverse weather conditions brought down food grain production which further led to low industrial output. Due to hike in price of petroleum products and fertilizers, external sector

was deteriorated. Reserve money was explosive and it led to crowing out effect which is a threat to long run growth. All these factors were responsible for raise in general inflation. These difficulties put pressure on conduct of monetary policy. Therefore, there was need of an innovative policy which could bring equilibrium in economy. So, monetary policy was sharply shifted to a new regime

4.2.3- New Regime of Monetary Policy with Partial Reforms (1984-1991)

The debates and economic conditions discusses above led to comprehensive review of monetary policy and carried out necessary changes in the institutional set up as well as monetary policy framework. A high level committee under the chairmanship of Prof. Sukhamoy Chakravarty was set up in December 1982 to review monetary policy and to come up with new solutions. The most important objectives of committee was to review critically the structure and operation of monetary system with the basic objective of planned development, to examine various instruments of monetary policy, to review interaction between monetary policy and public debt. Management, to recommend suitable actions of formulation as well as operation of monetary policy and credit policy. The committee submitted its report in 1985. According to Chakravarty Committee Formulation of monetary policy should be consistent for the plan priorities so that mobilization of saving and utilization of natural resources could be social purposive. Although the saving rate has increased during the past decades but public investment was more than saving, so that this additional investment was made by deficit financing. This deficit financing led to inflationary pressure. To check this inflationary pressures committee was emphasized on tapping of the savings of public in a greater measure than past, by raising more savings from public sector enterprisers and increasing efficiency of both revenue and expenditure. This committee argued that RBI should focus on strong 'Price Stability'. Price stability does not mean that constant price level which was prevailing in past, but it should be consistent with an annual rise of 4 percent in the wholesale price index. Government should focus on increasing output which would led by 4 percent rise in WPI index. On the other hand, RBI should control the expansion of reserve money and money supply. Agricultural output was hitted by fluctuations of weather conditions which led to inflationary pressure, so this committee adopted strong supply management measures. At the same time,

committee also advocated demand management would controlled by volume of money and credit. These measures can be possible through the well co-ordination between Government and RBI.

Monetary policy should be formulated on the basis of monetary target. The committee emphasized on the inter-relationship between money, output and price. According to committee, target for growth of money supply (i.e. M_3) should be based on three factors such as anticipated growth in output in the light of the price situation. Monetary targets should be declared in advance. Target should be modified on the necessity of the time if there would some deviations of anticipated output and price situation in economy.

Chakravarty committee also pointed out that major cause of money growth was the substantial increase in amount of RBI credit to Government since 1970s. The important cause of high level of monetization of debt was due to low rate of interest rate of Government securities. The interest rate was so low that no bank, financial institution (public or other institutions) was willing to buy government securities or treasury bills. That's why the entire money required by government was borne by RBI. Therefore, the committee suggest rise in interest rate of securities so that non-banking institution would willing to buy and burden on RBI would be low which consequently would reduce money supply. Another fallacy was that 'joint Family' approach of balance sheet of government, RBI and Commercial banks existed, with transaction of different segment without common principle led to loss of transparency, accountability and an incentives to seek efficiency(Reddy, 2000b).

During this period, the interest rate of Government securities and credit market were tightly regulated. The credit was made to the government via stipulating SLR. Commercial banks are made to keep a fixed portion of their liabilities to invest in Government securities at below market rates, which is known as 'financial repression'. SLR was touched its highest point 38.5 by September 1990 (Samantray, 2003). But this increased in SLR was not sufficient to meet the government expenditure, so RBI was forced to be a residual subscriber to government. So this situation leads to automatic monetization in terms of

providing short term credit to Government. During this period, CRR was used for neutralizing the inflation.

4.2.4- Post-Reforms with Financial Deepening (1992-2007)

In 1991, India experienced sever macroeconomic crisis. The balance of payment was deteriorated drastically. Foreign exchange was drastically fall such that India has no capacity to import food items for more than two weeks. This crisis was forced to initiate new era of monetary policy. The reforms were introduced with the twin programs of stabilization and structural adjustment. The financial sector got its importance in the reform process which was recommended by Narasimham Committee- I (1991) and – II (1998). After the recommendations of Chakravarty Committee (1985), still there was excess burden on RBI because she was forced to supply additional money to meet the heavy expenditure of Government. Therefore, again Narasimham Committee (1991) gave recommendation for curtailing excess burden of RBI. According to the recommendations of these two committees, the Memorandum of Understanding (MoU) was signed between the Government and RBI in 1994 and RBI achieved a greater autonomy to conduct monetary policy. Way and Means Advances (WMA) was introduced to adjust temporary mismatch. As a result the proportion of net RBI credit to government out of reserve money was declined to 50 percent.

In the post-reform period, more emphasis was laid to develop and deepen various components of financial market such as foreign exchange market, money market and government security market. So that there was a significant shift of direct to indirect monetary policy. To widen money market, various period maturity Treasure Bill such as 14 days TB, 91 days TB and 364 TB were introduced. The interest rate of money market and security market was determined by market mechanism. Zero coupon bonds were introduced. All these measures had created not only a new treasury culture, but also create additional revenue to Government. So, the dependency on SLR was reduced. CRR was also brought down to 4.5 percent effective from June 2003 from 10 percent in January 1997 and 15 per cent in October 1992 (Samantray, 2003). Full convertibility of Rupee in Current account was introduced in Foreign exchange market since August 1994. Tarapore Committee was recommended a road map to capital account convertibility. Banks

are given to determine their domestic term deposit rates and prime lending rates (PLRs), except certain categories of export credit and small loans below 2 Lakh rupees. All Money market was set free. Bank rate was again activated in 1997. Since 2001-02, there were three broad objectives set by RBI in money market. They are (i) ensuring stability in short-term interest rate (ii) Minimizing Default Risk (iii) achieving balanced development in all segments of money market. All these reforms helped to improve economic conditions. Indian economy was shifted to a new stage.

4.2.5- Global Financial Crisis Period (2007-2012)

Monetary policy during global financial crisis era has been frequently changing. On the eve of the crisis policy emphasized on both financial inclusion and recent development in banking sector. On the behalf of this, a high level committee was set up to review 'Lead Bank Scheme' with the objective of monitoring the operation of commercial banks for achieving inclusive growth (RBI, 2007).

In September 2008, CDS taken as centre-stage as one of the reason for Lehman Brothers' insolvency which accentuated global financial crisis. With the case of Lehman fail, market participants and supervisors were criticized with the crash of a CDS. In consequences of the crisis, the U.S government planned a complete regulatory regime for OTC derivatives. U.S Legislative's step forward like Dodd Bill which was came into force in July 2010 as Wall Street restructuring and consumer protection act. The important objective of this Bill was to bring intelligibility and responsibility to the derivative markets. Poor management of counterparty risk, interconnectedness of outsized market participants, non-transparency of deal and positions, difficulty relating to actual risk exposures and hazard of corruption, were issues which occupied the mind of monetary regulators. Like U.S, India was not more less in policy attention. A high level committee was set up to review credit system and to bring preventive measures as the precaution to financial crisis. A Draft report of the internal group on suggested to introducing of CDS for corporate bonds. The most objective of this report to reduce risk and efficient management (RBI, 2010). There are also several response has been taken by RBI to handle out of financial crisis. These

response are reviewing financial system of capital flows and emerging market economy (RBI, 2009), Report on development of housing start-up index in India (RBI, 2009), Financial Stability Report (RBI, 2010), Reviewing of operating procedure of monetary policy (RBI, 2011), report of working group on the issues and concerns in the NBFC sector Report and Recommendations (RBI, 2011).

4.3- Analysis of Monetary Trends In India Since 1970-71

The above section elaborated changing perspectives on monetary policy in India since independence. But there is a need to highlight monetary trends during this period. This section includes various variables such as CPI_{ag}, CPI_{iw}, IIP, WPI, Foreign exchange reserve, Foreign exchange rate, Money supply, Bank Rate, SLR, Repo Rate and Reverse Repo Rate. For presentation of results related to trends, this section is divided into following three sub-sections.

(i)   Trends in Monetary Policy Key Rates

(ii)   Trends in Inflation and Output

(iii)   Trends in Forex Market.

