Development Research Group

Study
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TRANSMISSION OF MONETARY POLICY AND THE BANK LENDING CHANNEL: ANALYSIS AND EVIDENCE FOR INDIA

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EXECUTIVE SUMMARY

Introduction

In the financial sector of an economy, given the asymmetric information and moral hazard, bank intermediation is seen to be crucial, since only banks specialise in monitoring their borrowers. Under situations of asymmetric information, since publicly-issued bonds and bank-intermediated loans are not close substitutes, a large number of borrowing firms would turn out to be bank-dependent. In this scenario, monetary policy has a reason to operate not only through the conventional *money channel*, but also, and more importantly, through the *bank lending channel*. To the extent monetary policy shocks influence credit supply independently of influencing credit demand, theoretical considerations make it imperative for monetary policymakers to pay attention to the bank lending channel.

The present study is an attempt to characterise the process of monetary policy transmission in India and identify the role of bank lending channel in it. The objective of the study is to examine three specific questions related to transmission mechanism in the post-liberalisation period. First, how monetary policy "shocks" transmit their influence in a VAR framework, given the simultaneity between monetary policy variables and other economic variables and how effective are the chosen policy instruments? Second, how does bank lending respond to changes in monetary policy? Third, following a given change in monetary policy, is there any asymmetry in the lending behavior of 'big' and 'small' banks? It needs to be stated at the outset that the main focus of the study is on examining the response of bank lending to changes in monetary policy.

The study broadly covers the period 1993-94 to 2002-03. Data used in this study are both published and unpublished. Published data are available in various RBI publications. The unpublished data are the quarterly confidential supervisory data available with the Offsite Monitoring and Surveillance Division (OSMOS) of RBI. Adhering to the confidentiality norm relating to RBI unpublished data, no raw data were made available to the external expert.

In terms of methodology, both VAR and structural models continue to be used in the current literature. While VAR is suitable to identify

policy shocks from the feedback rule, the structural models can be used to examine the overall impact of the policy changes. The present study deploys both types of techniques.

VAR Analysis

In examining the role of the bank lending channel in monetary policy transmission, we focus on two policy instruments – change in Bank Rate (CH_BR) and the Cash Reserve Ratio (CRR). These two instruments have been chosen in preference to others because their medium-term impact on bank lending can be expected to be direct and fairly quick.

Researchers have acknowledged that an important problem faced by a central bank is establishing the effects of monetary policy actions in the economy. The problem arises as policy actions reflect the policymaker's response to developments in the economy. In India, while designing monetary policy, the RBI takes into account the 'feedback' from developments in the real sector. To understand how the monetary policy actions transmit through the economy, it is imperative to distinguish between the outcome of central bank's policy action and the variables that the policy reacts to. For this, the component of monetary policy that is not reactive to other variables has to be identified. To accomplish this task, a VAR framework is used and the response of the economy to exogenous monetary policy shocks is examined.

Structural VAR has been estimated with monthly data for all Indian scheduled commercial banks. The vector includes the variables log IIP (Index of Industrial Production), log WPI (Wholesale Price Index), log M3, CPR (Commercial Paper Rate) and the chosen policy instrument. Two policy instruments considered are CRR and change in Bank Rate (CH_BR).

The results show that on the basis of variance decompositions, there is not much difference as between CRR and CH_BR as alternative policy instruments. However, on the basis of plausibility of relationships as given by the impulse response functions, CRR seems to perform relatively better *vis-à-vis* the Bank Rate.

Using structural VAR, effects of alternative policy instruments are compared for nominal effective exchange rate, net foreign institutional

investment inflows, foreign exchange reserves, trade balance, BSE market capitalisation, new capital issued by non-governmental public limited companies and bank credit.

Alternative specifications of the structural VAR model are examined. The sensitivity analysis indicates that the chosen model is the best on the basis of model selection criteria. Since qualitatively impulse responses do not vary much, it indicates robustness of the chosen model.

Bank Lending Channel

The bank lending channel has two aspects. First, it is emphasised that bank credit is special. There is no close substitute for bank loans, both on the asset side of banks' balance sheets and on the liability side of borrowers. Especially, households and small firms lack access to forms of credit other than bank loans. Second, monetary policy changes have a direct effect on bank credit. Following a monetary tightening which drains resources from the banking system, banks have to readjust their portfolio by reducing their supply of loans, given the imperfect substitutability between loans and other assets. Loan supply being reduced, banks increase lending rate or reduce their loans. Therefore, a reduction in the supply of loans leads to a rise in the external finance premium for bank-dependent borrowers whose activity is adversely affected. As a result, credit allocated to bank-dependent borrowers may fall causing these borrowers to curtail their spending.

Most studies based on aggregate data suffer from a severe identification problem: the inability to establish whether the decrease in credit that is observed after a monetary contraction is induced by a fall in bank loan supply or driven by a fall in borrowers' demand. In the latter case, the lending channel would not be relevant. In this respect, recent studies based on disaggregated data are much more informative. The advantages of disaggregated data are that the response of credit variables can be analysed in combination with other hypotheses that follow from the theoretical literature underlying the credit view.

The study first conducts a panel data analysis of the scheduled commercial banks (excluding regional rural banks and foreign banks) in India. Deleting the outlier observations and banks for which consistent data over the entire time span are not available, leaves us with 51 banks,

comprising 27 public sector banks, 16 old private sector banks and 8 new private sector banks.

The data employed in the study fall into following categories:

Bank balance sheet data: We employ the following variables of banks' balance sheet, *viz*., loans advanced by commercial banks, funds (defined as the aggregate of deposits and borrowings) with commercial banks and commercial banks' investments in government securities. These variables have been scaled by transforming them in terms of logarithms. Finally, the natural logarithm of total assets is included to control for bank size.

Monetary Policy Variable: While there is no consensus on the best indicator of monetary policy stance, we consider two variables: one on the quantity front, *viz.,* the Cash Reserve Ratio, and another on the price front, *viz.,* the Bank Rate.

The results are supportive of the existence of a bank lending channel in India. Several features of the results deserve a mention. First, the response of advances to a change in the policy variable turns out to be significant at conventional levels, irrespective of whether the price variable (Bank Rate) or the quantity variable (CRR) is considered. In particular, banks tend to cut back lending and adjust their funds in response to a policy action. Second, the results also indicate that prudential norms, as proxied by banks' capital adequacy ratios, exert a significant influence on bank lending. Third, the gradual opening up of the economy has been making a perceptible impact on banks' lending behaviour. Finally, the differential response of bank groups suggests that it is primarily the public sector banks that are more reactive to the policy shocks.

Asymmetry between Big and Small Banks

Given the asymmetry in the resource base, assets and expected income, among other features, between big and small banks, would their response to policy shocks be different? This is an important question. If the balance of evidence suggests that the impact of monetary policy shocks on small banks is more severe *vis-à-vis* big banks, this would lend additional support to the existence of a bank lending channel for

monetary transmission. We categorised banks on the basis of total assets to see if there is any asymmetry in the response of 'big' and 'small' banks to a given contractionary monetary policy shock. Big banks differ from small banks in a variety of ways. It is possible that after a contractionary monetary policy shock, big banks are able to maintain the existing loan supply, given the size of their assets. Big banks have a larger resource base, higher expected income from investments, larger spread and have larger expected income from stock and foreign exchange markets. All this may allow big banks to circumvent the problems of liquidity crunch.

All the 57 scheduled commercial banks have been identified on the basis of the size of their total assets. To arrive at a demarcation between big and small banks, top 60 percentile of banks when ranked according to total assets have been taken as 'big' banks, while bottom 20 percentile constitutes the 'small' bank group. Therefore, from 57 banks, 46 banks figure in the panel analysis, out of which 26 are big banks. The analysis is based on annual data. The two policy instruments considered are CRR and Bank Rate.

To test the hypothesis of potential asymmetry in lending behaviour between small and big banks, the loan offer function is specified in such a way that only supply side factors are included on the right hand side. This ensures that the loan supply function is properly distinguished from the loan demand function.

In view of the observed asymmetry in their resource base, and in the major items of their assets and liabilities, and liquidity, big and small banks are expected to differ in significant ways. The panel data analysis indicates that on the basis of the relative strength of these differing characteristics, the lending behaviour of big and small banks also differs in response to a policy shock. In particular, small banks are more acutely affected by contractionary monetary policy shocks as compared to big banks. This implies that given their limited ability to fund lending activity under a contractionary policy shock, the response of small banks is more pronounced as compared to the big banks, which have adequate liquid balances and/or are able to easily access non-deposit sources of funds. This differential feature of the transmission

process – for big and small banks – would indicate that since banks are conduits for the central bank's monetary transmission – larger the proportion of small banks in the system, the more responsive is bank lending expected to be to a contractionary monetary policy shock.

Some Inferences

The study suggests the existence of a bank lending channel in the Indian context. The analysis based on econometric techniques seems to validate this point. This would suggest that the central bank, while formulating monetary policy, is likely to encounter independent shifts in the loan supply. These changes in bank loan supply would also induce changes in bank portfolios.

Evidence seems to point to the fact that the response of big banks to monetary policy shocks differs from that of small banks, with the latter being more compliant. In particular, large banks with a wider resource base can more successfully insulate their loan supply from contractionary policy shocks *vis-à-vis* the small banks with limited opportunities to access markets for resources in a contractionary monetary policy regime. This would imply that bank mergers and other moves towards consolidation in the banking sector, which are likely to lead to creation of bigger banks, have implications for the efficacy of monetary policy.

The study is indicative of the fact that despite the scaling down of the Cash Reserve Ratio and the Bank Rate over the period of financial reforms, a quantitative instrument like the CRR continues to be important along with the price instrument like the Bank Rate. This is primarily so in a medium-term framework, as adopted in the present study. The change in Repo Rate, which has emerged as an important signalling rate in the short-run, is likely to have implications for short-term portfolio choice of banks.

