A Project Draft

On

"Policy Interest Rates, Market Rates, Inflation and Economic Growth"

Project Investigator
Dr. Charan Singh
CEO and Director, EGROW Foundation
998, Sector 29, Arun Vihar,
Noida- 201301, UP-India

Team
Arvinder S Sachdeva
Former Senior Advisor, GoI
Balbir Kaur
Former Advisor, RBI
Dr. Pabitra K Jena
Assist Prof, SMVD University

The study has benefitted from discussions with Prof. Ashima Goyal (IGIDR), Prof. Bandi Kamaiah (University of Hyderabad), Prof. N R Bhanumurthy (NIPFP and BASE, Bengaluru), Prof. Vighneswara Swamy (IBS), Prof. Lokendra Kumawat (Delhi University), Dr. C Rangarajan (former Governor, RBI), S K Hota (MD, National Housing Bank), Mohan Tanksale (former CMD, Central Bank of India), S S Kohli (former CMD, Punjab National Bank), Udaya Kumar (MD and CEO, Credit Access Grameen Koota), Subrata Gupta (Former MD, NABARD Financial Services), Pillarisetti Satish (Executive Director, Sa-Dhan).

The econometric contribution by Prof Vighneswara Swamy and Prof. Lokendra Kumawat, is also thanfully acknowledged.

Section 1

Introduction

Monetary policy, as part of macro-policy, impacts economic growth and financial stability. The Reserve Bank of India (RBI) operates monetary policy through interest rates to finally impact inflation and economic growth. The extent to which monetary policy intervention affects the real economy has been a central theme in academic studies and public policy. Being a key indicator of financial markets, interest rates have a strong impact on the economy. To identify the transmission mechanism of monetary policy, operated through interest rate, on economic growth, is a challenging task faced by policy-makers and academics.

Interest rate is a unique instrument which impacts many sectors. A higher interest rate can deter investment but attract the much needed capital flows for growth which can cause exchange rate to appreciate and adversely impact exports. Also, in a fiscally constrained country, cost of borrowing tends to rise with increasing interest rates which further acts as a drag on growth of the economy through curtailing investment, both in public sector and through crowding out, in private sector. Investments, in particular, can show considerable sensitivity to variations in interest rates though it can be argued that other variables, like uncertainty, also play a role in investment decisions.

The last several years have witnessed greater reliance on monetary policy instruments to bring about stabilisation in output levels and controlling rate of inflation, especially since 2008. This has been particularly the case in most of the advanced economies, which have witnessed low inflation (generally lower than the mandated target), and who despite pursuing loose monetary policy for an extended period continue to experience low levels of inflation. One issue that has been raised in recent literature relates to effectiveness of unconventional monetary policy since 2008, in particular when interest rates are very low - often close to zero or even in the negative zone, and persistently so. Unconventional monetary policies are again being followed because of Covid-19. However, it's too early to assess about its transmission and impact on growth, investment, inflation, etc.

The situation in developing countries and more so in India, however, has been somewhat different. India, witnessed close to double-digits annual average increase in the price level in the early years of the decade starting in 2010. However, since 2013-14, the inflation rate has declined to an average of less than 5 percent per annum. Of course, the reduction in inflation is not attributable to monetary policy alone and a number of other factors have played a role. However, of late and more so, ever since India formally adopted 'inflation targeting' in 2016 as one of key mandates of the Reserve Bank of India, monetary policy has come to centre-stage for controlling inflation.

The effectiveness of monetary policy depends on the overall policy environment within which an economy functions. The liberalisation of financial markets in India since the early 1990s has proceeded at a gradual pace and has been characterised by permitting new banks to join, creation of new markets, and strengthening of money and G-Secs market.

The above mentioned factors, apart from many others, tend to have an impact on the transmission mechanism of the measures adopted by monetary authorities. In India, for example, large requirements on banks to hold government securities and persistently high fiscal deficit (Centre and States) have an impact on transmission of monetary policy measures to market rate of interest. However, greater economic and financial integration with the rest of world in the form of liberalisation of capital account, higher capital inflows, and flexible exchange rates, pose challenges to the effectiveness of monetary policy.

Most of the literature in the context of monetary transmission in India seems to suggest that there is limited pass-through from policy rates to deposit and lending rates, inflation and output. Monetary policy also affects the exchange rate but transmission from exchange rate channel to output and inflation also appears muted.

It can be argued that monetary transmission in the recent period was reasonably swift across various money market segments, given the directions by the RBI since 2014. However, the

transmission to bank deposits and lending has been delayed and partial. The fact is that most of the lending is contracted at floating rates while most of the deposits are contracted at fixed interest rates. This asymmetry tends to impede the transmission to lending rates. In addition, competitive pressure from mutual funds and small savings schemes have also impacted transmission mechanism.

In order to improve the transmission from policy rates to other market rates (borrowing and lending rates), the Reserve Bank of India has recently shifted from marginal cost of funds based lending rates (MCLR) regime to external benchmarking of lending rates. Accordingly, the Reserve Bank has mandated all scheduled commercial banks (excluding regional rural banks) to link all new floating rate loans to micro and small enterprises to an external benchmark. Accordingly, with effect from October 1, 2019, commercial banks were given the freedom to choose any of the following external benchmarks - a) RBI's Policy Repo Rate, b) Government of India 3/6 month Treasury Bill yield published by Financial Benchmarks India Private Ltd (FBIL), and c) Any other benchmark market interest rate published by FBIL. Early indications seem to suggest that there has been an improvement in transmission to fresh loans sanctioned in the sectors where new floating rates have been linked to external benchmarks. This is because, unlike the MCLR system where transmission to lending rates was dependent on changes in deposit rates, the transmission to lending rates under external benchmarks system is not contingent upon interest rates on deposits.

Research Question or Hypothesis

The objective of the present study is to identify linkages between policy interest rate, and economic growth, aggregate investment, and inflation,.

Section Scheme

After this Introduction, in Section 2 the literature on subject of transmission mechanism of monetary policy is reviewed. This is done both in the context of developed as well as developing countries with special focus on monetary transmission in India. Section 3 begins by discussing

the evolution of the operating framework of monetary policy in India. The framework has evolved since the introduction of the Prime Lending Rate in 1994 till the adoption of the new monetary policy framework, inflation targeting, in 2016. In 2019, several of the existing loan products have been linked to the Repo Rate with the intention of improving monetary policy transmission in the economy. In Section 4, the Research Methodology used in the study which includes the empirical estimation techniques to examine the different mechanisms of monetary policy transmission in India is discussed. In Section 5, quantitative results are discussed after a brief trend analysis. In this section, impulse response functions, and SVAR estimation has been used that attempts to investigate the relationship between Repo rate, and private corporate investment, inflation, asset prices and GDP growth. Finally, in the next section, broad conclusions that emerge from the study, and recommendations are presented.

Section 2

Review of Literature

The objective of monetary policy, as was nearly universally accepted until 2008, was to achieve price stability with the objective of ensuring sustainable economic growth. Since 2008, after global financial recession, even financial stability has been included in the objectives of monetary policy. Thus, in the current context, the efficacy of monetary policy actions lies in the speed and magnitude with which they achieve the final objectives of price stability while considering growth and financial stability.

The literature on transmission of monetary policy is very vast, and has been extensively examined, especially in context of advanced countries. The literature covers the relationship between monetary policy & growth, and inflation, as well as transmission mechanism through various channels. To have an efficient transmission mechanism, it would be necessary to have healthy banks, well developed financial markets, market determined interest rates and robust payment and settlement system (Acharya, 2020). The transmission mechanism is characterized by time lags that tend to differ because of differences in economic and market structures in different countries.[1] These lags vary from 1-14 quarters across advanced and emerging economies. In EMEs, transmission is generally weaker and lags are generally shorter - average lag of 33.5 months for all countries as compared with 42 months in the case of the US, 48 months for the euro area, and in the range of 10-19 months for transition economies that became new EU members (Havránek and Rusnák, 2012). In Brazil, monetary policy transmission through aggregate demand channel takes between 2 and 3 quarters: the interest rate affects consumer durables and investment in between 1 and 2 quarters, and the output gap takes another quarter to impact inflation (Bogdanski *et al.*, 2000).

1 RBI (2014) explains in detail about the lags.

The section also presents a discussion on literature on transmission mechanism in India. A brief review of literature is presented in this section and more focused, in tabular format, is placed in Annexure 1.

2.1: Monetary Policy and Investment

An important aspect considered across literature has been the role played by the cost of capital, or the interest rate in determining the level of investment. This makes it critical to investigate different channels through which monetary policy can have an impact on the aggregate economy by influencing the decision of the firm to invest. There have been several approaches that have been adopted to explain the decision of a firm to invest. Some of these theories take a macroeconomic perspective on the issue while there are several micro-founded firm level behaviour explanations that have also been provided to explain the investment behaviour across several countries.

It has been argued that despite several monetary policy measures taken in advanced economies since the financial crisis, the global economic recovery has been slow and a major reason behind this has been the subdued pace of investment activity. It is commonly considered that four factors have been considered as potential drivers of investment at a macroeconomic level, namely *demand expectations, financial conditions, uncertainty and supply shocks.* Monetary policy typically affects financial conditions and has an impact on demand expectations as the transmission to the real economy is often through the investment channel. Since the financial crisis of 2008 these factors have been central to the debate on investment. In particular, despite aggressive and prolonged period of unconventional monetary policy combined with record low levels of interest rates, the economic prospects in many countries continued to remain weak. Moreover, weakening economic prospects globally are expected to lead to a decline in the returns on investment, thereby dampening the formation of new capital and delaying the replacement of old capital. Uncertainty may also have persistently negative effects on business investment. Finally, unexpected negative supply shocks, such as the fall in labour productivity across countries, could diminish future profit expectations and lead to a decline in investment activity.

There have been several different approaches that have been adopted to explain the decision of a firm to invest. Chatelain et al. (2003) focused on rich datasets for Germany, France, Italy, and Spain and estimated investment behaviour using user costs, sales, and cash flow. The key result was that investment is sensitive to cost of capital. The findings were consistent with the study by Mojon, Smets & Vermeulen (2002). In contrast, Eberly (1997) argued using firm level data from 11 countries that there were nonlinearities present due to presence of different fixed or non-quadratic costs. These non-linearities were present between the investment and fundamentals. Cuthbertson & Gasparro (1995) examined the neoclassical intertemporal framework where Tobin's marginal Q determines the real investment level. They found that investment was dependent on average Q, capital gearing and output which was then used to explain the fixed investment in UK's manufacturing sector between 1968 to 1990, using an error correction model.

Sharpe and Suarez (2015) explorde the reasons behind the mixed evidence of the impact of interest rates on investments. They used a survey of Chief Financial Officers (CFOs) of different companies to study the sensitivity of investment plans and find that decreases in interest rates have little impact on investment decisions but any increase in interest rates has a significant impact on investment. Their results indicated that CFOs either mention adequate cash as the key factor for the lack of sensitivity of interest rates on investment. They further found that this insensitivity is more for firms that don't have financial constraints or firms with no near term plans to borrow while investment is also insensitive to interest rate changes for firms that expect a higher growth rate in the coming year.

Hambur and Cava (2018) analysed the investment behaviour of firms for Australia by compiling a dataset that allows them to study the distribution of borrowing costs and the relationship between cost of capital and fixed capital investment. They found a high degree of heterogeneity in cost of capital which has increased post-2008 as good companies are able to raise capital cheaply while the cost of capital for the bottom companies has increased significantly. They used the distribution of borrowing costs and find a significant inverse relationship between the cost of borrowing and corporate investment. Ottonello and Winberry (2019) considered the role of financial frictions as they attempted to study the investment channel. They found that companies

with low debt burdens and high credit ratings tend to respond more to monetary shocks. This finding is then interpreted using a New Keynesian model with default risk. Their model shows that the relatively flat marginal cost of financing of investment for low risk firms enables them to be more responsive to monetary shocks.

Jobst & Lin (2016) examined negative interest rates in the Euro-zone and found that the negative interest rates resulted in easing financial conditions along with a modest expansion in credit. They argue that the zero lower bound is thus less binding as originally imagined. However, they discuss that substantial rate cuts may end up outweighing the benefits from higher asset values and stronger aggregate demand.

Agarwal and Kimball (2019) explored the possibility of deep negative interest rates to combat economic recessions. They argue that Central Banks have the power to enable deep negative rates whenever needed which maintains the power of monetary policy in future to address output gaps in a short time. They discuss the factors that explain how standard transmission mechanisms from interest rate cuts to aggregate demand remain unchanged in the deep negative rate territory.

The important finding across literature is that generally interest rates have an impact on the aggregate economy through the investment channel.

2.2: Monetary Policy and Inflation

One issue that has been covered extensively in literature has been the relationship between interest rate and inflation. Despite historically lower levels of interest rates, central banks have consistently undershot their inflation targets since the 2008 financial crisis in a number of advanced economies. This makes it important to look at the relationship between interest rates and inflation – more so, how it has evolved over time. The relationship between policy interest rate and inflation has been studied extensively in the literature.

Pennacchi (1991) looked at the dynamics of real interest rates and rates of inflation expectations in the context of an equilibrium asset pricing model. Considering the real interest rates and inflation to be mutually dependent processes, there is a strong evidence of a negative and significant correlation between real interest rates and expected inflation.

Crowder and Hoffman (1996) examined the long run relationship between interest rates and inflation. They find strong evidence in support of the traditional "tax adjusted" Fisher equation and find that a one percent increase in inflation results in a 1.34 percent increase in nominal interest rates. Post tax effects, the Fisher effect is the same as unity which is consistent with the conventional Fisher equation.

Cochrane (2016) highlighted that the standard "New-Keynesian" model worked well for explaining the stability of inflation even at a zero-interest rate peg. Christensen and Spiegel (2019) examined Japan's negative policy rates which were introduced in 2016 and argued that market expectations for inflation over the medium term fell immediately. The reaction indicates the uncertainty which has been around the efficacy of negative policy rates as a tool to stimulate economic growth when inflation expectations are anchored at lower levels. They further mention the desirability of pre-emptive measures to avoid a situation of the zero-interest rate bound. Frankel (2006) finds that the relationship between real interest rates and real commodity prices is empirically supported (Annexure 1).

Bhalla (2018) noted that inflation in the US averaged 1.9 percent between 1996 and 2009 – and that in the next 8 years it averaged 1.2 percent. He further mentioned that world growth has moved inversely with world inflation and argues that output gap does not explain the moderation in inflation. The contention is that the decline in share of working age population is consistent with the structural decline in inflation and he argues that the excess global supply of college graduates due to expansion of education has resulted in stagnation of wages. This, in turn, has kept wages low resulting in a structurally lower level of inflation despite an accommodative monetary policy that has been adopted by several countries post the Global Financial Crisis in 2008.

2.3: Channels of Transmission of Monetary Policy

Monetary policy transmission occurs through several alternative channels, viz., interest rate, credit, exchange rates, and asset prices (Mishkin, 1995). In the recent literature, expectations channel has also been mentioned, but that has not been explored in this study.

Interest rate channel

With the deepening of financial systems and growing sophistication of financial markets, most central banks are increasingly using indirect instruments rather than direct measures. Adjustments in policy interest rate, for instance, directly affect short term money market rates which then transmit the policy impulse across the financial system, including deposit and lending rates. Eventually, consumption, saving and investment decisions of economic agents and eventually aggregate demand, output and inflation are impacted. The interest rate channel of transmission has become the cornerstone of monetary policy in most countries. Mohanty and Turner (2008) argued that credible monetary policy frameworks put in place across EMEs in recent years have strengthened the interest rate channel of monetary policy transmission.

In the case of advanced economies (AEs), the interest rate channel works by impacting the cost of capital. This channel has been found to be strong, and has exhibited good information content about future movement of real macroeconomic variables (Bernanke and Blinder, 1992). In the case of EMEs, which do not have well-functioning and integrated capital markets, and in which other markets are fragmented and relatively illiquid, monetary transmission through the interest rate has been found to be relatively weak. Furthermore, the interest rate channel is also rendered weak during surges in capital inflows. On an average, the pass-through coefficients for transmission from policy rates to lending rates across Asian economies declined by about 30-40 basis points during episodes of capital inflows (Jain-Chandra and Unsal, 2012). Transmission from policy rates to money market rates and retail lending rates was found to be strong in transition economies of Europe, but the transmission to longer maturity rates was somewhat weak (Égert and MacDonald, 2009).

Mukherjee and Bhattacharya (2011) found that the interest rate channel impacted private consumption and investment in EMEs, with and without inflation targeting (IT). Their results suggest that interest rates have significant impact on private sector activity both in inflation targeting emerging market economies and potential inflation targeters in MENA region. The estimates show that the real interest rates have statistically significant and negative impact on private investment in both group of countries (0.662 in IT EMEs and 0.029 in non-IT MENA

EMEs). In Sri Lanka, Amarasekara (2008) found interest rate channel to be important for monetary policy transmission.

Acosta-Ormaechea and Coble (2011), compared the monetary policy transmission in dollarised and non-dollarised economies found that the interest rate channel in terms of real rates affecting investment was found to be more important in Chile and New Zealand. Gumata et al. (2013) attributed strengthening of the interest rate channel in many EMEs to reduced fiscal dominance, more flexible exchange rates and development of market segments.

Credit Channel

The credit channel of monetary transmission operates through both the bank lending channel and the balance sheet channel (contractionary monetary policy decreases collateral valuation and net worth of firms, raises agency costs and affects firms' activity levels). Mishra, Monteil and Sengupta (2016) find that the monetary transmission through bank lending channel is carried out in two stages- from policy rates to bank lending rates and from bank lending rates to aggregate demand (Annexure 1). Evidence from the euro area suggests that the bank lending channel was more pronounced than the balance sheet channel in the case of firms, while for households, it was the other way round (Cicarrelli, et al, 2010). The bank lending channel is also found to have a larger impact on banks that are small, less capitalised and less liquid. Some evidence suggests that firms substitute trade credit for bank loans at times of monetary contraction, thus weakening the credit channel. This is particularly the case for EMEs.

Takáts et al (2013) find that declining bank credit to the private sector will not necessarily constrain the economic recovery after output has bottomed out following a financial crisis. From 39 financial crises, which – as the one in 2008-09 – were preceded by credit booms, they suggest that in these crises the change in bank credit, either in real terms or relative to GDP, consistently did not correlate with growth during the first two years of the recovery. In the third and fourth year, the correlation becomes statistically significant but remains small in economic terms. The lack of association between deleveraging and the speed of recovery does not seem to arise due to

limited data. In fact, data shows that increasing competitiveness, via exchange rate depreciations, is statistically and economically significantly associated with faster recoveries.

Deteriorating bank balance sheets due to crisis-induced credit losses could have made it difficult for some banks to meet the minimum capital requirements and expand credit supply, as issuing new equity (given the scarcity of capital and heightened investor risk aversion) or cutting dividends proved difficult and costly (Borio and Zhu, 2012). Weakened bank balance sheets limited the supply of credit during the 2008 crisis (Foglia et al., 2010; Holton et al., 2012; and Puri et al., 2011). The size of non-performing assets indeed increased at the beginning of the crisis and did not decline substantially until late-2012 in a number of countries, especially those where house prices dropped substantially (the United Kingdom, the United States and some euro area countries). Even so, the extent of non-performing loans has risen surprisingly little so far in some euro area countries (OECD, 2012, 2013).

In the case of Sub-Saharan Africa, excluding South Africa, the bank lending channel has been found to work feebly, given that informal finance dominates credit markets and the penetration of institutional finance is limited, leading to low competition from the banking sector. However, in the case of many EMEs, especially where bank-oriented financial systems exist, the credit channel has remained strong. Using the VAR framework, Disyatat and Vongsinsirikul (2003) found that in Thailand, in addition to the traditional interest rate channel, banks played an important role in monetary policy transmission mechanism, while exchange rate and asset price channels were relatively less significant. For the Philippines, Bayangos (2010) found the credit channel of monetary transmission to be important. Ncube and Ndou (2011) showed that monetary policy tightening in South Africa can marginally weaken inflationary pressures through household wealth and the credit channel. While informal finance weakens monetary transmission, the credit channel remains important in the case of micro-finance institutions.

Exchange Rate Channel

An important channel of monetary transmission has been the exchange rate that is either directly influenced by the central bank or gets impacted by its actions. Typically, the exchange rate channel works through expenditure switching between domestic and foreign goods. For instance,

contractionary monetary policy would lead to higher interest rates and consequent appreciation of the domestic currency making foreign goods cheaper causing demand for domestic goods and net exports to fall resulting in a decline in output.

However, this may also reduce external debt in domestic currency terms. Both effects transmit to aggregate demand and the price level. Empirical evidence suggests that the exchange rate channel is strong in economies with freely floating exchange rates, but its impact is dampened in case central bank intervenes in the foreign exchange market. For instance, in the case of Latin American countries, lower exchange rate flexibility relative to their peers in Asia seems to have resulted in weaker transmission of policy rates. Acosta-Ormaechea and Coble (2011), comparing the monetary policy transmission in dollarised and non-dollarised economies found that the exchange rate channel played a substantial role in controlling inflationary pressures in Peru and Uruguay. Hnatkovska, Lahiri and Vegh (2008) find that relationship between interest rates and exchange rates is non-monotonic (Annexure 1).

Asset Price Channel

Apart from exchange rates, changes in other asset prices such as equities and house prices also impact inflation and growth. Equity prices are dampened in response to contractionary monetary policy and the resultant wealth effects and collateral valuation changes feed through to consumption and investment. The asset price channel is quite weak in many EMEs where equity markets are small and illiquid, but relatively strong in countries that have well developed equity markets. Transmission is also found to be limited in countries with weak property price regimes and poorly developed and illiquid real estate markets. In countries like the US and Australia, where the mortgage market is well integrated with capital markets, the asset price channel turns out to be quite strong. In general, stock prices respond faster to contractionary monetary policy, though the intensity and lags of transmission are impacted by the liquidity in the stock markets.

Horatiu (2013) observed a significant impact of asset prices on both consumption and investment, two economic actions that can help the economy. Mahat and Abdullahi (2015)

established that the asset price channel of monetary transmission mechanism in Kenya is not effective. Shah, Chen, Shafi, and Shah (2015) find that stock prices have a negative long run relationship with investment and output. Jones and Bowman (2019) found that the pass-through of short-term repo rate shocks to asset prices and real activity appears stronger compared to money supply shocks. Nombulelo, Kabundi and Ndou (2013), found that a rise in the short-term rate affects demand for stock negatively and consequently stock prices drop. The all-share index does not react upon impact, and eventually decreases gradually, attaining the lowest level of 0.32 percent after 2 quarters. House prices do not react contemporaneously, but the effect is statistically significant, reaching a minimum value of 0.08 percent after two quarters.

2.4: Experience of Unconventional Monetary Policy

In the wake of global financial crisis (GFC) many Central banks had to depart from what can be termed as conventional monetary policy (because of the failure of the financial system to respond adequately to it) to adopt unconventional monetary policy tools. The unconventional monetary policy includes, among others, negative interest rates, expanded lending operations, assets purchase programmes and forward guidance.

One issue that has been raised in the recent literature relates to effectiveness of unconventional monetary policy with near zero rates of interest. Borio and Hofmann (2017) suggested that, "-both conceptually and empirically there is support for the notion that monetary policy is less effective when interest rates are persistently low." This was on account of two reasons - "(i) headwinds that typically blow in the wake of balance-sheet recessions when interest rates are low (e.g. debt overhang, an impaired banking system, high uncertainty, resource misallocation)." And, "(ii) Inherent non-linearities linked to the level of interest rates (e.g. impact of low rates on banks' profits and credit supply, on consumption and savings behaviour - and on resource misallocations)." There is evidence that the headwinds experienced from recovery from balance-sheet recessions may deter the effectiveness of monetary policy and that lower rates can impact consumption as well as credit. A high level of uncertainty may lead to risk aversion, which may dampen the impact of lower interest rates (Kamiah, 2020).

Negative interest rates

In recent years, especially after the global financial crisis (GFC) of 2008, some countries have experimented with negative interest rates. Prior to GFC, it was widely believed that there was a 'zero lower bound' for the policy interest rate, implying that nominal interest rates could never be negative. This was because if interest rates were negative, people would simply choose to hold their savings in cash and deposits would be unavailable to banks for lending or other purposes. However, post GFC some countries that have negative policy rates include Sweden, Denmark, Switzerland, European Central Bank, Hungary, Norway and Japan. Bean and Broda et. al. (2015) hypothesize that a higher propensity to save in the world along with a lower propensity to invest and increasing demand for safer risk-free assets has been putting the downward pressure on interest rates. Carlos and Kose et al (2016) mention that the transmission channels have worked as expected, during the negative interest rate regime, through the interest rate, credit, and exchange rate channels. Torsten (2016) mentions that the confidence costs of negative interest rates outweigh its small economic benefits and for a majority of banks negative interest rates have seen no uptick in lending volumes. Moreover, due to negative yields in the Euro area, investors preferred the US markets where yields were still attractive. Andreas and Lin (2016) discuss about the pass-through of negative interest rates on the economy and their impact on lifting inflation and aggregate demand. Potter and Smets (2019), observe that the policy of negative nominal interest rates along with other unconventional monetary policy measures had a reasonably strong impact in terms of reducing government bond yields as well as yields on corporate debt. They may have also helped in raising stock prices. However, the pass-through to retail deposit rates appear to have a floor of zero because of the possibility of shifting to cash.

Expanding Lending Operations

In recent years, since 2008, after the GFC, a number of central banks introduced new lending measures or adjusted existing ones in order to improve liquidity mainly in the short-term money markets. More such measures were introduced to provide monetary accommodation during 2010-16. Central banks increased the frequency of repo auctions, provided funds for longer maturities, increased the range of acceptable collaterals, and broadened the set of institutions that could participate in monetary operations. Potter and Smets (2019), summarised vast literature, and concluded that these measures helped in easing liquidity strains, restore monetary

transmission channels, eased funding conditions for non-financial corporations and households. The unconventional measures were largely successful in supporting stronger growth and higher inflation. However, the effects of these measures were heterogeneous across Euro area, with countries that had a more fragile banking system benefitting less. Studies from several Euro countries suggest that ECB's long-term refinancing operations (LTRO) increased credit supply to non-financial corporations and targeted LTROs resulted in faster lending growth and lower lending rates.