4.3.1- Trends in Monetary Policy Key Rates

Monetary authority (RBI) had initiated changes in monetary instruments to tackle monetary flow and to ensure targeted growth. Table 4.1 explains various trends in monetary policy key interest rates during 1970-71 to 2012-13. On the eve of the independence, monetary policy was implemented largely through direct instruments of monetary control such as prescribed deposit and lending rates of commercial banks, selective credit control over sensitive commodities, sector specific standing facilities, Statutory Liquidity Ratio (SLR) and Cash Reserve ratio (CRR) and Bank rate was used as a general instrument of interest rate policy (RBI, 2011). Table 4.1 highlights trends in India's main monetary policy instruments during the period from 1970-71 to 2012-13. Data revealed that Bank rate (active rate) has continuously rising from 6.40 per cent during 1970-75 (FYA) to 11.50 per cent during 1990-95 (FYA[1]). Since then, it has substantially declined to 6.00 per cent during 2005-10 (FYA) form 11.50 per cent during 1990-95(FYA). However, it increased to 7.50 per cent afterwards during the period 2010-13

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[1] FYA denotes for Five Yearly Average

(FYA). Similar trend has also been recorded in case of Statutory Liquidity Ratio (SLR) which has increased consistently to 37.5 per cent during 1985-90 from 29.8 per cent during 1970-75 (FYA). But, it showed clear-cut decline in its value from 37.5 per cent during 1985-90 (FYA) to 24 per cent during 2010-13(FYA). This hike in bank rate manifested Central Bank's efforts to curtail inflationary pressure during concerned period. Impact of alarming situation of fiscal crisis of late 1980s can easily be realized from the increasing values of bank rate as well as SLR during specific period. After Chakravarty Committee report, there is also increase in bank rate till 1994-95, but there is a marginal decline in SLR from 37.5 per cent to 37.1 per cent during 1985 to 1995. Since 1994-95, both bank rate and SLR started to decline which indicates towards lessening importance of these tools for monetary policy.

There was a paradigm shift from reliance on direct instrument to Liquidity management system through open market operation through buying and selling of government securities, Repo and Reverse repo under the Liquidity Adjustment Facility (LAF) which was activated in June 2000 (RBI, 2003). Table 3.1 exposes declining trend in both repo and reverse repo rate till 2004-05 financial year. Since then, it registered an increasing trend from 6.50 per cent and 4.75 per cent in 2003-04 to 7.75 per cent and 6.00 per cent in 2007-08 respectively. Surprisingly when there global financial crisis was incidental worldwide, both repo and reverse repo rate recorded steep decline from 7.75 per cent and 6.00 per cent in 2007-08 to 4.87 per cent and 3.37 per cent in 2009-10 respectively. However, there is increase in both ratios to 7.90 per cent and 6.90 per cent in 2010-11, but again a decline was there in their values respectively to 7.75 and 6.75 per cent in 2012-13. It is held that these monetary instrument experienced frequent changes during period since 2003-04. Comparing trends of repo and reverse repo rates during pre and post global crisis period, it is established that frequency of changes in repo and reverse repo rates was higher during global financial crisis as compared to pre-global crisis, which indicates that monetary policy was more active during post-crisis period as compared to pre-crisis period.

Table 4.1:
Monetary Policy Key Rates during 1970-71 to 2012-13

(In Percentages)

Years	Bank Rate*	SLR*	Year	LAF	
				Repo rate	Reverse Repo rate
Pre- Reforms Periods					
1970-71 to 1974-75	6.40	29.80	2003-04	6.50	4.75
1975-76 to 1979-80	9.00	33.40	2004-05	6.00	4.62
1980-81 to 1984-85	9.80	34.80	2005-06	6.25	5.25
1985-86 to 1989-90	10.00	37.50	2006-07	7.25	5.87
Post-Reforms Periods					
1990-91 to 1994-95	11.50	37.10	2007-08	7.75	6.00
1995-96 to 1999-00	10.26	28.25	2008-09	7.25	4.16
2000-01 to 2004-05	6.50	25.00	2009-10	4.87	3.3
2005-06 to 2009-10	6.00	24.8	2010-11	6.12	4.82
2010-11 to 2012-13	7.50	24.00	2011-12	7.90	6.90
			2012-13	7.75	6.75

Note: * Values for these variables are Five Yearly Averages (FYA) in percentages.
Source: Author's Calculations.

Thus, it is held that RBI laid more emphasis on bank rate and SLR for controlling inflationary tendencies in Indian economy during pre-reform period as compared to post-reform period because value of these two rates are continuously declining since the introduction of economic reforms particularly in its financial sector. In addition, Repo and Reverse Repo Rates have been emerged as active tools to control inflationary tendencies since the beginning of 2000s. Particularly after the incidence of Global financial crisis, these rates are mainly used to maintain financial stability in the country.

4.3.2- Trends in Inflation and Output

Growth in inflation and output rates are the two important factors which highly determines of nature and extent of changes monetary policy instruments during different economic conditions, so it is necessary to analysis the trend of inflation and output. Table 4.2 describes major trends in inflation and output in Indian economy by examining the growth rate of indices namely CPI_{ag}, CPI_{iw}, WPI and IIP during the period from 197071 to 2012-13. The five yearly averages of

indices namely WPI, CPI_{ag}, CPI_{iw} touched the highest point of 13.31 per cent, 13.92 per cent, and 12.17 per cent respectively during 1970-71 to 1974-75, where as the lowest IIP growth has witnessed. The factors, responsible for high inflation and low IIP growth were war expenditure (indo-Bangladesh), fall Agricultural production due to adverse weather, rise in world food price, rapid increase in M3, widespread riots in Gujarat and Famine in Maharashtra (Joshi & little, 1987).IIP showed a rapidly increasing trend since 1970-71 to 1989-90, but then IIP followed by up and down without showing systematic trend. Whereas during post-reform period, IIP is fluctuated between 4.09 per cent and 8.97 per cent. The highest IIP growth rate (8.97 per cent) was achieved in 2005-10 which indicates that there was a marginal adverse effect of global financial crisis.. During 2010-11 to 2012-13, IIP has declined to 4.09 per cent. In the period of 1970-75, WPI inflation was 13.31 per cent and for the next five year it came down to 4.65 per cent

In case of CPI_{ag} and CPI_{iw} there was no systematic trend. But, CPI_{ag} fell down to -0.01 per cent rate of growth. Second highest value of WPI inflation (4.34 per cent) was recorded during 1980-85. In overall, WPI growth during pre-reforms period is highly volatile as compared to post-reform period. However, the highest WPI (10.99 per cent) was recorded in 1990-95. During the subsequent period, WPI was more stable which fluctuated around 5 per cent. However, during 2010-13, there is a sharp increase in WPI inflation from 5.53 per cent in 2005-10 to 8.62 per cent. This sharp increase of WPI recorded due to high food inflation in Indian economy.

Table 4.2:
Trends in Inflation and Output in India during 1970-71 to 2012-13

(In Percentages)

Years	CPI$_{ag}$	CPI$_{iw}$	IIP	WPI
Pre- Reforms Period				
1970-71 to 1974-75	13.92	12.17	3.49	13.31
1975-76 to 1979-80	-0.01	2.66	5.24	4.65
1980-81 to 1984-85	8.65	10.15	6.36	9.34
1985-86 to 1989-90	7.49	6.51	8.49	6.65
Post-Reforms Period				
1990-91 to 1994-95	10.93	10.42	5.26	10.99
1995-96 to 1999-00	6.67[#]	8.56	7.30	5.24
2000-01 to 2004-05	2.08	3.93	5.76	5.22
2005-06 to 2009-10	8.66	-6.62*	8.97	5.53
2010-11 to 2012-13	9.41	9.41**	4.09	8.62

Note: * and ** indicates Five Financial Yearly Average (2006-07 to 2011-12) and two years financial year average (from 2011-12 to 2012-13) respectively at base 2001=100. Other values of CPI $_{iw}$ are based on 1982=100# shows Four Years Average from 1970 to 1995 based on base year 1960-61=100 and from 1995 to 2012 based on base 1986-87=100.
Source: Author's Calculation

However, there is a focus of building monetary policy creditability to face financial crisis. Report on financial stability and on operating procedure of monetary policy, looking into Non-Banking Financial Companies (NBFCs) and establishment of Credit Default Swap (CDS) show the well response to face crisis. In this period, there was internal threat of rising inflation rate above its target level (i.e. 5 per cent) as compared to pre-crisis period and also external shocks. In this situation, the response of RBI as a watch dog as the frequency of changing repo rate was high as compared to pre-crisis and it played crucial role to tackle this. It can be concluded in nutshell that RBI proved praiseworthy to mitigate the adverse effects of external factors, but failed completely to check incidence of high inflation particularly during post global crisis period since 2005-06. However it is impossible to prove truthful all ways around in the context of recent monetary theory. Monetary policy accompanied by fiscal policy in the context of new-Keynesian framework can save the economy from external vicissitudes but could not fade away the adverse impact of increasing money supply through fiscal stimuli in the economy. In this regard, it is held that monetary policymaker

performed the best given the economic constraints and save the economy from bad affects of unregulated-liberalization globalization.