Prudential regulations have an important role to play in influencing lending decisions of banks. In particular, the institution of capital adequacy ratios has made banks more concerned with the risk-return profile of loans, since additional lending warrants additional capital base so as to satisfy the regulatory capital standards.

Chapter 1

AN OVERVIEW

1.1 Introduction

The transmission of monetary policy has been explained in the literature through a variety of models. In these models, monetary policy actions influence real variables through various channels. In a money-in-utility function model, under *flexible prices,* an inflationary increase in money supply influences spending decisions through real balances, while in a cash–in–advance model, the impact is transmitted by raising the cost of the purchases. In a *sluggish wage-price regime*, the IS-LM depicts the impact of monetary policy on real variables. In a closed economy, the key variable in the process of transmission is the interest rate, while in an open economy this role is played by the exchange rate.

In such a framework of the 'money view' of the transmission mechanism, credit markets remain passive. In an aggregative analytical model like IS-LM, it is assumed that bonds and money are the only two assets, with bonds and other financial assets being close substitutes. As Bernanke and Blinder (1988) observe, if besides money and bonds, bank–intermediated loans are taken as the third asset as distinct from publicly-held bonds, banking sector is clearly seen to play an additional and a special role of extending intermediated loans. Bank intermediation is seen to be especially crucial in a situation of asymmetric information and moral hazard, since only banks specialise in monitoring their borrowers. Under situations of asymmetric information, since publicly-issued bonds and bank-intermediated loans are not close substitutes, a large number of borrowing firms would turn out to be bank-dependent. In this scenario, monetary policy has a reason to operate not only through the conventional *money channel*, but also and more importantly through the *bank lending channel*. To the extent monetary policy shocks influence credit supply independent of influencing credit demand, theoretical considerations make it imperative for monetary policymakers to pay attention to the bank lending channel. The extent to which central banks – in the Indian case, the Reserve Bank of India - would do so, will depend on the quantitative and qualitative

aspects of the transmission mechanism and working of the bank lending channel, which will be examined in this study.

1.1.1 Monetary Policy Formulation in India: A Brief Digression

The principles which have shaped the formulation of monetary policy in India in the recent years include concerns about output as well as price fluctuations, financial instability, alignment of fiscal policy with monetary policy, accountability of the central bank and a forward-looking character of monetary policy. The stance of monetary policy emanating from the Reserve Bank of India has been continually evolving in line with the economic situation.

Since 1997, the lessons of the Asian financial crisis and the structural changes in the financial system underway 1991 onwards, provided the impetus for intensifying the process of financial sector reforms in India which focuses on fortifying the organisational efficiency of banks in an environment characterised by greater specialisation, technological change, introduction of universal banking and a growing openness of the economy.

As a result of these on-going reform measures, the monetary policy environment, framework and operating procedures in India have undergone significant changes since the early 1990s, influencing the transmission of monetary policy to the real sector. The objective of the reforms has been to develop an efficient and integrated financial market and to switch over increasingly to the use of indirect instruments of monetary control and, hence, enhance the efficacy of monetary policy transmission. With a series of reform measures in money, government securities and foreign exchange markets, the markets have now grown in size, depth and activity paving the way for flexible use of indirect monetary policy instruments.

The monetary policy framework in India from the mid-1980s till 1997-98, can be defined as a monetary targeting framework on the lines recommended by the Committee on the Working of the Monetary System (Chairman: Prof. S. Chakravarty) in 1985. Because of the reasonable stability of the money demand function, the annual growth in broad money (M3) was used as an intermediate target of monetary policy to achieve

monetary policy objectives. In practice, the monetary targeting approach was used in a flexible manner with a 'feedback' which implied that target ranges had to be modified in the light of information available on expected output performance which might itself be a consequence of several factors.

More recently, the importance of other factors, *inter alia*, credit and interest rates, in the formulation and operation of monetary policy have come to the fore underlining their significance in the monetary policy transmission process. A multiple indicator approach was announced in 1998-99, wherein interest rates or rates of return in different markets (money, capital and government securities markets) along with such data as on currency, credit extended by banks and financial institutions, fiscal position, trade, capital flows, inflation rate, exchange rate, refinancing and transactions in foreign exchange available on high frequency basis are juxtaposed with output data for obtaining policy perspectives. Such a shift has been gradual and a logical outcome of deregulation and liberalisation of the financial markets combined with increasing openness of the economy since the early 'nineties. While the 'exclusive' use of broad money as an intermediate target was de-emphasised, the growth in broad money (M3) continues to be used as an important indicator of monetary policy. Similarly, while inflation is not targeted, monetary policy statements continue to indicate a tolerable level of inflation taking into account the global trends and domestic compulsions.

1.2 Scope and Objective of the Study

Against the backdrop of the arguments in Section 1.1 above, the present study is an attempt to characterise the process of monetary transmission in India and identify the role of bank lending channel in it. The objective of the study is to examine three specific questions related to transmission mechanism of monetary policy in India in the post-liberalisation period. First, how monetary policy "shocks" transmit their influence in a VAR framework, given the simultaneity between monetary policy variables and other economic variables and how effective are the chosen policy instruments? Second, how does bank lending respond to changes in monetary policy? Third, following a given change in monetary

policy, is there any asymmetry in the lending behavior of 'big' and 'small' banks? It needs to be stated at the outset that the main focus of the study is on examining the response of bank lending to changes in monetary policy.

1.3 Data and Econometric Methodology

The analysis pertains to various subsets of the scheduled commercial banks in India as per the requirements of the objective of investigation. The study broadly covers the period 1993-94 to 2002-03. Data used in this study are both published and unpublished. Published data are available in various RBI publications. The unpublished data are the quarterly confidential supervisory data made available by the Offsite Monitoring and Surveillance Division (OSMOS) of RBI.

In terms of methodology, both VAR and structural models continue to be used in the current literature (Walsh, 1998; Mahadeva and Sinclair, 2002). While VAR is suitable to identify policy shocks from the feedback rule, the structural models can be used to examine the overall impact of the policy changes as such. The present study deploys both types of techniques.

In the VAR analysis, aggregative monthly data relating to all scheduled commercial banks are used for the period April 1993 to April 2001. Data on non-monetary variables like Index of Industrial Production (IIP), Trade Balance (TB), WPI, CPI have been taken from the *Handbook of Statistics on Indian Economy*.

The OSMOS data are used for a panel data analysis (for 51 scheduled commercial banks excluding Regional Rural Banks and Foreign Banks) for examining the existence of a bank lending channel for the period March 1997 to June 2002. A loan offer function is specified and the impact of changes in monetary policy is examined.

For analysing the asymmetrical lending behaviour of big and small banks, to changes in monetary policy, a pooled regression analysis is conducted on 26 'big' and 20 'small' banks, for the period 1996-2002, with banks classified on the basis of their total assets.

1.4 Organisation of the Study

The study is organised into seven chapters. The present chapter has dealt with formulation of the problem, the theoretical background, the objectives and methodology of the study. Chapter 2 analyses the issues pertaining to transmission of monetary policy and highlights the factors which have a bearing on it. Chapter 3 reviews the literature on various channels of transmission of monetary policy, both at the theoretical and empirical levels. Transmission of monetary policy shocks is empirically examined in a VAR framework in Chapter 4. Chapter 5 estimates structural equations for bank advances and bank investments on the assets side and funds available to banks on the liability side to investigate the impact of monetary policy changes on these variables. Chapter 6 examines whether there is any asymmetry in the lending behaviour of 'big' and 'small' banks following a given change in monetary policy. The main findings along with the major policy recommendations emanating from the study are presented in Chapter 7.

Chapter 2

TRANSMISSION MECHANISM OF MONETARY POLICY: ISSUES AND PERSPECTIVES

2.1 Introduction

The understanding of the process of transmission of monetary policy is a critical input for its designing and implementation. In a country like India, the economic structure is undergoing crucial transformation through changes in both intersectoral primacy and intersectoral linkages. The processes of economic liberalisation and prudential regulation of the financial sector are under way. The financial sector is changing in terms of its competitiveness, depth and spread. Wide-ranging reforms are globalising the capital market. As a result, macroeconomic environment and financial structure are both changing[1]. Consequently, channels of monetary policy transmission are evolving continuously. These dynamics make the issue of monetary policy transmission all the more intriguing, especially in view of the fact that in the monetary policy literature, the monetary transmission process is described as a "black box" as there is little consensus on how it works[2]. In the present study, the focus is on (a) the transmission of monetary policy impulses, (b) the resultant changes in the portfolios of commercial banks acting as conduits for monetary policy and (c) in particular, on the asymmetry in the loan supply between big and small banks following monetary policy changes.

In this chapter, we first briefly outline the channels of monetary policy transmission (see, for example, Mishkin, 1995), distinguishing between the *conventional* channels of transmission mechanism and the *additional* channels, which are activated in open economies. Subsequently, we focus on the new issues of changing financial structure and macro-economic environment – both as derivatives of financial liberalisation and opening up of the Indian economy in the post-1993 period. As we see, these developments have important implications for the transmission mechanism of monetary policy.

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[1] For a discussion on issues related to financial deregulation in India, see Pandit (1992).

[2] See Bernanke and Gertler (1995).

2.2 Channels of Transmission of Monetary Policy

Monetary policy influences the economy through at least four important channels: the money channel; the credit channel; the asset valuations or balance sheet channel; and the exchange rate channel. One can describe these channels very briefly, there being detailed surveys of literature in this area[3].

(i) Interest Rate Channel

The interest rate channel is described in the literature under the rubric "Money View". Monetary policy induced changes in money supply (M) influence nominal interest rate (i), i.e., the cost of credit, investment (I) and, thereby, the level of GNP (Y).

$$M\downarrow \Rightarrow i \uparrow \Rightarrow I\downarrow \Rightarrow Y\downarrow$$

(ii) Credit Channel (Credit View)

The credit channel is considered under two streams – bank lending channel and the balance sheet channel.