Large Scale Asset Purchase Programmes (APP)

Large scale APPs were another measure adopted by the central banks in some countries to address the disruptions in the transmission mechanism of monetary policy and provide additional monetary stimulus. The instruments purchased included covered bank bonds, corporate bonds, commercial paper, agency mortgage-based securities, other asset- based securities, real estate investment trusts, exchange-traded funds and public sector bonds. Central banks mainly purchased public sector issued securities, although in some cases they also purchased other securities. These operations were generally large scale and lasted for long period. Most countries that undertook large scale asset purchase programmes reported a reduction in bond yields to varying degrees. These also helped in lowering lending rates. Several studies estimated the macro-economic effects of asset purchases and the effects were estimated to have been positive both for output and inflation. However, a number of central banks also reported side-effects of APPs that included lower trading volumes of government bonds, price distortions for certain specific bonds, etc. Spillovers to other countries were also observed in the form of higher capital inflows leading to an appreciation of exchange rates vis-à-vis US$, significant increase in stock prices. Disruptive spillovers were also associated with announcement/expectation of reversal of assets purchase programmes e.g. the 'taper tantrum' episode.

Forward Guidance

During the global financial crisis, a few central banks from advanced economies adopted forward guidance (FG), generally to support accommodative stance and ease monetary policy because inflation was below the target, and in some cases to address the issue of depressed output growth and high unemployment rate. According to Potter and Smets (2019), select Central banks

reported that FG worked through reducing long term interest rates by inducing expectation of prevalence of lower policy rates for longer term (and hence lowering uncertainty), thus lowering term premia. The nature of FG also changed as the situation developed from ad hoc to more concrete, initially calendar based and subsequently economic conditions based. For example, ECB provided neither calendar nor outcome based conditions when it introduced FG for policy rate in July 2013. However, by July 2015, ECB included outcome based guidance, linking policy actions to expected future path of inflation. Studies suggest that generally FG was effective in reducing yields. ECB's FG had largest impact on bonds of intermediate maturities. FG in the US reduced interest rate uncertainty independent of effects on the expected levels of rates.

Krugman, Dominques and Rogoff (1998) discuss unconventional monetary policy in the context of problem of deflation which prevents real interest rates to fall for full employment to be achieved and mentioned the need for central bank to raise inflation expectations to reduce real interest rates. Reifschneider and Williams (2000) use a modified Taylor Rule and analyse the deviations in output that were an outcome of the zero bound. They find that the commitment effect was indeed significant and had an impact on both output and inflation in the US. Fujiki and Shiratsuka (2002) found a positive impact on output and inflation for Japan. The results are consistent with similar studies by Fujiwara et al. (2005) and Braun and Waki (2006).

Morgan (2009) looks at the effectiveness of unconventional monetary policy and explores their importance for emerging markets. He highlights how such policies are instrumental when the policy rates fall to zero, in the event of a credit crunch or an increase in risk premium which impairs the monetary policy transmission. It is observed that quantitative easing policies have a limited impact on bond yields but other kinds of asset purchases (non-government bonds) have been more successful in relieving market stress such as funding blockages even as such unconventional policies have had limited impact in stimulating economic growth.

2.5: Monetary Transmission in India

The effectiveness of monetary policy depends on the overall policy environment within which an economy operates. The liberalisation of financial markets in India since the early 1990s has proceeded at a gradual pace and has been characterised by "---relaxation of restrictions on entry

into banking, creation of new markets for government bonds and other securities and the reduction of quantitative controls on international capital flows. Banks and other financial institutions are still subject to mandated holdings of government bonds and large public sector deficits continue to impact financial markets." Ghate and Kletzer (2016).

Acharya (2020) observed from the evidence that monetary transmission in India has not been satisfactory in the recent period. As against the policy rate cut of 200 basis points during January 2015 to May 2018, the weighted average term deposit rate (WATDR) declined by 193 basis points. However, the weighted average lending rate (WALR) on outstanding rupee loans declined only by 154 base points. Reduction in the WALR on fresh rupee loans was higher at 205 base points as the banks passed on the benefits in the reduction of MCLRs more to the new borrowers than to the existing borrowers. However, significant transmission occurred *only* post-demonetization following the increase in low-cost current and saving account deposits due to surplus liquidity with the banking system. In the more recent period, in response to the increase in the policy rate by 50 basis points (from June to December 2018), WALR on fresh rupee loans increased by 48 basis points, but only 6 basis points on outstanding rupee loans. Also, the median base rate hardly moved. Since about 24 percent of banks' loan portfolio is still at the base rate/ BPLR, this impaired the overall monetary transmission to outstanding rupee loans.

In India, many alternate approaches have been applied to study monetary transmission dynamics. Swamy (2016) and Acharya (2017) have explored different transmission channels in greater detail. Ray, Joshi and Saggar (1998), Al-Mashat (2003), RBI (2004), Aleem (2010), Bhattacharya et al. (2011), Khundrakpam and Das (2011) and Khundrakpam and Jain (2012) used VAR. New Keynesian model (NKM) to assess transmission sas been estimated by Patra and Kapur (2012), Goyal (2008) and Anand et al. (2010). Individual equations of the NKM, mainly concentrated on Philips curve, were estimated by Kapur and Patra (2000), Dua and Gaur (2009), Paul (2009), Patra and Ray (2010), Mazumdar (2011), and Singh et al. (2011). Mohanty and Klau (2004), Virmani (2004), Srinivasan et al. (2008), Takeshi and Hamori (2009), Anand et al. (2010), Hutchison et al (2010), and Singh (2010) have examined Taylor-type rules.

In India, an emerging economy, in addition to effectiveness of different channels, there has been a growing debate regarding the impact of interest rates on investments, as increasing the growth

rate is the prime objective of the Government. The RBI has to support this high growth. This recent discussion then is focussed on the ability of the RBI to stimulate growth by lowering interest rates. The underlying assumption under most Taylor-type monetary policy rules has been that economic growth does respond to monetary stimulus. Therefore, it is intuitive to expect aggregate demand to react to monetary stimulus through the investment channel. The alternative view is that lowering interest rates has limited impact, unless capacity utilization is high. This argument focuses on the underlying economic conditions and argues that a firm's investment function depends more on its current capacity utilization and future expectations rather than the cost of capital or interest rates. The extension of this argument suggests that cyclical downturns cannot be impacted by interest rates. It is therefore important to investigate the impact of interest rates on the investment cycle. RBI (2013) concluded, after extensive research, that lower interest rates do not necessarily support investment and growth.

On the effect of interest rates, Al-Mashat (2003), using a structural vector error correction model (VECM) for the period 1980:Q1 to 2002:Q4, found that interest rate and exchange rate channels strengthen the transmission impact of monetary policy while there was little evidence on the working of bank lending channel due to presence of directed lending under priority sector lending (Annexure 1). The RBI (1998)) pointed to some evidence of interest rate channel of monetary transmission. Singh and Kalirajan (2007), using cointegrated VAR approach, highlighted the significance of interest rate as the major policy variable for conducting monetary policy in the post-liberalised Indian economy. Pandit and Vashisht (2011) provided evidence that the policy rate channel of transmission mechanism - a hybrid of the traditional interest rate channel and credit channel - operated in India and other EMEs (Annexure 1). Mohanty (2012) showed that there was a co-integrating relationship between monetary policy interest rate movements with rates across different segments of financial markets (Annexure 1). Furthermore, lending rates for certain sectors such as housing and automobiles responded relatively faster to policy changes as compared to other sectors. Interest rate channel accounted for about half of total impact of monetary shocks on GDP growth and about one-third of total impact on inflation, indicating the importance of interest rate channel for monetary policy transmission in India. Kapur and Behera (2012) found that the interest rate channel was effective in the Indian context and the magnitude of its impact on growth and inflation was comparable to that in major

advanced and emerging economies (Annexure 1). Yanamandra (2015) concluded that interest rate channel was dominant and impacted cost of funds in the economy. Acharya (2017) also found the interest rate channel to be the strongest in the context of monetary transmission in India. Goyal and Aggarwal (2017) found that interest rate channel, with repo rate as the policy rate, is the most effective medium to influence market rates in India (Annexure 1). Sengupta (2014) found that the interest rate and asset price channels have become stronger and the exchange rate channel, although weak, shows a mild improvement in the post-LAF period (Annexure 1).

Pandit and Vashisht (2011) examined the credit channel for India and six other EMEs in a panel regression framework and found that the policy rate was an important determinant of firms' demand for bank credit, which confirmed the role of countercyclical monetary policy tool for setting the pace of economic activity (Annexure 1). Das (2015) found that there is a significant, albeit slow, pass-through of policy changes to bank interest rates in India (Annexure 1). Banerjee (2011) examined the direction of credit-output causality for the period 1950-2011 and found changes in the causality direction over the period: output was predominantly driven by credit in the pre-1980s period, there was nearly no relationship between the two during the 1980s and credit was being primarily driven by output in the post-reform period. Swamy (2016) observed that the bank lending channel remained the principal means of transmission of monetary policy shocks to the real sector, while asset price or exchange rate channels were not found to be important in the Indian context.

Mitra and Chattopadhyay (2020) argued that monetary transmission in the recent period was full and reasonably swift across various money market segments and the private corporate bond market. However, transmission to bank deposits and lending has been delayed and partial. They attribute this to rigidity in banks' deposit interest rates. As most of loans are contracted at floating rates, while most of the deposits are contracted at fixed interest rates, transmission mechanism tends to get muted. In addition, competitive pressure from mutual funds and small savings schemes have also impacted transmission mechanism.

In a recent paper, Eichengreen, Gupta and Choudhary (2020) studied the transmission from changes in Repo rate to government bond yields of different maturities (1, 2, 5, 10 years), treasury bill rates and average lending rates on new and outstanding loans and find that transmission is greater for treasury bills and bonds of shorter durations and transmission improved somewhat after adoption of inflation targeting regime (IT). Transmission to bank lending rates was relatively weak and did not improve with IT. Acharya (2017) and Dua (2020) also find that transmission, to money market and long term interest rates, is relatively complete but transmission to bank lending and deposit rates is less complete and slow.

Evidence on the exchange rate channel appears to be mixed. The exchange rate channel is found to be feeble in India with some evidence of weak exogeneity (Ray, Joshi and Saggar (1998). Bhattacharya, Patnayak and Shah (2010) found the evidence of incomplete but statistically significant exchange rate pass through (Annexure 1). While changes in policy interest rates may influence movements in exchange rates, the level of the exchange rate is not a policy goal, as the RBI does not target any level or band of the exchange rate but focusses on volatility in exchange rates. Aleem (2010) pointed out that the exchange rate response to monetary policy shock was important from the perspective of a proper comprehension of monetary transmission mechanism in India (Annexure 1). Bhattacharya *et al.* (2011), based on VECM model, suggested that the most effective transmission of monetary policy impacting inflation was through the exchange rate channel. The long-run co-integrating relationship revealed that an increase of 100 bps in the call money rate had a negligible impact on industrial production (the activity variable) and a reduction of only 1 bps in inflation; in comparison, one percent currency depreciation increased inflation by 20 bps. Salunkhe and Patnaik (2017) provide an in-depth analysis of the relationship between policy rate and inflation (Annexure 1).

On the asset price channel, empirical evidence for India indicates that asset prices, especially stock prices, react to interest rate changes, but the magnitude of the impact is small. While interest rates cause changes in stock prices, the reverse causality does not hold. This validates the point that monetary policy in India does not respond to asset prices, but the asset price channel of

monetary policy exists (Singh and Pattanaik, 2012). Further, the wealth effect of increasing equity prices in stock market has only a short run and small effect on consumption demand in India (Singh, 2012). It is held that with the increasing use of formal finance (from banks and non-banks) for acquisition of real estate, the asset price channel of transmission has improved. However, during periods of high inflation, there is a tendency for households to shift away from financial savings to other forms of savings such as gold and real estate which are considered to provide a better hedge against inflation. To the extent that these are funded from informal sources, they may respond less to contractionary monetary policy, thus weakening asset price channel in India.

Khundrakpam and Jain (2012), using SVAR examine relative importance of various channels and conclude that interest rate channel, credit channel and asset price channel are important while exchange rate channel is weak (Annexure 1).

There are significant monetary policy transmission lags which have been observed by several authors. RBI (2005) using a VAR framework for the period 1994-95 to 2003-04 found that monetary tightening through a positive shock to the Bank Rate had the expected negative effect on output and prices with the peak effect occurring after around six months. Anand et al. (2010) employed a DSGE model framework and their results indicated that the peak effect of a 100 bps increase in the nominal policy rate (call rate) was 35-45 bps on output and around 15 bps on inflation and the peak effect on both output and inflation was felt in the first quarter after the policy rate shock. Patra and Kapur (2010) found that aggregate demand responded to interest rate changes with a lag of at least three quarters. However, the impact of monetary policy could persist up to two years (Annexure 1). Mohanty (2012), using a quarterly structural VAR model, found that the peak effect on output growth was observed with a lag of two quarters and that on inflation with a lag of three quarters while the overall impact persisted through 8-10 quarters. Mishra (2016), however, observed monetary easing through a positive shock to broad money had a positive effect on output and prices with peak effect occurring after about two years and one year, respectively. Further, exchange rate depreciation led to increase in prices with the peak effect after six months.

2.6: Conclusion

The review of literature, globally and domestically, reveals that interest rate channel is most significant amongst four different channels. The choice of techniques, as well as variables, have varied in different countries and for different time periods. The empirical literature has also considered call money rates, in addition to the policy rate or the Repo rate while estimating the transmission mechanism.

Section 3

Evolution of Monetary Policy Operating Framework in India

Globally, in most countries, monetary policy framework has evolved in response to and in consequence of financial developments, openness and shifts in the underlying transmission mechanism. The issue became important after the global financial crisis in 2008 when the focus of the economists was drawn to financial stability, in addition to price stability, the traditional objective of the central bank. In India, in 1997, after the Asian Crisis, the RBI had followed the Multiple Indicator Approach (MIA), which had macroeconomic and financial indicators, and one of which was inflation. The purpose of adopting MIA was to factor economic-wide considerations, ranging from fiscal to financial sector, while fixing the policy interest rate. In this brief section, evolution of the monetary policy in India is discussed.

3.1: Evolvement of Policy Objectives

The evolution of the monetary policy framework in India can be seen in various phases and has been following the developments taking place in the financial system and the changing nature of the economy (Mohanty, 2012; Das, 2020). The recent developments in the supervision and regulation of the financial institutions and the growing importance of the nonbanking financial intermediaries has renewed the focus to revise the framework. The focus remains on promoting seamless real-time transactions with anchored expectations of the public and improving the credibility of policy in ensuring price stability with growth and a resilient financial system in place.

The Reserve Bank of India was established in 1935. During the formative years (1935-1950), the focus of monetary policy was to regulate the supply of and demand for credit in the economy through the Bank Rate, reserve requirements and open market operations (Deshmukh, 1948). During the development phase (1951–1970), monetary policy was geared towards supporting plan financing, which led to introduction of several quantitative control measures to contain the consequent inflationary pressures (Bhattacharya, 1966). While ensuring credit to preferred sectors, the Bank Rate was often used as a monetary policy instrument. During 1971–90, the focus of monetary policy was on credit planning as 20 banks had been nationalized, pursuing

social objectives (Narasimham, 1977). Both the statutory liquidity ratio (SLR) and the cash reserve ratio (CRR) prescribed for banks were used to balance government financing and inflationary pressures. The 1980s saw the formal adoption of monetary targeting framework based on the recommendations of the RBI (1985). Under this framework, reserve money was used as the operating target and broad money (M3) as an intermediate target. Thus, the monetary policy was dynamically responding to the evolvement of the economic factors in the economy (Malhotra, 1985). Subsequently, structural reforms and financial liberalisation in the 1990s led to a shift in the financing paradigm for the government and commercial sectors with increasingly market-determined interest rates and exchange rates.

In the 1990s, as the efficacy of the monetary targeting framework got undermined with liberalization and financial innovations, the need to revise the existing framework emerged (Rangarajan, 1997). In April 1998, the Reserve Bank of India formally adopted the multiple indicators approach. In this approach, in addition to monetary aggregates, indicators like credit, inflation, output, exchange rate, trade flows, market returns, and fiscal performance were used to formulate policy. With increasing market orientation, the deregulation of interest rates enabled the shift from direct instruments towards indirect instruments of monetary policy. Short term interest rates became instruments to signal monetary policy stance of RBI. To ensure stable short term interest rates, the emphasis was laid on integrating the money market with other segments of the financial market.

In the period following the Global Financial Crisis (GFC) in 2008-09, the credibility of Multiple indicator approach was questioned for not providing a clearly defined nominal anchor. In 2014 based on the recommendations of the Committee on Monetary Policy Framework (Chairman: Urjit Patel; RBI (2014)), it was recommended that inflation should be the nominal anchor for the monetary policy framework. The Government of India (GoI) and RBI on February 20, 2015, signed the Monetary Policy Framework Agreement (MPFA), adopting flexible inflation targeting formally with the amendment of the RBI Act 2016. The new objective restates maintaining price stability as the primary objective while observing the objective of growth. The numerical target of 4 percent for CPI headline inflation has a tolerance band of +/-2 percent. The relative emphasis on growth and inflation depends on the emerging developments in the economy.

The liquidity management operations of the RBI were able to move away from direct instruments to indirect market-based instruments. Beginning in April 1999, the RBI introduced liquidity adjustment facility (LAF) to manage liquidity through Repo (repurchase Agreements, liquidity injection) and reverse Repo (liquidity absorption) operations. From 2003 till May 2, 2011, monetary policy signals were provided through changes in both Repo and reverse Repo rates in conjunction with variations in the cash reserve ratio. During episodes of excess liquidity (2001 through 2006 and again from 2008:Q4 to 2010:Q2), the reverse repo rate was the effective policy rate. On the other hand, during episodes of monetary tightening/liquidity shortage (2007:Q1 to 2008:Q3 and 2010:Q3 to 2011:Q4), the repo rate became the effective policy rate. Thus, the policy rate, during the post-2003 period, switched between Repo and Reverse Repo rates. While this helped to develop interest rate as an important instrument of monetary transmission, this framework witnessed certain limitations due to the lack of a single policy rate and the absence of a firm corridor. In this context, the RBI introduced a new operating procedure in May 2011 where the weighted average overnight call money rate was explicitly recognised as the operating target of monetary policy and the Repo rate was made the only one independently varying policy rate to transmit policy signals more transparently.

3.2: Improving Transmission Mechanism

Along with the evolution of monetary policy operating framework, there has also been a gradual move towards improving the effectiveness of monetary policy transmission to bank lending rates. The focus on developing the financial sector was at the core of reforms undertaken since 1991 (Singh, 2005). In this context, to help develop financial markets, market determined interest rates through auctions were introduced in the government securities market, primary and secondary dealerships were set up, new financial instruments were conceived and experimented, and in general, liberalisation of the markets was initiated. To ensure that the monetary policy is independent, the system of automatic monetisation of deficit through ad hoc Treasury Bills was stopped in 1997 by an agreement between the RBI and the Central Government. To take care of the fiscal requirements, short term financing of the central and State Governments, through ways and means advances was modernised. To ensure an adequate supply of instruments with appropriate maturity, the maturity period of government securities was modulated, considering the requirements of insurance, provident and pension funds. To ensure that the banking system is

robust and competent, macroprudential norms and early warning signals were devised for financial institutions by mid-2000s. The regulatory and supervisory mechanism of the banking system, mainly commercial banks, was strengthened. The RBI was liberal in granting licenses to private and foreign banks to operate in the country. The licensing scheme for new types of banks was also initiated under which small and payment banks were operationalised. The consolidation exercise of public sector banks was also successfully completed in recent years. The development finance institutions like IDBI, ICICI and HDFC were discontinued and merged with commercial banks. India also became an active member in evolving Basel norms and meeting the requirements stipulated by Bank for International Settlement.

The RBI also made efforts to strengthen the regulatory and supervisory function in the case of urban and state cooperative banks, and non-banking finance companies. The country witnessed the growth of self-help groups and microfinance institutions with the active support of National Bank for Agriculture and Rural Development since mid-1980s.

As the markets developed and integration improved, the expectation of the RBI was that transmission should also be more effective. Acharya (2020) and RBI (2017) discuss the evolvement of benchmarking rates and the efforts made by the RBI to improve transmission of the monetary policy through the banking channel. In 1994, the RBI introduced the concept of prime lending rate (PLR). To introduce transparency, in 2003, the banks were advised to fix benchmark PLR (BPLR) and provided the freedom to lend below BPLR. Since then, the RBI has changed the system from BPLR to base rate in 2010, to marginal cost based lending rate in 2016 and external benchmark rate in 2019 (Table – 3.1).

However, as can be observed, the benchmarking was mainly on the lending operations of the commercial banking sector and urban cooperative banks. The NBFCs including housing finance companies, SHGs, and MFIs followed their independent pattern, based on the cost of borrowings. These institutions borrowed at different rates from different sources and their lending rates were not related to the RBI's policy rate. The flow of credit from these sources is nearly one-third of the total credit flow in the economy or almost half from the commercial banking sector, is substantial, and impacts the transmission to the real sectors of the economy.

Table – 3.1: Evolution of Lending Rate System in India

Year	Lending rate	Introduction
1994	Prime Lending Rate (PLR)	The PLR regime was introduced in 1994. However, both PLR and spread over PLR were seen to vary widely across banks/bank groups. Moreover, the PLRs continued to be rigid and inflexible in relation to the overall direction of interest rates in the economy.
2003	Benchmark Prime Lending Rate (BPLR)	With the aim of introducing transparency and ensuring appropriate pricing of loans—wherein the PLRs truly reflected the actual costs—the PLR was converted into a reference benchmark rate and banks were advised in 2003 to introduce the BPLR system. Under this system, banks were given the freedom to lend below the BPLR. While lending below the BPLR was expected only to be at the margin, it was observed that about 77 percent of banks' loan portfolio was at sub-BPLR. This affected the transmission of monetary policy instruments. Given these limitations, the PLR and BPLR systems did not lead to monetary transmission to the real economy to the desired extent.
2010	Base Rate	In July 2010, the BPLR system was replaced with the base rate system and banks were asked to calculate bank-specific base rate based on an indicative formula prescribed by the Reserve Bank and the spread over the Base Rate. Banks were allowed flexibility in the determination of cost of funds; they could use average, marginal or blended cost for base rate calculation. This flexibility, however, resulted in opacity in the computation of base rate. This was seen when the average cost of funds was used which remained somewhat rigid due to the term nature of fixed-rate deposits. The change in the spread over the base rate over time was not uniform across borrowers.
2016	Marginal Cost Based Lending Rate (MCLR)	In April 2016, Marginal Cost-Based Lending Rate system was introduced for banks which were linked to the marginal funding cost of each bank based on the prescribed formula for its computation, even as it provided for some discretion to banks. However, even under the MCLR system, the transmission to the existing borrowers has remained muted as adjustments to the MCLR and/or spread over MCLR by banks were done in many cases in an arbitrary manner. This was evident from the fact that overall lending rates were kept high in spite of monetary policy being accommodative from January 2015 to May 2018.
2019	External Benchmark Rate	From April 1, 2019, floating rate loans (personal or retail loans, loans to micro and small enterprises, and any other category of loans at the bank's discretion) extended by banks have been linked to either the policy repo rate or a market benchmark rate (three-month or six-month T-bills or any other rate produced by Financial Benchmark India Private Limited [FBIL]). The spread over the benchmark rate would remain unchanged unless the borrower's credit assessment undergoes a substantial change and as agreed upon in the loan contract.

Source: Acharya (2020) and RBI (2017).

3.3: Conclusion

The monetary policy, as well as objectives, have evolved over the years, globally and domestically. The RBI has been examining the issue of transmission and taking initiatives to make the transmission more complete. The RBI made extensive efforts since 1994 to develop the markets initially which have become more integrated in recent years. The RBI also made efforts to benchmark the lending rates so that the policy rate is effectively reflected in the banking operations. Hence the expectations by the RBI that transmission of the monetary policy will be more swift. However, the lending rate of the credit offtake from NBFCs, SHGs and MFIs, which constitute about one-third of total lending, are yet not aligned with the RBIs policy rate.

Section 4: Methodology of the Study

The data used in this study has been extracted from the Reserve Bank of India, Government of India - Ministry of Statistics and Program Implementation (MoSPI), Ministry of Labour and Employment (MoL&E) and Ministry of Finance (MoF) for empirical investigation.

3.1 Variables and Data Sources

The study used quarterly data from the first quarter (Q1) of 1998 to the fourth quarter (Q4) of 2018-19. The quarterly data pertain to the variables such as Gross Domestic Product , Inflation, Money Supply, Repo Rate, Index of Industrial Production, Government Final Consumption Expenditure, Private Final Consumption Expenditure, Gross Capital Formation, Exports, Imports, Exchange Rate, BSE-Sensex, NSE-Nifty, Public Investment, Private corporate Investment and Household Investment as macroeconomic variables to understand different channel of monetary transmission in India. The details of the computation of the data are presented in Annexure 2.

Adjusted Real GDP is computed by splicing GDP at constant price of 1999-2000, 2004-05 and 2011-12 data at 2011-12 prices and then adjusted with error so that sum of four Spliced Quarterly Real GDP (2011-12) is equal to Annual Real GDP (2011-12). IIP growth rate is computed by splicing Index of Industrial Production at 2011-12 base and then growth of index. Repo rate is the quarterly arithmetic average. Real Effective Exchange Rate (REER) and Nominal Effective Exchange Rate (NEER) rate at trade based weight is computed by splicing both index at 2004-05 base. WPI inflation rate is computed by splicing Index of WPI at 2011-12 base and then growth of index. CPI inflation is computed by taking CPI-IW and CPI- Combined (Urban + Rural), First CPI-IW is taken from April, 1998 to December 2009 then from January, 2010 CPI- Combined is taken, after that both indexes spliced at 2011-12 base, finally taken growth of quarterly index to get CPI inflation. It is observed that the CPI-Combined has a strong and statistically significant correlation with the CPI-IW so CPI- IW can be used before 2010 (RBI, 2014).

Prime Lending Rate is Quarterly arithmetic average of Prime Lending Rate (PLR) from April, 1998 to March, 2003, Benchmark Prime Lending Rate (BPLR) from April, 2003 to June, 2010, Base Rate from July, 2010 to March, 2016, and Marginal Cost of fund based Lending Rate (MCLR) from April, 2016 to March, 2019.