4.3.3-Trends in Foreign Trade and Forex Market

In the context of open-economic environment characterized by foreign competition in trade and finance activities, variations in external sector variables play a crucial role in monetary policy formulation. Monetary policy has been used as to provide credit for developmental needs upto 1991. Since the implementation of economic reforms, three is paradigm shift in development strategy from inward oriented import substitution to outward oriented export promotion one. Establishment of WTO changed the world economic order and being its fouder member, India has already accessed to it rules and commitments. Under the influence of changing domestic and global economic environment, India has been continuously integrating with world economy since beginning of 1990s. It is, therefore, necessary to look upon the behavioral pattern of monetary variables of Indian trade and foreign exchange. Table 4.3 reveals trends of india's forex market during the period form 1970-71 to 2012-13 using unit value and volume index of exports and imports.

Table 4.3:
Trends in Foreign Trade in India during 1970-71 to 2012-13.

(In percentages)

Years	Growth rate of price index of foreign Trade			
	Unit Value Index		Volume Index	
	Exports	Imports	Exports	Imports
Pre-Reforms Period				
1970-71 to 1974-75	12.53	22.65	5.82	4.17
1975-76 to 1979-80	6.28	6.71	7.82	9.27
1980-81 to 1984-85	10.1	8.00	2.67	6.89
1985-86 to 1989-90	10.49	7.96	8.03	8.15
Post--Reforms Period				
1990-91 to 1994-95	12.58	7.56	10.89	12.94
1995-96 to 1999-00	4.28	6.87	10.21	11.87
2000-01 to 2004-05	5.67	9.62	12.67	8.69
2005-06 to 2009-10	8.54	6.96	8.21	14
2010-11 to 2012-13	13.3	31.97	10.62	-2.27

Note: Growth has been calculated by taking average of percentage change over five years.
Source: Author's Calculations

Growth of unit value index of export was found to be higher during pre-reform period as compared to post-reform period as double-digits growth was recorded during the period 1970-90 except during 1975-80. On the other side, double-digit growth was recorded only in 1990-95 during post-reforms period. Similarly, there was a declining trend in growth of import unit value index from 22.65 per cent in 1970-75 to 7.96 per cent in 1985-90. But, it has increased from 7.56 per cent in 1990-95 to 31.97 per cent in 2010-13. Thus, it is established that import unit value index behaved differently during pre and post-reform period. Thus, the impact of change development strategy could easily be realized from variations in the growth of export and import unit value indices. Growth of both import and export volume index was single-digit, but registered upward trend during the period from 1970-80. On the other, the growth of import and export volume index was double-digits during the period ranging from 1990-91 to 2012-13, but experienced highly fluctuating trend.

Table 4.4:
Trends in Foreign Exchange Reserves, Exchange Rate and Money Supply in India during 1970-71 to 2012-13. **(In percentages)**

Years	Foreign exchange Reserve	Exchange Rate	Money Supply (Broad money)
Pre-Reforms Periods			
1970-71 to 1974-75	5.28	7.68	15.22
1975-76 to 1979-80	42.3	8.51	19.33
1980-81 to 1984-85	-2.1	9.75	16.89
1985-86 to 1989-90	-7.05	13.82	17.55
Post--Reforms Period			
1990-91 to 1994-95	47.71	26.16	18.00
1995-96 to 1999-00	9.35	38.30	16.35
2000-01 to 2004-05	30.63	46.53	14.83
2005-06 to 2009-10	17.22	44.62	20.08
2010-11 to 2012-13	1.67	49.30	14.38

Note: Growth has been calculated by taking average of percentage change over five years.
Source: Author's Calculations

Table 4.4 highlights trends in trends in foreign exchange reserves, exchange rate and money supply in India during 1970-71 to 2010-11. Growth of

foreign exchange reserves increased from 5.28 per cent in 1970-75 to 42.30 per cent in 1975-80. Subsequently, it has experienced negative growth of -2.10 per cent and -7.05 per cent during 1980-85 and 1985-90 respectively, which is the indicator of serious imbalance in India's external sector during 1980s. During the period since 1990-95 foreign exchange reserve recorded double-digits growth except during 2010-13. Growth was highest of 47.71 per cent during 1990-95 followed by 30.63 per cent during 2000-05.

Growth of the exchange rate theoretically manifests depreciation of particular countries currency. India's exchange rate has experienced ever-increasing growth from 7.68 per cent to 49.30 per cent during the period ranging 1970 to 2013. Data also shows that growth of exchange rate was lower (single digit during majority of periods) during pre-reform period as compared to post-reform period which was high of more than 25.00 per cent over the period.

Trends in growth of money supply reveal that there was a high growth of broad money since 1970-71 to 2010-13. Moreover, growth of broad money was found to be higher during post-reform period as compared to pre-reform period. In addition, highest growth of 20.08 per cent was recorded during post-global crisis period which clearly indicates provision of fiscal stimulus through deficit financing to fade away adverse impact of global financial crisis. However, it has created implications by various ways, particularly in case of incidence running inflation in Indian economy. It also indicates towards loose fiscal stance in Indian economy which has serious implications for effectiveness of monetary policy throughout the period since 1970-71.

4.4- Concluding Remarks

Based on above discussion on changing perspectives on India's monetary policy, it is concluded that the evolution of monetary policy has gone under rapid change during past sixty years. The initial formative phase was most tough period for the banking history in India since independence; however its functions were limited during this period. But the independency enjoyed by her was curtailed. During banking expansion and social controlled period (1964-84), RBI was put pressured for development needs through following deficit finance (i.e. monetization). During the partial-reform period and full-reform period monetary

authority got more autonomy to make changes in key rates so as to influence level of income and employment and maintaining economic stability through controlling inflationary/deflationary tendencies. Thus, there is development in monetary policy formulation and execution during the period since independence. However, RBI played a significant role and responded to global financial crisis by frequent changes in key interest rates especially since 2000s. There was lots of difficulties for monetary authority, but still it is well controlled with slow and steady growth. Now-a-days, monetary policy playing dual role i.e. inflation targeting and output growth (Rangarajan, 2001).

Analysis of trends in India's monetary policy asserts that there was a significant fluctuation during pre and post reforms period. Bank rate and SLR were the main instruments of monetary policy in India during pre-reform period. Both bank rate and SLR are increasing during pre-reform period. After implementation of reforms, both bank rate and SLR has experienced decreasing trend. However, both rates are remains high during pre-reform period as compared to post-reform period. In 2003-04, RBI focused on LAF (both Repo and Reverse Repo rate) as policy instruments. There is no systematic trend in both repo and reverse repo rate. The highest repo and reverse repo rate was achieved during 2011-12. CPI_{ag} fell to negative during 1975-80. CPI_{ag}, CPI_{iw} and WPI remain high during post-reform period as compared to pre-reform period. Especially, during global financial crisis, inflation touched its highest point. There is increasing trend of IIP during pre reform period but it remains higher during post reform period. Export and import of unit value index is more during pre crisis period. But export and import volume index is higher in post reform period. Foreign exchange reserve was low during pre-reform period. It has substantially increased in post-reform period. Exchange rate is continuously rising since 1970s. Growth of money supply was also higher during post-crisis period as compared to pre-reform period.

CHAPTER - V

ESTIMATING MONETARY POLICY RESPONSE DURING

PRE AND POST-GLOBAL FINANCIAL CRISIS PERIOD

5.1- Introduction

In the previous chapter, trends of monetary policy since independence with respect different economic situations have analysed. On the eve of the planning era the monetary policy in India was primarily based on credit planning. Gradually, this credit plan was shifted to selective sectoral credit. However, overall objective of monetary authority was to stabilize money market and monetary targeting was introduced to enhance the level of output. Now-a-days two broad objectives of monetary authority are price stability (explicit objective) and economic growth (implicit objective) (Rangarajan, 2001). Monetary policy in the country should be formulated such a way that both explicit and implicit objective will be achieved simultaneously. This chapter provides a brief historical journey of two modern views on monetary policy and presents results and discussions based on econometric estimation.

5.2- A Brief Historical Overview

Each and every economic agent is both affecting and affected by themselves. There is well furnishing statement that if one economic agent fluctuates from its predetermined path, then it will affect whole economy and the result may positive (i.e. boom) or negative (i.e. depression). The negative impact proved to be severer than positive impact and recently witnessed as the Global Financial Crisis. This crisis was not resulted due to Macro imbalances, but due to the micro-mismanagement. Moreover easy monetary policy in major financial institutions, wide use of highly complex debt structure instruments, inadequacy of banking supervision, unidirectional method to achieve objective welcomed to this crisis (Merrouche and Nier, 2010).

However there is a circular relation from interest rate setting of central bank to growth of output. Central banks usually implement their policy by looking pre-

achieved growth rate, target growth rate and inflation targeting. From the market side, output also behaves with respect to change in interest rate. If interest rate falls then it will leads to more investment through investment multiplier and hence leads to more output and income (Lange, 1943), on the other side if income increases it will leads to more demand for investment goods which leads to rise in interest rate so that market will be equilibrium.