(a) Bank Lending Channel

Bank lending channel emphasises the role of changes in banks' balance sheet items, i.e., in deposits and loans as conduits for monetary policy transmission. Under this channel, credit availability aspect is emphasised.

$$M\downarrow \Rightarrow (\text{Bank Deposits}) \downarrow \Rightarrow (\text{Bank Loans}) \downarrow \Rightarrow I\downarrow \Rightarrow Y\downarrow$$

(b) Balance Sheet Channel

The balance sheet channel emphasises the impact of monetary policy induced changes on the asset prices, value of the borrowers' collateral and actual borrowings with final impact on investment and income.

(Monetary Contraction) $\Rightarrow$ high i $\Rightarrow$ (Low Asset Prices) $\Rightarrow$ (Fall in Collateral Values) $\Rightarrow$ (Low Borrowings) $\Rightarrow$ Low I $\Rightarrow$ Low Y

(iii) Asset Price Channel

Policy-induced interest rate changes affect the level of asset prices – principally those of bonds, equities and real estate – in the economy. Where

[3] See Mishkin (1995), Taylor (1995), Bernanke and Gertler (1995), Walsh (1998).

long-term fixed-interest bond markets are important, higher short-term interest rates may lead to a decline in bond prices. As such markets develop, this channel of transmission may be strengthened.

$$M\downarrow \Rightarrow i \uparrow \Rightarrow \text{Discounted Cash Flow} \downarrow \Rightarrow \text{Tobin q} \downarrow \Rightarrow I\downarrow \Rightarrow Y\downarrow$$

(iv) Exchange Rate Channel

For an open economy, with flexible exchange rates, monetary policy induced changes in money supply or rates of interest can influence the level of income through exchange rate (e) and net exports (NX). This is the exchange rate channel[4]. Alternatively, monetary policy intervention can impact upon capital inflows through changes in interest parity conditions[5]. Given the fact that a managed float system of exchange rates ensures fluctuations within a band, effects of monetary policy need not be through the exchange rate channel only. Inflows and outflows of capital, for instance, respond directly to policy-induced changes in interest rate.

$$M\downarrow \Rightarrow i \uparrow \Rightarrow e \uparrow \Rightarrow NX \downarrow \Rightarrow Y\downarrow$$

(v) Capital Flow Channel

$$\Delta M \Rightarrow \Delta i \Rightarrow \Delta \text{ (Interest Rate Differential)} \Rightarrow \Delta \text{ (Capital Flows)} \Rightarrow \Delta I \Rightarrow \Delta Y$$

2.3 Factors Influencing the Transmission Mechanism

The way monetary policy transmits its influence through the channels mentioned earlier is itself shaped by several factors. The first is the context, in other words the objective, which motivates the central bank to formulate its policy package. About the objectives of monetary policy, in general, there is a near consensus that for advanced countries, price stability ought to be the primary objective. It is also agreed that monetary policy cannot steer an economy along the path of long-term growth[6]. In the short run, the mainstream view is that monetary policy has a definite role in influencing stability and growth of an economy.

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[4] Obstfeld and Rogoff (1995,1996) use an intertemporal general equilibrium framework in expounding an analytical model in which choice of the exchange rate regime has significant implications for monetary policy.

[5] McCallum (1994), among others, has empirically tested the interest parity conditions and found plausible support for covered interest parity.

[6] Examining data for 110 countries for 30 years, McCandless and Weber (1995) conclude that in the long run while the correlation coefficient between inflation and money growth is nearly one, there is no long run correlation between money growth and growth rate of output.

For the developing countries, the stylised facts in this respect are different and monetary policy is viewed as playing an important role.

(a) In the first place, in developing countries, output is usually concentrated in a smaller range of goods and services and financial markets are not very deep. This makes diversification of risk very difficult. In order to counter the destabilising shocks, countervailing monetary policy would be all the more important in developing countries.

(b) Given the underdeveloped state of financial and non-financial markets, the operation of market forces in some spheres of economic activity may be weak, non-optimal or even non-existent. This leads to the case for policy-directed lending or priority sector lending as an important adjunct of long-term monetary policy.

(c) For a large number of enterprises in the underdeveloped countries, availability of bank credit is a constraint. This makes the credit availability channel all the more important.

(d) On account of indexation of wage contracts and other structural rigidities in both labour and goods markets, control of inflation through a typical contractionary policy may not be easy. The root cause of inflation could be a fiscal distortion like a high fiscal deficit, which can effectively be tackled through a judicious mix of fiscal discipline with a supportive monetary policy.

(e) For some developing countries, the position on the balance of payments front is generally vulnerable. Maintaining orderly conditions in the balance of payments, through appropriate monetary policy interventions in the foreign exchange market, assumes importance under such circumstances.

Having outlined some of the stylised facts regarding the developing countries, which have a bearing on the relevance of monetary policy therein, the factors which influence the monetary policy transmission and its pace, especially when financial deregulation and other reforms are under way, are as follows:

(1) In the first place, an important aspect of monetary policy operation is the set of instruments deployed by the monetary authority. Using Indian data, it is observed (Table 2.1) that in the post-liberalisation period during the period July 4, 1991 to October 30, 2002, as an instrument of monetary policy, Bank Rate has been changed on 16 occasions and between October 8, 1992 to November 16, 2002, Cash Reserve Ratio (CRR) has been changed on 36 instances. The quantitative instrument CRR has been changed more frequently, possibly because the Bank Rate may not be capable of equilibrating the demand and supply positions in a financial market which is not only imperfectly competitive but whose sub-markets are less than perfectly integrated.

In Table 2.2 given below, one episode of increase in CRR and its impact is examined in detail. It is observed that following a rise in CRR in 1994, the contractionary policy has resulted in a fall in the growth of bank

Table 2.1 Use of Monetary Policy Instruments in India

Bank Rate		Cash Reserve Ratio		Bank Rate		Cash Reserve Ratio	
Rate per cent	Effective Date	Ratio	Effective Date	Rate per cent	Effective Date	Ratio	Effective Date
11	4/7/91	15	8/10/92	9	29-04-1998	10	11/4/98
		14.5	17-04-1993			11	29-08-1998
12	9/10/91	14	15-05-1993			10.5	13-03-1999
		14.5	11/6/94			10	8/5/99
		14.75	9/7/94	8	2/3/99	9.5	6/11/99
		15	6/8/94			9	20-11-1999
11	16-04-1997	14.5	11/11/95	7	2/4/00	8.5	8/4/00
		14	9/12/95			8	22-04-2000
10	26-06-1997	13.5	27-04-1996	8	22-07-2000	8.25	29-07-2000
		13	11/5/96			8.5	12/8/00
9	22-10-1997	12	6/7/96	7.5	17-02-2001	8.25	24-02-2001
		11.5	26-10-1996			8	10/3/01
		11	9/11/96	7	2/3/01	7.5	19-05-2001
		10.5	4/1/97	6.5	23-10-2001	5.75	3/11/01
11	17-01-1998	10	18-01-1997	6.25	30.10.2002	5.5	29-12-2001
		9.75	25-10-1997			5	01.06.2002
10.5	19-03-1998	9.5	22-11-1997			4.75	16.11.2002
		10	6/12/97	6.00	29.4.2003		
10	3/4/98	10.5	17-01-1998				
		10.25	28-03-1998				

Source: Handbook of Statistics on Indian Economy.

credit and an increase in bank borrowing from RBI. When CRR increased from 14 per cent to 14.5 per cent, there was an increase in Call Money Rate. However, thereafter, some deviations were observed from this normal response but finally as CRR settled at a high rate of 15 per cent from the original 14 per cent, Call Money Rate continued to rise. The impact of the contractionary policy on bank investments is not very clear. The fact that bank borrowings from RBI had increased indicates that banks could have used these to meet their portfolio commitments.

Table 2.2 Impact of Contractionary Policy – Evidence from Monthly Data

(Amount in Rs. crore)

Year	CRR	Bank Credit (BC)	Growth Rate of BC	Monthly Average Call Money Rate	Investments by Banks in Government and Other Approved Securities	Bank Borrowings from RBI
1994						
April	14	1,66,892	1.50	4.90	1,42,119	48,205
May	14	1,65,928	-0.57	5.84	1,43,863	46,490
June	14.5	1,64,714	-0.73	6.7	1,45,423	48,148
July	14.75	1,67,681	1.80	5.98	1,45,333	49,369
August	15	1,66,910	-0.45	5.75	1,46,999	55,026
September	15	1,77,808	6.53	15.27	1,47,759	52,778
October	15	1,80,794	1.67	7.89	1,47,979	55,526
November	15	1,83,684	1.59	8.37	1,48,618	54,291
December	15	1,87,965	2.33	9.71	1,52,286	51,263
1995						
January	15	1,94,016	3.22	15.32	1,48,039	53,408
February	15	1,97,100	1.58	13.27	1,48,324	56,792
March	15	2,11,560	7.33	13.74	1,49,253	47,760
April	15	2,08,638	-1.38	10.91	1,50,679	57,097
May	15	2,08,476	-0.08	13.39	1,50,890	53,454
June	15	2,08,688	0.10	14.43	1,51,866	55,555
July	15	2,11,578	1.38	11.28	1,52,175	56,612
August	15	2,12,523	0.45	10.11	1,54,430	56,434
September	15	2,21,789	4.35	12.09	1,56,218	58,010
October	15	2,25,940	1.87	20.70	1,58,037	54,552

Source: Handbook of Statistics on Indian Economy.

(2) The next important aspect of monetary policy transmission that is examined is the extent to which the change in instruments controlled by RBI such as Bank Rate, influences the variables which most directly affect conditions in both financial and non-financial sectors such as call money rate, loan rate, deposit rate and rate of exchange. Table 2.3(A) and 2.3(B) give the correlation matrices for these variables in pre and post-liberalisation periods.