Quarterly Private Corporate Investment (percentage of GDP) is computed by taking an individual share of Private Corporate Investment in Total Gross Capital Formation from Annual Private Corporate Investment data and then multiplied this share with Quarterly Total Gross Capital Formation data (at current price). Finally computed ratio of Private Corporate Investment to Quarterly GDP (at current price). Quarterly Public Investment (% of GDP) is also computed by the same way as Quarterly Private Corporate Investment is computed. Nominal Exchange rate is exchange rate of INR in terms of USD.

Index of National Stock Exchange (NSE), Non Food Credit (NFC), Total Deposit, Prime Lending Rate (PLR), G-Sec/Treasury Bill Yields, Weighted Average Call Money Rate, Commercial Paper interest rate, Certificate of Deposit Interest Rate and 5 Year AAA Rating Corporate Bond yield are quarterly arithmetic average. The details of the particular sources of the data are presented in Annexure 2. The data used for analysis is in Table 4.1 and the variable key is presented in Table 4.2.

Table 4.1: Data Used for Analysis

S. No.	Name of the variable	Unit of Measurement	Data Source
1	Gross Domestic Product (GDP)	Spliced adjusted level at Constant 2011-12 Prices (in Crore)	National Accounts Statistics (NAS)
2	IIP	Spliced Growth Rate (Base: 2011-12 = 100)	CSO
3	Repo Rate	Average of Quarter Starting from Apr-June	RBI
4	Real Effective Exchange Rate (REER)	Spliced Index Number, (Base: 2004-05 = 100) at Trade Based Weight	RBI
5	Nominal Effective Exchange Rate (NEER)	Spliced Index Number, (Base: 2004-05 = 100) at Trade Based Weight	RBI
6	Exchange Rate (INR/USD)	In INR/USD	RBI
7	National Stock Exchange (NSE)	Quarterly Average Index at Base: 1995=1000	RBI
8	Non-Food Credit (NFC)	Quarterly Average in Crore	RBI
9	Total Deposit	Quarterly Average in Crore	RBI
10	Prime Lending Rate	In Percent	RBI and Commercial Bank
11	CPI	Spliced Growth Rate Based on (Base: 2011-12=100). From 2010 January CPI-combined and prior to that CPI-IW	RBI
12	WPI	Spliced Growth Rate Based on (Base: 2011-12 = 100).	RBI
13	G-Sec/Treasury Bill Yields	Quarterly Average- 91 Day, 364 Day, 5 Year G-Sec, 10Year G-Sec	EPW Research Foundation
14	Weighted Average Call Money Rate	Quarterly Average	RBI
15	Commercial Paper	Quarterly Average of Lower Rate of Interest	EPW Research Foundation
16	Certificates of Deposit	Quarterly Average of Lower Rate of Interest	EPW Research Foundation
17	5 Year AAA Rating Corporate Bond	Quarterly Average Yield	Fixed Income Money Market and Derivatives Association Of India

Note- Quarter is starting from Apr- Jun.
All the growth rate is taken from corresponding previous quarter

Table 4.2: Variable Key

	Variables	Symbol
1	Repo Rate	REPO
2	NSE Index	NSE
3	BSE Index	BSE
4	Private Corporate Investment (as % of GDP)	PCI
5	91 Days- 6 months Deposit Rate	DR91
6	1-2 years Deposit Rates	DR2Y
7	Lending Rates -Prime Lending Rate	PLR
8	91 days - G-Sec Rates	T91/TBR91
9	364 days G-Sec Rates	T364/TBR364
10	5 Year G-Sec Rates	5GSEC
11	10 Year G-Secs	10GSEC
12	Weighted Average Call Money Rate	WACR
13	Lower CP rate	LCP
14	Lower CD rate	LCD
15	Bond Market AAA rated	5YCB
16	Consumer Price Index- Inflation	CPI/INFCPI
17	Wholesale Price index-Inflation	WPI/INFWPI
18	Exchange Rate - ln transformed	ER
19	Nominal Effective Exchange Rate	NEER
20	Log Transformed NEER	LnNeer
21	Real GDP (in crores)	RGDP
22	Real GDP - growth rate	ZRGDP/ RGDGR/GDPGR/GZGDP
23	IIP-growth rate	ZIIP
24	Log Non-Food Credit -growth	LNNFC
25	Non-Food Credit – growth	NFC/GNFC
26	Total Deposits - growth	ZTD
27	Total Deposits (crores)	TDR

Notes: 1) Z suffix denotes growth rates, and
2) Ln suffix and Log denote Logarithmic transformation

3.2 Empirical Investigation Methodology

The methodology followed is standard in the empirical analysis. The stationarity of the variables is examined since regressing on non-stationary[2] time series can lead to spurious regression outcomes. The tests for

2 Time-series with mean and autocovariances independent

identifying unit root in individual time series are Augmented Dickey-Fuller (1979) test with Akaike Information criteria (AIC) and Schwarz information Criterion (SC), and Phillips-Perron(1986) test.[3]

Consider a simple AR (1) process:

$$y_t = \rho y_{t-1} + x'_t \delta + \varepsilon_t \quad \text{- (1)}$$

where x_t are optional exogenous regressors which may contain a constant, or a constant and trend, ρ and ὁ are the parameters to be estimated, and the ε_t are assumed to be white noise. If the modulus of $|\rho| \geq 1$, y is a (trend-) stationary series. The unit root tests that we perform have the null hypothesis H_0: $\rho = 1$ against the one-sided alternative H_1: $\rho < 1$. In some cases, the null is tested against a point alternative.

The Augmented Dickey-Fuller (ADF) test is performed by subtracting y_{t-1} from both sides of the equation:

$$\Delta yt = \alpha yt_{-1} + x'_t \delta + \varepsilon_t \quad \text{- (2)}$$

where $\alpha = \rho - 1$. The null and alternative hypothesis may be written as,

$$H_{0:} \alpha = 0$$

$$H_1 : \alpha < 0$$

and evaluated using the conventional t-ratio for α:

$$t_\alpha \text{ ¿} \hat{\alpha} / (se(\hat{\alpha})$$

where $\hat{\alpha}$ is the estimate of α, and $se(\hat{\alpha})$¿ is the standard coefficient error.

Phillips-Perron[4] tests assess the null hypothesis of a unit root in a univariate time series y. All tests use the model:

$$y_t = c + \delta t + a y_{t-1} + e(t).$$

The null hypothesis restricts $a = 1$. Variants of the test, appropriate for series with different growth characteristics, specify the drift and deterministic trend coefficients, c and δ, respectively, to be 0. The tests use modified Dickey-Fuller statistics to account for serial correlations in the innovations process $e(t)$.

After performing the unit root tests, the next step is to select the optimal lag. For lag order selection various criterion are used like, likelihood-ratio test statistic (LR), Akaike Information Criteria (AIC), Final prediction error (FPE), Schwarz Information Criteria (SC) and Hannan-Quinn Information criteria (HQ) test under the environment of Vector Auto Regression(VAR).

3 at 5% level of significance.

4 Phillips, Peter & Perron, Pierre. (1986).

Finally, in order to see the policy response, the study uses a Structural Vector Auto Regressive (SVAR) framework with external variables as exogenous variables to control for external influences. Sim's vector auto-regression (VAR) methodology has been extensively used in examining the efficacy of monetary policy transmission across several countries. According to Sims et al., (1990), the VAR approach is constructed to identify the relation of the variables instead of parametric estimation. This approach provides a major advantage of taking into account the simultaneity between monetary policy instruments and relevant macroeconomic variables. However, there are several versions of VAR models to examine monetary policy transmissions such as the traditional VAR, Structural VAR (SVAR) and Factor Augmented VAR (FAVAR). SVAR models, unlike the traditional VAR models, provide explicit behavioural interpretations for all the parameters. The main purpose of structural VAR (SVAR) estimation is to obtain non-recursive orthogonalization of the error terms for impulse response analysis. This alternative to the recursive Cholesky orthogonalization requires the user to impose enough restrictions to identify the orthogonal (structural) components of the error terms. Following Bernanke and Blinder (1992), we use a standard SVAR approach to examine how monetary policy shocks affect the real economy. The SVAR model has been preferred as it enables providing explicit behavioral interpretations of the parameters.

SVAR is a multivariate, linear representation of a vector of observables on its lags and (possibly) other variables as a trend or a constant. The interpretations of SVAR models require additional identifying assumptions that must be motivated based on institutional knowledge, economic theory, or other extraneous constraints on the model responses. Only after decomposing forecast errors into structural shocks that are mutually uncorrelated and have an economic interpretation, one assesses the causal effects of these shocks on the model variables. These exogenous variables are assumed to have both contemporaneous and lag impact on the endogenous variables without any feedback effect. Further, in view of the limited number of variables which can be considered in the SVAR without losing degrees of freedom, each of the channels of transmission is examined only one at a time. This involves estimating a baseline SVAR model, which is augmented by the variables representing a particular channel of transmission each time separately. It will isolate purely exogenous, purely independent movements or shocks to variable of interest and see how macroeconomic variables react to it i.e., via the impulse response. The structural model isolates purely exogenous shocks and gets the responses of the endogenous variables after the economy is hit by these shocks. Uncovering the structural model is called identification. This is identified as follows:

A structural model of the form where X_t depends on its lag and structural shocks u_t assuming that the structural shocks are independent among themselves.

$$A X_t = \beta_0 + \beta_1 X_{t-1} + u_t$$

Or in general form it is given as,

$$A X_t = \sum_{i=1}^{n} \beta_1 X_{t-1} + u_t, u_t \quad N(0, D)$$

where X_t is a (N ×1) vector of the endogenous variables and β_1 is a (N ×N) matrix containing the parameters on the i[th] lag, with A representing the contemporaneous interactions between the variables. The (N × 1) vector of disturbances,u_t represents the structural shocks and has covariance matrix D, which is a diagonal matrix containing the variances. It is the fact that the covariances of u_t are all zero that gives ut its structural interpretation, since each shock is, by definition, unique.

In the first phase of empirical analysis in order to understand the effect of policy rate on various sectors the study has employed SVAR approach. In the following SVAR model shocks has been provided in form of repo rate, 91 Treasury bill rate and weighted call money rate to NSE, GDP, WPI, 5YGSEC and 5YCB.

In matrix form, it can be expressed as:

$$\begin{bmatrix} 1 & a_{12} & a_{13} & a_{14} & a_{15} \\ a_{21} & 1 & a_{23} & a_{24} & a_{25} \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} \\ a_{41} & a_{42} & 0 & a_{44} & a_{45} \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} Y_t \\ X_t \\ Z_t \\ P_t \\ T_t \end{bmatrix} = \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} & \beta_{14} & \beta_{15} \\ \beta_{21} & \beta_{22} & \beta_{23} & \beta_{24} & \beta_{25} \\ \beta_{31} & \beta_{32} & \beta_{33} & \beta_{34} & \beta_{35} \\ \beta_{41} & \beta_{42} & \beta_{43} & \beta_{44} & \beta_{45} \\ \beta_{51} & \beta_{52} & \beta_{53} & \beta_{54} & \beta_{55} \end{bmatrix} \begin{bmatrix} Y_{t-1} \\ X_{t-1} \\ Z_{t-1} \\ P_{t-1} \\ T_{t-1} \end{bmatrix} + \begin{bmatrix} u_Y \\ u_X \\ u_Z \\ u_P \\ u_T \end{bmatrix}$$

Multiplying the VAR by A^{-1} we get the reduced form VAR i.e. given as:

$$A^{-1} A X_t = A^{-1} \beta_0 + A^{-1} \beta_1 X_{t-1} + A^{-1} u_t$$

Or $X_t = G_0 + G_1 X_{t-1} + e_t$, i.e. the reduced form, given $A^{-1} A = I$

Here I is the identity matrix. Matrix A also relates to structural shocks u and forecast errors e_t:

$$e_t = A^{-1} u_t$$

Forecast errors *e* is a linear combination of the structural shocks *u.* Being a theoretical construct, it is non-observable. As Sims (1986) highlighted, it is an interpretation of historical data. What we have at hand is the evolution of the key financial system variables. While estimating, we run regressions of each variable against its past and the past of other variables in the system. The study will get the structural model of the form:

$$A X_t = \beta_0 + \beta_1 X_{t-1} + u_t$$

This isolates the exogenous shocks and measures the impact of these shocks on the variables included in the model. Given the objective of the current study, we have imposed restrictions on the contemporaneous relationship of endogenous variables and also on the old matrix A. As we had,

$$e_t = A^{-1} u_t,$$

To show the relationship between forecast errors and structural shocks, Bernanke and Mihov (1998), Blanchard and Perotti (2002) use a more general way of relating the errors and shocks in SVARs:

$$A e_t = B u_t,$$

Where, specification of these equations can have both errors and shocks on the right hand side. To get the system responses to shocks one needs to have;

$e_t = A^{-1} u_t$ or $e_t = F u_t$, where $F = A^{-1} B$

For this, the study uses a modified version of Kim and Roubini's (2000) non-recursive identifying restrictions on the contemporaneous coefficients taking into account key macroeconomic variables. The standardized structural shocks comprise of shocks on monetary policy rate, the capital markets, the banking sector, the real sector output and the exchange rate. The contemporaneous matrix A with restrictions is specified by matrix patterns and/or text expressions. Pattern matrices are a convenient way to place simple and constant constraints on the individual elements of a structural matrix, whereas on the other side, the text expressions provide the full range of allowed constraints. Here the study takes into account the short run representation, given the fact that policy targets are pursued with short to medium term horizon.

The short run restriction on REPO, NSE, GDP, WPI, 5YGSEC and 5YCB can be defined as

$$A=\begin{bmatrix} 1 & C(5) & C(9) & C(10) & C(12) & C(15) \\ 0 & 1 & 0 & 0 & C(13) & C(16) \\ C(1) & C(6) & 1 & C(11) & 0 & 0 \\ C(2) & 0 & 0 & 1 & 0 & 0 \\ C(3) & C(7) & 0 & 0 & 1 & C(17) \\ C(4) & C(8) & 0 & 0 & C(14) & 1 \end{bmatrix}$$

In the above model, the study will put restrictions on various parameters when it will change its policy instrument (i.e., Repo Rate, Call Money Rate & 91 Days Tresurery Bills) for testing different monetary policy transmission channels in India.

Section 5

Trend Analysis and Quantitative Results

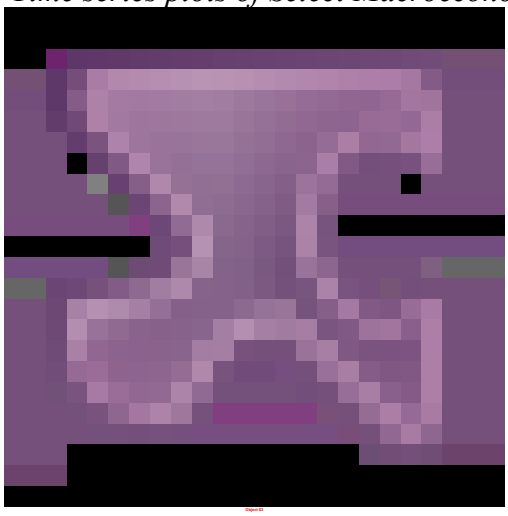
The monetary policy, along with objectives and instruments, has evolved in recent years, both globally and domestically. The global financial crisis exposed the risk of having the monetary policy focus exclusively on single objective of inflation. The meltdown in the financial system alerted the policy makers that monetary policy should also be accountable for the banking system and financial sector system through which the monetary policy operates.

In the previous sections, the discussion has focussed on the review of literature and various channels of monetary transmission, and evolution of monetary policy in India and the Methodology of the Study. In this section, trend analysis of data related to monetary policy and different channels of monetary transmission is presented to evaluate the relationship between different variables. Then quantitative results are presented.

5.1: Repo Rate and Macro variables

The plot of growth rate in real GDP and Repo exhibits a mixed trend over the period of analysis (Fig 5.1). In recent period, it is noteworthy that real GDP growth has increased following a decline in repo rate in most instances. In 2003 and 2009, there has been monetary tightening leading to slower growth. The monetary easing has been continuous since 2011. From 2015-18, significant transmission of monetary policy occurred post-demonetization following the increase in low-cost current and saving account deposits due to surplus liquidity with the banking system.

Figure 5.1: - Time series plots of Select Macroeconomic Variables



There has been a consistent depreciation of the Indian rupee in relation to the US Dollar, mainly due to interest rate and inflation differential. The post-2008 rush for US dollars is also apparent from Fig - 5.2. However, a modest improvement in our exchange rate came with the backdrop of high repo rates in the early 2000s. The RBI, as other central banks, intervene in the foreign exchange market to contain volatility. An inverse relationship between Repo rates and private corporate investment is noted in most years, with a clear trend n 2000, 2004, 2008 and 2009 (Fig - 5.3).

Figure 5.2

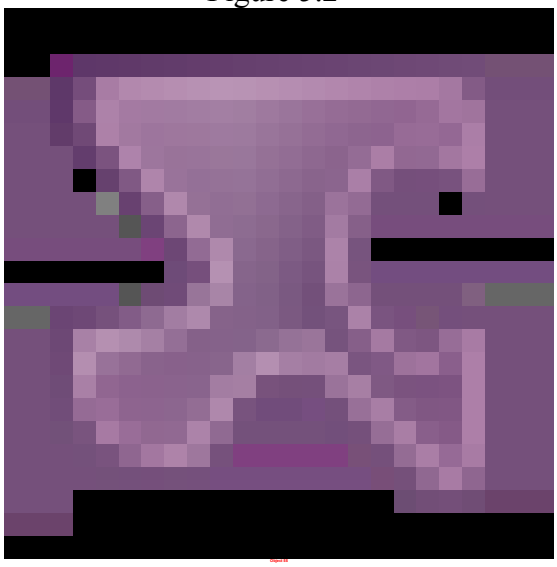
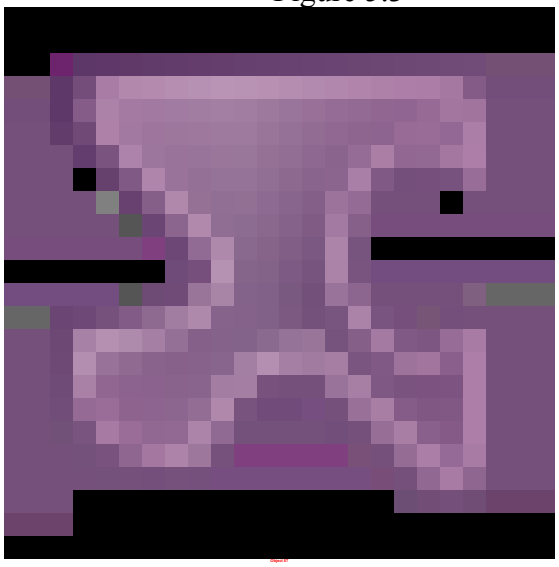


Figure 5.3



The deposit rates are more closely related to the Repo rate while the prime lending rate, factoring the risk premia follows the trend in recent years (Fig - 5.4). There is a broad co-movement of the three series or similar pattern over the time period under consideration. A consistent decline in the growth rate of non food credit growth can be observed from the highs of 2004 (Fig 5.5).

Figure 5.4

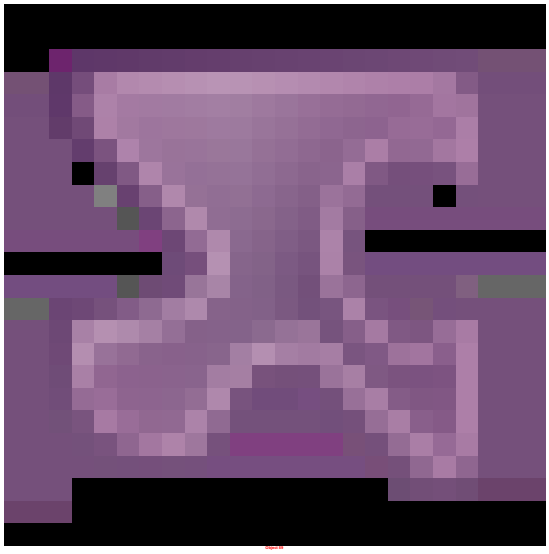
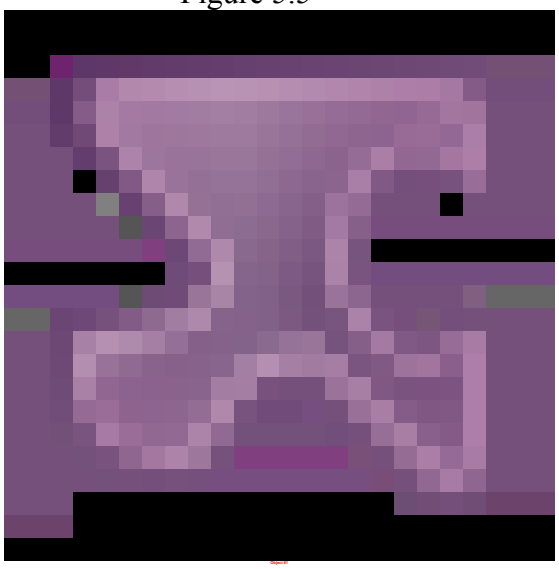
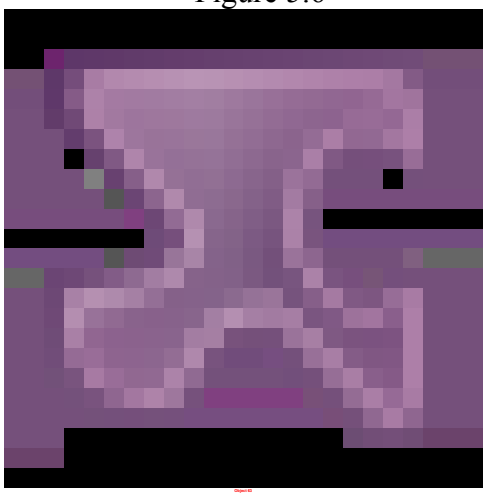


Figure 5.5



The asset prices, in terms of BSE and NSE have consistently increased suggesting a strong time trend given the reforms and growth in the economy (Fig - 5.6).

Figure 5.6



The relationship between price variables and Repo rate is consistent with the fact that RBI increases policy rate during periods of high inflation (Fig 5.7). During 2014, inflation based on the consumer price index was high because of higher food prices due to 2014 agricultural drought. Inflation based on the wholesale price index slowed, mainly on account of lower fuel prices. Repo rate, weighted average call rate, commercial paper rate and certificate of deposit rate tend to co-move during the period under study (Fig 5.8).

Figure 5.7

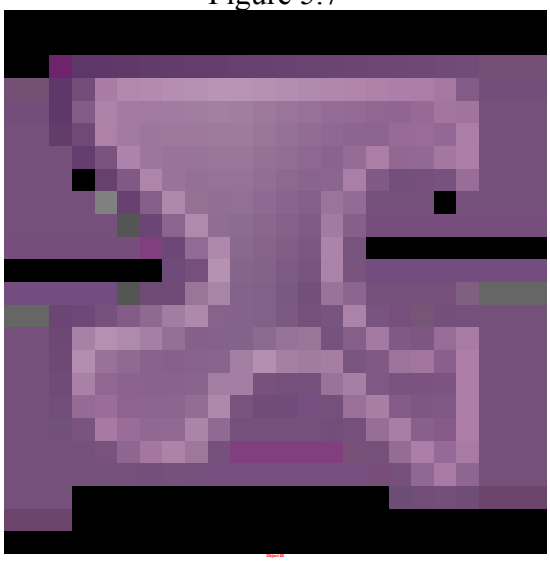
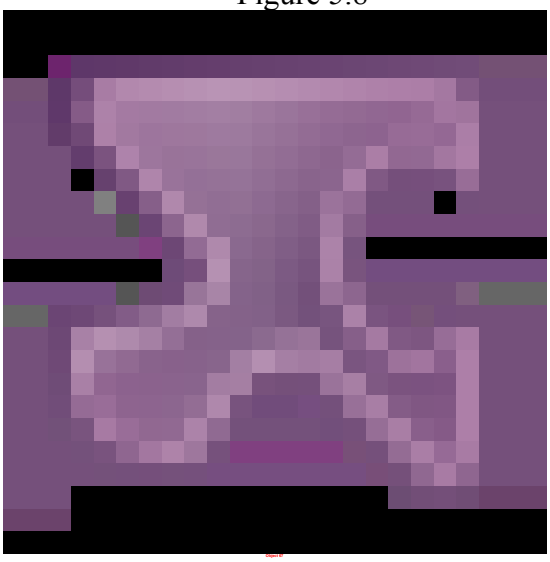


Figure 5.8



The co-movement of the yields on government paper – 91-day Treasury Bills, 5-year G-Sec and 10-year G-Sec Yield and Repo Rate, from 2001. The figure shows that Repo has broadly remained within the range provided by 91-day Treasury bills (Fig 5.9). The trend in 5 year AAA corporate bond yield is similar to that of G-Secs. While the graph shows that the variables tend to co-move, however, it is noteworthy to observe the narrowing risk premiums on corporate bonds over the years which is reflected in the reduction in yields in 1998Q1 to 2018-19Q1 (Fig 5.10).