Over the last two century there is a silent revolution linking to the monetary policy and output. As the time passes new theories are coming to exist by replacing old theories. Mercantilist views, classical views, Keynesian view, Neo classical views, monetary views, rational expectation and modern theories. The classical economist like Adam smith, David Ricardo, J.B Say and J.S Mill placed a great faith on market behavior and its natural adjustment process as a means to restore full employment in the economy in long-run. The interest rate, wage rate etc. are free floating in nature. If there is some fluctuation in money or product market, then it is only for short run, in long-run both markets will be in equilibrium by flexibility of interest, wage rate. Supply will be based on exactly to match demand condition resulting no overproduction in long run. Markets are cleared completely based on the assumption of perfect competition, so that each and every economic agent has perfect knowledge about market conditions. According to classicalists, the role of money has nothing more than a 'Veil' due to which aggregate demand is always equal to aggregate supply. In the classical theory the rate of interest is always determined competitively by the supply of and demand for loanable funds or by aggregate saving and aggregate investment. There is no role of money to influence production in long-run. So, in long-run Money is neutral (Froyen, 2012).

The incidence of great depression forced economists to re-think causes of unemployment and deflation representing them as economic crisis. There was paradigm shift in the way to analysis economic phenomenon in 1936 with the publication of 'General Theory of Employment, Interest and Money ' by John Maynard Keynes. Until the great depression, most of the economists were working on business cycle theory in the context of classical framework. Great Depression witnessed intellectual failure as world economy was not able to restore earlier levels of employment and output and macroeconomics was called

for. The general theory offered a new interpretation of events and also an conceptual framework as well as a clear argument of government interference. Keynes had introduced the concept of investment multiplier (Lange, 1943). Unemployment was incidental primarily due to lack of effective demand which can be increased through more investment, which further leads to more output and more income. Keynesian theory of demand for money explains how interest rate setting would affect aggregate demand and also highlights the inefficiency of monetary policy during liquidity trap. Hence, Liquidity preference idea was based on *'Animal Spirits'* which played as a major factor behind shifts in demand and output (Keynes, 1937). During the early 1950s, a new revolution emerged in Macroeconomic literature. Out of serious criticisms of classical and Keynesian ideas individually, which is formed as "Neoclassical Synthesis". Both ideas had been satisfying their role in different time horizons. The classical idea was based on long run where as Keynesian one based on short run as Keynes believed that *"in long run, we are all dead".* The Synthesis explained the interaction between both short run and long run by advocating that monetary policy can affect to real variable up to its full employment level, but it has no effect on real variable after full employment level.

Another revolutionary idea emerged in 1960s by a small and influential minority named as 'Monetarist'. The intellectual monetarist's leader Milton Friedman argued that our understanding of economic phenomenon is very limited. According to him, a systematic money growth will lead to more output and this monetary policy has a significant role in improving an economy. The decade 1960s, debate between Keynesian and Monetarists dominated the economic literature which was centered with the issue regarding Phillips curve, and effectiveness of monetary and fiscal policies.

Despite the debate between Keynesian and Monetarists, macroeconomics looked like a successfully and mature field around 1970. All intellectual frameworks, provided in previous discussions, were remained validated for some years, but this field was faced by crisis within a next few years. By the mid-1970s most of the nations are faced stagflation, the phenomenon introduced in economic literature at the first time. In the early 1970s, a group of economists like Robert Lucas from Chicago, Thomas Sargent from Minnesota and Robert Barro from

Chicago strongly opposed the mainstream macroeconomics that involve in monetary policy versus fiscal policy. Lucas and Sargent (1979) argued Keynesian economics ignored the implications of rational expectation. The way they have proceed by assuming that people formed their rational expectations, is based on the information they have. So, three broad implications of rational expectations of Keynesian macroeconomics had highly criticized by new-classical macroeconomics. The first implication of rational expectations was that the people's expectations are subject to change over the time by the influence of economic factors as well as social factors. So whatever macro econometric models suggest, that is only to capture the set of relations in the past. This relation between economic variables is influenced by past and present values of exogenous variables. Hence, it was proved with help of macro econometric models that past policy is a poor guide to what would happen under new policies. This critique of macro-econometric models became known as the *'Lucas Critique'*. The second implication revealed that when the rational expectations are applied on Phillips curve analysis in the Keynesian models, the results are delivered actually un-Keynesian conclusions. In Keynesian framework, slow adjustment of prices and wages resulted slow return of output at natural level. But according to Lucas, this adjustment process highly depends on the wage setter's backward-looking expectations of inflation. Once the assumption would made that wage setters had rational expectations, the adjustment process will be much faster. So the anticipating increase in money supply will lead only inflation, that is a un-Keynesian conclusion. However, Lucas agreed that in Keynesian model, only unanticipated shock in monetary policy can affect output and lead to validate Keynesian theory. Predictable moments of money supply have no effect on output. The third implication of rational expectations theory reveals that if the people and firms had rational expectations, it was wrong to think that policy as to control of a complicated system. Rather it is right way to think that policy as a game between policymakers and economic agents,, not for optimal control of inflation/deflation, but for a game theory (Lucas, 1972).

5.3- Two Modern Formulations

However, during the recent three decades two new modern Rules emerged in monetary economics for examining responsiveness of monetary policy using

different macroeconomic variable in different economic situations. These two rules are McCallum Rule and Taylors Rule. The essential effort of these two rules is to develop simple and transparent system that could assure improved macroeconomic performance of a particular economy through monetary policy.

The McCallum rule (McCallum, 1987) explains that the growth rate of monetary base (as an instrument) is a non-discretionary feedback rule for nominal GDP (as a target). Accordingly, this rule assumes that the change in monetary base initiate changes in high-power money through changes in reserve requirements. So, reserve requirements have the important role to play to control economic activities.

On the other, Taylor rule (Taylor, 1993) prescribes an adjustment of interest rate instruments in a systematic manner in response to changes in inflation and macroeconomic activities. In Taylor's rule, interest rate played important role rather than monetary base. Now-a-days most of the central banks are controlling economic activities through appropriate interest rate setting. In India, RBI responds to different economic situation by changing key interest rates. Henceforth, it is important to analysis behavior of India's monetary policy using Taylor's Rule. In this chapter, behavior of India's monetary policy during pre and post-global crisis period is analyzed using this rule.

5.4- Results and Discussions

Recent developments in monetary theory state that the role of monetary authority, not only to regulate the money market, but also for maintaining stability in goods market, is very essential. Taylor's rule (1993, 2001) argued that the apex monetary authority should follow a systematic pattern of adopting policy. In case of India, systematic pattern has been followed by RBI for maintaining economic stability during different economic situation. Therefore, this section presented the results of Taylor's rule equation during pre and post financial crisis.

The issue relating to the operational Taylor's rule is, whether forward-looking or backward looking to be used. Clarida et al., (1998) used forward-looking rule for the US, the UK and Japan. Moreover, rule is behaving quite well when it uses the recent inflation rather than using forecast of future inflation and

output. A promise to increase interest rate after inflation increase; will immediate contract aggregate demand because of the shock that is expected to increase inflationary pressure and further there will be quick adjustment as economic agents are rational to anticipate future rates. Consequently, there will be less impact on goods market (Patra and Kapur, 2012). Henceforth, this study emphasized on backward looking Taylor's rule.

To tackle problem of different order of Integration, ARDL approach has applied to estimate Taylor's rule equation. The variables that are used for estimating Taylor's rule have different order of integration. The variable Index of Industrial production gap (IIP) is Integrated of order zero i.e. I(0), which highlights Data is stationary at its level. On the other, data related to Consumer price Index for agriculture gap (CPI_{ag}), Consumer Price Index for industrial workers gap (CPI_{iw}), Wholesale Price Index gap (WPI), Interest Rate (IR) and Exchange rate has integration of order one i.e. I(1) (Appendix B), which highlights that variables are stationary in its first difference.

The goodness of fit of a model specified is an important issue. There are two methods to determine the presence of goodness of fit. These two are R^2 and Adjusted R^2. R^2 is the per cent of effectiveness of independent variable on dependent variable or it shows the level of variance covered due to explanatory variables in explaining dependent variable. Adjusted R^2 is same as R^2 , but it imposes penalty as the number of explanatory variables increases. The range of both R^2 and Adjusted R^2 lies between 0 to 1. The issue behind goodness of fit is, high R^2 with insignificant coefficient might be disappointing results, but R^2 is encountered by difference in order of Integration used in regression and number of observation. Gujarati (2010) asserts that if the objective is more concerned with logical and theoretical relevance of explanatory variables to dependent variable, the R^2 has less importance. So in this process if model obtains high R^2, then it is well and good; on the contrary if R^2 is low, it does not mean the model is necessary bad. Autocorrelation is another issue that could mislead econometric estimation. Usually, DW statistics can be used for detecting first-order autocorrelation. But, the study utilizes LM-test and represents LM-statistics to deal with the problem of higher order autocorrelation. High values of R^2 and adj. R^2 in estimated regression equation assure that model explains the behaviour of

dependent variable up to a large extent. Results of LM-statistics further reveals that problem of autocorrelation have been efficiently checked. Moreover ARDL approach in a recent technique to tackle the problem of different orders of integration and it also assures that latter has been checked accurately in this estimation.