From the correlations derived, it appears that, in the pre-liberalisation period, mainly due to the administered nature of interest rates, Bank Rate and loan/deposit rates were highly correlated. During this period, due to the prevalent capital controls and the controlled

Table 2.3 (A): Pre-Liberalisation Correlation Matrix – 1970 to 1990

	Call Money Rate	**Bank Rate**	**Deposit Rate (1 to 3 yrs)**	**SBI Advance Rate**	**Exchange Rate**
Call Money Rate	1	0.70 (24.72)	0.62 (18.32)	0.51 (12.64)	0.52 (13.05)
Bank Rate		1	0.81 (42.02)	0.92 (111.63)	0.64 (19.59)
Deposit Rate (1 to 3 yrs)			1	0.81 (44.72)	0.80 (40.93)
SBI Advance Rate				1	0.61 (18.02)
Exchange Rate					1

The figures in parentheses are the relevant t-values.

Table 2.3 (B): Post-Liberalisation Correlation Matrix – 1991 to 2001

	Call Money Rate	**Bank Rate**	**Deposit Rate (1 to 3 yrs)**	**SBI Advance Rate**	**Exchange Rate**
Call Money Rate	1	0.186 (1.73)	0.499 (5.98)	0.434 (4.81)	-0.694 (-12.05)
Bank Rate		1	0.791 (19.01)	0.748 (15.31)	-0.515 (-6.30)
Deposit Rate (1 to 3 yrs)			1	0.46 (5.313)	-0.41 (-4.39)
SBI Advance Rate				1	-0.768 (-16.85)
Exchange Rate					1

The figures in parentheses are the relevant t-values.

exchange rates, the relationship between interest rates and the exchange rate is perverse.

During the post-liberalisation period, interest rates were deregulated and there was a regime switch in the exchange rate policy. In this period, while Bank Rate is positively correlated with loan and deposit rate, it is negatively correlated with exchange rate. Due to decontrol of most interest rates, the size of the correlation coefficients between Bank Rate on the one hand and loan and deposit rate on the other have decreased which is as per *a priori* expectations.

(3) An important means by which monetary policy affects economic activity is by altering the liquidity position or the cash flow position of economic agents. This depends not only on the extent of change in the new loan and deposit rates (considered above) but also on how quickly the changes are transmitted. This *per se* depends on the terms to maturity of financial contracts. Term to maturity of a financial investment determines the frequency of rolling over at new policy-altered rates. Larger the term of financial contracts, smaller would be the frequency of rolling over of investments and propagation of monetary shocks. Table 2.4 shows the maturity pattern of bank deposits of selected maturities. It is observed that after 1993, maturity pattern of bank deposits has changed in an important way. Deposits of less than one-year maturity have increased from 26.5 per cent to 43.3 per cent and corresponding deposits of maturity of more than one year have declined. The fall in deposits of higher maturity is in accordance with broadening and deepening of financial markets in recent years. There is a decline in the market-determined interest rates including the deposit rates. There is also an element of uncertainty about the future rate of interest. This explains the change in the maturity pattern of the deposits mentioned above. Since this development has curtailed rolling over period for time deposits, it has important implications for the transmission of the monetary policy.

Table 2.4: Maturity Pattern of Bank Deposits

(per cent)

Term	1993	1998	2001
Upto 1 year	26.5	27.5	43.3
More than 1 year	73.5	72.5	56.7

Source: Statistical Tables Relating to Banks in India.

(4) A positive development resulting from economic reforms, liberalisation and the growth of financial sector in India has been the volume of resources raised through the stock market[7]. Growth of the stock market has a significant impact on the monetary policy transmission process. Between 1993-94 and 1999-2000, annual rate of growth of resources raised through bank deposits was 18 per cent, while rate of growth of resources raised through stock market were annually growing at 38 per cent (Pandit, 2002). Table 2.5 gives data on secondary market transactions in government securities. Increasing width and depth of the financial markets have an important bearing on how policy-controlled rates affect other rates and ultimately the spending decision of the economic agents. Absence of a proper policy frame often gives rise to growth of kerb markets, which are largely immune to policy-controlled changes in interest rates. In recent years, growth of securities markets has given an impetus to greater competitiveness in fund deployment. As a result, the monetary policy impulses can be expected to be more quickly reflected in the stock prices – providing appropriate signals to investors for funds deployment.

(5) Effectiveness of monetary policy transmission is also influenced by the way bank credit is deployed. The Report of the Committee on the Financial System (Chairman: Shri M. Narasimham), in its Report in 1991, drew the attention of policymakers towards a system of pre-emptive

Table 2.5: Secondary Market Transactions in Government Securities

(Rs. crore)

Year	Outright Transactions	Repo Transactions	Total
1995	32,674.02	93,007.15	1,25,681.17
1996	64,617.77	47,983.02	1,12,600.79
1997	1,61,556.70	20,241.88	1,81,798.58
1998	1,60,572.34	31,665.06	1,92,237.40
1999	3,73,859.08	70,460.36	4,44,319.44
2000	4,89,723.85	1,13,785.95	6,03,509.80
2001	11,14,131.26	2,73,269.72	13,87,400.98
2002	13,58,802.33	4,89,031.81	18,47,834.14

Source: Handbook of Statistics on Indian Economy.

[7] Impact of liberalisation on stock market valuation and Tobin q in India is examined by Pandit and Siddarthan (2003).

deployment of credit in which 38 per cent of non-food credit is "allotted" to the priority sector. This "allotment" is continuing at this high level – the corresponding figure was 42.5 per cent for the year 2002-03[8]. So a very high percentage of credit, which is deployed under policy rules, does not respond to either market signals or subsequent monetary policy impulses. This restricts the impact of transmission of monetary policy.

(6) Along with the reform of the domestic financial sector, the Indian economy is opening up. Firms are allowed to raise capital abroad. Controls on foreign capital movements are now by and large dismantled for a large number of categories of firms and individuals. Table 2.6 gives the magnitude of capital flows.

A monetary tightening can induce firms to switch to foreign borrowings. This can limit the incidence of monetary policy. However, since only large firms can borrow abroad, the incidence of monetary policy changes falls on small firms, making the overall final impact somewhat uncertain.

Table 2.6: Capital Flows in India

(Amount in Rs. crore, ratios in per cent)

Year	A. Direct Investment		B. Portfolio Investment		Total (A+B)
	Amount	Ratio to total	Amount	Ratio to total	Amount
1990-91	174	94.05	11	5.95	185
1991-92	316	96.93	10	3.07	326
1992-93	965	56.33	748	43.67	1,713
1993-94	1,838	14.11	11,188	85.89	13,026
1994-95	4,126	25.57	12,007	74.43	16,133
1995-96	7,172	43.83	9,192	56.17	16,364
1996-97	10,015	46.00	11,758	54.00	21,773
1997-98	13,220	66.38	6,696	33.62	19,916
1998-99	10,358	102.54	-257	-2.54	10,101
1999-00	9,338	41.59	13,112	58.41	22,450
2000-01	10,686	45.87	12,609	54.13	23,295
2001-02	18,619	65.89	9,639	34.11	28,258

Source: Handbook of Statistics on Indian Economy.

[8] The figure pertains to public sector banks as on the last reporting Friday of March.

2.4 Concluding Observations

The chapter highlights the factors which would influence the transmission of monetary policy in India. In essence, it serves as a backdrop for an empirical examination of the major issues raised in the study: (a) how monetary policy shocks transmit their influence in a VAR framework (b) does a bank lending channel exist in India; (c) if yes, how does it differ across bank groups; (d) which monetary policy instrument(s) drive the bank lending channel in the medium-term, and (e) is the response of big and small banks different in respect of a given monetary policy shock. These questions, which form the core of the study, are taken up in the subsequent chapters.

Chapter 3

BANK PORTFOLIO CHANGES AND MONETARY POLICY TRANSMISSION: A SELECT REVIEW OF LITERATURE

3.1 Introduction

In recent years, a vast literature has developed on the effectiveness of monetary policy and the channels through which such policy operates. This renewed interest in monetary transmission needs to be viewed within the context of a revival of theories that stress the relevance of the financial system in aggregate economic activity.

In the first decades after the World War II, the role of credit market imperfections in the monetary transmission process was largely ignored in the mainstream literature. This conventional approach is also known as the *money view*. Following, for instance, the standard IS-LM framework, the financial assets are distinguished as money and bonds, of which the latter are supposed to be representative for the entire capital market. Since banks do not play an essential role in this model, it was perceived that there was no need to distinguish bank loans from other bank assets. According to this approach, therefore, monetary policy worked primarily through its impact on the capital market interest rate.

In contrast, another important strand of the recent literature, gathered under the name *credit view*, focuses on financial phenomena that are likely to play a role in the transmission of monetary policy, such as financial intermediation and credit rationing (Bernanke and Blinder, 1988). Starting from the assumptions that the capital market is characterised by imperfections and that bank assets - in particular bank loans and security holdings - are imperfect substitutes, various transmission channels may work in addition to the standard interest rate channel.

3.2 Bank Lending Channel

As discussed earlier in Chapter 2, two important channels of monetary transmission under the credit view include the balance sheet channel and the bank-lending channel (BLC). The bank lending channel is a separate channel that reinforces the operation of the money channel for monetary policy transmission. Its existence is predicated on capital market imperfections, arising, *inter alia* from asymmetric information. To the extent that the bank lending channel operates, monetary policy can influence aggregate demand not only through interest rates as in the traditional money channel, but also through its impact on the supply of bank loans. When monetary policy is tightened, lendable funds tend to contract and the loan supply schedule shifts upwards, which enhances the interest rate-induced effect on aggregate demand.