Figure 5.9

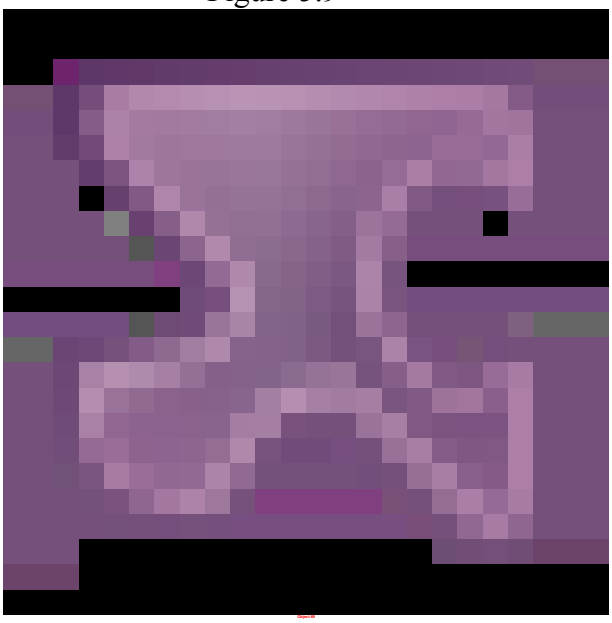
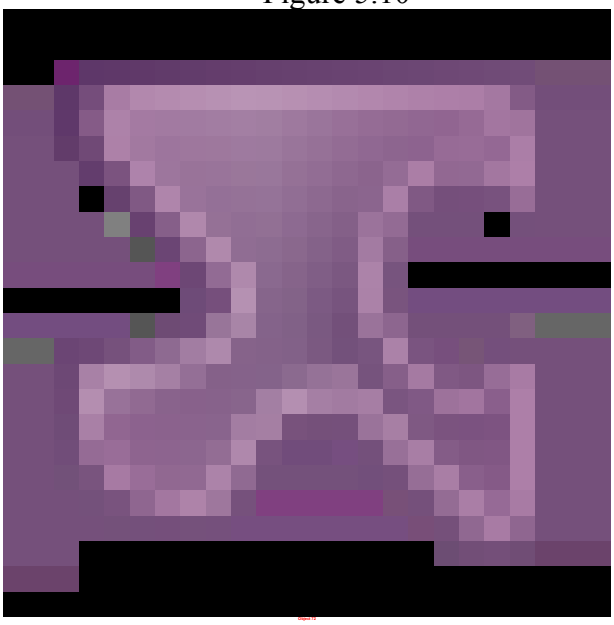


Figure 5.10

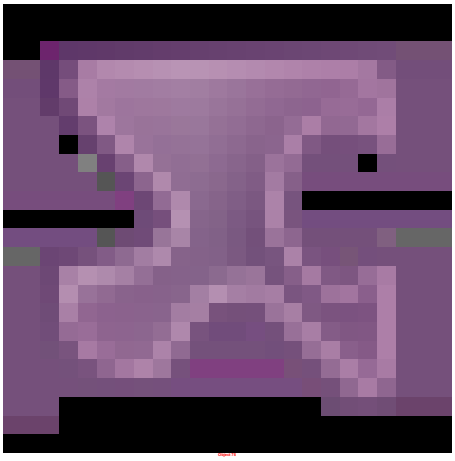


5.2: Growth, Prices and Investment

The relationship between growth and inflation is presented in Fig - 5.11. results are consistent with the fact that as inflation increases with the rise in economic activity accelerates GDP growth rate. The high growth period of 2003-2008 coincided with low inflation. However, towards the latter part of the period as inflationary pressures rose it warranted monetary tightening. From 2008-10, reflecting the impact of global financial crisis, growth decelerated and weak commodity prices and relatively stable exchange rate contained inflation. That created the space for monetary easing. .

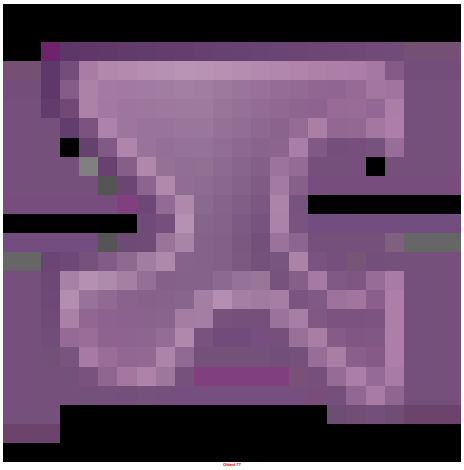
The relationship between growth rate of real GDP and private corporate investment is presented in Fig - 5.12. The figure shows that increase in private corporate investment growth rate has a positive impact on GDP growth rate, which is consistent with economic theory. Investment is a component of aggregate demand (AD). Therefore, if there is an increase in investment, it will help to boost AD and economic growth.

Figure 5.11



From 2010-12, India recovered ahead of the global economy, and actual growth in 2010–11 at 9.3 percent exceeded the expectations and our potential growth rate. With a sharp recovery in growth, inflation too caught up rapidly, partly complicated by a rebound in commodity prices (Fig - 5.11). From 2012-14, softening of inflation created space for monetary easing. However, growth is yet to pick up reflecting both weak global demand, domestic supply constraints and slowdown in corporate investment. At the macroeconomic level supply bottlenecks and sluggish demand can depress Marginal Efficiency of Capital, which can more than offset the beneficial impact of a lower lending rate on investment and growth.

Figure 5.12



5.3: Correlation Analysis

The selection of variables for modeling exercise is based on undertaking a comprehensive analysis in addition to the time-series plots illustrated earlier. Further, cross correlation matrix was examined (Table 5.1, detailed correlation statistics in Annexure 3). The correlation coefficients of the Repo rate with other macroeconomic variables for four distinct time periods reveals mixed results. Finally, after testing for unit roots (Annexure 4), pair-wise granger causality tests for individual variables were also estimated (Annexure 5). However, it needs to be recognized that there are limitations of statistical exercise such as that of establishing causality between two variables at a point in time (as is estimated by Granger causality) that are often influenced by numerous exogenous and endogenous shocks that operate on dynamic basis. Therefore, based on macroeconomic intuition some variables that may not show a statistical causality, but are known from theory to have a causal relationship have also been considered. Illustratively, though statistically, Repo Rate and WACR, CPI, NFC do not show causality but has been considered in the study.

Table 5.1: Correlation Coefficient of Repo Rate with other Macroeconomic variables

	Repo Rate with			
	1998-2002	**2003-2007**	**2008-2012**	**2013-2018**
REPO	1.00	1.00	1.00	1.00
ZRGDP	-0.19	0.05	-0.07	0.29
WPI	-0.18	-0.08	0.49	0.10
CPI	0.12	0.36	-0.35	0.63
PCI	-0.27	0.34	-0.29	0.36
NEER	-0.37	0.07	-0.45	-0.47
BSE	-0.61	0.66	0.41	-0.72
NSE	-0.59	0.67	0.30	-0.70
PLR	-0.14	0.86	-0.40	0.90
DR2Y	-0.25	0.72	0.50	0.94
WACR	-0.53	0.53	0.95	0.93
5GSEC	-0.51	0.52	0.88	0.85
5YCB	-0.54	0.49	0.88	0.86
T91	-0.60	0.66	0.97	0.92
NFC	-0.07	-0.33	0.26	0.48

5.4: Analyzing the dynamic response of instrument specific variables[5]

After testing for the unit-roots (Annexure 4) to examine the time series characteristics of the variables in the analysis, the dynamic response of specific variables to a shock to Repo rate is investigated, i.e., NSE (asset prices), ZRGDP (Real Sector Output), WPI (Price variable), and 5GSEC and 5YCB (markets).

These variables have been selected based on the signaling properties, i.e., ZRGDP, NSE, 5GSEC, 5YCB and WPI. The variable GDP is for real output reflecting the wealth creation ability and overheating risk. For the capital markets, the logarithmic series of National Stock Exchange index (NSE) has been considered, which indicates the liquidity disruptions that may be a materialization of the market's ability to allocate surplus funds to investment opportunities within the economy efficiently. Five-year G-Sec Yields (5GSEC) along with high-quality, triple A rated market corporate bond rates (5YCB) have been considered as a proxy for understanding the investment sentiment in the economy. Finally, Wholesale price index (WPI) has been considered as a

5 We would like to thank Dr. Pabitra Kumar Jena, School of Economics, Shri Mata Vaishno Devi University, Katra for analysis in this sub-section.

measure of inflation or price stability.[6] The restrictions imposed on Structuarl VAR are presented in Annexure 6.

Further, the SVAR is used to understand the interest rate transmission using the Repo Rate (REPO), 91-day Treasury bills rate (T91), and Weighted Average Call Money Rate (WACR) as alternative policy variables. Repo rate is the official policy rate used in RBIs' monetary policy. Repo appears as the principal transmission instrument of monetary policy in India (Mohan, 2004). Further, it had been observed by Taylor and Williams, 2010) that the Repo rate worked efficiently in transmitting the monetary policy signal. The weighted average call money rate (WACR), under the operational objective of liquidity management, is the key variable. As per the policy mandate, it should be reverting towards the repo rate over time (Patra & Kapur, 2016), sharing an equilibrium relationship with the repo rate in the long run. The 91-day Treasury bills rate was considered a proxy for a policy interest rate as WACR is more volatile than the 91-day Treasury rates (Kumawat and Bhanumurthy, 2016).

Table 5.2: Composite SVAR Matrix

	NSE	**ZRGDP**	**WPI**	**5YCB**	**5GSEC**
REPO	0.93*	0.71*	-0.06	0.86*	0.82*
	(2.34)	(10.34)	(-0.70)	(3.56)	(3.50)
	[0.01]	[0.00]	[0.48]	[0.00]	[0.00]
T91	1.65*	0.50*	-0.02	1.33*	1.32*
	(4.75)	(11.32)	(-0.42)	(8.93)	(8.68)
	[0.00]	[0.00]	[0.66]	[0.00]	[0.00]
WACR	1.94*	0.87*	-0.06	1.58*	1.60*
	(3.94)	(11.35)	(-0.57)	(5.67)	(5.70)
	[0.00]	[0.00]	[0.56]	[0.00]	[0.00]

Notes: Restrictions are presented in Annexure 6.
* indicates significant at level 5%.
t statistics values are written in () brackets whereas p-values are described in [] brackets

From the above composite SVAR Matrix (Table 5.2), the first row indicates coefficient values for the impact of the shock on Repo rate significantly impact the NSE, i.e., NSE at a 5% level of significance with a coefficient value of 0.93. Further, there is a significant impact of policy rate on the growth rate of Gross Domestic Product (ZRGDP), and on yields of 5-year Corporate Bonds (5YCB) and 5 Year Government Security (5GSEC) with

6 The current policy mandate of RBI is to target CP inflation, due to aggregation issues in CPI series prior to 2012, we consider WPI as a measure of inflation.

the magnitude of 0.71, 0.86 and 0.82. respectively. However, coefficient of WPI is not significant. The impact of a shock in policy rate is highest for Stock Market, followed by Five Year Corporate Bond, 5 Year Government Security and Gross Domestic Product.

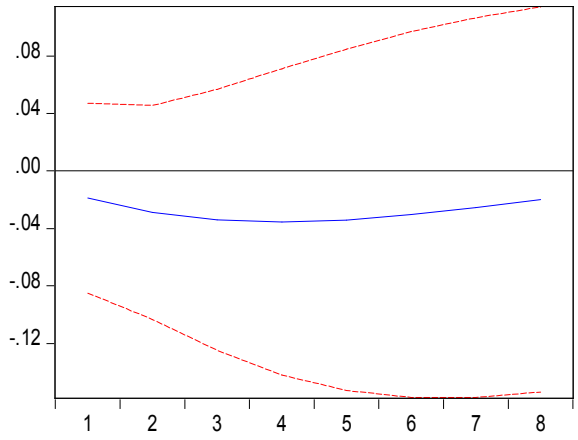
Similarly, the second row of composite SVAR Matrix shows shock in 91-days Treasury Bill on NSE, growth in real GDP, 5YCB) and 5GSEC is significant with the magnitude of 1.65, 0.50, 1.33 and 1.32, respectively. Whereas shock in 91 Days Treasury Bill on WPI is not significant. The impact of a shock in 91 Days Treasury Bill is highest for Stock Market, followed by corporate bonds, Government securities and GDP.

Finally, the third row of composite SVAR Matrix indicates coefficient values for the impact of the shock on call money rate significantly impacts NSE. Further, there is a significant impact of policy rate on the growth of real GDP, 5-year corporate bonds and 5-year Government securities, with the magnitude of 0.87, 1.58 and 1.60 respectively. Whereas the coefficient of WPI is not significant. The impact of a shock in call money rate is highest for stock market, followed by 5-year Government securities, 5- year Corporate Bond and growth in real GDP.

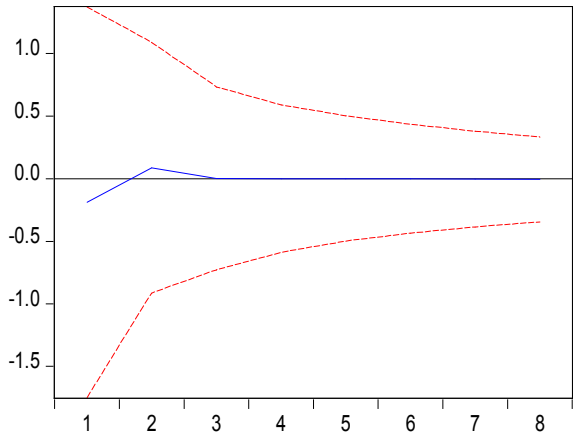
It is evident from the above analysis that the three rates i.e. Repo rate, 91 days Treasury bills and call money rate is providing similar results. Therefore, the Reserve Bank of India can use any of the instruments depending upon the condition of the economy to make monetary policy more effective and dynamic. Further, this study reported that policy rates have no impact on wholesale price index. By keeping the mandate of price stability in the next section a comprehensive empirical analysis has been attempted to know the impact of policy rates on consumer price index in India with the help of SVAR approach, given that CPI is the focus variable under inflation targeting.

Figure 5.13: Impulse Response Function of Variables to a Shock in Policy Repo Rate

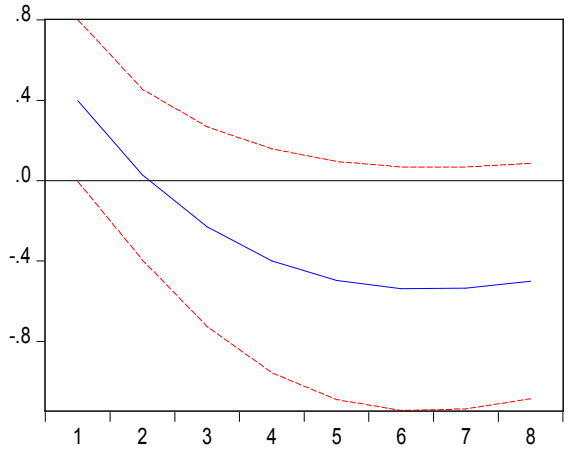
Response of LNNSE to REPO



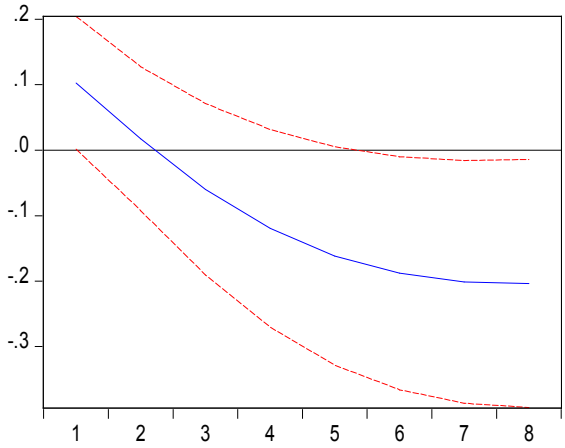
Response of RGDPSGR to REPO



Response of WPI to REPO



Response of _5YRGSEC to REPO



Response of _5YRAAACB to REPO

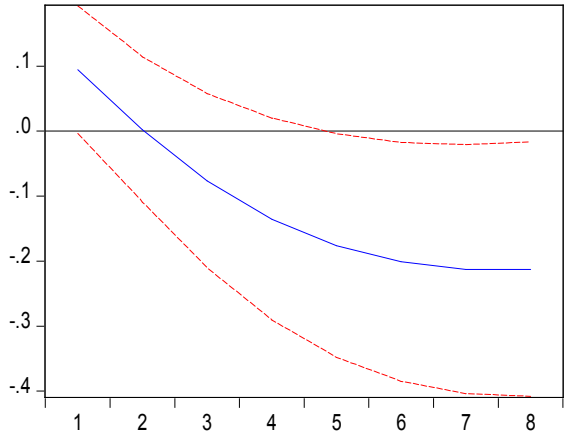


Figure 5.13 highlights the impulse response functions for the reaction of variables under consideration to shocks in the Repo rate (REPO). Each graph tracks the effect of a one-time shock on the Repo rate and future values of each sector/instrument specific variable. In the case of NSE, shock in NSE leads to a negative response, thus indicating that Repo rate shocks harm market stakeholders/ induce a shift in the stock market outcomes. Initially, for real output, there is a surge in GDP for a period of 1 quarter, and it again sticks to around zero, indicating no change in output growth. The impact of Repo shock on the inflation index, i.e., WPI, is negative except for the initial two and half periods. In the GSEC market, 5-year security shows a negative response to the policy rate shock except for the initial two periods. The five-year high-rated corporate bond indicates an adverse reaction to the REPO rate shock except for the initial two periods.

The impulse response functions for the reaction of variables under consideration to shocks in 91-days T-bill Yield (91DAYTBY) is presented in Fig- 5.14. Each graph tracks the effect of a one-time shock on 91-days T-bill yield and future values of each sector/instrument specific variable. In the case of NSE, shock in NSE leads to a negative response except for the initial two periods, thus indicating that 91-days T-bill yield shocks market stakeholders, inducing a shift in the stock market outcomes. The shock of 91-days T-bill yield in GDP is negative except for the initial five periods. The shock on the inflation index, i.e., WPI, is negative except for the initial three periods. In the case of G-Secs market, the 5 Year Government security shows an inverse response to the shock in form of 91-days T-bill yield. The 5-year corporate bond indicates an adverse reaction to the 91-days T-bill yield shock.

Figure 5.14: Impulse Response Function of Variables to a Shock in 91 Days Treasury Bill

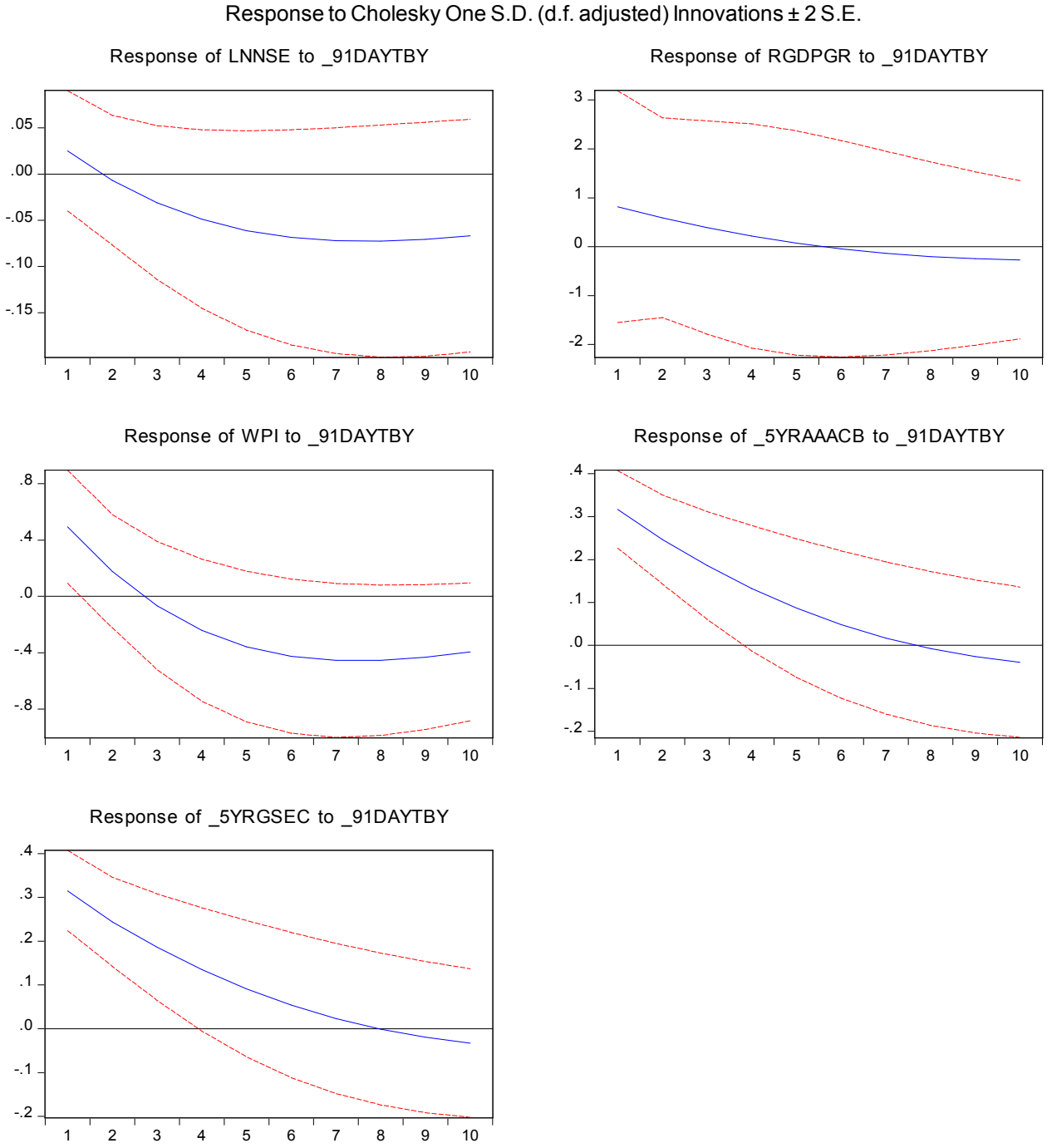
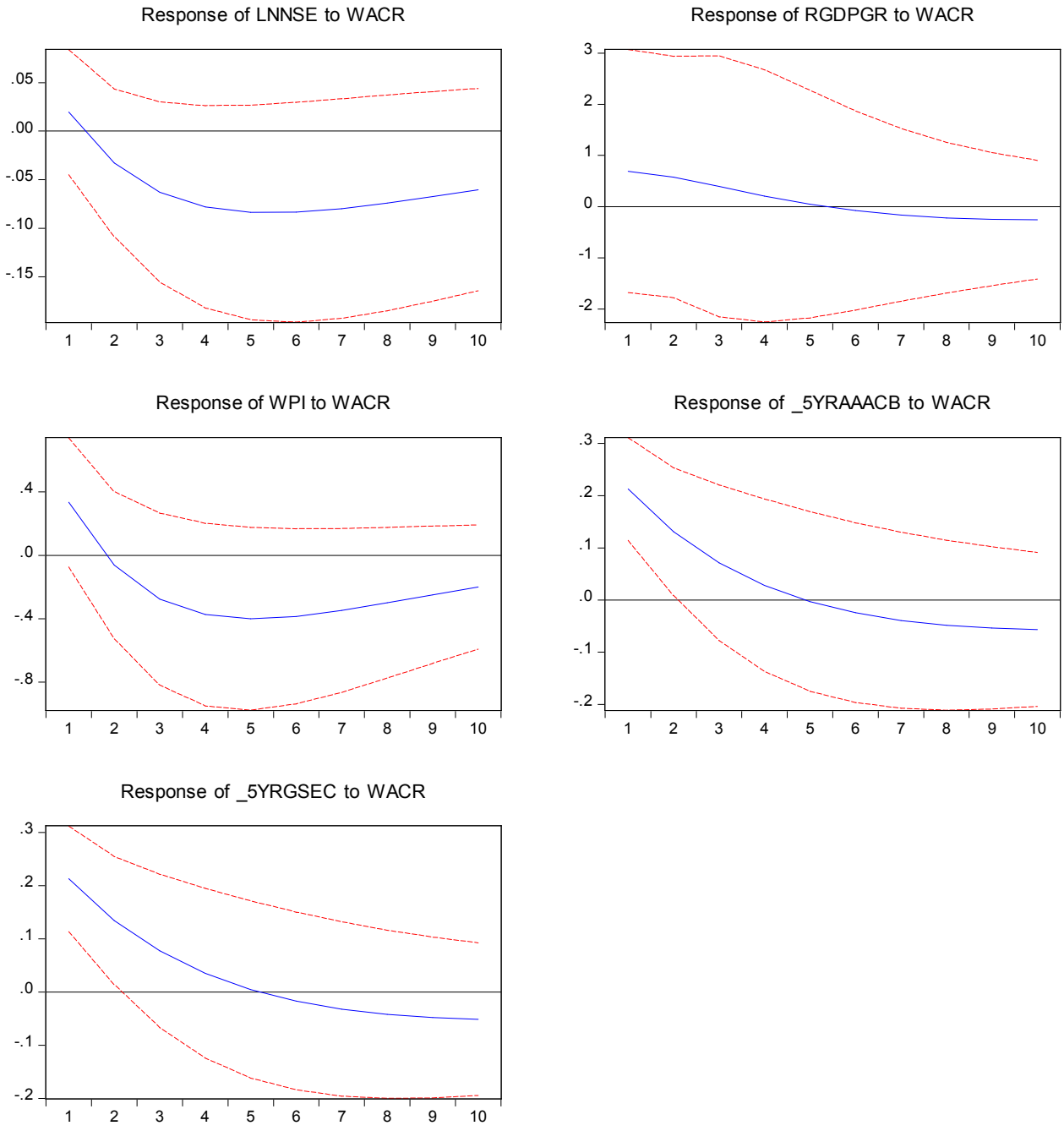


Figure 5.15: Impulse Response Function of Variables to Shock in Call Money Rate



The impulse response functions for the reaction of variables under consideration to shocks in the call money rate (WACR) is presented in 5.15. Each graph tracks the effect of a one-time shock on the call money rate and future values of each sector/instrument specific variable. In the case of NSE, shock in NSE leads to a negative response except for the first quarter, thus indicating that call money shocks harm market stakeholders/ induce a shift in the stock market outcomes. The shock of call money rate to growth in real GDP is negative except for the initial five periods. The shock on the inflation index, i.e., WPI, is negative except for the initial two periods. In the case of the G-Secs market, the 5-year Government security shows a negative response to the shock in call money except for the initial five periods. The 5-year corporate bond indicates an adverse reaction to the call money rate shock except for the initial five quarters.

Interpretation of the Variance Decomposition Results

The forecast error decomposition is the percentage of the variance of the error made in forecasting a variable due to a specific shock at a given horizon. Thus, the forecast error decomposition is like a partial R^2 for the forecast error by forecast horizon (Stock and Watson, 2001). The results from variance decomposition analysis explain the future uncertainty of a time series under consideration due to future shocks into other time series. Here, it helps understand the impact of the future shock on policy variables under consideration in both the long run and short-run and distinguish whether it is due to own lag or another variable that feeds into variance.