The estimates describing behavior of India's monetary policy with respect to interest rate during pre and post global financial crisis are presented in two tables, table-1 and table 2. Table 1 represents long-run relationship during both pre as well as post-crisis periods. Results of both simple and exchange rate augmented Taylor's rule equations are presented in both the tables. Both tables include results of six ARDL regression equations for pre-crisis as well as post-crisis. Among these six, initial three regression equations represent outcomes of closed or simple Taylor's rule which excludes exchange rate. The succeeding three regressions equations represent open or exchange rate augmented Taylor's rule. Similarly, Table 2 represents the dynamics of short-run relationship of variable specified in model. Again in this table, initial three regression equations in both pre-crisis and post-crisis show short-run dynamisms of Simple Taylor's rule. Whereas succeeding three regression equations represent short-run dynamism of exchange rate augmented Taylor's rule.

Table-5.1 Long- Run Estimates of Taylor's Type Rule Under ARDL Approach During Pre (2001Q1-2008Q1) and Post Crisis Period (2008Q2-2012Q4)

SI. No	CPI$_{ag}$ Gap Coefficients	t-ratio	p-value	CPI iw Gap Coefficient	t-ratio	p-value	WPI Gap Coefficient	t-ratio	p-value	IIP Gap Coefficient	t-ratio	p-value	Ex. Rate Coefficient	t-ratio	p-value	R^2	Adj R^2	LM static	p-val
1	0.84	2.41	0.24							-.002	-.006	.99				0.94	0.93	3.80	0.43
2				(1.16)***	6.08	0.00				0.01	0.13	0.89				0.97	0.96	3.37	0.49
3							0.101	0.25	0.80	0.418	0.787	0.439				0.95	0.94	2.51	0.64
4	0.473	1.17	0.9							0.72	1.22	0.23	-0.65	-1.49	0.1	0.96	0.95	4.46	0.34
5				(1.17)***	7.032	0.00				0.032	0.298	0.76	-0.079	-1.09	0.2	0.97	0.96	3.23	0.51
6							0.811	0.32	0.74	4.28	0.49	0.62	-3.04	-0.54	0.59	0.95	0.94	3.72	0.44
7	1.73	0.64	0.52							-1.92	-7.78	0.44				0.91	0.89	6.75	0.14
8				1.32	1.30	0.24				-1.20	-1.77	0.09				0.92	0.90	6.28	0.17
9							-0.51	-0.28	0.77	-1.23	-0.54	0.59				0.86	0.83	9.01	0.06
10	1.40	0.63	0.53							-1.58	-0.77	0.45	0.09	0.27	0.78	0.91	0.88	7.52	0.11
11				-1.76	-1.23	0.24				1.04	1.007	0.33	0.50	1.707	0.11	0.94	0.92	8.87	0.64
12							(0.26)*	1.85	0.08	0.04	0.15	0.87	0.03	0.53	0.6	0.91	0.89	6.38	0.17

Pre-crisis Period (rows 1–6); Post-crisis Period (rows 7–12)

Note: ***, **, * represents 1%, 5%, 10% level of significance Source: Author's own calculation.

5.4.1- Long-Run Analysis of India's Monetary Policy Response

This section represents the long-run behaviour of India's monetary policy with respect to specified in the model. Long-run relationship between output, inflation, exchange rate with interest rate are highlighted by the results of regression equations in following tables. Table 1 displays the long-run estimates of Taylor's rules equations using ARDL approach during pre and post-crisis period.

5.4.1.1- Pre-crisis Period (2001Q1-2008Q1)

Regression equation 1 (in table 5.1) represents responsiveness interest rate to IIP gap and CPI_{ag} gap during pre-crisis period. The P-value of both IIP gap and CPI_{ag} gap are 0.99 and 0.24 respectively. The LM-statistics (3.80) with p-value (0.43) highlights absence of autocorrelation problem. Coefficients of both independent variables are found to be insignificant. Thus, it is concluded that Interest rate setting by India's monetary policy during pre-crisis period has no long-run co-integration with CPI_{ag} gap and IIP gap.

Regression equation 2 (in table 5.1) describes responsiveness of Interest rate to IIP gap and CPI_{iw} gap during pre-crisis period. The coefficient of CPI_{iw} (1.16) is statistically highly significant at 1 per cent level (p-value is 0.00). Whereas the coefficient of IIP gap (0.01) is statistically insignificant (p-value is 0.89). The LM statistics tells that this regression results are free from autocorrelation. Interestingly, these results exhibit that Interest rate has long-run relationship with CPI_{iw} during pre-crisis period.

Regression equation 3 (in table 5.1) shows the long-run responsiveness of Interest rate to IIP gap and WPI gap during pre-crisis period. It is immediately apparent from results of third regression equation that neither WPI coefficient (0.101) nor IIP gap coefficient (0.418) are statistically significant. Since the LM statistics (2.51) is highly insignificant, so there is no autocorrelation. In the present stance, it is concluded that when the regression added WPI gap as the proxy of inflation there is no long-run co-integration between IIP gap and WPI gap.

Regression equation 4 (in table 5.1) represents the responsiveness of interest rate to three explanatory variables such as IIP gap, CPI_{ag} gap and

exchange rate. Coefficient of CPI_{ag} (0.473), IIP gap (0.72) and exchange rate (-0.65) are insignificant without having autocorrelation problem. In nutshell, it is concluded that exchange rate, CP_{lag} gap and IIP gap have no long-term relationship with interest rate.

Regression equation 5 (in table 5.1) comprises of CPI_{iw} gap as the proxy of inflation, IIP gap as proxy of output gap and exchange rate and shows slightly different results than preceding one. It comes out that coefficient of CPI_{iw} gap (1.17) is highly significant, whereas all other variables are statistically insignificant. Thus, LM-statistic (3.23) highlights that this regression equation is free from autocorrelation. Therefore, it is evident that only CPI_{iw} has long-run relationship with interest rate.

Regression equation 6 (in table 5.1) comprises of WPI gap, IIP gap as the output gap and exchange rate. Result show that LM-statics (3.72) is insignificant showing no presence of autocorrelation problem. Insignificant coefficients of WPI gap (0.811), IIP gap (4.28) and exchange rate (-3.04) assert that all three explanatory variables have no long-run responsiveness with interest rate during concerned period.

It can be concluded from table 5.1 that India's monetary policy has no long-run responsiveness to changes in inflation of agriculture commodities, wholesale prices, Industrial production and exchange rate during pre-global crisis period as all the values of all the respective coefficients of these macroeconomic indicators were found to be statistically insignificant. However, it turned out to be highly responsive to inflation in industrial commodities which is evident from significant of two coefficients of CPI_{iw} during this period.

5.4.1.2- Post-crisis Period (2008Q2-2012Q4)

Estimation results of Taylor's rule through the ARDL approach to co-integration analysis in post-crisis period are summed up in following discussions. Like pre-crisis period, post-crisis period covers six regression equations. Out of which first three are the results from simple Taylor's rule and last three are results of exchange rate augmented Taylor's rule.

Regression equation 7 (in table 5.1) comprises of CPI_{ag} gap, IIP gap as independent variable. The coefficient of IIP gap (-1.92) is found to be insignificant. Coefficient of CPI_{ag} gap (1.73) is also statistically insignificant. Besides, LM-statistics (6.75) is also showing insignificant. Thus, interest rate setting has no long-run responsiveness to CPI_{ag} gap and IIP gap during concerned period.

Regression equation 8 (in table 5.1) shows responsiveness of interest rate to CPI_{iw} gap and IIP gap. This regression shows similar results as explained by the previous regression. Both the coefficient of CPI_{iw} gap (1.32) and IIP gap (-1.20) were found to be insignificant without having autocorrelation problem as LM-statistics (6.28) is insignificant. Therefore, it is evident that India's monetary policy has no long-run responsiveness to inflation and output during post-crisis period.

 Regression equation 9 (in table 5.1) consists of WPI gap and IIP gap as explanatory variables and highlighted similar results as that of preceding two equations. The coefficient of WPI gap (-0.51) and IIP gap (-1.23) reflects negatively sign which violates the Taylor's assumption that coefficient should have positive sign. Additionally, these two coefficients are statistically insignificant with insignificant coefficient of LM statistics (9.01). Hence, it also exhibits interest rate is not responsive to changes in WPI gap and IIP gap during the concerned period.

Regression equation 10 (in table 5.1) represents the exchange rate augmented Taylors rule and consists of CPI_{ag} gap, IIP gap and exchange rate as explanatory variables to interest rate. The coefficient of CPI_{ag} (1.40), IIP gap (-1.58) and exchange rate (0.09) are registered statistically insignificant values. Value of LM-statistics (7.52) shows absence of autocorrelation in estimation. So, it is to be held that aforesaid variables do not explain variations in interest rate during post crisis period.