The relevance of this mechanism follows directly from the fact that banks have a specific function as financial intermediaries, which is in contrast with their role in the "money view". Hence, the focus is on the 'specialness' of the asset side of the banking sector's balance sheet. The BLC centres on the premise that bank loans are of special importance, particularly for bank-dependent small firms in monetary policy transmission (Bernanke, 1993; Kashyap and Stein, 1994, 1997). This special nature of bank loans is attributable to the more realistic presumption that bank loans differ from publicly-issued securities in a meaningful way (i.e., an imperfect substitutability of the two assets). In contrast, the pure money view of the transmission mechanism is characterised by the simple two-asset (money and publicly-issued securities) framework where bank loans are conveniently lumped together with the securities. The BLC presumes that small and medium-sized firms, facing informational frictions in financial markets, rely primarily on bank loans for external finance, because it is not feasible for such borrowers to issue securities in the open market. To assert the existence of a distinctive lending channel of monetary policy transmission, it is important to correctly identify whether a reduction in bank lending following tight monetary policy is largely the consequence of an inward shift in loan supply (i.e., the loan supply effect), rather than just an inward shift in loan demand (i.e., the loan demand effect).

It is important to note that the credit view does not preclude the mechanism underlying the money view, but rather provides a more general approach, allowing for various mechanisms that either enhance the effects of the interest rate channel, or can be considered as an additional channel of monetary policy transmission.

3.3 Studies on the Bank Lending Channel: US Evidence

The bank lending channel has been theoretically analysed by Bernanke and Blinder (1988) in a model that expands the conventional IS-LM framework by taking into account the bank loan market. Loans and bonds are assumed to be imperfect substitutes, both for borrowers and banks. This implies that, along with the bond rate, the bank lending rate is also introduced in the analysis, as it influences loan demand and supply and the demand for output. A key result of the Bernanke-Blinder model is that there is no bank lending channel when (a) loan supply is perfectly elastic with respect to the loan rate, i.e., loans and bonds are perfect substitutes in the bank portfolios, or (b) loan demand is perfectly elastic with respect to the loan rate, or output demand does not respond to changes in the loan rate, both cases implying that borrowers view loan and bond financing as perfect substitutes. When these conditions are satisfied, the demand for and the supply of loans cannot be defined separately from the corresponding demand for and supply of bonds.

The implications of the Bernanke-Blinder (1988) model are not easy to test empirically, and thus, "sharp measurements of the (channel's) potency is a challenging task" (Bernanke and Gertler, 1995, p.42). A number of studies over the last decade have indirectly tested for the existence of the bank lending channel by examining timing relationships either between quantity variables (output, loans, money and other bank or firm balance sheet items) or between price variables (interest rates or interest rate differentials). Following the first route, Bernanke and Blinder (1992) have applied Vector Autoregression (VAR) analysis to US data to examine the impulse response function of bank loans, securities and deposits to a positive innovation in the Federal Funds rate. Their results demonstrated that there is (i) an immediate decline in the volume of securities and deposits and a delayed decline in the volume of bank loans, and (ii) over a

somewhat longer time span, a rebuilding of bank securities holdings and a further decline in loans, essentially matching the decline in deposits. These results were felt to be consistent with the credit channel, but also with the money channel, since loans responded with the same lag as unemployment to the monetary policy shock.

An insight into the distinctive feature of the lending channel may be gained by examining the real effect of a sharp rise in open-market interest rates following a tightening of monetary policy. The key point is that the real effects of higher interest rates may be amplified through the lending channel beyond what would be predicted if policy were transmitted solely through the traditional interest rate (cost of capital) channel. As market interest rates rise subsequently to monetary tightening, investment falls not only due to a higher cost of capital that compels most firms (including larger ones) to cut back on their demand for investment (i.e., *via* the interest rate channel), but also due to a reduction of bank loan supply to the small and medium sized firms in particular (i.e., *via* the lending channel). Thus, the lending channel would reinforce the dampening effect of rising market interest rates on investment by generating a further decline in those small firms' spending on investment, which, in turn, can aggravate the downturn in the real economic activity.

In an attempt to separate the effect of loan demand from loan supply, Kashyap, Stein and Wilcox (KSW, 1993) examined movements in the mix between bank loans and a close substitute (i.e., commercial paper) for bank finance to firms, following changes in monetary policy. According to the authors, the bank lending channel makes the following prediction: a tightening of monetary policy would cause the supply of bank loans to decline by more than the supply of commercial paper, whereas the composition of firms' external finance would not be affected if monetary policy operated solely through the money channel. KSW found evidence that tight monetary policy leads to an increase in commercial paper issuance, while bank loans slowly decline. Oliner and Rudebusch (1995, 1996) questioned the usefulness of changes in the aggregate financing mix as an indicator of the operation of the bank lending channel. Instead, they proposed an alternative explanation: monetary tightening does not

only reduce the demand for all types of external finance, but it also redirects all types of credit from small firms to large firms, which rely more heavily on commercial paper financing. In this case, commercial paper issuance may rise relative to bank loans even when the supply of bank loans remains unchanged. Thus, heterogeneity in loan demand rather than shifts in loan supply would explain a change in the mix between bank and non-bank financing. Using data on US manufacturing sector, Oliner and Rudebusch (1995) found almost no evidence that a monetary shock changes the composition of bank and non-bank debt for either small or large firms, which is not consistent with the existence of the bank lending channel. In response to this observation, KSW (1996) reported that even among large firms, there appears to be substitution away from bank loans to commercial paper after a monetary contraction. Their statistical results, however, are not very robust; when the federal funds rate is used as the monetary policy indicator, they do not support the existence of the bank lending channel as is also the case with Oliner-Rudebusch study. A common limitation of all studies dealing with the issue of the existence of a bank lending channel through the estimation of timing relationships is that they concentrate on relatively short-term responses, which may not be very informative in view of the fact that banks are prevented from adjusting their loan stock quickly after a monetary policy change, due to loan commitments and other contractual agreements (Bernanke and Blinder, 1992, p.919) and that the observed responses may admit alternative interpretations, not necessarily restricted to the shifts in the supply of credit.

The difficulties in distinguishing shifts in loan demand from shifts in loan supply have prompted researchers to focus on panel data to explore some of the cross-sectional implications of the lending view, namely, that responses of banks and firms to changes in monetary policy may differ, depending on their characteristics. In particular, as regards banks, the existing evidence indicates that, due to agency and/or search costs, they may experience increasing costs of non-deposit external finance, which are higher for small banks. Thus, small banks are expected to be affected more by a monetary contraction.

Kishan and Opiela's (2000) paper extended the above analysis to include, along with the asset size, an additional differentiating characteristic - the degree of capitalisation of the bank. The role of bank capital is two-fold. It is an indicator of bank health and, therefore, an indicator of the bank's ability to raise funds from alternative sources during a contractionary policy. Moreover, prudential supervision, and in particular, capital adequacy requirements, may affect the composition of bank asset portfolios, in the sense that well-capitalised banks are less constrained during periods of tight monetary policy, since these banks can isolate, to some extent, their loan portfolios from monetary shocks. Kishan and Opiela (2000), using a model of a representative bank, arrived at the conclusion that the effect of capital on the response of loans to monetary policy changes is positive. Thus, the better capitalised a bank is, the less responsive its loans will be to changes in policy. Their empirical results provide strong evidence that the smallest and least capitalised banks are the most responsive to monetary policy, a finding consistent with loan supply shifts for this category of banks. However, for larger banks, accounting for about 80 per cent of the system's assets, loan responses to monetary policy changes are not statistically significant, suggesting that a bank lending channel may not hold in total.

Most studies based on aggregate data suffer from severe identification problem: the inability to establish whether the decrease in credit that is observed after a monetary contraction is induced by bank supply or driven by a fall in borrowers' demand. In the latter case, the lending channel would not be relevant. In this respect, recent studies based on disaggregated data are much more informative. The advantages of disaggregated data are that the response of credit variables can be analysed in combination with other hypotheses that follow from the theoretical literature underlying the credit view. Information asymmetries, for instance, are presumably more relevant for specific categories of borrowers which suggests that banks may attempt to adjust their loan portfolio following a monetary contraction, substituting high-quality loans for low-quality loans, known as 'flight to quality'. Gertler and Gilchrist (1998) use quarterly panel data of a large number of non-financial firms in the United States, taking into account borrower heterogeneity. It appears from this study

that, following a monetary contraction, the amount of bank credit to small firms is reduced, while large firms initially attract more (mostly short-term) credit as a buffer to compensate for declining cash flows. Yet, although this is consistent with the credit view in the sense that credit is 'special', there is still no general agreement to what extent these findings should be interpreted as self-evident in support of the bank lending channel.

3.4 Bank Lending Channel: Evidence from Other Countries

Following from the seminal work of Bernanke and Blinder (1988), there have been several country case studies examining the existence or otherwise of a bank lending channel. The tests of the lending channel discussed above which are based on bank characteristics are based on US data. Favero *et al* (1999) empirically investigated the existence of a lending channel for Europe also using disaggregated bank data. They tested the same hypotheses as Kashyap and Stein (2000) for four European countries (France, Germany, Italy and Spain), with cross-section data for 1992 and bank reserves as the monetary policy variable. Overall, they found no evidence of a lending channel in these countries. For certain size groups, however, their results were counter-intuitive. For example, they found that small banks in Germany, Italy and France use their excess liquidity to expand loans in the presence of monetary policy tightening, contrary to the prediction of the bank lending hypothesis.