The forecast error variance has been estimated for eight periods (quarters) to study the decomposition of variance (Table – 5.3). In this analysis, the first four periods as short run and long run as the 5^{th} period onwards. In the short run, for the NSE, 99.56 percent of Forecast error variance (FEV) is explained by the lag of NSE. So other variables do not have a significant influence on NSE, i.e., they have a strong exogenous impact. Further, in a long horizon of 8 periods, 95.15 percent of FEV is explained by NSE. So, a strong exogeneity is exhibited by other variables in predicting NSE in the future. For GDP, 85.034 percent of FEV is explained by the lag of output growth itself in the short run. So, other variables do not significantly influence GDP, i.e., they also have a strong exogenous impact. In a long horizon of 8 periods, 80.35 percent of FEV is explained by output lag. So, a strong exogeneity is exhibited by other variables in predicting real output growth in the future. In the case of WPI, the short-run outcomes are explained by the lag of WPI itself, while in the long horizon, 78.90 percent variance is explained by own lag, while the REPO rate explains 13.0 percent variance followed by 5.7 percent by 5GSECs. For government securities with a five-year maturity, in the short horizon, own lag of 5GSECs explains 94.2 percent forecast error variance while in the long horizon, REPO and 5-year CB explain 14.25 and 13.74 percent variance with own lags' impact reducing to 64.1 percent. Finally, in the case of 5-year CB, in the

short horizon, only 9.38 percent of the variance is explained by the own lag while 5-year G-Secs explains 84.7 percent variability in the first period and 72.76 percent till period 4. Further, the exogeneity withers in the long horizon as other variables continue to explain more than 86 percent of the variance in these high rated corporate bonds.

Table 5.3: Forecast Error Variance Decomposition

Period	**S.E.**	**REPO**	**NSE**	**ZRGDP**	**WPI**	**5GSEC**	**5YCB**
Variance Decomposition of NSE:							
1	0.62	0.43	99.56	0.00	0.00	0.00	0.00
2	0.82	0.75	98.50	0.27	0.03	0.25	0.18
3	0.93	1.04	97.74	0.29	0.10	0.51	0.29
4	0.99	1.27	97.11	0.31	0.20	0.78	0.31
5	1.04	1.43	96.54	0.31	0.31	1.07	0.30
6	1.06	1.51	96.02	0.32	0.44	1.38	0.29
7	1.08	1.53	95.56	0.33	0.58	1.70	0.27
8	1.09	1.51	95.15	0.33	0.72	2.00	0.26
Variance Decomposition of ZRGDP:							
1	0.28	0.07	8.60	85.34	0.00	5.86	0.10
2	0.39	0.08	8.31	80.50	0.07	5.73	5.29
3	0.47	0.08	8.35	80.43	0.07	5.75	5.30
4	0.53	0.08	8.37	80.40	0.07	5.75	5.30
5	0.57	0.08	8.39	80.39	0.07	5.75	5.30
6	0.61	0.08	8.40	80.37	0.07	5.75	5.30
7	0.64	0.08	8.41	80.36	0.07	5.75	5.30
8	0.66	0.08	8.42	80.35	0.07	5.76	5.30
Variance Decomposition of WPI:							
1	6.76	5.07	0.00	1.13	86.55	7.14	0.08
2	6.99	2.92	0.00	1.33	87.65	7.76	0.31
3	6.99	2.96	0.00	1.47	87.59	7.59	0.37
4	6.99	4.42	0.00	1.51	86.48	7.17	0.38
5	6.99	6.61	0.02	1.52	84.72	6.70	0.41
6	7.00	9.00	0.07	1.51	82.69	6.27	0.43
7	7.00	11.21	0.15	1.50	80.69	5.94	0.47
8	7.00	13.04	0.28	1.49	78.90	5.74	0.52
Variance Decomposition of							

5GSEC:							
1	1.76	5.32	0.45	0.00	0.00	94.21	0.00
2	2.33	3.02	0.79	0.78	0.00	85.52	9.85
3	2.67	2.91	1.53	1.34	0.01	81.61	12.58
4	2.89	4.66	2.63	1.49	0.01	77.60	13.58
5	3.05	7.55	3.8	1.52	0.01	73.07	13.94
6	3.17	10.92	5.12	1.51	0.02	68.46	13.94
7	3.26	14.25	6.30	1.47	0.08	64.11	13.74
8	3.32	17.24	7.39	1.43	0.21	60.24	13.45
Variance Decomposition of 5YCB:							
1	0.44	4.82	1.07	0.00	0.00	84.71	9.38
2	0.59	2.51	1.42	1.25	0.02	79.32	15.45
3	0.70	2.95	2.44	1.60	0.05	76.61	16.32
4	0.78	5.26	3.76	1.65	0.06	72.76	16.48
5	0.85	8.58	5.15	1.64	0.05	68.27	16.29
6	0.91	12.23	6.49	1.59	0.06	63.70	15.90
7	0.95	15.71	7.73	1.53	0.12	59.45	15.43
8	1.00	18.75	8.85	1.48	0.25	55.70	14.94

Cholesky Ordering: REPO, NSE, 5GSEC, 5YCB, ZRGDP and WPI

To conclude this initial part of the analysis, findings show that the variables' response has been significant to the shock in Repo rate (REPO) except the WPI inflation. In the case of a shock to call money rate, the price stability variable's response was again insignificant while the other variables showed significant results. The impact of a shock in the call money rate was highest for the stock market variable (NSE). Finally, for the impact of a shock in 91 days T-bills rate, the price variable's response remained insignificant. The highest magnitude of the impact was accounted for the stock market variable, i.e., NSE. All the variables other than price stability showing a significant response underscores that interest rate transmission has been effective, especially in accounting for the liquidity alterations within the economy, which may arise market's ability to channelize surplus funds to the potential investors in an efficient manner. The highest magnitude of response of NSE to shock in all three policy variables underscores the same. There has been no overheating risk or a serious implication on the wealth creation ability due to shock in policy variables for the real output. For the private corporate sector and the government securities, the response to shock in policy interest rates has remained significant and in line with the theory that interest rate spikes imply bond yields to rise.

Dynamics of Private Corporate Investment, Inflation and GDP[7]

The purpose of our estimation exercise is to better understand the impact of monetary policy on the real variables through various transmission channels. It is interesting to note that the Repo rate, call money and 91-day Treasury Bill rate show a similar trend in transmitting the signal to the economy. It is therefore natural to further explore the impact of a change in policy rate to inflation, private investments and GDP as the exercise is important for understanding the dynamics of the relationship between these variables. To explore this issue, the Repo rate is being used as the policy rate in the SVAR estimation. In that regard, the transmission of the policy rate to CPI Inflation is explored, as CPI is used as the anchor for inflation targeting, explicitly adopted by the RBI since 2016 though it was considered an important policy variable from 2014 onwards. Then, the exercise explores the effect of policy rate on private capital investment. The transmission of monetary policy to the real economic output happens traditionally through the private capital investment channel and thus, this question is critical to develop our understanding with regard to the relationship of monetary policy with the real economy. Finally, the relationship between the Repo rate and growth of real GDP is estimated. The restrictions imposed on SVAR are presented in Annexure 7.

The SVAR Impulse Responses of all the variables is presented in Fig – 5.16. The SVAR impulse response functions imply that an increase in the policy Repo rate is associated with a fall in CPI by -0.03, -0.10 & -0.19 in the second, third and fourth quarters, respectively. Further negative impact increases upto seventh quarter and thereafter negative impact gradually decreases. In response to the first shock, the maximum decline in CPI (-0.41) occurs with a lag of 5 to 8 quarters. The strong negative effect on CPI is experienced during shock 2 during which the maximum decline of -2.75 occurs in the 5th to 8th quarters (Table 5.4). Finally, it is assumed that the impact of repo rate on CPI would decline further after 8th quarter if the economy will continue to work under normal conditions and there would be no bigger policy decision from the government or the RBI in the long run (Annexure 8 provides estimates until 20 quarters).[8]

The accumulated response of PCI reports that during the third shock, an increase in policy Repo rate is associated with a decrease in PCI by -0.18 , -0.12 and -0.08 in the second, third and fourth quarters, respectively (Table 5.4, Annexure 8). Thereafter, the response declines gradually to stagnate (Figure 5.16). During the fourth shock, PCI responds with a decrease of -0.20 in the 2nd, 3rd, and 4th quarters, and thereafter the

7 We would like to thank Dr. Vighneswara Swamy, IBS Hyderabad for his analysis for this sub-section.
8 As the real sector is being considered, estimation has especially been made upto 20 quarters in Annexure 8.

response gradually decreases to -0.13 in the 8th quarter. The accumulated response of Real GDP Growth Rate (GDPGR) implies that during the fourth shock, an increase in policy Repo rate is associated with a decrease in Real GDP Growth Rate (GDPGR) by -0.10 in 2nd quarter, -0.83 in the fourth quarter, -1.52 in sixth quarter and -1.88 in 8th quarter. (Table 5.4).

Figure 5.16: SVAR Impulse Responses

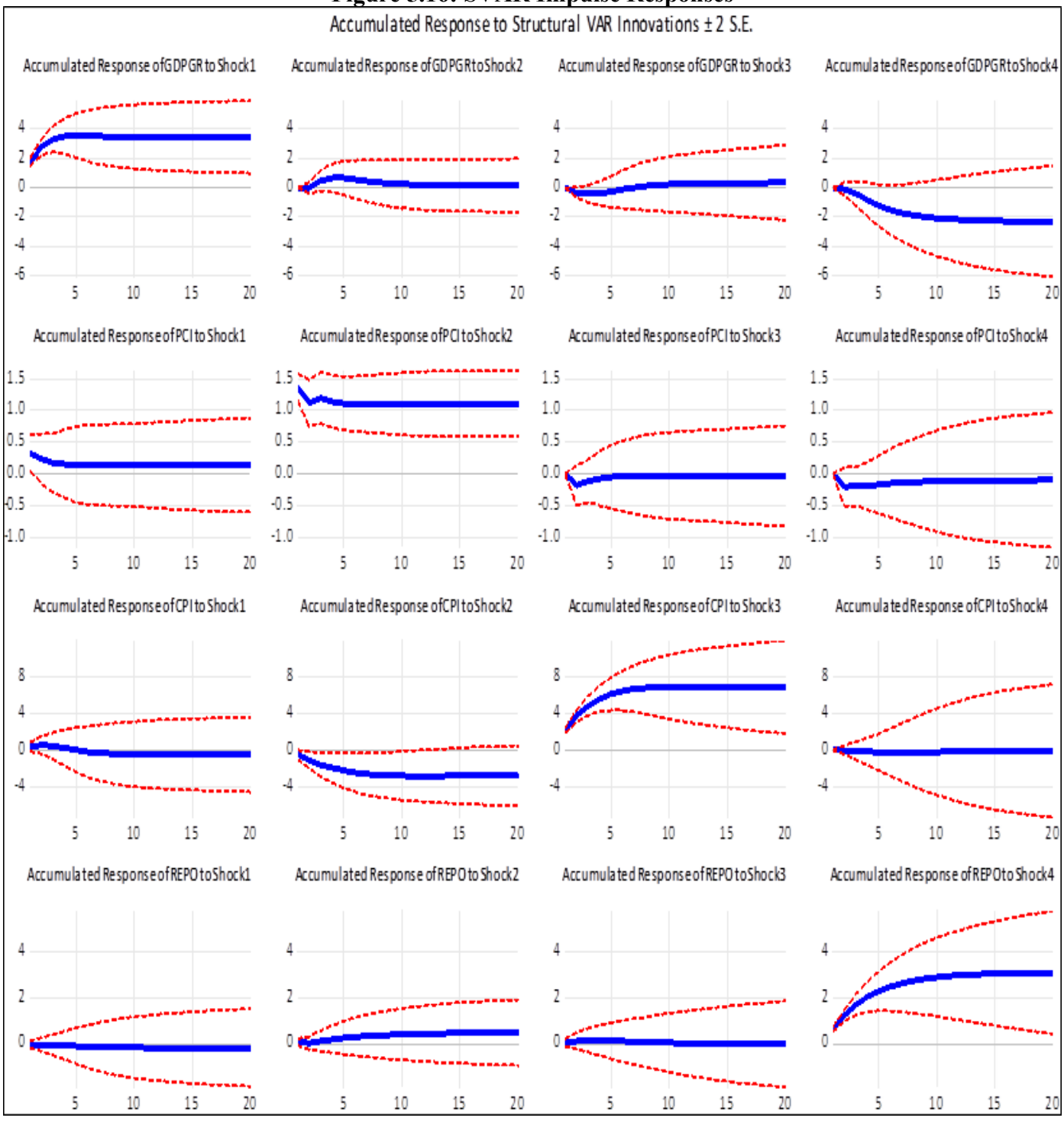


Table 5.4: SVAR Impulse Responses

	Accumulated Response of GDPGR:				Accumulated Response of PCI:				Accumulated Response of CPI:			
Period	Shock1	Shock2	Shock3	Shock4	Shock1	Shock2	Shock3	Shock4	Shock1	Shock2	Shock3	Shock4
1	1.76	0.00	0.00	0.00	0.32	1.37	0.00	0.00	0.32	-0.52	2.13	0.00
2	2.80	-0.01	-0.34	-0.10	0.24	1.12	-0.18	-0.20	0.53	-1.14	3.72	-0.03
3	3.32	0.49	-0.42	-0.39	0.17	1.20	-0.12	-0.20	0.42	-1.64	4.81	-0.10
4	3.52	0.67	-0.39	-0.83	0.15	1.14	-0.08	-0.20	0.20	-1.97	5.58	-0.19
5	3.55	0.66	-0.26	-1.22	0.14	1.11	-0.05	-0.17	-0.03	-2.26	6.10	-0.26
6	3.54	0.56	-0.11	-1.52	0.14	1.10	-0.04	-0.15	-0.21	-2.49	6.44	-0.29
7	3.52	0.45	0.03	-1.73	0.14	1.10	-0.03	-0.14	-0.33	-2.65	6.65	-0.29
8	3.50	0.37	0.13	-1.88	0.14	1.10	-0.03	-0.13	-0.41	-2.75	6.76	-0.27

SVAR Responses of GDP growth

Findings

Impact of Repo rate on Inflation

The SVAR impulse response functions suggest that an increase in the Repo rate is associated with a fall in CPI by -0.03, 0.21, -0.33 & 0.41 for the first shock in the 5th, 6th, 7th and 8th quarter, respectively (Table 5.4). In response to the first shock, the maximum decline of -0.41 occurs with a lag of 8 quarters (Fig 5.16). The strong negative effect on CPI is experienced during shock 2 during which the maximum decline of -2.75 occurring between 5th to 8th quarters.

Impact of Repo rate on Private Corporate Investment

The accumulated response of PCI reports that during the third shock, an increase in policy Repo rate is associated with a decrease in PCI by -0.18 in the 2nd quarter (Table 5.4). Thereafter, the response declines gradually to stagnate at -0.03 from the 7th quarter (Fig 5.16). During the fourth shock, PCI responds with a decrease of -0.20 in the 2nd quarter, and thereafter the response gradually decreases from the 5th quarter.

Impact of Repo rate on GDP growth

The accumulated response of growth rate of GDP shows that during the fourth shock, an increase in policy Repo rate is associated with a decrease in growth rate if GDP by -0.10 in the 2nd quarter, and -0.39 in the third quarter. During the 4th quarter, the response of growth rate of GDP is -0.83, and -1.88 during the 8th quarter (Table 5.4, Annexure 8).

To conclude, given the importance of monetary policy in reviving economic growth during times of distress, this study offers an empirical assessment of the relationship between repo rate, inflation, private corporate investment and growth of real GDP. Following the SVAR model, this study finds evidence that increase in Repo rate has a negative effect on CPI inflation, with a lag of two-quarters and a moderating impact on inflation with a lag of five-quarters. The SVAR impulse response functions suggest that an increase in the Repo rate is associated with a fall in CPI by -0.03 for the first shock in the 5th quarter. The study reveals that private corporate investment responds to a positive shock to Repo rate with a decline during the 2nd quarter. The accumulated response shows that during the third shock, an increase in Repo rate is associated

with a decrease in private corporate investment by -0.18 in the 2nd quarter. During the fourth shock, private corporate investment responds with a decline of -0.20 in the 2nd quarter. The response of private corporate investment steadily decreases after the 5th quarter.

In a special estimation, results reveal that GDP growth responds to 1-percentage point Repo rate rise (impulse) with a decline of about -0.31 percent in the fourth quarter, and -0.12 percent in the 8th quarter. Every 100-basis points reduction in Repo rate can lead to a rise in private corporate investment by around 18 basis points in the 2nd quarter.

Evaluating the Transmission Mechanism of Monetary Policy in India[9]

The previous two sub-sections looked at the impact of changes in repo-rates on various macroeconomic variables. While the first sub-section concluded that the monetary mechanism was not contemporaneous and that Repo rate, 91-day Treasury bills and call money rates exhibited similar tends , the second sub-section provided the relationship between these variables with a lag thereby explaining the dynamics of adjustment in real economy as a response to changes in Repo rates. The conclusion of both sections was that there does exist a macroeconomic relationship between monetary policy and the real economy. In this sub-section, a baseline model is constructed which is then augmented by considering various variables to capture the impact through different monetary channels. The estimation is carried out through SVAR, closely following Khundrakpam and Jain (2012) and Mohanty (2012).

The previous results have used the Repo rate, discount rate on 91-day Treasury bills and the weighted average call money rate. The baseline model is constructed by including growth of real GDP growth ((ZRGDP), CPI inflation (CPI)) and repo rate (REPO). Then the baseline model is extended by including variables, each capturing one channel of monetary transmission, in order to assess the effectiveness of that channel. Finally, we use the model to estimate the response of GDP growth rate to a 200-bps shock to repo rate, in order to estimate the models' implication for the response of GDP growth rate to a big monetary policy push.

9 We would like to thank Dr. Lokendra Kumawat, Ramjas College, Delhi University for his analysis for this sub-section.

In this estimation, we further extend the model by including 91-day Treasury Bill rate as the RBI announces various measures in addition to the Repo rate, even though it has been the main instrument during the last two decades. Therefore, one would expect that short-term interest rates such as call money rate and Treasury bills rate tend to capture the effects of monetary policy in an all-encompassing pattern, absorbing the effects of other measures in a better way. Of these two short term money market rates, call rate is more volatile than 91-day Treasury bill rate, even though the two move together in the long run (Kumawat and Bhanumurthy, 2018). Therefore, in this exercise, 91-day Treasury bills (T91) rate has also been explored in the baseline and augmented model in addition to Repo rate, as the policy variable.

i. SVAR Baseline Model

In the baseline model, the variables are (in the order in which these are taken in estimations): real GDP growth (ZRGDP), CPI inflation (CPI) and Repo rate (REPO)/91-day T-bill yield (T91). This is the simplest specification to study the effect of monetary policy on the real variables, as it includes the real GDP growth, inflation rate and the policy rate. As measure of inflation, we take CPI inflation since that is the measure targeted by the RBI. The identification restrictions imposed in the SVAR are as follows: (i)no contemporaneous effect of shocks in inflation and interest rates to GDP growth (ii) only GDP growth has a contemporaneous impact on inflation, and (iii) no contemporaneous impact of GDP growth and inflation shocks to policy interest rate, implying monetary policy reacts to GDP and prices only with some lags. These are in line with those in the existing literature (e.g., Kundrakpam and Jain, 2012).

Two variants of the baseline model are considered, as discussed: the first variant considers the Repo rate while the second version considers the 91-Day Treasury yields as an alternative to Repo Rate.

Table 5.5: Forecast error variance decomposition at 12 lags - Baseline model with Repo rate

Variable	**SE**	**Contribution to Forecast error variance**		
		Shock1	Shock2	Shock3
GDP	2.15	91.56	0.11	8.33
CPI	3.41	1.13	98.82	0.05
REPO	1.10	0.09	1.24	98.66

Table 5.6: Forecast error variance decomposition at 12 lags - Baseline model with TBR91

Variable	**SE**	**Contribution to Forecast error variance**		
		Shock1	Shock2	Shock3
GDP	2.17	80.67	1.75	17.56

CPI	3.39	2.31	97.10	0.58
T91	1.43	19.97	6.48	73.54

These results from forecast error variance decomposition presented in Tables 5.5 and 5.6 indicate that the policy rate accounts for some fraction of forecast error variance of GDP growth in 12th quarter. This result is much stronger with T-bill rate than with Repo rate.

Figure 5.17 gives the response of GDP growth to one standard deviation shock to Repo Rate and the Treasury Bill rate, from the baseline model. It shows that a positive shock to repo rate leads to a decline in GDP growth, and the effect peaks in about 4 quarters. A similar impact is observed for a shock to T-bill rate, and the magnitude of the impact is higher when compared to a shock to Repo rate.

Figure 5.17: Response of GDP Growth to one s.d. shock to Repo & TBR 91 rate

ii. Augmented Models: Evaluating the channels of monetary transmission

On the basis of the two baseline models, several iterations are attempted by adding other key macroeconomic variables aimed at identifying channels of monetary transmission and checking the robustness of these results. These iterations are carried out by adding one-by-one different variables representing different channels of monetary transmission. The two models are estimated for each variable of this type: one taking the variable as exogenous and another one taking it endogenous. Taking a channel-specific variable as exogenous blocks the dynamic interactions of that variable with the other variables, thus blocking that channel; while taking it as endogenous allows that channel to operate. The differences between these two models thus

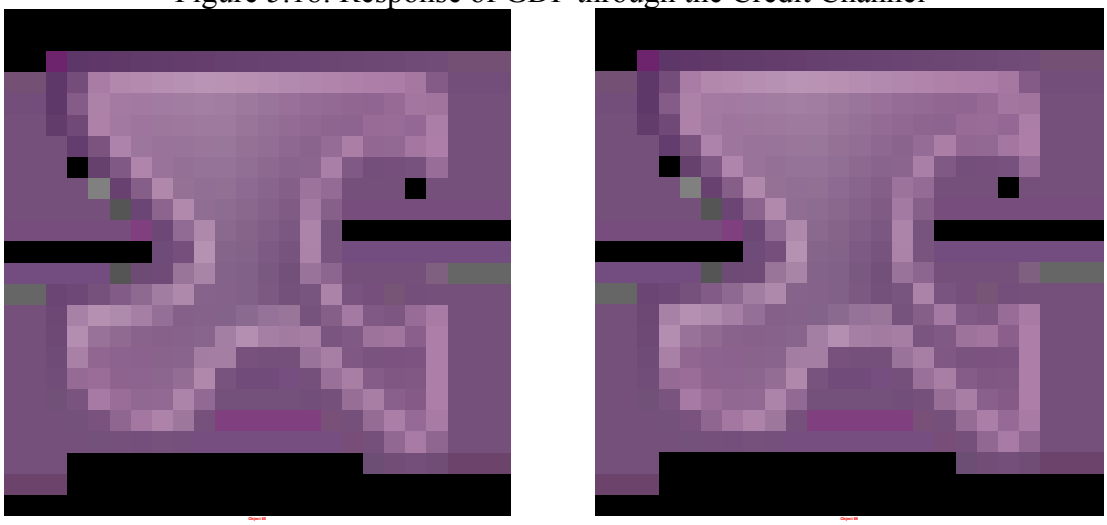
provide information about the effectiveness of that channel. Identification of the structural shocks is based on the same set of restrictions as in the baseline models, with no restriction on the contemporaneous effect of the other variables on the channel variable.

Among the channel-specific variables, the non-food credit growth (GNFC) is taken to capture the impact of any change in monetary policy through the credit channel. Similarly, the use of the variable (quarterly growth of) BSE Sensex (dlog(BSE)) is taken to capture the impact through the asset price channel. Typically, both these channels have been important channels of monetary transmission for some economies. The exchange rate channel of monetary transmission is estimated using the variable NEER, again in quarterly growth form (dlog(NEER).

Credit channel

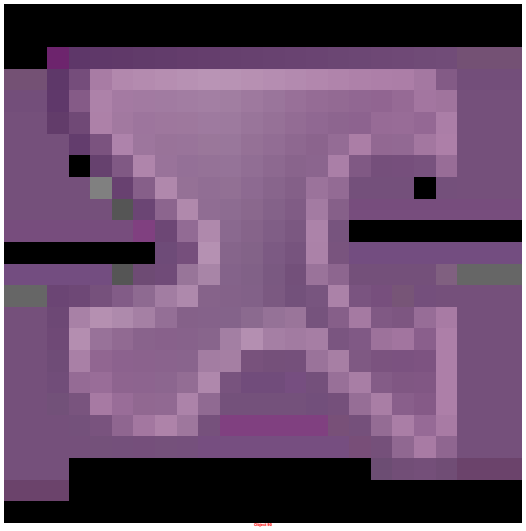
The credit channel is studied through the non-food credit. In order to see the role of non-food credit in the transmission of this shock, the baseline SVARs with Non-food credit growth (GNFC) is estimated (Fig – 5.18). As discussed above, when GNFC is taken as exogenous the transmission through this channel is blocked, and therefore the difference between the response functions of GDP growth to one standard deviation shock to the policy rate as estimated from these two models highlights the role of GNFC in this transmission. The positive shock to the policy rate leads to a decline in GDP growth. The peak effect is observed in the fourth quarter and this effect is stronger with Treasury bill rate than with Repo rate.

Figure 5.18: Response of GDP through the Credit Channel



Comparing the responses of the GDP growth to policy rate shocks from the GNFC-exogenous and GNFC-endogenous models, we find that for the first three/four quarters the two are almost identical, but thereafter the response is higher in the GNFC-exogenous model. These results imply that there are issues in the transmission of Treasury bill shocks through NFC growth, i.e., the credit channel. This is important as credit growth typically is considered to be one of the traditional channels of monetary transmission. Figure 5.19 presents the data on CPI Inflation, 91-day T-bills, growth in GDP and growth in Non-Food Credit. The data shows a systematic reduction in credit growth irrespective of the state of the economy.