Regression equation 11 (in table 5.1) in which CPI_{iw} gap, IIP gap and exchange rate are taken as independent variables for explaining variation in interest rate, reveals similar results as that of preceding equations. It has found that coefficients of IIP gap (1.04) and exchange rate (0.50) are insignificant. Coefficient of CPI_{iw} gap (-1.76) has shown negatively insignificant value. LM-statistics (8.87) shows absence of autocorrelation in model. Therefore, it is evident

that model does not explains responsiveness of interest to inflation, output and exchange rate in the long run during post-crisis period.

Regression equation 12 (in table 5.1) specifies WPI gap, IIP gap and exchange rate as independent variables for determining changes in interest rate. Coefficient of WPI gap (0.26) is statistically significant at 10 per cent level. Whereas the coefficient of IIP gap (0.04) and exchange rate (0.03) indicates statistically insignificant values. LM-statistics (6.38) indicates that there is non-occurrence of autocorrelation. Thus, results establish that WPI gap is important to determined interest rate whereas IIP gap and exchange rate has no such importance during post-crisis period.

It can be concluded from table 5.1 that India's monetary policy has no long-run responsiveness to changes in all specified macroeconomic indicators during post-global crisis period as all the values of all the respective coefficients of these macroeconomic indicators were found to be statistically insignificant. However it turned out to be responsive to WPI gap as its coefficients turned out to be statistically significant (at 10 per cent level) during this period.

5.4.1.3- Comparing Pre and Post-Crisis Periods

Comparing pre and post-global crisis estimates, it is held that India's monetary policy exhibited long-run responsiveness to changes in inflation of industrial commodities only and vice-versa in case of all other specified macroeconomic indicators, which is clearly highlighted from the results that coefficient of CPI_{iw} is statistically significant at 1 per cent level of significance during pre-crisis period, whereas of $CPI_{ag,}$ WPI and exchange rate were turned out to be insignificant. On the other hand, it highlighted responsiveness only to wholesale price index gap and vice-versa in case other four indicators during the post reform period as coefficient of this indicator in statistically significant and of all other four indicators are insignificant.

Table 5.2: Short Run Estimates of Taylor Type Rule under ARDL Approach During Pre (2001Q1-2008Q1) and Post (2008Q2-2012Q4) Crisis Period

SI. No	CPI ag Gap			CPI (iw) Gap			WPI Gap			IIP Gap			Ex. Rate			R^2	Adj. R^2	LM test	
	Coefficient	t-ratio	p-value	Coefficient	t-ratio	p-value	Coefficient	t-ratio	p-value	Coefficient	t-ratio	p-value	Coefficient	t-ratio	p-value			Lm static	p-value
1	(0.104)***	3.13	0.00							-.123	-.006	.99				0.94	0.93	3.80	0.43
2				(0.302)***	4.08	0.00				0.004	0.138	0.89				0.97	0.96	3.37	0.49
3							0.007	0.243	0.81	0.0304	0.845	0.406				0.95	0.94	2.51	0.64
4	(0.148)***	2.64	0.01							(0.084)*	1.97	0.06	0.079	1.17	0.25	0.96	0.95	4.46	0.34
5				(0.32)***	5.59	0.00				0.009	0.304	0.76	-0.022	-1.14	0.26	0.97	0.96	3.23	0.51
6							0.021	0.559	0.58	(0.115)***	2.62	0.015	(0.113)*	1.80	0.08	0.95	0.94	3.72	0.44
7	(-0.15)	-3.13	0.007							(0.173)***	4.44	0.001				0.91	0.89	6.75	0.14
8				0.230)***	-3.34	0.005				(0.209)***	5.12	0.00				0.92	0.90	6.28	0.17
9							0.04	0.721	0.48	0.117	1.65	0.12				0.86	0.83	9.01	0.06
10	0.152)***	4.26	0.00							(0.172)***	(4.26)	0.00	0.010)*	-2.83	0.01	0.91	0.88	7.52	0.11
11				(-0.21)	-2.96	0.01				0.073	1.02	0.323	(0.107)**	2.53	0.02	0.94	0.92	8.87	0.64
12							0.085	1.22	0.24	0.014	0.181	0.85	0.011	0.35	0.72	0.91	0.89	6.38	0.17

Pre-crisis Period: rows 1–6
Post-crisis Period: rows 7–12

Note: *, **, * represeents 1%,5%,10% level of significance. Source: Author's own calculation.**

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5.4.2- Short Run Analysis of India's Monetary Policy Response

Table 5.2 represents the short-run dynamics of Taylor's rule during pre and post crisis periods which represents responsiveness of interest rate with inflation, output and exchange rate

5.4.2.1- Pre-crisis Period (2001Q1-2008Q1)

According to the Taylor's rule six regression equations are divided into two sections. Initial three equations are based on simple Taylor's rule and last three regression equations are based on exchange rate augmented Taylor's rule.

Regression equation 1 (in table 5.2) comprises of CPI_{ag} gap and IIP gap for explaining the variations in interest rate. The coefficient of CPI_{ag} gap (0.104) is highly significant, but the coefficient of IIP gap (-0.123) is insignificant with negative sign. LM statistic (3.80) is insignificant indicating that no autocorrelation in the model. Therefore, interest rate shows short-run relationship with CPI_{ag} during pre-crisis period.

Regression equation 2 (in table5.2) consists of CPI_{iw} gap and IIP gap as determining variable to interest rate. The coefficient of CPI_{iw} (0.302) found to be highly statistically significant, but of IIP gap (0.004) is insignificant. There is no autocorrelation problem as LM statistic (3.37) is insignificant. Thus, monetary policy is primarily concerned with CPI_{iw} rather than output in pre-crisis period.

Regression equation 3 (in table 5.2) represents results related WPI gap and IIP gap in the pre crisis period. The coefficient of both WPI gap (0.007) and IIP gap (0.0304) are statistically insignificant. In addition, the LM statistic (2.51) shows model is not suffering from autocorrelation problem. With these results, it is held that monetary policy is not determined by changes in WPI gap nor IIP gap as there is no such short-run relationship found during pre reforms period.

Regression equation 4 (in table 5.2) represents the outcomes of exchange rate augmented Taylor's rule. Coefficient of CPI_{ag} gap (0.148) and IIP gap (0.084) are statistically significant. But the coefficient of exchange rate (0.079) is found to be statistically insignificant. LM-statistics manifests absence of autocorrelation

problem. Therefore, interest rate has short run relationship with CPI_{ag} gap and IIP gap during pre-crisis period.

Regression equation 5 (in table 5.2) shows short-run relationship CPIiw, IIP gap and exchange rate with interest rate. From the results, it is clear that the coefficient of CPI_{iw} gap (0.32) is highly significant. But all other coefficients are showing unsatisfactory results. So, that only CPI_{iw} has short run relationship with interest rate and IIP gap and exchange rate were not important to determine interest rate through monetary policy during pre crisis period..

Regression equation 6 (in table 5.2) consists of WPI gap, IIP gap and exchange rate as the independent variable shows similar results as that of preceding equation. The coefficient of IIP gap (0.115) and exchange rate (0.113) are significant at 1 per cent and 10 per cent level respectively. Moreover, insignificant LM-statistics (3.72) highlights absence of autocorrelation in model. Thus, monetary policy is more responsive to IIP gap and exchange rate in short-run during pre-crisis period.

It can be concluded from table 5.2 that India's monetary policy has high short-run responsiveness to changes in prices of agriculture commodities, prices of industrial commodities, Industrial production and exchange rate during pre-global crisis period as the values of the respective coefficients of these macroeconomic indicators were found to be statistically significant in many cases. However, it proved non-responsive to wholesale prices during this period, which is evident from insignificant values of coefficients of WPI gap during this period.

5.4.2.2- Post-crisis Period (2008Q2-2012Q4)

Similarly to pre-crisis period, post-crisis period also represents short-run relationship between output gap, inflation gap, exchange rate. Initial three regression equations are related to simple Taylor's rule and last three are exchange rate augmented Taylor's rule.

Regression equation 7 (in table 5.2), considers CPI_{ag} gap and IIP gap as independent variables. Coefficient of CPI_{ag} gap (-0.15) is showing negative sign with significant value which is unacceptable according Taylor's rule. Further, the coefficient of IIP gap (0.173) is also showing insignificant result. From the LM

statistics (6.75) indicates model is free from autocorrelation. In short, it concluded that both of variables are showing short run relationship.

Regression equation 8 (in table 5.2), CPI_{iw} gap and IIP gap are taken as explanatory variables for interest rate Coefficient of CPI_{iw} gap (0.230) and IIP gap (0.209) are found to be significant at 1 per cent level. LM-statistics (6.28) shows absence of autocorrelation in the model. Hence, results shows strong short-run relationship between CPI_{iw}, IIP gap with interest rate during post crisis period.