In a study to examine the existence of a bank lending channel for New Zealand for the period 1965-1987, Guender (1998) fails to discern the existence of a bank lending channel. This assessment was based on the observation that changes in various indicators of monetary policy did not affect either the composition or price of bank credit relative to non-bank credit as envisioned by the bank lending view. A study on the existence of the bank lending channel for Germany by Kakes *et al* (1999) suggests that banks respond to a monetary contraction by adjusting their securities holdings, rather than reducing their loan portfolios. The main implication of the result is that a bank lending channel is not an important transmission mechanism. An empirical assessment of the bank lending channel for Poland for the period January 1994 to June 2001 demonstrates the

existence of the bank lending channel (Hurlin and Kierzenkowski, 2001). Loupias *et al* (2002) examine the existence of a bank lending for France comprising 312 banks over the period 1993-2000. Towards this end, they estimate a dynamic, reduced form specification allowing for asymmetries in loan supply across banks, depending on their size, liquidity and capitalisation. The results suggest the existence of a bank lending channel and more for illiquid as compared with liquid banks (liquidity being defined as sum of cash and inter-bank assets). Finally, a study on bank lending channel for 11 EMU countries for the period 1991 to 1999 suggests that undercapitalised banks, irrespective of their size, tend to respond more to change in monetary policy (Altunbas *et al*, 2002).

Majority of the studies have primarily been related to developed countries. Limited studies have been forthcoming in the context of emerging markets. In a study to test the existence of a bank lending channel for Korea, Kim (1999) observed that bank lending played a significant independent role in amplifying the real effects of tightened monetary policy, which was implemented in response to the Asian crisis. The study, however, covered the period 1991-1998, coinciding with the economic crisis, which, in a way, significantly limited the empirical appeal of the model. Using data for the period 1990-2002, Alfaro *et al* (2003) detect the presence of a bank lending channel in Chile, having an independent and significant effect in terms of macroeconomic activity.

3.5 Channels of Monetary Transmission: Evidence from India

In the case of India, the earlier empirical evidence demonstrated that changes in money supply lead to changes both in output and prices, although the price effects of an increase in money supply are stronger than the output effects (Rangarajan and Arif, 1990; Jadhav, 1994). The Working Group on Money Supply (RBI, 1998) found a strong unidirectional causation running from real output to real money. Besides, the output response operating through the interest rate channel turned out to be stronger and more persistent than that of the credit channel. A comparison of monetary impulses transmitted through interest rate effects and through liquidity effects for the period 1961-2000 indicates that the interest rate

channel has emerged as a significant factor in explaining the variation in real activity in the 1990s as compared with its negligible impact in the 1980s. The liquidity effect, although significant, diminished in terms of magnitude. More recent work (RBI, 2003) has examined the transmission mechanism in India using monthly data for the period spanning April 1994 to December 2002 *vis-à-vis* the 1980s (April 1981 to June 1990) using a vector autoregression framework. The results indicate that a positive shock to broad money over time leads to higher output, while a positive shock to the call money rate produces the reverse effect. More importantly, shocks to the call money rate in recent years are found to take almost a year to have the expected negative effect on output, reflecting the monetary policy lags. A positive shock to non-food credit has the expected positive effect on output and the response during the post-1994 period is quicker, supportive of the existence of a narrow credit channel in the Indian context.

3.6 Concluding Observations

Although there has been a significant body of literature emerging on the bank lending channel in the US and for other European countries, relatively limited work on this issue has been forthcoming in the Indian context. The majority of the literature in the Indian context has explored the transmission of monetary policy through the credit and/or the interest rate channel. In a primarily bank-based economy, with imperfections in the financial markets, there are reasons to believe that the bank lending channel could be operative and this becomes a major concern of the present study.

Chapter 4

TRANSMISSION MECHANISM OF MONETARY POLICY IN INDIA: A STRUCTURAL VAR ANALYSIS

4.1 Introduction

In examining the role of the bank lending channel in monetary policy transmission, we propose to focus on two policy instruments – change in Bank Rate and the Cash Reserve Ratio. These two instruments have been chosen in preference to others because their medium term impact on bank lending can be expected to be direct and fairly quick. Since in using economic data, endogeneity and exogeneity of variables is not always clear, to examine the plausibility and effectiveness of these two instruments, we use a VAR framework. In monetary policy transmission in particular, there is bound to be a feedback and in presence of feedback, intervention and transfer function analyses are inappropriate. Only VAR analysis can treat all variables as jointly endogenous (Enders, 1995). In the present chapter we use the structural VAR analysis in which economic theory is used in imposing an economic structure on the VAR model. Towards the end, robustness of the model is examined and model selection criteria are compared.

4.2 VAR Framework

The VAR framework has been adopted in several empirical studies for examining the impact of money and monetary policy on the real economic activity. Pioneered by Sims (1972), this methodology allows placing minimum restrictions on how monetary policy shocks impact the economy. This is a distinct advantage, given the absence of any consensus on the monetary policy transmission mechanism. More importantly, the VAR approach recognises the inevitable simultaneity between the monetary policy variables and other economic variables. Christiano, Eichenbaum and Evans (1999) and Leeper, Sims and Zha (1996) provide excellent surveys of earlier attempts of using VAR[9].

[9] For detailed a write-up see Chapter 1, C.E. Walsh (1998).

The exact identification of monetary policy transmission channels becomes difficult in the presence of uncertainties prevalent in the economic system, both in terms of response of economic agents to monetary policy signals and the proper assessment by the monetary authority of desired policy measures. The matter is particularly complex in developing countries where the transmission mechanism of monetary policy is in a constant process of evolution due to significant ongoing structural transformation of the economy.

Christiano, Eichenbaum and Evans (1994) have acknowledged that an important problem faced by a central bank is establishing the effects of monetary policy actions in the economy. The problem arises as policy actions reflect the policymaker's response to developments in the economy. In India, while designing the monetary policy, the RBI takes into account the 'feedback' from developments from the real sector. To understand how the monetary policy actions transmit through the economy, it is imperative to distinguish between the outcome of central bank's policy action and the variables that the policy reacts to. For this, the component of monetary policy that is not reactive to other variables has to be identified. To accomplish this task, in a VAR framework, response of the economy to exogenous monetary policy shocks is examined.

Under the VAR approach used to examine the transmission mechanism, identifying assumptions are made to estimate the feedback rule of the central bank. The identifying assumptions include a specification of the functional form of the feedback rule, the variables in the rule, and the variables controlled by the central bank, i.e., its policy instruments. In this way, the VAR approach recognises explicitly the simultaneity between monetary policy and other economic variables, as well as the dependence of the economic variables on the economy. It is important to be cautious while specifying the identifying assumptions, as the VAR model would generate misleading results in case any wrong assumption is made.

The focal point of the strategy is the disturbance term in the regression equation of the form:

$$S_t = \omega(\phi_t) + \sigma \varepsilon_{st} \qquad (1)$$

where S_t is the policy instrument; ω is the feedback rule of the monetary authority; φ_t is the information set that the monetary authority looks at when setting S_t, it includes the history of all variables included in the model. σ is a monetary policy shock where ε_{st} is a serially uncorrelated shock normalised to have a unit variance and σ is the standard deviation of the monetary policy shock assumed to be a positive number.

The dynamic response of a variable to a monetary policy shock can be measured by the current and lagged values of the residuals in the equation. This procedure is asymptotically equivalent to VAR:

$$Z_t = A_o + A_1 Z_{t-1} + A_2 Z_{t-2} + ... + A_q Z_{t-q} + u_t \quad (2)$$

In the literature, the standard VAR is identified using the Choleski decomposition. Since the reduced form errors are correlated, Choleski decomposition isolates the underlying structural errors by recursive orthogonalisation, with the innovation in the first equation untransformed, the innovation in the second equation taken as orthogonal to the first and so on. This implies that:

$$U_t = C\varepsilon_t$$

where, C is a lower triangular and ε_t is a covariance matrix. The recursiveness assumption implies that the disturbance term ε_t, in the monetary authority's reaction function, is orthogonal to the elements of their information set, φ_t. This assumption corresponds to the notion that economic variables are determined in block recursive way**.** The Choleski decomposition has been criticised on several grounds. First, it is not a sufficient condition for identification; also, it is silent on the ordering that should be adopted in tracing the impulse response functions. Therefore, this analysis is not capable of identifying the role played by monetary policy rules. Second, since u_t is one period ahead forecast error in Z_t, it doesn't have any structural interpretation. If one is interested only in forecasting, Choleski decomposition is sufficient. On the other hand, if one wants to trace out impulse response and variance decomposition of an innovation in vector Z_t, then it is necessary to use structural shocks, and not forecast errors, u_t.

4.3 Structural VAR Model

Bernanke (1986) and Sims (1986) have proposed alternative ways of looking at the factorisation problem which imposes more of an economic structure. These have been dubbed as 'structural VARs'. In the VAR model:

$$B x_t = \lambda_o + \lambda_1 x_{t-1} + u_t \quad \text{where } E(u_t u_t') = \Sigma_t \text{ and } t = 1, 2, \ldots, N \tag{3}$$

the lag coefficients λ_n are estimated by single equation OLS regardless of any restriction on matrix Σ. Matrix Σ is a symmetric matrix, containing only $(n^2 + n)/2$ distinct elements and there are n^2 unknowns in the structural model. Now in order to exactly identify the structural model it is important to impose $(n^2 - n)/2$ restrictions. Note that a structural VAR can be estimated if it is exactly or over identified.

4.4 Empirical Analysis

The structural VAR has been estimated for the monthly data for all the Indian scheduled commercial banks spanning from April 1993 to April 2002. The data has been sourced from various RBI publications. The vector x_t includes the variables: log (IIP), log (WPI), log (M3), Commercial Paper Rate (CPR) and the policy instrument.

Two policy instruments have been considered in the present analysis. The instruments are Cash Reserve Ratio (CRR) and change in Bank Rate (CH_BR). It may be mentioned here that empirical results with CH_BR were better than with Bank Rate. A positive (negative) shock to CH_BR and CRR correspond to contractionary (expansionary) monetary policy shock.