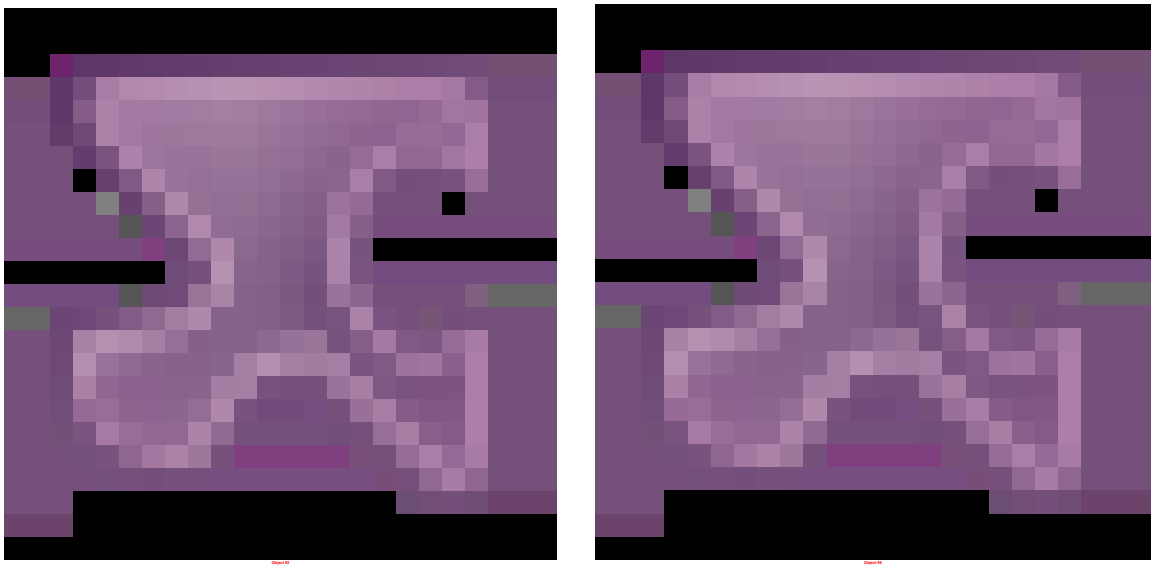
Figure 5.19: Baseline Variables and Growth of Non-Food Credit



Asset price channel

The effect of this channel is studied through dlog (BSE) i.e., quarterly growth rate of BSE Sensex, which is a measure of stock returns. Figure 5.20 shows that a positive shock to Treasury -bill rate leads to a decline in stock returns from second quarter onwards and the effect peaks in the fourth quarter. Again the magnitude of the impact is greater for 91-day Treasury-bill rate. This is consistent as any shock in bond market will have an impact on the equity markets which will subsequently have an impact on the overall growth rate.

Figure 5.20 Response of GDP through the Asset Price Channel



Comparing the response of GDP growth to Treasury-bill rate shock from the dlog(BSE)-exogenous and dlog (BSE) - endogenous specifications, we find that up to 10th quarter, the response is higher in the dlog(BSE)-endogenous specification, indicating an important role of the asset price channel.

Exchange rate channel

The effect of this channel is studied through dlog (NEER), i.e., quarterly rate of nominal appreciation of Indian rupee (Fig 5.21). Interestingly, a positive shock to the policy rate leads to a depreciation of the rupee immediately, though it rebounds sharply in the next quarter. Further, the response of GDP growth to policy rate shock continues to be higher in the dlog (NEER)-endogenous specification than that in the corresponding dlog (NEER)-exogenous specifications even after 12 quarters, highlighting the role of exchange rate channel in monetary transmission. The results are similar for the two estimations. As in the other cases, the quantum of impact is lower for a Repo shock than a 91 Day Treasury-bill shock.

Figure 5.21: Response of GDP through the Exchange Rate Channel

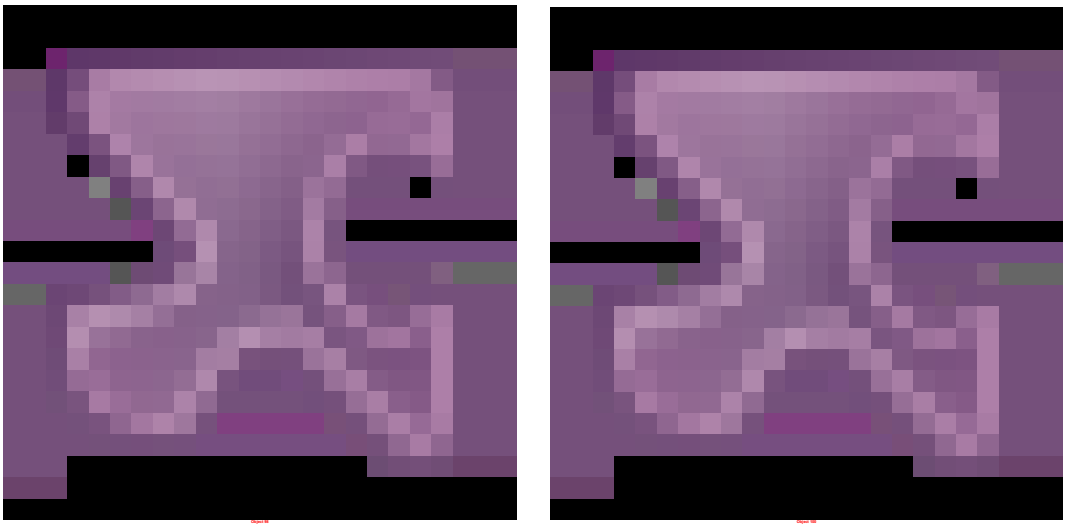
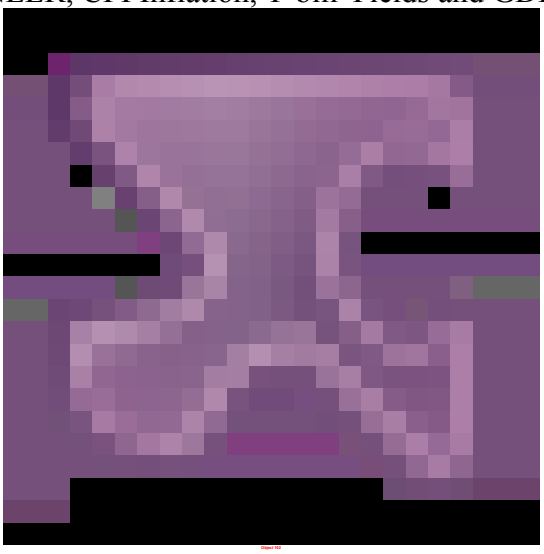


Figure 5.22 illustrates the limited change in the nominal effective exchange rates even as other variables have been volatile. The results obtained above are contrary to conventional wisdom, however, and can probably be explained, given that the exchange rate policy of the RBI has been classified by some scholars as managed float. That is, there is a range in which RBI attempts to keep the rupee against the dollar, given the political circumstances, though the intervention is generally resorted when volatility is high. Therefore, any intervention by the RBI distorts the movements of the nominal exchange rates and this distortion could be the reason for the contrary results obtained above.

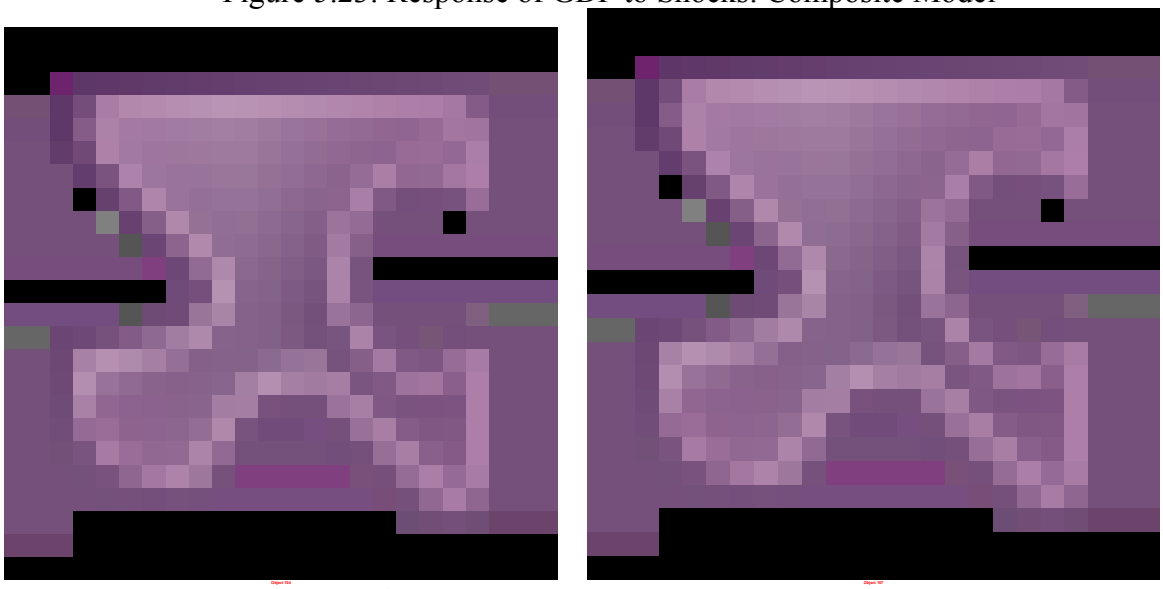
Figure 5.22: Change in NEER, CPI Inflation, T-bill Yields and GDP Growth Rates



Interest rate channel

On the basis of the above exercise, a composite model is estimated to capture the combined effect of the three channels. Again, SVAR models were estimated with all the three models exogenous and all of them endogenous.. The basic idea here is that the difference between the impulse response of GDP growth from all-three-exogenous and all-three-endogenous models will give the role of the three channels taken together. The remaining response then would be attributable to the channels other than these three, and it seems that in India interest rate channel is the only other important channel.We find that up to 8th quarter the response is higher in all-endogenous specifications than in all-exogenous specifications. [10] In fact, at the peak, i.e. in the fourth quarter, the response in the all-endogenous specification is about 50% higher than the all-exogenous specification when Tbill rate is taken as the policy rate. When the repo rate is used as the policy rate this figure is about 25%. In line with the pattern observed in the baseline and individual-channel-estimations, the responses of GDP are similar in the repo rate and the Treasury bill-rate specifications, even though the quantum of impact of a repo shock is lower than the 91-day Treasury bill rate shock

Figure 5.23: Response of GDP to Shocks: Composite Model



The results show that up to 8th quarter the response is higher in all-endogenous specifications than in all-exogenous specifications. [11] In fact, at the peak, i.e. in the fourth quarter, the response

10 For identification of structural shocks, we use the same set of restrictions as in the channel-variable-endogenous specifications above, with one additional set of restrictions: the three channel-specific variables do not have any contemporaneous effect on each other.

11 For identification of structural shocks, we use the same set of restrictions as in the channel-variable-endogenous specifications above, with one additional set of restrictions: the three channel-specific variables do not have any contemporaneous effect on each other.

in the all-endogenous specification is about 50 percent higher than the all-exogenous specification when Treasury bill rate is taken as the policy rate. When the Repo rate is used as the policy rate this figure is about 25 percent. In line with the pattern observed in the baseline and individual-channel-estimations, the responses of GDP are similar in the Repo rate and the Tbill-rate specifications, even though the quantum of impact of a Repo shock is lower than 91-day Treasury bill shock.

Figure 5.24: Response of INFCPI to Shocks: Composite Model

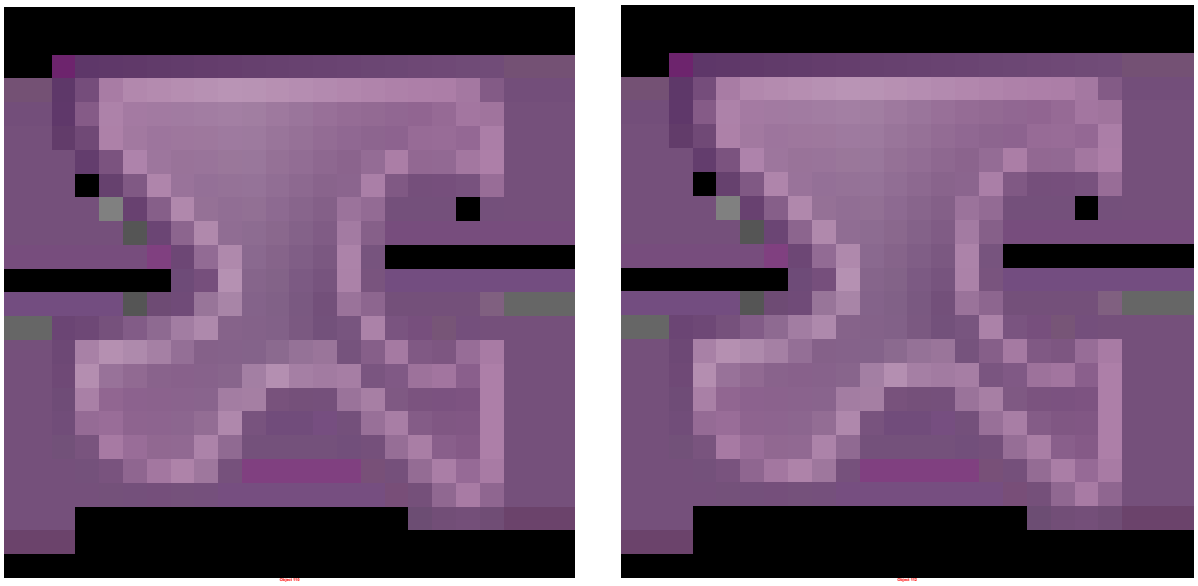


Figure 5.24 presents the response of INFCPI to a Repo and a TBR91 shock. The key observation is that the impact across a shock to either variable is identical and it peaks in period 3. However, a Repo rate shock has a significantly lower impact on INFCPI than compared to a Treasury bill shock. This feature is consistent with what was observed for the response of growth in real GDP.

To conclude, in order to see the implications of the models for the possible response of GDP growth to a large monetary stimulus in terms of Repo rate reduction, an estimation is made for the accumulated response of different variables to a 200 points negative shock to Repo rate in Table 5.7. This is done by estimating the all-endogenous model discussed above, with Repo rate as the interest rate variable. The projections were obtained by scaling the impulse response function obtained from the SVAR model in such a way that the shock to the repo rate is (-) 200 bps.[12] However, it would be best to interpret the result on a four quarter projections because in

12 It must be noted that while studying effects of such large shocks it may not be appropriate to draw inferences too much ahead in future though estimation has been made upto 12 quarters. Therefore, in the text, discussion has been restricted to 4 quarters

the long run, the variables may be impacted by various developments, global and domestic, including initiatives by the Government and the RBI.

Table 5.7**:** Accumulated response of different variables to 200 bps negative shock to Repo rate (GNFC, Dlog (BSE), Dlog (NEER) endogenous)

Period	GDP	CPI	REPO	NFC	DLOG(BSE)	DLOG(NEER)
4	2.21	0.24	-6.12	2.66	0.04	0.03
8	4.64	0.32	-8.82	9.94	0.10	0.05
12	5.46	0.60	-9.89	18.53	0.12	0.06

Table 5.7 shows the accumulated response of real GDP growth to a 200-bps negative shock to repo rate. It shows a 2.21 percent increase after 4 quarters. The overall impact of the change continues beyond 12 quarters. The impact of a shock on inflation over a longer period seems to be muted which suggests a limited role of monetary policy in affecting future inflation. This probably could be due to the greater role of food prices in shaping up price expectations than monetary anchoring of inflation expectations.

To conclude this sub-section, dynamic interrelations among GDP growth, CPI inflation and policy rate, using structural VAR models were examined. The results were obtained using Repo rate as the policy rate as also using 91-day Treasury bill rate, as an alternative. There is a substantial impact of policy rate shocks to the GDP growth, with the peak effect coming in the fourth quarter. The composite models attempted to identify the robustness of the fit to facilitate projections. Finally, the response of real GDP growth to a 200 bps negative shock to Repo rate was estimated and found that the cumulative effect after four quarters will be about 2.2 percentage points.

Section 6

Conclusion

The purpose of the study was to analyse how macroeconomic variables respond to monetary policy and to better understand the transmission mechanism that governs it. The monetary policy has evolved over the years along with the objectives of monetary policy. Initially, the objective of monetary policy was to ensure price stability but since 2008, financial stability is part of the monetary policy objectives.

In India, the RBI has been making efforts to develop the financial markets since 1992 and ensure better integration of the markets. The RBI adopted a multiple indicator approach in 1998, after the Asian crisis, in which inflation was one of the indicators, along with other variables from the fiscal, financial and external sector. In 2016, India formally adopted inflation targeting as a monetary policy objective. Thus, during this period, there was transition from multiple indicators, including wholesale prices, to focus on consumer prices.

The channels of monetary policy transmission are interest rates, bank credit, asset prices and exchange rates. There has been extensive empirical literature on estimating the transmission mechanism of the monetary policy through these channels. However, the RBI has repeatedly observed that the policy impulses have not been transmitted to the market, especially through the banking system, and has been initiating policy measures to ensure efficient and quick transmission, especially with respect to movement in the lending rate of banks.

In this study, Structural VAR has been used to study the relationship between various macro-variables and the policy rate. This study has explored the transmission mechanism by considering shocks in repo rate, call money rate and 91 Treasury bill rate. The impulse response functions and variance decomposition analysis were undertaken to study the monetary transmission in India using various model specifications. We begin by considering the impact of a shock whether in call money rates, Repo rate and 91-day Treasury bills on different macro-variables. This is followed by an exercise that focuses exclusively on the impact of Repo rate on rate of growth of GDP, private corporate investment and inflation. Finally, a baseline model of

SVAR is estimated and then augmented by adding different transmission channels to understand the impact of monetary policy in India.

In an interesting finding, impact of Repo rate, weighted call money rate and 91 day Treasury bills yield similar results. The augmented models with Repo rate and 91-day Treasury bills are estimated subsequently, and we observe that while the direction of the impact is the same for the Repo rate versions of the models, however, the magnitude of the impact is lower than the specifications which include 91-day Treasury Bill rates. Therefore, the baseline and augmented modelling exercise illustrates that monetary transmission is partial – and that changes in Treasury bill yields have far more impact on macroeconomic aggregates than changes in the Repo rate. This makes sense given that government securities serve as a benchmark for corporate debt and cost of capital in the country. The low transmission of changes in Repo rate as compared with 91-day Treasury bills is due to multiple factors including the policy of small savings rate that impacts the long end of the yield curve.

The macro variables used in the analysis to estimate the impact of the Repo rate were chosen after considering the correlation matrix, pair-wise granger causality, trend analysis and intuition based on economic logic and monetary theory. Finally, SVAR estimation was based on growth rate of GDP (real sector), Prices (WPI and CPI), asset prices (BSE and NSE), interest rates (91 days Treasury bIlls, 5 year government securities and 5-year triple A rated corporate bonds), credit (non-food credit) and exchange rates (NEER). The results reveal that the Repo rate does impacts the macro variables, especially, growth, private corporate investment and prices.

In a hypothetical case of a 200-bps negative shock to Repo rate, the real GDP growth would be enhanced by 2.21 percent after 4 quarters. In another estimation, following a different specification of SVAR, the impact for a 100 basis negative shock in the Repo rate, growth rate of GDP, would record a rise of 0.31 percent in the fourth quarter. The impact of a shock on inflation is muted which implies a limited role of monetary policy in affecting future inflation. One possible reason for this could be the high weights of food and fuel in India's CPI measure which is less influenced by changes in interest rates. Thus, the policy Repo rate does have an impact on the real sector of the economy, implying that transmission is taking place, though muted, in the economy

For the last three decades, RBI has tried to improve the issue of monetary transmission, however, it has not had the extent of the impact that was desired. The transmission of changes in Repo rates to lending rates is often too slow which blunts the ability of monetary policy to stimulate the economy during economic slowdowns. Though RBI has made recent amends by getting banks to offer more products that are linked with the Repo rates, the lack of transmission is an outcome of the high small savings rates that are offered to depositors which restricts the ability of banks to reduce their deposit rates. The other reason could be that about two-third of total outstanding formal credit is extended by instruments that are impacted by the Repo rates while one-third of the credit is extended through NBFCs, Micro-Finance Institutions and other financial intermediaries which are not linked to the Repo rates.

Recommendations

In view of the study conducted, the following recommendations are being made -

- Given that the transmission mechanism is muted/partial, monetary policy has a lower impact than it would due to small savings rates which act as a de-facto floor on deposit rates. Therefore, linking deposit rates on small savings rates will be effective to assist with monetary transmission.
- The impact of short-term yields (91-day Treasury bills) is significantly higher than the Repo rate. Therefore, the RBI could consider moving to a similar framework as in the US Fed where it sets a target range for the US Federal Securities as an instrument to set interest rates in the economy.
- The limited impact of policy rate changes on CPI further points to the need to relook at the target for inflation. The probable reason could be that the present CPI uses 2011-12 weights from the then CES Survey, but consumption basket is likely to have shifted significantly over the years. The composition of the basket, given the weightage of food and fuel, needs to be examined. There should be further research on the appropriate indicator for inflation going forward.
- The monetary policy framework also requires tweaking given its sole focus on inflation targeting. What is needed is a dual mandate with explicitly defining the range of India's potential growth rate to ensure RBI and the MPC can maintain an accommodative stance as and when needed, giving weightage to growth, especially in a young demographic country like India.

- Many NBFCs have emerged as important institutions that contribute significantly to credit creation, it is important to link their rates with the Repo rates to ensure monetary transmission.

Bibliography

Acharya, Viral V (2020), "*Improving Monetary transmission through the banking channel: The case of external benchmarks in bank loans*" Vikalpa, Vol. 45, Issue 1, 32-41, 2020.

Acharya, Viral V (2017), "*Monetary transmission in India: Why is it important and why hasn't it worked well?*" Inaugural Aveek Guha Memorial Lecture at Homi Bhabha Auditorium, Tata Institute of Fundamental Research (TIFR).

Agarwal, Ruchir and Kimball, Miles S.(2019),"*Enabling Deep Negative Rates to Fight Recessions: A Guide*", IMF Working Paper No. 19/84.

Aleem, Abdul (2009), "*Transmission mechanism of monetary policy in India*", Journal of Asian Economics, Vol. 21, Issue 2 186-197.

Amarasekara, Chandranath (2008), "The Impact of Monetary Policy on Economic Growth and Inflation in Sri Lanka", Central Bank of Sri Lanka.

Ammer, John, Clara Vega, and John Wongswan, (2010), "*International transmission of U.S. monetary policy shocks: Evidence from stock prices*", Journal of Money, Credit and Banking, Vol. 42, Issue 1, 179-198.

Anand, Rahul, Shanaka Peiris and Magnus Saxegaard (2010), "*An estimated model with macrofinancial linkages for India*", International Monetary Fund, Working Paper No. WP/10/21.

Andreas Jobst and Huidan Lin (2016), Negative Interest Rate Policy: Implications for Monetary Transmission and Bank Profitability in the Euro Area, IMF, Washington DC.

Ball, Laurence and Niamh Sheridan (2003), "*Does inflation targeting matter?*, NBER Working Paper No. 9577.

Ball, Laurence and Mazumder Sandeep (2011)."*Inflation dynamics and the great recession,*" Brookings Papers on Economic Activity (Spring), 337-381.

Banco Central Do Brasil (2019). Inflation Report 2019. Brazil.

Banerjee, Krittika (2011), "*Credit and growth cycles in India: An empirical assessment of lead and lag behaviour*", Reserve Bank of India, RBI Working Paper Series, WPS (DEPR): 22/2011.

Bank of Russia (2018). Report on Monetary Policy Guidelines for 2019-21. October 2018. Russia.

Bank of Russia (2017). Report on Monetary Policy Guidelines for 2018-20. November 2017. Russia.

Bayangos, Veronica (2010),"*Does the bank credit channel of monetary policy matter in the Philippines?*", Bangko Sentral ng Pilipinas, 2-34.
Bean, Charles, Christian Broda, Takatoshi Ito and Randall Kroszner (2015), "*Low for long? Causes and consequences of persistently low interest rates*", Geneva Reports on the World Economy 2017.

Bernanke, Ben and Alan Blinder (1992), "*The federal funds rate and the channels of monetary transmission*", American Economic Review, Vol. 82, Issue 4, 901-921.

Bhatt, Vipul and Kundan Kishor (2016),"*Measuring trend inflation and inflation persistence for India*", Monetary Policy in India: A Modern Macroeconomic Perspective, Part IV.

Bhattacharya, P C (1966), Monetary Policy and Economic Development, B F Madon Memorial Lecture delivered at Indian Merchants Chamber, Mumbai on February 1966, RBI, Mumbai.

Bhattacharya, Rudrani, Ila Patnaik and Ajay Shah (2011), "*Monetary Policy Transmission in an Emerging Market Setting*", International Monetary Fund, Working Paper WP/11/5.

Bhaumik, Kumar Sumon (2010), "*Implications of bank ownership for the credit channel of monetary policy transmission: evidence from India*", Journal of Banking and Finance, Vol. 35, Issue 0, 2418-2428.

Bogdanski, Joel, Alexandre Antonio Tombini and Sérgio Ribeiro da Costa Werlang (2000), "*Implementing inflation targeting in Brazil*", Banco Central Do Brasil, Working Paper Series July, 2000.

Borio, Claudio and Boris Hofmann (2017), "*Is monetary policy less effective when interest rates are persistently low*?", Monetary and Economic Department, BIS Working Papers No 628.

Borio, Claudio and Haibin Zhu (2012), "*Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism?*", Journal of Financial Stability, Vol. 8, Issue 4, 236-251.

Calza, Alessandro, Tommaso Monacelli, and Livio Stracca (2007), "*Mortgage Markets, Collateral Constraints, and Monetary Policy: Do Institutional Factors Matter?",* CEPR Discussion Papers, No. 6231.

Campa, Jose and Linda Goldberg (1995), "*Investment in manufacturing , exchange rate and external exposure*", Journal of International Economics, Vol.38, Issue 3–4 ,297-320.

Carlos Arteta, Ayhan Kose, Marc Stocker, and Temel Taskin (2016) *Negative Interest Rate Policies: Sources and Implications,* London: CEPR.

Chatelain, Jean Bernard, Andrea Generale, Philip Vermeulen, Michael Ehrmann, Jorge Martinez Pages and Andreas Worms (2003), " *Monetary policy transmission in the Euro area: New evidence from micro data on firms and banks*", Journal of European Ecoonomic Association, Vol. 1, Issue 2-3, 731–742.

Christensen, Jens H. E, and Mark M. Spiegel (2019) "*Assessing Abenomics: Evidence from Inflation-Indexed Japanese Government Bonds* ", Federal Reserve Bank of San Francisco Working Paper 2019-15.
Chinoy, Sajjid, Kumar Pankaj and Mishra Prachi (2016), "*What is responsible for India's sharp disinflation?*" IMF Working Paper 16/166.

Ciccarelli, Matteo, Angela Maddaloni and José-Luis Peydró (2010), "*Trusting the bankers: A new look at the credit channel of monetary policy*", European Central Bank, Working Paper Series, No 1228 / July 2010.

Cochrane, J (2016), " *Do Higher Interest Rates Raise or Lower Inflation ?"*accessed on 5th July, 2020 from https://faculty.chicagobooth.edu/john.cochrane/research/papers/fisher.pdf.

Cornell, Bradford (1982), "*Money supply announcements, interest rates, and foreign exchange",* The University of Chicago Press.

Crowder, W. J. & Hoffman, D. (1996). "*The long-run relationship between nominal interest rates and inflation: The fisher equation revisited*", Journal of Money, Credit and Banking, Vol. 28, Issue 1, 102-118.