Regression equation 9 (in table 5.2) shows relation of interest rate with WPI gap and IIP gap Results show that coefficient of WPI gap (0.04) and IIP gap (0.117) are statistically insignificant. LM statistics (9.01) does not diagnose autocorrelation. Therefore, result shows no short-run relationship between WPI and IIP gap with interest rate.

Regression equation 10 (in table 5.2) represents the outcome of exchange rate augmented rule. Coefficient of exchange rate (-0.010) is highly significant. Coefficient of CPI_{iw} gap (0.152) and IIP gap (0.172) are statistically significant. LM statistics (7.52) detects no autocorrelation. Thus, the results indicate monetary policy is primarily concerned with CPI_{ag} and IIP in short run rather than exchange rate during post crisis period.

Regression equation 11 (in table 5.2), coefficient of CPI_{iw} gap (-0.21) is found to be negatively less significant and violates the pre-assume norm of Taylor's rule. Coefficient of exchange rate (0.107) is significant. Whereas of IIP gap (0.073) is insignificant is free from autocorrelation problem in the case of LM statistics (8.87). From the above results reveals that exchange rate has short-run relationship with interest rate setting in post-crisis period.

Regression equation 12 (in table 5.2) uses WPI gap, IIP gap and exchange rate as explanatory variable to interest rate. Coefficients of WPI gap (0.085), IIP gap (0.014) and exchange rate (0.011) are statistically insignificant without having autocorrelation problem. Therefore, it is held that there is no short-run relationship between WPI gap, IIP gap, and exchange rate gap with interest rate setting.

It can be concluded from table 5.2 that India's monetary policy has exhibited high short-run responsiveness to changes in prices of agriculture

commodities, prices of industrial commodities, Industrial production and exchange rate during post-global crisis period as the values of the respective coefficients of these macroeconomic indicators were found to be statistically significant in many cases. However, it proved non-responsive to wholesale prices during this period, which is evident from insignificant values of coefficients of WPI gap during this period.

5.4.2.3- Comparing Pre and Post-Crisis Periods

Comparing pre and post-global crisis estimates, it is established that India's monetary policy exhibited high short-run responsiveness to changes in prices of agricultural commodities, price of industrial commodities, fluctuations in industrial output and depreciation/appreciation of exchange rates during both pre and post global crisis periods as values of coefficients of all respective macroeconomic indicators were found to be statistically significant in many case. However, it showed no causality with changes in whole sale prices during both pre and post-global crisis periods as no value of its coefficients was found to be statistically significant. Moreover, monetary policy was turned to highly responsive to industrial output and exchange rate during post-global crisis period as compared to pre-global crisis period, which is quite justified given the adverse effects of global crisis on national output and external sector during the concerned period. Thus, monetary policy changes in India during the period under study was turned out to be in line with the internal and external economic environment which is characterized by increasing intensive-globalization in world economy.

5.5- Concluding Remarks

Based on above results and discussion, study reveals, results that are varying in different manner in long-run and short-run during pre and post- global crisis period. Analysis of monetary policy response to global crisis unleashed the efficiency of India's monetary policy to respond with respect to frequently changing economic environment. Monetary policy in India was found to be highly responsive to industrial output and exchange rate during post-global crisis period as compared to pre-global crisis one. The analysis shows that the focus of monetary policy was on inflation during pre-crisis period because monetary policy was on absorption mode (Patra and Kapur, 2012). As the adverse effects of global

crisis were realized in the Indian economy, the policy makers reacted in line using monetary policy instruments for maintaining economic stability in terms of output and exchange rates during post-crisis period.

Further, monetary policy was found to be irresponsive to output and exchange rate and responsive to inflation (especially in industrial commodities) in long-run. On the other, it exhibited high short-run responsiveness to inflation and output. Thus, fifth hypothesis of this study i.e. "Short run Taylor's type rule is more effective than long run Taylor's type rule during pre and post-crisis period" is proved to be true. As Interest rate is more responsive in short-run to exchange rate also during post-crisis period as compared to pre-crisis period. Therefore, sixth hypothesis that "Exchange rate is more important for implementing monetary policy for open economy during pre and post-crisis" is also proved.

CHAPTER - VI
SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

The present study attempts to examine India's monetary policy response to global financial crisis through the estimating Taylor's rules. It also provides a comprehensive overview of India's monetary policy as well as root causes of Global financial crisis, are presented chapter I. Review of literature is carried out in Chapter II. Subsequently, Chapter III deals with data sources and methodology that specifies the model used for estimation.

Before undertaking econometric analysis for unleashing empirical realities in existing economic environment in India, it is necessary to study the evolution of monetary policy since inception of planning period for clear understanding evolution and development of monetary policy in India. For this, chapter IV presents the analysis of perspective and trends of monetary policy in India since independence. From this analysis, it is found that, the monetary policy in India was described by credit planning up to mid-1980s. In this period, the main responsibility of Reserve Bank of India was to ensure credit flows to various sectors. The whole economy was controlled by planning authority under the non-institutional supervision of Planning Commission and the job of RBI to control and regulate economic activities was limited. The financial needs for development activities were provided by RBI without any compromise, which led huge credit flows to different sector. Implementation of social control and nationalization of commercial banks put pressures on monetary authority and it created heavy constraint on banking operation. During this regime, monetary policy was conducted under limited scope. Therefore, there was a need for shifting monetary policy from one regime to another regime. This was materialized with the constitution of high level committee to review monetary policy under the leadership of Professor Sukhamoy Chakravarty in 1982. The recommendations of Chakravarty Committee report was implemented, so that there was a radical change of monetary policy with the objectives of price stability and economic growth. There was initiation of co-ordination between monetary and fiscal policy to reduce fiscal burden that welcomed partially financial reform during 1985-90. The

economy was completely opened in 1991-92 which further increased the scope of monetary policy. This liberalization process created a conducive environment in terms of liberalizing interest rates, introducing the auction system in government securities, making foreign exchange rate flexible glided by marshalian scissor of demand and supply, including day-to-day liquidity management for policy operations etc. Monetary policy became more sensitive to Global financial crisis after collapse of Lehman Brothers in 2008. However, RBI played a significant role and responded to global financial crisis by frequent changes in key interest rates especially since 2008 and introducing Credit Default Swap for corporate bonds. .

Analysis of trends in India's monetary policy asserts that there was a significant fluctuation during pre and post reforms period. Bank rate was the main instruments during pre reform period. Both bank rate and SLR are increasing during pre reform period. After implementation of reforms, both bank rate and SLR has decreasing trend. However, both rates are remains high during pre reform period as compared to post reform period. In 2003-04, RBI focused on LAF (both Repo and Reverse Repo rate) as policy instruments. There is also no systematic trend in both repo and reverse repo rate. The highest repo and reverse repo rate was achieved during 2011-12. CPI_{ag} fell to negative during 1975-80. CPI_{ag}, CPI_{iw} and WPI remains high during post reform period as compared to pre reform period. Especially, during global financial crisis, inflation touched its highest point. There is increasing trend of IIP during pre reform period but it remains higher during post reform period. Export and import of unit value index is more during pre crisis period. But export and import volume index is higher in post reform period. Foreign exchange reserve was low during pre reform period. It has substantially increased in post reform period. Exchange rate is continuously rising since 1970s. Money supply was also more during post crisis period as compared to pre reform period.

Based on Taylor's rule results and discussion, study reveals that, results are varying in different manner in long-run and short-run during pre and post-global crisis period. Analysis of monetary policy response to global crisis unleashed the efficiency of India's monetary policy to respond with respect to frequently changing economic environment. Monetary policy in India was found to be highly responsive to industrial output and exchange rate during post-global

crisis period as compared to pre-global crisis one. The analysis shows that the focus of monetary policy was on inflation during pre-crisis period because monetary policy was on absorption mode. As the adverse effects of global crisis were realized in the Indian economy, the policy makers reacted in line using monetary policy instruments for maintaining economic stability in terms of output and exchange rates during post-crisis period.

Monetary policy was found to be irresponsive to output and exchange rate and responsive to inflation (especially in industrial commodities) in long-run. On the other, it exhibited high short-run responsiveness to inflation and output. Thus, fifth hypothesis of this study i.e. "Short run Taylor's type rule is more effective than long run, during pre and post-crisis period" is proved to be true. As Interest rate is more responsive in short-run to exchange rate also during post-crisis period as compared to pre-crisis period. Therefore, sixth hypothesis that "Exchange rate is more important for implementing monetary policy for open economy during pre and post-crisis" is also proved. Although this study concluded similarly to most of the theoretical and empirical evidences that monetary policy is more responsive to real variables in short-run as compared to long run, it is necessary to include transitory real effect, so that monetary policy could be more responsive. According to New-classical, monetary policy is ineffective in long run. But if expenditure rises through monetization, then monetary policy has nothing to do. So in this perspective, there should be proper co-ordination between monetary policy and fiscal policy which can improve economic conditions.