Once the preferred instrument is chosen, based on impulse responses and variance decomposition, its effects are analysed on a group of open economy variables and other domestic variables. The vector of variables, say D_t, on which the monetary shock is assessed, includes, log of Nominal Effective Exchange Rate (LNEER), log of Net Foreign Institutional Investment Inflows (LNFII)(taken from the capital market data), log of Net Foreign Exchange Reserves (LFXR), log of Bombay Stock Exchange Market

Capitalisation (LBSE), log of new capital issued by non– governmental Public Limited Companies (LPSK) and trade balance[10] (TB).

4.4.1 The Model

$$CRR_t = f_1(LM3_t) \tag{4}$$

$$LM3_t = f_2(LWPI_t, LIIP_t) \tag{5}$$

$$CPR_t = f_3(CRR_t, LWPI_t) \tag{6}$$

$$LWPI_t = f_4(LM3_t, LIIP_t) \tag{7}$$

$$LIIP_t = f_5(LM3_t, CPR_t) \tag{8}$$

In the above model, CRR can be substituted by CH_BR while considering the Bank Rate as a policy instrument. All the variables in the model appear in levels. Fuller (1976, theorem 8.5.1) shows that differencing produces no gain in asymptotic efficiency in an autoregression even if it is appropriate. In a VAR, differencing throws information away because a VAR in differences will not capture the cointegrating relationship and there are no gains in terms of asymptotic efficiency. The model will be solved using structural decomposition techniques. The policy instrument will be chosen on the basis of impulse response functions and variance decompositions. In the innovation analysis, orderings assume importance in case of a standard VAR where Choleski decomposition is the identification scheme. Since ours is a structural VAR, where we impose restrictions according to economic theory, orderings are not important.

4.4.2 Policy Shocks

(a) CRR as Policy Instrument: The model, when estimated with two lags, gives smallest values for AIC and BIC criteria (the values are reported in Table 4.1). From equation (3), Bx_t matrix is:

---

[10] Some variables have been taken in logarithms, as the resultant standard errors from variance decompositions are smaller. The variables in percentages are not in logarithms. Trade Balance is negative for some years and enters without logarithms.

$$\begin{pmatrix} 1 & UC1 & 0 & 0 & 0 \\ 0 & 1 & 0 & UC2 & UC3 \\ UC4 & 0 & 1 & UC5 & 0 \\ 0 & UC6 & 0 & 1 & UC7 \\ 0 & UC8 & UC9 & 0 & 1 \end{pmatrix} \begin{pmatrix} CRR \\ LM3 \\ CPR \\ LWPI \\ LIIP \end{pmatrix}$$

Table 4.1: Lag Length Selection Criterion

Policy Instrument	AIC	BIC
CRR: p=1	-1297.0339	-1369.5991
p=2	-1356.1356	-1488.5052
CH_BR: p=1	-1067.1671	-1139.7324
p=2	-1131.0359	-1263.4055

AIC: Akaike Information Criteria; BIC: Bayesian Information Criteria.

where UCi are the restrictions imposed. The results have been presented in Table 4.2. The Chi-square statistic for over-identification restriction and its significance level in Table 4.2 does not reject the over-identification restriction, implying that this model is consistent with our data set. Figure 4.1 presents the impulse response of variables in the model to one unit shock in CRR. The impulse responses[11] show that this model is a satisfactory description of monetary policy. With an increase in CRR, money supply (LM3) decreases, the market-determined interest rate (CPR) rises and increases for 5 months before the onset of a decline in its growth rate.

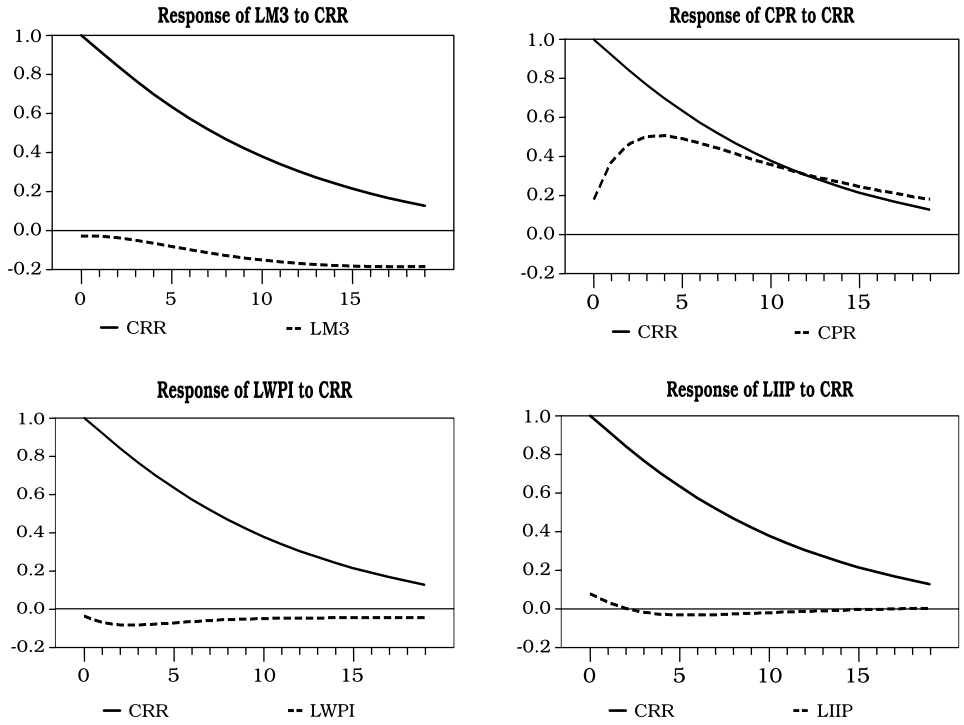
Table 4.2: Structural VAR - CRR as Policy Shock

CRR	LM3	CPR	LWPI	LIIP
1	1.53(0.12)	0	0	0
0	1	0	-8.5 (0.00)	-0.44(0.66)
-0.32 (0.74)	0	1	-0.69 (0.49)	0
0	-221(0.00)	0	1	-166 (0.00)
0	689 (0.00)	-0.52 (0.00)	0	1
Test for Over-Identification: Chi Square 0.02 (0.87)				

Figures in parentheses are p-values.

[11] It has not been possible for us to supplement the impulse response analysis for Structural VAR by the construction of confidence intervals.

Figure 4.1 Impulse Response to CRR Policy Shock



With a rise in CRR, the price variable initially increases in the first month but starts declining after the second month forming a hump shaped figure. As a result of increasing CRR and market interest rate, output (LIIP) declines.

(b) CH_BR as Policy Instrument: In this case, the model with two lags gives smallest values for AIC and BIC criteria. The model estimated is given by:

$$\begin{pmatrix} 1 & UC1 & 0 & 0 & 0 \\ 0 & 1 & 0 & UC2 & UC3 \\ UC4 & 0 & 1 & UC5 & 0 \\ 0 & UC6 & 0 & 1 & UC7 \\ 0 & UC8 & UC9 & 0 & 1 \end{pmatrix} \begin{pmatrix} CH\_BR \\ LM3 \\ CPR \\ LWPI \\ LIIP \end{pmatrix}$$

The Chi-square statistic (in Table 4.3) does not reject the hypothesis for over-identification, implying that our model is appropriate for the data. Figure 4.2 gives the impulse response of the variables in the model to one unit shock in CH_BR. With an increase in CH_BR, i.e., a contractionary

Table 4.3: Structural VAR - Change in Bank Rate as Policy Shock

CH_BR	LM3	CPR	LWPI	LIIP
1	65.1 (0.00)	0	0	0
0	1	0	-7.5 (0.00)	-0.3 (0.75)
-0.05 (0.99)	0	1	-7.01 (0.00)	0
0	16.2 (0.00)	0	1	2.63 (0.00)
0	3.6 (0.00)	-0.001 (0.99)	0	1
Test for Over-Identification Restrictions: Chi Square 0.29 (0.60)				

Figure in parentheses are p-values.

policy, the money supply decreases and the price variable, after registering an initial drop, increases till the tenth month. There is inconsistency in the behaviour of output and market-determined interest rate.

One can select a policy instrument on the basis of the impulse responses as well as the variance decomposition. As between CRR and CH_BR as alternative policy instruments, there is not much difference in the variance decomposition presented in Table 4.4, but the impulse response functions give plausible relationships among variables in case CRR is taken as the policy instrument.

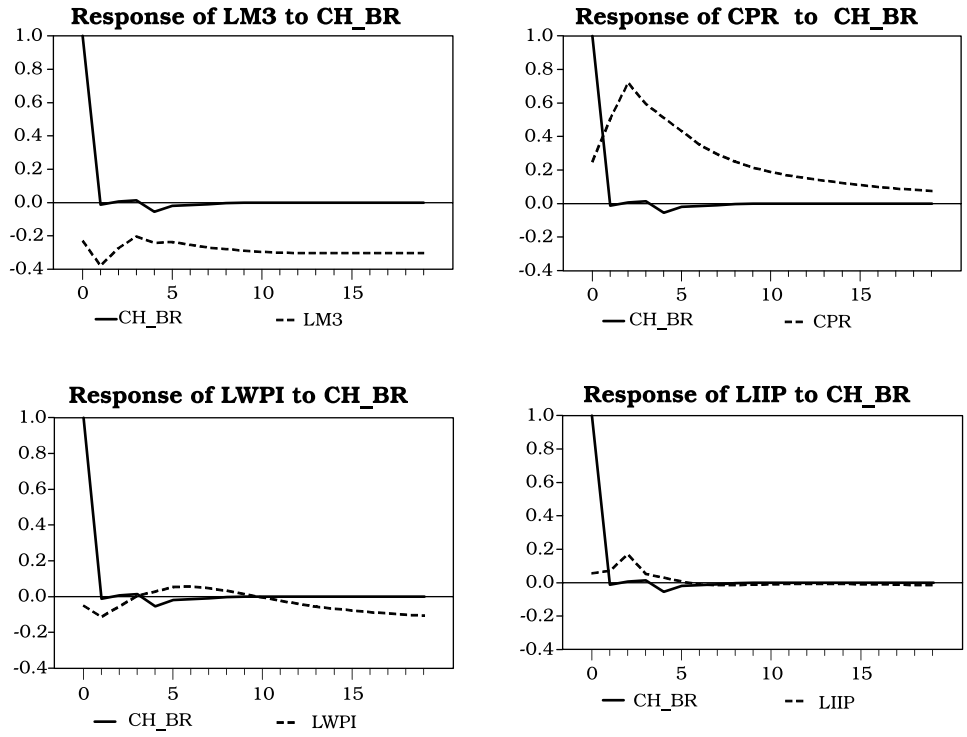
4.5 Comparing the Effects of Alternative Policy Instruments on Individual Parameters

We can now analyse the effects of the chosen policy instruments CRR and CH_BR on the vector of variables on which the policy shock is assessed.