Cuthbertson, K. & D. Gasparro (1995), "*Fixed investment decisions in UK manufacturing: The importance of Tobin's Q, output and debt*", European Economic Review, 1995, Vol. 39, Issue 5, 919-941.

Das, Praggya and Ashish Thomas George (2017), "*Comparison of consumer and wholesale prices indices in India: An analysis of proprieties and source of divergence*", Reserve Bank of India Working Paper Series, WPS (DEPR): 05/2017.

Das, Shaktikanta (2020), "*Seven Ages of India's Monetary Policy*" Speech given at St. Stephen's College, University of Delhi on January 24, 2020.

Das, Sonali (2015), "*Monetary policy in India: Transmission to bank interest rates*", IMF Working Paper, WP/15/129.

David L. Reifschneider and John C. Williams, (2000),"*Three lessons for monetary policy in a low-inflation era*," Conference Series ; [Proceedings], Federal Reserve Bank of Boston, pages 936-978.

Deshmukh, C D (1948), Central Banking in India – A Retrospect, Speech delivered on the Founders Day of the Gokhale Institute of Politics and Economics, Pune on March 20, 1948, RBI, Mumbai.

Disyatat, Piti and Pinnarat Vongsinsirikul (2003), "*Monetary policy and the transmission mechanism in Thailand*", Journal of Asian Economics, Vol.14, Issue 3, 389-418.

Dua Pami (2020), "*Monetary Policy Framework in India",* Indian Economic Review, Vol. 55 Issue 1, 117 - 154.

Dua, Pami and Gaur, Upasana (2009),"*Determination of inflation in an open economy Phillips curve framework*", Centre for Development Economics, New Delhi, Working Paper No. 178.

EBA (2012), Final Report on the Implementation of Capital Plans Following the EBA's 2011 Recommendation on the Creation of Temporary Capital Buffers to Restore Market Confidence, European Banking Authority, October.

Eberly, Janice, Jan Van Mieghem (1997), "*Multi-factor dyanamic investment under uncertainity*", Journal of Economic Theory, Vol. *75*, Issue 2, 345-387.

Égert, Balazs and Ronald MacDonald (2009), "*Monetary transmission mechanism in central and eastern Europe: Surveying the surveyable",* Journal of Economic Survey, 2009, Vol. 23, Issue 2, 277-327.

Eichengreen, Barry (2014), "*Losing interest*", Project Syndicate, University of California, Berkeley Economics, 11 April.

Eichengreen Barry, Gupta Poonam and Choudhary Rishab (2020), "*Inflation Targeting in India: An Interim Assessment"*, India Policy Forum, July 2020, NCAER.

European Central Bank (2017). ECB Economic Bulletin, Issue 6/2017.

European Central Bank (2016). "*Business investment developments in the euro area since the crisis*", Economic Bulletin, Issue 7, 3-97.

Foglia, Piersante and Santoro (2010), "*The Importance of the Bank Balance Sheet Channel in the Transmission of Shocks to the Real Economy*", mimeo.

Frankel, Jeffrey A. (2006), "*The effect of monetary policy on real commodity prices*", NBER Working Paper No. 12713.

Frankel, Jeffrey A. (1987), "*International capital flows domestic economic policies*", NBER Working Paper No. 2210.

Frankel, Jeffrey A. (1979), "*On the mark: A theory of floating exchange rates based on real interest differentials",* American Economic Association.

Froot, A Kenneth, Jeremy Stein (1991), "*Exchange rate and foreign direct investment: An imperfect capital markets approach*", Quarterly Journal of Economics, Vol. 106, Issue 4 1191-1217.

Fujiki, Hiroshi and Shiratsuka, Shigenori, (2002), "*Policy Duration Effect under the Zero Interest Rate Policy in 1999-2000: Evidence from Japan's Money Market Data*", Monetary and Economic Studies,Vol. 20, Issue 1, 1-31.

Fujiwara et al.(2015),"*Policy regime change against chronic deflation? Policy option under a long-term liquidity trap*", Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute Working Paper, 37 (C) (2015), 59-81.

Ghate, Chetan and Kenneth Kletzer (2016), "*Monetary policy in India: A modern macroeconomic perspective*", Springer India.

Goyal, Ashima (2008a), "*Incentives from exchange rate regimes in an institutional context*", Journal of Quantitative Economics, Vol. 6 , Issue 1&2, 101-121.

Goyal, Ashima (2008b), "*Macroeconomic policy and the exchange rate: Working together?*" Chapter 7 in India Development Report 2008, R. Radhakrishna (ed.), 96-111, New Delhi: IGIDR and Oxford University Press.

Goyal, Ashima and Deepak Kumar Agarwal (2017), "*Monetary transmission in India: Working of price and quantum channels*," Indira Gandhi Institute of Development Research, Mumbai Working Papers 2017-017.

Gumata, Nombulelo, Alain Kabundi and Eliphas Ndou (2013), "*Important channels of transmission monetary policy shock in South Africa*", Economic Research Southern Africa (ERSA) Working Paper 375.

Hambur, Jonathan & Gianni La Cava, (2018). "*Do Interest Rates Affect Business Investment? Evidence from Australian Company-level Data,*" RBA Research Discussion Papers rdp2018-05, Reserve Bank of Australia.

Havranek, Tomas and Marek Rusnák (2012), "*Transmission lags of monetary policy: A meta-Analysis*" William Davidson Institute, Working Paper No-1038.

Hedberg, W. and J. Krainer (2012), "*Credit Access Following a Mortgage Default*", FRBSF Economic Letter, No. 2012-32, October.

Hnatkovska, Viktoria, Amartya Lahiri and Carlos Vegh (2008), "*Interest rates and the Exchange rate: A non- monotonic tale*", NBER Working Paper No. 13925.

Holton, Sarah, Martina Lawless, and Fergal McCann (2012), "*Credit Demand, Supply and Conditions: A Tale of Three Crises*", mimeo, Central Bank of Ireland.

Hutchison, Michael, Rajeswari Sengupta and Nirvikar Singh (2010), "*Estimating a monetary policy rule for India*", Economic and Political Weekly, 45(38), 67-69.

Inoue, Takeshi and Shigeyuki Hamori (2009), "*An empirical analysis of the monetary policy reaction function in India*", IDE Discussion Paper 200, 1-10.

Jain-Chandra, Sonali and Filiz Unsal (2012), "*The effectiveness of monetary policy transmission under capital inflows: Evidence from Asia*" IMF Working Paper No. 12/265.

Jalan, Bimal (2003), "*Exchange Rate Management: An Emerging Consensus*", *Speech*, Reserve Bank of India, at 14th National Assembly of Forex Association of India on August 14, 2003.

Jalan, Bimal (2000), "*Agenda for banking in millennium*", *Speech*, at the Conference of the Bank Chairmen held on January 6, 2000 at the National Institute of Bank Management, Pune.

Jalan, Bimal (1999), "*International financial architecture: Developing countries' Perspective*", *Speech*, 49th Anniversary Lecture – Central Bank of Sri Lanka, at Colombo on 25th August, 1999.

Jalan, Bimal (1998), "*Towards a more vibrant banking system*", *Speech*, at the Bank Economists Conference (BECON' 98) held at Bangalore on 16-12-1998.

Jannsen, Nils, Galina Potjagailo and Maik H. Wolters (2019), "*Monetary policy during financial crises: Is the transmission mechanism impaired?*", International Journal of Central Banking, Vol. 15, Issue 4, 81-126.

Jimenez, Gabriel, Steven Ongena, Joes-Luis Peydro, and Jesus Saurina (2012), "*Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications*", American Economic Review, Vol. 102, Issue 5, 2301-2326.

Jobst, Andreas A. and Lin, Huidan (2016), "*Negative Interest Rate Policy (NIRP): Implications for Monetary Transmission and Bank Profitability in the Euro Area*",IMF Working Paper No. 16/172.

Jones, Bradely and Joel Bowman (2019), "*China's evolving monetary policy framework in International context*", Reserve Bank of Australia, International Department, Research Discussion Paper, RDP 2019-11.

Kapur, Muneesh, and Harendra Behera (2012), "*Monetary transmission mechanism in India: A quarterly model",* RBI Working Paper Series, WPS (DEPR): 09/2012.

Kapur, Muneesh and Michael Patra (2000), "*The price of low Inflation*", RBI Occasional Papers, Vol. 21 , Issue 2 and 3, 191-233.

Kathryn M. Dominguez, Kenneth S. Rogoff, and Paul R. Krugman (1998), "*It's Baaack: Japan's Slump and the Return of the Liquidity Trap*",Brookings Paper on Economic Activity, No.2, 137-205.

Khundrakpam, Jeevan Kumar (2011), "*Credit channel of monetary transmission in India- How effective and long the lag*", RBI Working Paper Series, WPS (DEPR): 20/2011.

Khundrakpam, Jeevan Kumar and Dipika Das (2011), "*Monetary policy and food prices in India*", RBI Working Paper Series, No. 12, 1-20.

Khundrakpam, Jeevan Kumar and Rajeev Jain (2012), "*Monetary policy transmission in India : A peep inside the black box*", RBI Working Paper Series, WPS(DEPR): 11/2012.

Klau, Marc and Mohanty, Madhusudan S. (2004), "*Monetary policy rules in emerging market economies: Issues and evidence*", BIS Working Paper No. 149.

Ksantini, Majdi and Younes Boujelbène (2014), "*Impact of financial crises on growth and investment: An Analysis of panel data*", Journal of International and Global Economic Studies, Vol. 7, Issue 1, 32-57.

Kumawat, Lokendra and N R Bhanumurthy (2016), *Regime shift in India's Monetary Policy*, NIPFP Working Paper No. 177, 1-21.

Lee, Kang Soek, and Richard Werner (2018), "*Reconsidering monetary policy: An empirical examination of the relationship between interest rates and nominal GDP growth in the U.S., U.K., Germany and Japan*", Ecological Economics Vol. 146, Issue 4, 26–34.

Mahadeva, Lavan and Katerina Smidkova (2004), "*Modelling transmission mechanism of monetary policy in the Czech Republic*", Mahadeva, Sterne (ed.) Monetary policy framework in a global context, Routledge, London.

Malhotra, R N (1985), Monetary Policy for Dynamic Growth, Speech at Indian Chamber of Commerce, Kolkata, December 12, 1985, RBI, Mumbai.

Mashat, Al, (2003), "*Monetary policy transmission in India: Selected issues and statistical appendix*", IMF Country Report 2003.

Mian, Atif, Kamalesh Rao, and Amir Sufi (2012), "*Household Balance Sheets, Consumption, and the Economic Slump*", mimeo, Princeton University and University of Chicago.

Minford, Patrick and Naveen Srinivasan (2008), "*Determinacy in new keynesian models: a role for money after all?,*" Cardiff Economics, Working Papers E2009/21, Cardiff University, Cardiff Business School, Economics Section, revised Apr 2011.

Mishkin Frederic (1995), "*Symposium on Monetary Policy Transmission Mechanism*" Journal of Economic Perspectives, Vol. 9 Issue 4, 3-10.

Mishra, Prachi, Peter Montiel and Rajeswari Sengupta, (2016), "*Monetary transmission in developing countries: Evidence from India*", IMF Working Paper 16/167.

Mitra, Arghya Kusum and Sadhan Kumar Chattopadhyay (2020), "*Monetary policy transmission in India – Recent trends and impediments*", RBI Monthly Bulletin for 2020, Monetary Policy Department, RBI.

Mohan, Rakesh and Partha Ray (2018), "*Indian monetary policy in the time of inflation targeting and demonetisation*", Brookings India Working Paper- 4.

Mohan, Rakesh (2007), "*Monetary policy transmission in India*", Bank of International Settlement papers no 35.

Mohanty, M.S and Deepak (2012), "*Evidence of Interest Rate Channel of Monetary Policy Transmission in India*", RBI Working Paper Series, WPS (DEPR): 6/2012,1-53.

Mohanty, M.S and Kumar Rishabh (2016), "*Financial intermediation and monetary policy transmission in EMEs: What has changed post-2008 crisis?*", Monetary and Economic Department, BIS Working Paper No 546.

Mohanty, M.S and Marc Klau (2008), "*Monetary policy rules in emerging market economies: issues and evidence*" Monetary and Economic Department, BIS Working Papers No 149.

Mohanty, M.S and Philip Turner (2008), "*Monetary policy transmission in emerging market economies: what is new?*", Bank of International Settlements, *BIS Papers No.35.*

Mojon, Benoit, Frank Smets and Philip Vermeulen (2002), "*Investment and Monetary Policy in Euro Area*", Journal of Banking & Finance, 2002, Vol. 26, Issue 11, 2111-2129.

Morgan,P.(2009),"*The Role and Effectiveness of Unconventional Monetary Policy*", Working Paper 163. Tokyo: Asian Development Bank Institute.

Morten Bech and Aytek Malkhozov (2016), *How have central banks implemented negative policy rates?* Bank for International Settlement, BIS Quarterly Review, Bank for International Settlements.

Mukherjee, Sanchita and Rina Bhattacharya (2011), "*Inflation targeting and monetary policy transmission mechanisms in emerging market economies*", IMF Working Paper No. 11/229.

Narasimham, M (1977), Development of Indian Banking Sector – Some Issues, Speech delivered Association, May 28, 1977, RBI, Mumbai.

Ncube, Mthuli and Eliphas Ndou (2011), "*Inflation targeting, exchange rate shocks and output: Evidence from South Africa*" African Development Bank Group, Working Paper No 134.

OECD (2013), OECD Economic Outlook, No. 93, OECD Publishing.

OECD (2012), OECD Economic Outlook, No. 91, OECD Publishing.

OECD (2012), OECD Economic Outlook, No. 92, OECD Publishing.

Ormaechea, Santiago Acosta and David Coble (2011), "*Monetary transmission in dollarized and non-dollarized economies: The cases of Chile, New Zealand, Peru and Uruguay*", IMF Working Paper, WP/11/87.

Ottonello, Pablo and Thomas Winberry (2018), "*Financial Heterogeneity and the Investment Channel of Monetary Policy,*" NBER Working Papers 24221, National Bureau of Economic Research, Inc.

Pandit, B. L. (2006), "*Transmission of monetary policy and bank lending channel in India*" Reserve Bank of India, Development Research Group Study, Mumbai.

Pandit, B.L., Ajit Mittal, Mohua Roy and Saibal Ghosh (2016), "*Transmission of monetary policy and the bank lending channel: Analysis and evidence for India*", Department of Economic Analysis and Policy, Reserve Bank of India, Mumbai, January 2016, Study No. 25.

Pandit, B.L and Pankaj Vashisht (2011), "*Monetary policy and credit demand in India and some EMEs*", ICRIER Working Paper, WP No. 256.

Panetta, Fabio and Paolo Angelini, Ugo Albertazzi, Francesco Columba, Wanda Cornacchia, Antonio Di Cesare, Andera Pilati, Carmelo Salleo, and Giovanni Santini (2009), "*Financial Sector Pro-cyclicality: Lessons from the Crisis*", Bank of Italy Occasional Papers, No. 44.

Patra, Michael Debabrata, Jeevan Kumar Khundrakpam and Joice John (2020), "*Exchange rate pass-through in emerging economies*", RBI Working Paper Series, RBI WPS (DEPR): 01/2020.

Patra, Michael Debabrata, Jeevan Kumar Khundrakpam, and S. Gangadaran (2017), "*The quest for optimal monetary policy rules in India*", Journal of Policy Modeling, Vol. 39, Issue 2, 349–370.

Patra, Michael Debabrata and Muneesh Kapur (2010), "*A monetary policy model without money for India*", International Monetary Fund, Working Paper No.10/183.

Patra, Michael Debabrata and Muneesh Kapur (2010), "*Inflation Expectations and Monetary policy in India: An Empirical Exploration*", International Monetary Fund, Working Paper No.10/84.

Paul, Biru Paksha (2009), "*In search of the phillips curve for India*", Journal of Asian Economics, Vol. 20, Issue 4, 479-488.

Pennacchi, George G, (1991) " *Identifying the Dynamics of Real Interest Rates and Inflation: Evidence Using Survey Data ,*" Review of Financial Studies , Society for Financial Studies, Vol. 4, Issue 1, 53-86.

Potter, Simon & Smets Frank (2019), "*Unconventional monetary policy tools: A cross country analysis*", Bank of International Settlement, Committee on the Global Financial System, CGFS Paper No. 63.

Prabu, Edwin A, Indranil Bhattacharyya and Partha Ray (2019), "*Impact of monetary policy on the Indian stock market: Does the devil lie in the detail?*", IIM Calcutta Working Paper Series, WPS No 822 /March, 2019.

Puri, Manju, Jorg Rocholl, and Sascha Steffen (2011), "*Global Retail Lending in the Aftermath of the US Financial Crisis: Distinguishing Between Supply and Demand Effects*", Journal of Financial Economics, Vol. 100, Issue . 3, 556-578.

R.A. Braun, Y. Waki(2006),"*Monetary policy during japans lost decade*", Center for Advanced Research in Finance, Faculty of Economics, The University of Tokyo.Vol. 52 Issue 2, 324-344.

Rajan, Ramkishen S. and Venkataramana Yanamandra (2015), "*Effectiveness of monetary policy in India: The interest rate pass-through channel. In: Managing the macroeconomy*", Palgrave Macmillan, London.

Rangarajan, Chakravarthi (2020), "*The New Monetary Policy Framework- What it Means"* NIPFP Working Paper Series no. 297.

Rangarajan, Chakravarthi (1997), Dimensions of Monetary Policy, Anantharamakrishnan Memorial Lecture delivered at Chennai on February 7, 1997, RBI, Mumbai.

Ray, Partha and Edwin Prabu (2013), "*Financial development and monetary policy transmission across financial markets: What do daily data tell for India?*", RBI Working Paper Series, RBI WPS (DEPR): 04/2013.

Ray, Partha, Joshi and M. Saggar (1998: "*New monetary transmission channels: Role of interest rate and exchange rate in the conduct of monetary policy*", Economic and Political Weekly, Vol. 33, Issue 44, 2787-2294.

Reserve Bank of India (2020). Article on Monetary Policy Transmission in India- Recent Trends and Impediments, RBI Monthly Bulletin for March 2020. Mumbai.

Reserve Bank of India (2019). Notification on External Benchmark Lending Rate, Mumbai, September 2019.

Reserve Bank of India (2017). Report of the Internal Study Group to Review the Working of the Marginal Cost of Funds Based Lending Rate System, Mumbai.

Reserve Bank of India (2014). Report of the Expert Committee to Revise and Strengthen the Monetary Policy Framework. Mumbai.

Reserve Bank iof India (2013) Real Interest Rate impact on Investment and Growth – What the Empirical Evidence for India Suggests, Inter-departmental Study.

Reserve Bank of India (2011). Report of the Sub-Committee of the Central Board of Directors of Reserve Bank of India to Study Issues and Concerns in the MFI Sector. Mumbai, January 2011.

Reserve Bank of India (2010). Monetary Policy Transmission through Financial Market, RBI Annual Report 2009-10, Mumbai, August 2010.

Reserve Bank of India (2005a). RBI Annual Report 2004-05, Mumbai, August 2005.

Reserve Bank of India (2005b). Report on currency and finance. Mumbai, 2003-04.

Reserve Bank of India (2005c). Report on Currency and Finance. Part VII, Monetary Transmission Mechanism, Mumbai, December 2005.

Reserve Bank of India (2004). RBI Annual Report 2003-04, Mumbai, August 2004.

Reserve Bank of India (2002). RBI Annual Report 2001-02, Mumbai, August 2002.

Reserve Bank of India (1998). Report of The Working Group on Money Supply, Mumbai, June 1998.

Reserve Bank of India (1992-2019). Report on Basic Statistical Returns of Scheduled Commercial Banks in India. Mumbai, 1992-93 to 2018-19.

Reserve Bank of India (1992-2019). Report on Handbook of Statistics on Indian Economy. Mumbai, 1992-93 to 2018-19.

Reserve Bank of India (1985), Report of the Committee to Review the Working of the Monetary System (Chairman: Sukhamoy Chakravarty), 1985, RBI, Mumbai.

Salunkhe, Bhavesh and Anuradha Patnaik (2017), "*The impact of monetary policy on output and inflation in India: A frequency domain analysis*", Economic Annals, Vol. 62, Issue, 113-154.

Schnabl, Gunther (2007), "*Exchange rate volatility and growth in small open economies at the EMU periphery",* European Central Bank (ECB) Research Paper Series, Working Paper No. 773.

Sengupta, Nandini (2014), "*Changes in transmission channels of monetary policy in India*", Economic and Political Weekly, Vol.49, Issue 49, 62-71.

Sharpe, Steven and Gustavo Suarez (2015), "*Why isn't Investment more sensitive to interest rates: Evidence from surveys*", Finance and Economics Discussion Series, Divisions of Research & Statistics and Monetary Affairs Federal Reserve Board, Washington, D.C.

Shatz, Howard and David Tarr (2000), "*Exchange rate overvaluation and trade protection: Lessons from experience*", World Bank Development Research Group Trade, Policy Research Working Paper No. 2289.

Singh, Bhupal (2011), "*How asymmetric is the monetary policy transmission to financial markets in India*", RBI Occasional Papers, Vol. 32, Issue 2, 1-31.

Singh, Bhupal. (2010), "*Monetary policy behavior in India: Evidence from taylor-type policy frameworks*", Reserve Bank of India, Mumbai, Staff Studies, SS (DEAP) 2/2010.

Singh, Bhaupal, Kanakaraj, A., and Sridevi, T.O. (2011), "*Revisiting the empirical existence of the Phillips curve for India*", Journal of Asian Economics, Vol. 22, Issue 3, 247–258.

Singh, Bhupal and Sitakantha Pattanaik (2012), "*Monetary policy and asset price interactions in India: Should financial stability concerns from asset prices be addressed through monetary policy?*", Journal of Economic Integration,Vol. 27, Issue 1 , 167-194.

Singh, Charan (2005), Financial Sector Reforms in India, SIEPR WP 241, Stanford University

Singh, Kanhaiya and Kaliappa Kalirajan (2007). "*Monetary transmission in post-reform India: An evaluation*" Journal of the Asia Pacific Economy,, Vol. 12, Issue 2 , 158-187.

Spiro, S Peter (1997), "*The effect of current account balance on interest rate*", Macroeconomic Analysis and Policy Branch, Ontario Ministry of Finance, July 1997.

Swamy, Vighneswara (2016), "*A study on the effectiveness of transmission of monetary policy rates in India*", Research Report, Indian Institute of Banking Finance, December 2016.

Takáts, Előd and Christian Upper (2013), "*Credit and growth after financial crises*", Monetary and Economic Department, Bank of International Settlement, BIS Working Papers No 416.

Torsten Slok (2016) *Negative interest rates: Confidence costs outweigh small economic benefits,* The Brookings, Washington DC.

Virmani Vineet 2004, "*Operationalsing Taylor-type rules for the Indian economy: Issues and some results*", ICICI Research Center and Institute for Financial Management and Research, Chennai, India, Working Paper 2004-07-04.

Wahi, Garima and Muneesh Kapur (2018), "*Economic activity and its determinants: A panel analysis of Indian states*", RBI Working Paper Series, WPS (DEPR): 04.

White, William (2012), "*Ultra Easy Monetary Policy and the Law of Unintended Consequences*", Federal Reserve Bank of Dallas Working Papers, No. 126.

Yanamandra, Venkataramana (2015), "*Exchange rate changes and inflation in India: What is the extent of exchange rate pass-through to imports?*", Economic Analysis and Policy, Vol. 47, Issue 3, 57-68.

Zhou, S. (2007), "*The dynamic relationship between the federal funds rate and the Eurodollar rates under interest rate targeting*", Journal of Economic Studies, Vol. 34, Issue 2, 90-102.

Annexure 1: Brief Review of Literature on Monetary Transmission – Select Studies

Year	Authors	Paper Title	Period of Study	Statistical Techniques	Observations and Variables taken into consideration	Results and Conclusions
2010	Rudrani, Bhattacharay, Ila Patnaik and Ajay Shah	Monetary policy transmission in an emerging market setting (IMF Working Paper) Source: https://www.imf.org/~/media/Websites/IMF/imported-full-text-pdf/external/pubs/ft/wp/2011/_wp1105.ashx	1997-2009	Vector Error Correction Model	Price series (WPI), Exchange rate, Interest rate (91-day treasury bills rate), IIP as proxy for output, US PPI (producer price index) as a measure of world tradeables inflation, 3-month treasury bills rate of US for capturing the monetary policy stance of rest of the world	This paper finds that the monetary policy transmission in India is weak. In India evidence of incomplete but statistically significant exchange rate pass-through is found. However, given a strong, though incomplete exchange rate pass-through, interest rates can impact inflation through the exchange rate.
2017	Ashima Goyal and Deepak Kumar Agarwal	Monetary transmission in India: Working of price and quantum channels (Indra Gandhi Institute of Development Research) Source: http://www.igidr.ac.in/pdf/publication/WP-2017-017.pdf	2002-2017	OLS regressions of event windows around change in repo rates	Repo Rate, Call money market rate, Collateralized borrowing and lending obligations, T-bills and G-Secs, Liquidity Adjustment Facility (LAF) injection and absorption, Cash reserve ratio, Open market operations, Foreign exchange market intervention, Market stabilisation scheme	The results find the interest rate channel, with repo rate as the policy rate, as the most effective medium to influence market rates. The speed of response is faster where there is more market depth. Also, size of the pass-through rises when rate and quantity variables are in sync.