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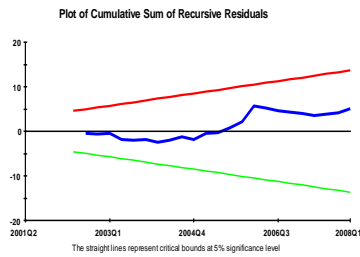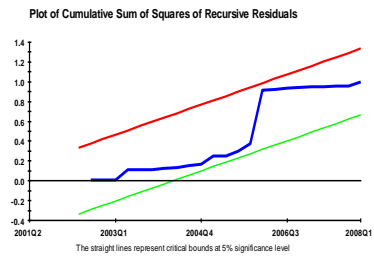
APPENDICES

Appendix A
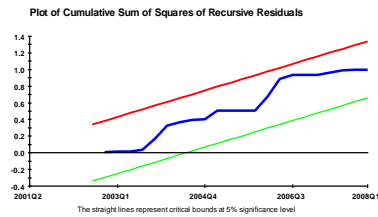
Model Stability Graphs

Pre-crisis Period

Graph 1: (Sl. No 1)

Graph 2: (Sl.No 1)

Plot of Cumulative Sum of Recursive Residuals

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

The straight lines represent critical bounds at 5% significance level

Graph 3: (Sl. No 2)

Graph 4: (Sl. No 2)

Plot of Cumulative Sum of Squares of Recursive Residuals

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

The straight lines represent critical bounds at 5% significance level

Graph 5:   (Sl. No 3)

Graph 6: (Sl. No 3)

Plot of Cumulative Sum of Recursive Residuals

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

The straight lines represent critical bounds at 5% significance level

Graph 7: (Sl. No 4)

Graph 8: (Sl. No 4)

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 9: (Sl. No 5)

Graph 10: (Sl. No 5)

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 11: (Sl. No. 6)

Graphs 12: (Sl. No. 6)

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Post-crisis Period

Graph 13: (Sl. No 7)

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 14: (Sl. No 7)

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 15: (Sl. No 8)

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 16: (Sl. No 8)

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 17: (Sl. No 9)

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 18: (Sl. No 9)

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 19: (Sl. No 10)

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 20: (Sl. No 10)

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 21: (Sl. No 11)

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 22: (Sl. No 11)

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 23: (Sl. No 12)

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Graph 24: (Sl. No 12)

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Appendix B

Results of Unit Root Test (Pre-crisis Period)

	ADF TEST	PP TEST	INTEGRETED ORDER
INTEREST RATE	-4.981495 (0.002)	-3.402771 (0.001)	I(1)
CPI ag Gap	-3.910209 (0.0004)	-3.849711 (0.0004)	I(1)
CPI iw Gap	-6.630954 (0.0000)	-6.689889 (0.0000)	I(1)
WPI gap	-3.898021 (0.0015)	-3.298021 (0.0019)	I(1)
IIP Gap	-2.149584 (0.0326)	-2.233916 (0.0269)	I(0)
Ex. Rate	-3.387837 (0.0015)	-3.387837 (0.0015)	I(1)

Source: Author's Calculations

Results of Unit Root Test (Post-crisis Period)

	ADF TEST	PP TEST	INTEGRETED ORDER
INTEREST RATE	-2.545884 (0.0144)	-2.593009) (0.0129)	I(1)
CPI ag Gap	-3.179742 (0.0035)	-2.379903 (0.0207)	I(1)
CPI iw Gap	-3.246341 (0.0029)	-3.238665 (0.0030)	I(1)
WPI gap	-4.641504 (0.0001)	-2.326769 (0.0233)	I(1)
IIP Gap	-3.573853 (0.0013)	-1.587189 (0.1037)	I(0)
Ex. Rate	-4.470665 (0.0002)	-4.431596 (0.0002)	I(1)

Source: Author's Calculations

Appendix C

Duration of Width of Corridor in India

Period		Repo	Reverse Repo Rate	Width Corrid	Operating Rate	Method of Changing Corridor	Monetary Policy Stance	Other instruments used
From	To							
27-04-2001	29-04-2001	9.00	6.75	225	Reverse repo		Provision of adequate liquidity, Vigil on Price level and Greater Flexibility to the interest rate regime in the medium term	
30-04-2001	27-05-2001	8.75	6.75	200	Repo	Lower Repo		Reduce CRR
28-05-2001	06-06-2001	8.75	6.50	225	Reverse Repo	Lower Reverse Repo		-
07-06-2001	04-03-2002	8.50	6.50	200	Reverse Repo	Lower Repo		Reduce the Bank rate and CRR
05-03-2002	27-03-2002	8.50	6.00	250	Reserve Repo	Lower Reverse Repo		-
28-03-2002	26-06-2002	8.00	6.00	200	Reverse Repo	Lower Repo		Reduce CRR
27-06-2002	29-10-2002	8.00	5.75	225	Reverse Repo	Lower Reverse Repo		-
30-10-2002	11-11-2002	8.00	5.50	250	Reverse Repo	Lower Reverse Repo	Provision Of adequate liquidity Support of revival fo investment demand, vigil on price level and continue the soft interest rate regime	Reduce Bank Rate
12-11-2002	02-03-2003	7.50	5.50	200	Reverse Repo	Lower Repo		Reduce CRR
03-03-2003	06-03-2003	7.50	5.00	250	Reverse Repo	Lower Reverse Repo		-
07-03-2003	18-03-2003	7.10	5.00	210	Reverse Repo	Lower Repo		-
19-03-2003	24-08-2003	7.00	5.00	200	Reverse Repo	Lower Repo		Reduce Bank Rate
25-08-2003	30-03-2004	7.00	4.50	250	Reverse Repo	Lower Reverse Repo		Reduce CRR
31-03-2004	26-10-2004	6.00	4.50	150	Reverse Repo	Lower Repo	Price Stability and maintaining monetary and interest rate environment conducive to growth and financial stability	Hike CRR
27-10-2004	28-04-2005	6.00	4.75	125	Reverse Repo	Hike Reverse Repo		-
29-04-2005	25-10-2005	6.00	5.00	100	Reverse Repo	Hike Reverse Repo		-
26-10-2005	23-01-2006	6.25	5.25	100	Reverse Repo	Hike Both		-
24-04-2006	07-06-2006	6.50	5.50	100	Repo	Hike Both		-
08-06-2006	24-07-2006	6.75	5.75	100	Reverse Repo	Hike Both		-
25-07-2006	30-10-2006	7.00	6.00	100	Repo	Hike Both		-
31-10-2006	30-01-2007	7.25	6.00	125	Repo	Hike Repo		Hike CRR
31-01-2007	30-03-2007	7.50	6.00	150	Repo	Hike Repo	Price stability, anchoring inflation expectations, maintaining growth momentum and financial stability	Hike CRR
31-03-2007	11-06-2008	7.75	6.00	175	Repo	Hike repo		Hike CRR
12-06-2008	24-06-2008	8.00	6.00	200	Repo	Hike Repo		-
25-06-2008	29-07-2008	8.50	6.00	250	Repo	Hike Repo		Hike CRR
30-07-2008	19-10-2008	9.00	6.00	300	Repo	Hike repo		Reduce CRR
20-10-2008	02-11-2008	8.00	6.00	200	Repo	Lower Repo	Price stability, anchoring inflation expectations, financial stability and financial inclusion	Reduce CRR
03-11-2008	07-12-2008	7.50	6.00	150	Repo	Lower Repo		Reduce CRR
08-12-2008	04-01-2009	6.50	5.00	150	Reverse Repo	Lower Both		-
05-01-2009	04-03-2009	5.50	4.00	150	Reverse Repo	Lower Both		Reduce CRR
05-03-2009	20-04-2009	5.00	3.50	150	Reverse Repo	Lower Both		-
21-04-2009	18-03-2010	4.75	3.25	150	Reverse Repo	Lower Both	Contain inflation, anchor inflation expectations and maintain interest rate regime consistent with price, output and financial stability	Hike CRR
19-03-2010	19-04-2010	5.00	3.50	150	Reverse Repo	Hike Both		-
20-04-2010	01-07-2010	5.25	3.75	150	Reverse Repo	Hike Both		Hike CRR
02-07-2010	26-07-2010	5.50	4.00	150	Repo	Hike Both		-
27-07-2010	15-09-2010	5.75	4.50	125	Repo	Hike Both		-
16-09-2010	10-02-2010	6.00	5.00	100	Repo	Hike Both		-
02-11-2010	24-01-2011	6.25	5.25	100	Repo	Hike Both		-
25-01-2011	To Date	6.50	5.50	100	Repo	Hike Both		-

Source: Report of the working group on operating procedure of monetary policy, March 2011