Annexure 2: Complete Data Description

S. No.	Name of the variable	Unit of Measurement	Data Source
1	Gross Domestic Product (GDP)	Spliced adjusted level at Constant 2011-12 Prices (in Crore)	National Accounts Statistics (NAS)
2	IIP	Spliced Growth Rate (Base: 2011-12 = 100)	CSO
4	Money Supply	Narrow and Broad - Both at Level	RBI
5	Gross Capital Formation	Level and % of GDP at Current Prices	NAS
6	Export	Level and % of GDP at Current Prices	NAS
7	Import	Level and % of GDP at Current Prices	NAS
8	Repo Rate	Average of Quarter Starting from Apr-June	RBI
9	Real Effective Exchange Rate (REER)	Spliced Index Number, (Base: 2004-05 = 100) at Trade Based Weight	RBI
10	Nominal Effective Exchange Rate (NEER)	Spliced Index Number, (Base: 2004-05 = 100) at Trade Based Weight	RBI
11	Exchange Rate (INR/USD)	In INR/USD	RBI
12	Foreign Direct Investment (FDI)	Gross and Net FDI in Crore	EPW Research Foundation
13	Foreign Institutional Investment (FII)	Net FII in Crore	EPW Research Foundation
14	Bombay Stock Exchange (BSE)	Quarterly Average Index at Base: 1983-84=100	RBI
15	National Stock Exchange (NSE)	Quarterly Average Index at Base: 1995=1000	RBI
16	Non-Food Credit (NFC)	Quarterly Average in Crore	RBI

17	Total Deposit	Quarterly Average in Rs. Crore	RBI
18	Total Credit	Quarterly Average in Rs. Crore	RBI
19	Prime Lending Rate	Level in percent	RBI and Commercial Bank
20	Private Corporate Investment	% of GDP at Current Price and Share in Total GCF derived from Annual Current Price NAS data	NAS
21	Household Investment	% of GDP at Current Price and Share in Total GCF derived from Annual Current Price NAS data	NAS
22	Public Investment	% of GDP at Current Price and Share in Total GCF derived from Annual Current Price NAS data	NAS
23	CPI	Spliced Growth Rate Based on (Base: 2011-12=100). From 2010 January CPI-combined and prior to that CPI-IW	RBI
24	WPI	Spliced Growth Rate Based on (Base: 2011-12 = 100).	RBI
25	G-Sec/Treasury Bill Yields	Quarterly Average- 91 Day, 364 Day, 5 Year G-Sec, 10Year G-Sec	EPW Research Foundation
26	Weighted Average Call Money Rate	Quarterly Average	RBI
27	Commercial Paper	Quarterly Average High and Low Rate of Interest	EPW Research Foundation
28	Certificates of Deposit	Quarterly Average High and Low Rate of Interest	EPW Research Foundation
29	5 Year AAA Rating Corporate Bond	Quarterly Average Yield	Fixed Income Money market and

			Derivatives Association of India
30	CRR	Quarterly Average in percent	RBI
31	Reverse Repo rate	Quarterly Average in percent	RBI
32	Bank rate	Quarterly Average in percent	RBI

Note- Quarter is starting from Apr- Jun
All the growth rate is taken from corresponding previous quarter

Annexure 3a: CROSS CORRELATION MATRIX

	CPI	WPI	NEER	NFC	NFDI	NFII	NSE	PLR	REER	REPO	RREPO	PCI	HINV	T364
CPI	1													
WPI	0.4	1												
NEER	0	0.4	1											
NFC	0	-0.3	-0.8	1										
NFDI	-0.1	-0.4	-0.7	0.8	1									
NFII	0.2	0.1	-0.1	0.2	0	1								
NSE	0	-0.3	-0.7	1	0.8	0.2	1							
PLR	0.2	0.2	0.6	-0.8	-0.6	-0.2	-0.7	1						
REER	-0.1	-0.2	-0.4	0.8	0.7	0.2	0.9	-0.7	1					
REPO	0.1	0.1	-0.2	0	0	0	0	0	0	1				
RREPO	0	-0.1	-0.5	0.5	0.3	0.1	0.4	-0.5	0.3	0.8	1			
PCI	0	-0.1	0.3	0.1	0.1	0.1	0.3	-0.1	0.2	-0.2	-0.2	1		
HINV	0.1	0.1	-0.6	0.4	0.3	0.2	0.2	-0.3	0.3	0.4	0.5	-0.7	1	
T364	0.1	0.1	-0.2	0	0	-0.1	0	0.2	-0.1	0.4	0.3	-0.3	0.1	1
T91	0.1	0.1	-0.3	0.1	0.1	0	0	0.1	-0.1	0.4	0.4	-0.3	0.2	1
WACR	0	0.1	-0.2	0	0	-0.1	0	0.1	-0.1	0.4	0.4	-0.3	0.2	0.9
ZRGDP	0	-0.3	-0.7	1	0.8	0.2	1	-0.8	0.9	0	0.4	0.2	0.3	0
DLOGBSE	-0.3	0	0.2	-0.1	-0.1	0.1	0	-0.1	0.1	-0.1	-0.1	0.4	-0.4	0.1
DLOGNEER	-0.2	-0.1	0.2	-0.1	-0.1	0.2	-0.1	0	0.1	-0.2	-0.3	0.1	-0.2	-0.2

3a: Correlation Matrix Contd.

	T91	WACR	ZRGDP	DLOGBSE	DLOGNEER
T91	1.0				
WACR	1.0	1.0			
ZRGDP	0.0	0.0	1.0		
DLOGBSE	0.0	0.0	0.0	1.0	
DLOGNEER	-0.2	-0.2	-0.1	0.3	1.0

Annexure 3b: Cross Correlation Matrix 1998Q1-2002Q4

	RR	*GDP*	*WPI*	*CPI*	*PCI*	*NEER*	*BSE*	*NSE*	*PLR*	*DR*	*CMR*	*5YGSEC*	*5YCB*	*91TB*	*NFC*
RR	1.0														
GDP	-0.2	1.0													
WPI	-0.2	-0.5	1.0												
CPI	0.1	-0.7	0.3	1.0											
PCI	-0.3	0.2	-0.3	0.2	1.0										
NEER	-0.4	0.5	0.0	-0.5	-0.4	1.0									
BSE	-0.6	0.5	0.1	-0.5	0.2	0.5	1.0								
NSE	-0.6	0.6	0.0	-0.6	0.1	0.6	1.0	1.0							
PLR	-0.1	-0.4	0.0	0.4	0.4	-0.5	-0.2	-0.3	1.0						
DR	-0.3	-0.1	0.2	0.3	0.3	0.2	0.2	0.3	0.0	1.0					
CMR	-0.5	0.2	0.4	-0.1	0.1	0.4	0.6	0.6	-0.2	0.5	1.0				
5YGSEC	-0.5	-0.3	0.5	0.5	0.3	0.1	0.2	0.2	0.2	0.8	0.8	1.0			
5YCB	-0.5	-0.3	0.5	0.4	0.3	0.1	0.3	0.3	0.1	0.8	0.8	1.0	1.0		
91TB	-0.6	-0.1	0.5	0.2	0.2	0.3	0.5	0.5	-0.1	0.7	0.9	0.9	0.9	1.0	
NFC	-0.1	0.7	-0.2	-0.8	-0.1	0.2	0.4	0.4	-0.1	-0.6	-0.2	-0.6	-0.6	-0.4	1.0

Annexure 3c: Cross Correlation Matrix 2003Q1-2007Q4

	RR	*GDP*	*WPI*	*CPI*	*PCI*	*NEER*	*BSE*	*NSE*	*PLR*	*DR*	*CMR*	*5YGSEC*	*5YCB*	*91TB*	*NFC*
RR	1.0														
GDP	0.0	1.0													
WPI	-0.1	0.4	1.0												
CPI	0.4	0.1	0.0	1.0											
PCI	0.3	0.4	-0.2	0.4	1.0										
NEER	0.1	0.5	-0.3	0.2	0.9	1.0									
BSE	0.7	0.3	-0.2	0.5	0.8	0.6	1.0								
NSE	0.7	0.3	-0.2	0.5	0.8	0.6	1.0	1.0							
PLR	0.9	0.3	-0.2	0.3	0.6	0.4	0.8	0.8	1.0						
DR	0.7	0.2	-0.1	0.3	0.5	0.4	0.8	0.8	0.8	1.0					
CMR	0.5	0.2	0.1	0.5	0.5	0.3	0.6	0.6	0.5	0.4	1.0				
5YGSEC	0.5	0.3	-0.1	0.6	0.9	0.7	0.8	0.8	0.7	0.5	0.7	1.0			
5YCB	0.5	0.3	-0.1	0.6	0.9	0.7	0.8	0.8	0.7	0.5	0.7	1.0	1.0		
91TB	0.7	0.3	0.0	0.5	0.8	0.6	0.9	0.9	0.7	0.6	0.9	0.9	0.9	1.0	
NFC	-0.3	0.2	0.0	0.3	0.6	0.6	0.2	0.2	-0.2	-0.2	0.3	0.6	0.6	0.4	1.0

Annexure 3d: Cross Correlation Matrix 2003Q1-2007Q4

	RR	*GDP*	*WPI*	*CPI*	*PCI*	*NEER*	*BSE*	*NSE*	*PLR*	*DR*	*CMR*	*5YGSEC*	*5YCB*	*91TB*	*NFC*
RR	1.0														
GDP	0.0	1.0													
WPI	-0.1	0.4	1.0												
CPI	0.4	0.1	0.0	1.0											
PCI	0.3	0.4	-0.2	0.4	1.0										
NEER	0.1	0.5	-0.3	0.2	0.9	1.0									
BSE	0.7	0.3	-0.2	0.5	0.8	0.6	1.0								
NSE	0.7	0.3	-0.2	0.5	0.8	0.6	1.0	1.0							
PLR	0.9	0.3	-0.2	0.3	0.6	0.4	0.8	0.8	1.0						
DR	0.7	0.2	-0.1	0.3	0.5	0.4	0.8	0.8	0.8	1.0					
CMR	0.5	0.2	0.1	0.5	0.5	0.3	0.6	0.6	0.5	0.4	1.0				
5YGSEC	0.5	0.3	-0.1	0.6	0.9	0.7	0.8	0.8	0.7	0.5	0.7	1.0			
5YCB	0.5	0.3	-0.1	0.6	0.9	0.7	0.8	0.8	0.7	0.5	0.7	1.0	1.0		
91TB	0.7	0.3	0.0	0.5	0.8	0.6	0.9	0.9	0.7	0.6	0.9	0.9	0.9	1.0	
NFC	-0.3	0.2	0.0	0.3	0.6	0.6	0.2	0.2	-0.2	-0.2	0.3	0.6	0.6	0.4	1.0

Annexure 3e: Cross Correlation Matrix 2013Q1-2018Q4

	RR	*GDP*	*WPI*	*CPI*	*PCI*	*NEER*	*BSE*	*NSE*	*PLR*	*DR*	*CMR*	*5YGSEC*	*5YCB*	*91TB*	*NFC*
RR	1.0														
GDP	0.3	1.0													
WPI	0.1	0.6	1.0												
CPI	0.6	0.6	0.3	1.0											
PCI	0.4	0.1	-0.3	0.4	1.0										
NEER	-0.5	-0.4	-0.3	-0.5	0.3	1.0									
BSE	-0.7	-0.3	0.0	-0.8	-0.7	0.3	1.0								
NSE	-0.7	-0.4	0.0	-0.8	-0.7	0.3	1.0	1.0							
PLR	0.9	0.1	-0.3	0.5	0.5	-0.4	-0.7	-0.7	1.0						
DR	0.9	0.2	-0.1	0.7	0.5	-0.5	-0.8	-0.8	0.9	1.0					
CMR	0.9	0.3	0.1	0.8	0.4	-0.6	-0.8	-0.8	0.9	1.0	1.0				
5YGSEC	0.9	0.4	0.1	0.7	0.1	-0.7	-0.6	-0.5	0.7	0.8	0.8	1.0			
5YCB	0.9	0.4	0.1	0.7	0.1	-0.7	-0.6	-0.5	0.7	0.8	0.9	1.0	1.0		
91TB	0.9	0.3	0.1	0.8	0.4	-0.6	-0.8	-0.8	0.9	1.0	1.0	0.9	0.9	1.0	
NFC	0.5	0.3	0.4	0.6	-0.3	-0.8	-0.3	-0.3	0.3	0.5	0.6	0.7	0.7	0.6	1.0

Annexure 4
Unit Root Test Results for all the Variables

Markets and Instruments	Serial Codes	Variables	Stage	ADF - AIC	ADF -SC	PP	Chosen order of Integration (I)
Policy Interest Rate		Repo Rate (RR)	Level with Intercept & Trend	0	1	0	0
A. Stock Market	A.1.	NSE	Level with Intercept & Trend	1	1	1	1
	A.2.	BSE	Level with Intercept & Trend	1	1	1	1
B. Deposit and Lending Rates	B.1.	91 Days- 6 months Deposit Rate (DR91)	Level with Intercept & Trend	0	0	0	0
	B.2.	1-2 years Deposit Rates (DR2Y)	Level with Intercept & Trend	1	1	1	1
	B.3.	Lending Rates -Prime Lending Rate (PLR)	Level with Intercept & Trend	1	1	1	1
C. G-Sec. Market Instruments	C.1.	91 days - G-Sec Rates (T91)	Level with Intercept & Trend	1	1	1	1
	C.2.	364 days Gsec	Level with	1	1	1	1

		Rates (T364)	Intercept & Trend				
	C.3.	5 Year GSec Rates (5YGSEC)	Level with Intercept & Trend	1	1	1	1
	C.4.	10 Year GSec (10YGSEC)	Level with Intercept & Trend	1	1	1	1
D	D.1	Call money (WACR)	Level with Intercept & Trend	1	1	1	1
	D.2	Lower CP rate (LCP)	Level with Intercept & Trend	1	1	1	1
	D.3	Lower CD rate (LCD)	Level with Intercept & Trend	1	1	1	1
E. Bond Market	E.1.	Bond Market AAA rated (5YCB)	Level with Intercept & Trend	1	1	1	1
F. Prices	F.1.	Consumer Price Index (CPI)	Level with Intercept & Trend	1	1	1	1
	F.2.	Wholesale Price index (WPI)	Level with Intercept & Trend	0	0	1	0
G. – External Sector	G.1.	Exchange Rate - ln transformed (ER)	Level with Intercept & Trend	1	1	1	1
	G.2. (ln transformed)	Nominal Effective Exchange Rate – log transformed (lnNEER), (NEER)	Level with Intercept & Trend	1	1	1	1
	G.2. (in absolute figures)	Real GDP (in crores)	Level with Intercept & Trend	1	1	1	1
H. Real Sector	H..1.	Real GDP -growth rate (ZRGDP)	Level with Intercept & Trend	1	1	0	1
	H.2.	IIP-growth rate (ZIIP)	Level with Intercept & Trend	1	1	0	1
I. Non-Food Credit and Deits	I.1.	Non-Food Credit -growth and	Level with Intercept & Trend	1	1	1	1

		absolute: (LNNFC) &					
	I.2.	Non-Food Credit – crores (NFC)	Level with Intercept & Trend	1	1	1	1
	I.3.	Total Deposits-growth (ZTD)	Level with Intercept & Trend	2	1	1	1
	I.4.	Total Deposits(crores)	Level with Intercept & Trend	1	1	1	1

Note: * indicates lag order selected by the criterion assuming a 5% level of significance. AIC: Akaike information criterion, SC: Schwarz information criterion, and PP: Phillips-Perron test statistic

Annexure 5: Pairwise Granger Causality test on all variables

Null Hypothesis: Repo Causes Variable		Lags	F-Statistic	Prob	Decision
REPO	NSE	1	3.23047	0.0765	Causality Exists***
REPO	DR91	1	6.23437	0.0148	Causality Exists **
REPO	PLR	6	3.2808	0.0077	Causality Exists*
REPO	5GSEC	1	5.62649	0.0204	Causality Exists **
REPO	10GSEC	1	9.72209	0.0026	Causality Exists*
REPO	LCP	2	4.71152	0.0121	Causality Exists**
REPO	LDP	4	3.62199	0.0102	Causality Exists**
REPO	5YCB	1	7.57806	0.0075	Causality Exists*
REPO	WPI	1	7.25867	0.0088	Causality Exists*
REPO	LnER	1	5.36949	0.0233	Causality Exists**
REPO	RGDP	4	2.74704	0.0359	Causality Exists**
REPO	NEER	1	3.37759	0.0702	Causality Exists***
REPO	YR	1	1.65235	0.2028	No Causality
REPO	T91	1	0.58853	0.4455	No Causality
REPO	T364	7	0.27129	0.9625	No Causality
REPO	WACR	7	0.75522	0.6268	No Causality
REPO	CPIINF	3	0.04411	0.9876	No Causality
REPO	LNNEER	1	1.6538	0.2026	No Causality
REPO	ZRGDP	1	0.14998	0.9793	No Causality
REPO	ZIIP	1	2.69051	0.1053	No Causality
REPO	LNNFC	1	0.26532	0.6081	No Causality
REPO	ZNFC	2	0.31781	0.7288	No Causality
REPO	ZTD	4	0.81289	0.5217	No Causality
REPO	TDR	1	0.37235	0.5217	No Causality

*Significant at 1% **Significant at 5 %, *** Significant at 10 % level

Annexure 6: Restrictions for SVAR

Table 1: Restriction for SVAR Estimation in Case of Shock in form of Repo Rate

	REPO	NSE	GDP	WPI	5YCB	5YGSEC
REPO	1	C(5)	C(9)	C(10)	C(12)	C(15)
NSE	0	1	0	0	C(13)	C(16)
GDP	C(1)	C(6)	1	C(11)	0	0
WPI	C(2)	0	0	1	0	0
5YCB	C(3)	C(7)	0	0	1	C(17)
5YGSEC	C(4)	C(8)	0	0	C(14)	1

Note: Table 1 shows restriction on SVAR matrix when external shocks are executed in form of repo rare with the above restriction. Here Variables under consideration are REPO, NSE, GDP, WPI, 5YCB & 5YGSEC to examine policy impact of call money.

Table 2: Restriction for SVAR Estimation in Case of Shock in form of Call Money Rate

	WACR	NSE	GDP	WPI	5YCB	5YGSEC
WACR	1	C(5)	C(9)	C(10)	C(12)	C(15)
NSE	0	1	0	0	C(13)	C(16)
GDP	C(1)	C(6)	1	C(11)	0	0
WPI	C(2)	0	0	1	0	0
5YCB	C(3)	C(7)	0	0	1	C(17)
5YGSEC	C(4)	C(8)	0	0	C(14)	1

Note: Table 2 indicates restriction on SVAR matrix when external shocks are imposed in form of call money rate with the above stated restriction. WACM, NSE, GDP, WPI, 5YCB & 5RGSEC are variables used for defining SVAR to see the policy impact of call money rate for monetary transmission in India.

Table 3: Restriction for SVAR Estimation in Case of Shock in form of 91Days T-bill Yield

	91DAYTBY	NSE	GDP	WPI	5YCB	5YGSEC
91DAYTBY	1	C(5)	C(9)	C(10)	C(12)	C(15)
NSE	0	1	0	0	C(13)	C(16)
GDP	C(1)	C(6)	1	C(11)	0	0
WPI	C(2)	0	0	1	0	0
5YCB	C(3)	C(7)	0	0	1	C(17)
5YGSEC	C(4)	C(8)	0	0	C(14)	1

Note: Table 3 specifies restriction on SVAR matrix when external shocks are provided in form of 91Days T-bill Yield with the above restriction. Variables taken for above SVAR are 91DAYTBY, NSE, GDP, WPI, 5YCB & 5YGSEC to measure impact of 91 days treasury bill rate on monetary transmission.

Annexure 7: SVAR Restrictions

Short-run Restrictions by Pattern Matrices

For many problems, the identifying restrictions on the A and B matrices are simple zero exclusion restrictions. In this case, you can specify the restrictions by creating a named "pattern" matrix for A and B. Any elements of the matrix that you want to be estimated should be assigned a missing value "NA". All non-missing values in the pattern matrix will be held fixed at the specified values.

For example, suppose you want to restrict A to be a lower triangular matrix with ones on the main diagonal and B to be a diagonal matrix. Then the pattern matrices (for a k=3k variable VAR):

$$A=\begin{bmatrix} 1 & 0 & 0 \\ NA & 1 & 0 \\ NA & NA & 1 \end{bmatrix} \qquad B=\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Short-run Restrictions in Text Form for Dynamics of Private Investments, Inflation and GDP

For more general restrictions, you can specify the identifying restrictions in text form. In-text form, you will write out the relation $Ae_t=Bu_t$ as a set of equations, identifying each element of the e_t and u_t vectors with special symbols. Elements of the A and B matrices to be estimated must be specified as elements of a coefficient vector. Under these restrictions, the relation $Ae_t=Bu_t$ can be written as:

$e_1=b_{11}u_1$

$e_2=-a_{21}e_1+b_{22}u_2$

$e_3=-a_{31}e_1-a_{32}e_2+b_{33}u_3$

The restrictions in the text form are as follows:

@e1 = c(1)*@u1

@e2 = -c(2)*@e1 + c(3)*@u2

@e3 = -c(4)*@e1 - c(5)*@e2 + c(6)*@u3

@e4 = -c(7)*@e1 - c(8)*@e2 + c(9)*@u3 + c(10)*@u4
where, @e1 represents REPO residuals, @e2 represents CPI residuals, @e3 represents PCI residuals, @e4 represents GDPGR residuals.

Long-run Restrictions

The identifying restrictions embodied in the relation Ae=Bu are commonly referred to as short-run restrictions. Blanchard and Quah (1989) proposed an alternative identification method based on restrictions on the long-run properties of the impulse responses. The (accumulated) long-run response C to structural innovations takes the form:

$C=\widehat{\Psi}_{\infty}A^{-1}B$

where $\widehat{\Psi}_{\infty}=(I-\widehat{A}_1-....-\widehat{A}_p)^{-1}$ is the estimated accumulated responses to the reduced form (observed) shocks. Long-run identifying restrictions are specified in terms of the elements of this C matrix, typically in the form of zero restrictions. The restriction
$C_{i,j}=0$ means that the (accumulated) response of the ith variable to the jth structural shock is zero in the long-run.

The expression for the long-run response $C=\widehat{\Psi}_{\infty}A^{-1}B$ involves the inverse of A. We place all the restrictions linear form in the elements of A and B, and the in the long-run restriction, the matrix A is an identity matrix.

To specify long-run restrictions by a pattern matrix, we create a named matrix that contains the pattern for the long-run response matrix C. Unrestricted elements in the C matrix should be assigned a missing value "NA". For example, suppose you have a k=3k variable VAR where you want to restrict the long-run response of the second endogenous variable to the first structural shock to be zero $C_{2,1}=0$. Then the long-run response matrix will have the following pattern:

$$C=\begin{bmatrix} NA & NA \\ 0 & NA \end{bmatrix}$$

A and B and are estimated by maximum likelihood, assuming the innovations are multivariate normal. We evaluate the likelihood in terms of unconstrained parameters by substituting out the constraints.

Identification Condition

The assumption of orthonormal structural innovations imposes k(k+1)/2 restrictions on the $2k^2$ unknown elements in A and B, where k is the number of endogenous variables in the VAR. To identify A and B, we provide at least

$2k^2-\frac{k(k+1)}{2}=\frac{k(3k-1)}{2}$ additional identifying restrictions. This is a necessary order condition for identification and is checked by counting the number of restrictions provided.

We have a 4-variable VAR that includes $Repo_t$, CPI_t, PCI_t, and $GDPGR_t$.

$$\begin{bmatrix} u_t^{repo} \\ u_t^{cpi} \\ u_t^{pci} \\ u_t^{gdpgr} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ b21 & 1 & 0 & 0 \\ b31 & b32 & 1 & 0 \\ b41 & b42 & b43 & 1 \end{bmatrix} \begin{bmatrix} \epsilon_t^{repo} \\ \epsilon_t^{cpi} \\ \epsilon_t^{pci} \\ \epsilon_t^{gdpgr} \end{bmatrix}$$

u is the vector of structural innovations and ϵ is the vector of errors from the reduced form equations where the vector is given by (Repo, CPI, PCI, GDPGR).

Annexure 8: SVAR Impulse Responses

	Accumulated Response of GDPGR:				**Accumulated Response of PCI:**				**Accumulated Response of CPI:**			
Period	Shock1	Shock2	Shock3	Shock4	Shock1	Shock2	Shock3	Shock4	Shock1	Shock2	Shock3	Shock4
1	1.76	0.00	0.00	0.00	0.32	1.37	0.00	0.00	0.32	-0.52	2.13	0.00
2	2.80	-0.01	-0.34	-0.10	0.24	1.12	-0.18	-0.20	0.53	-1.14	3.72	-0.03
3	3.32	0.49	-0.42	-0.39	0.17	1.20	-0.12	-0.20	0.42	-1.64	4.81	-0.10
4	3.52	0.67	-0.39	-0.83	0.15	1.14	-0.08	-0.20	0.20	-1.97	5.58	-0.19
5	3.55	0.66	-0.26	-1.22	0.14	1.11	-0.05	-0.17	-0.03	-2.26	6.10	-0.26
6	3.54	0.56	-0.11	-1.52	0.14	1.10	-0.04	-0.15	-0.21	-2.49	6.44	-0.29
7	3.52	0.45	0.03	-1.73	0.14	1.10	-0.03	-0.14	-0.33	-2.65	6.65	-0.29
8	3.50	0.37	0.13	-1.88	0.14	1.10	-0.03	-0.13	-0.41	-2.75	6.76	-0.27
9	3.49	0.30	0.20	-1.99	0.13	1.10	-0.03	-0.12	-0.46	-2.80	6.82	-0.25
10	3.48	0.26	0.25	-2.07	0.13	1.10	-0.03	-0.12	-0.49	-2.83	6.85	-0.22
11	3.47	0.22	0.28	-2.14	0.13	1.10	-0.03	-0.11	-0.50	-2.84	6.86	-0.20
12	3.47	0.20	0.30	-2.18	0.13	1.11	-0.03	-0.11	-0.51	-2.84	6.86	-0.18
13	3.47	0.18	0.32	-2.22	0.13	1.11	-0.03	-0.11	-0.51	-2.84	6.85	-0.17
14	3.47	0.17	0.33	-2.24	0.13	1.11	-0.03	-0.11	-0.51	-2.84	6.85	-0.16
15	3.47	0.16	0.33	-2.26	0.13	1.11	-0.03	-0.10	-0.51	-2.83	6.85	-0.15
16	3.47	0.16	0.34	-2.27	0.13	1.11	-0.03	-0.10	-0.51	-2.83	6.84	-0.14
17	3.47	0.15	0.34	-2.28	0.13	1.11	-0.03	-0.10	-0.51	-2.83	6.84	-0.14
18	3.47	0.15	0.34	-2.29	0.13	1.11	-0.03	-0.10	-0.51	-2.83	6.84	-0.13
19	3.47	0.15	0.34	-2.30	0.13	1.11	-0.04	-0.10	-0.51	-2.83	6.84	-0.13
20	3.47	0.15	0.35	-2.30	0.13	1.11	-0.04	-0.10	-0.51	-2.83	6.84	-0.13

Note: Factorization: Structural; Standard Errors: Analytic