Nominal Effective Exchange Rate (LNEER): With a rise in CRR (i.e., a contractionary policy shock), LNEER appreciates, reaching the lowest level in first six months. When the policy instrument is CH_BR, the LNEER depreciates initially for four months before it starts appreciating. The inferences are plausible only in the instance when CRR is used as the policy instrument.

Net Foreign Institutional Investment Inflows (LNFII): With a contractionary policy shock, as the foreign currency becomes cheaper, the FII are presented with an arbitrage opportunity to buy cheaper foreign

Figure 4.2 Impulse Response to CH_BR Policy Shock



currency in exchange of rupee, which results in a sharp rise in LNFII inflows. When CRR is the policy instrument, the foreign institutional investments rise to reach its peak in the fourth month to decline for a month before it recovers. With CH_BR as the instrument, a contraction leads to similar movements as noticed in the case of CRR.

Foreign Exchange Reserves (LFXR): A negative monetary shock would lead to a decrease in money supply and an appreciation implying an accumulation of foreign exchange reserves of a country. The results obtained with CRR conform to this expectation, as LFXR rises for first five months before declining, while the result associated with CH_BR is contradictory.

Trade Balance (TB): A contraction which leads to appreciation of exchange rate would worsen the trade balance. The change in trade balance would be positive after a contraction if the imports exceed exports. India had a negative trade balance in most of the months under scrutiny. Therefore, it is expected that a contraction would improve the trade balance

Table 4.4 (A): Variance Decomposition: CRR Policy Instrument

	Std Error	**CRR**	**LM3**	**CPR**	**LWPI**	**LIIP**
Decomposition of Variance for Series CRR						
1	0.277962	99.524	0.000	0.000	0.475	0.001
2	0.386875	98.612	0.009	0.782	0.369	0.228
3	0.466977	96.692	0.031	2.233	0.279	0.765
4	0.531871	94.124	0.072	4.042	0.216	1.546
5	0.586651	91.224	0.134	5.989	0.179	2.475
Decomposition of Variance for Series LM3						
1	0.009449	0.000	99.784	0.009	0.045	0.162
2	0.012991	0.001	94.327	0.199	0.061	5.413
3	0.015801	0.001	88.178	0.451	0.139	11.231
4	0.018253	0.009	82.934	0.714	0.223	16.121
5	0.020462	0.029	78.735	0.973	0.294	19.969
Decomposition of Variance for Series CPR						
1	0.845299	0.735	0.666	98.484	0.049	0.066
2	1.136272	3.215	0.698	90.753	0.860	4.474
3	1.328223	6.205	0.814	82.885	1.725	8.371
4	1.457998	9.438	0.984	76.741	2.301	10.535
5	1.546939	12.783	1.176	71.991	2.621	11.428
Decomposition of Variance for Series LWPI						
1	0.005309	0.003	9.737	0.466	81.862	7.932
2	0.006904	0.045	11.642	0.341	81.915	6.058
3	0.007871	0.094	13.425	0.787	80.975	4.718
4	0.008563	0.137	15.051	1.645	79.032	4.135
5	0.009120	0.166	16.507	2.737	76.281	4.308
Decomposition of Variance for Series LIIP						
1	0.040116	0.036	0.012	4.877	12.006	83.069
2	0.045597	0.063	0.272	5.982	11.440	82.243
3	0.047450	0.148	0.666	6.940	10.984	81.261
4	0.048350	0.240	1.084	7.742	10.645	80.288
5	0.048925	0.314	1.468	8.408	10.399	79.411

Table 4.4 (B): Variance Decompositions: CH_BR Policy Instrument

	Std Error	**CH_BR**	**LM3**	**CPR**	**LWPI**	**LIIP**
Decomposition of Variance for Series CH_BR						
1	4.080994	97.734	0.000	0.020	1.718	0.527
2	4.090698	97.278	0.002	0.031	1.968	0.721
3	4.093938	97.127	0.002	0.038	2.057	0.776
4	4.095007	97.079	0.003	0.042	2.085	0.792
5	4.095412	97.060	0.004	0.045	2.094	0.797
Decomposition of Variance for Series LM3						
1	0.009285	75.788	0.015	0.893	0.047	23.257
2	0.013034	60.932	0.092	1.234	1.294	36.447
3	0.015964	50.042	0.228	1.500	1.547	46.683
4	0.018511	42.352	0.353	1.698	1.580	54.017
5	0.020799	36.897	0.450	1.848	1.557	59.248
Decomposition of Variance for Series CPR						
1	0.893975	5.029	0.151	94.761	0.016	0.042
2	1.248788	11.733	0.113	84.974	2.622	0.558
3	1.475056	13.631	0.117	80.265	4.851	1.136
4	1.630974	14.421	0.147	77.350	6.548	1.534
5	1.741422	14.829	0.197	75.422	7.795	1.758
Decomposition of Variance for Series LWPI						
1	0.005310	0.002	15.751	0.035	83.305	0.908
2	0.006916	0.283	15.927	0.240	82.931	0.619
3	0.007882	0.293	15.710	0.826	81.813	1.357
4	0.008571	0.263	15.365	1.679	79.728	2.965
5	0.009119	0.234	14.955	2.680	76.888	5.244
Decomposition of Variance for Series LIIP						
1	0.040269	0.091	0.000	1.711	44.560	53.638
2	0.046212	0.426	0.217	2.070	44.479	52.808
3	0.048063	0.547	0.604	2.419	44.516	51.915
4	0.048814	0.610	1.029	2.739	44.491	51.131
5	0.049222	0.648	1.416	3.028	44.423	50.485

by reducing the cost of imports. The results confirm the expectation both for CRR and CH_BR.

BSE Market Capitalisation (LBSE): Generally a contractionary policy would increase the debt burden and make credit more expensive for the firms listed at the stock exchange. Therefore, a contraction is associated with a negative movement regarding the market capitalisation for these firms. However, impulse response functions show that with a contractionary policy, the market capitalisation is increasing.

New Capital Issued by Non-governmental Public Limited Companies (LPSK): As the interest rates increase with the pursuit of a tight policy, it becomes difficult for firms to raise funds in the stock markets. The issue of new capital is expected to decline with a contraction. Increase in CH_BR leads to a sharp decline, which lasts for two month after which, LPSK starts increasing. The effect of a rise in CRR on LPSK is contradictory.

Figure 4.3

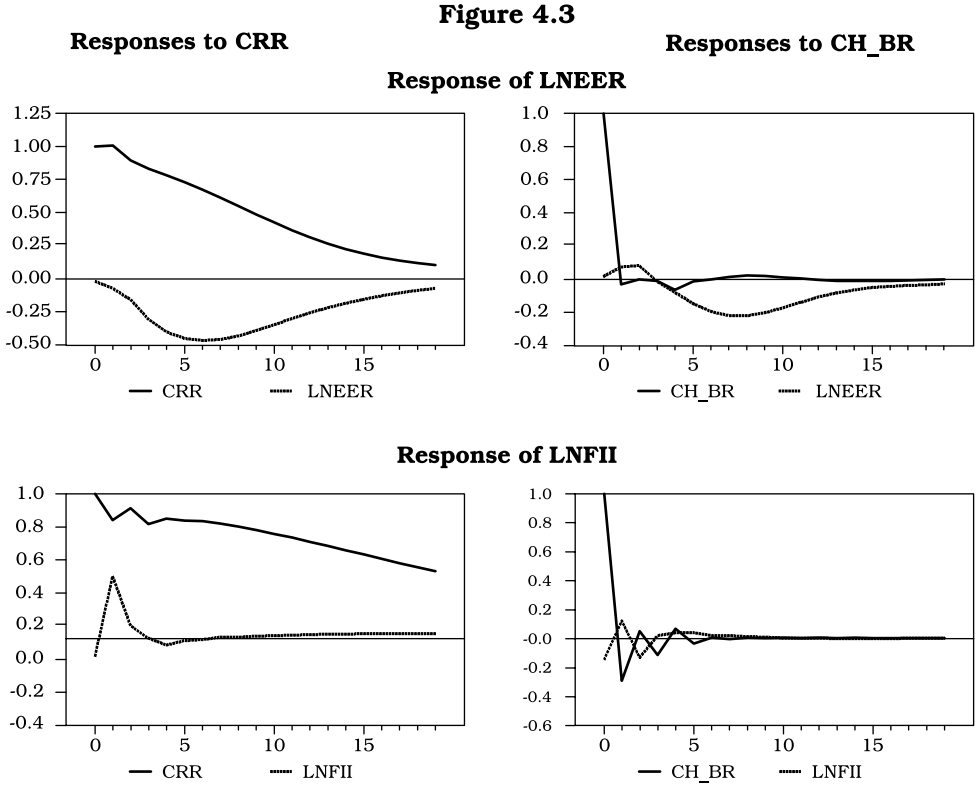


Figure 4.3 *(Contd...)*

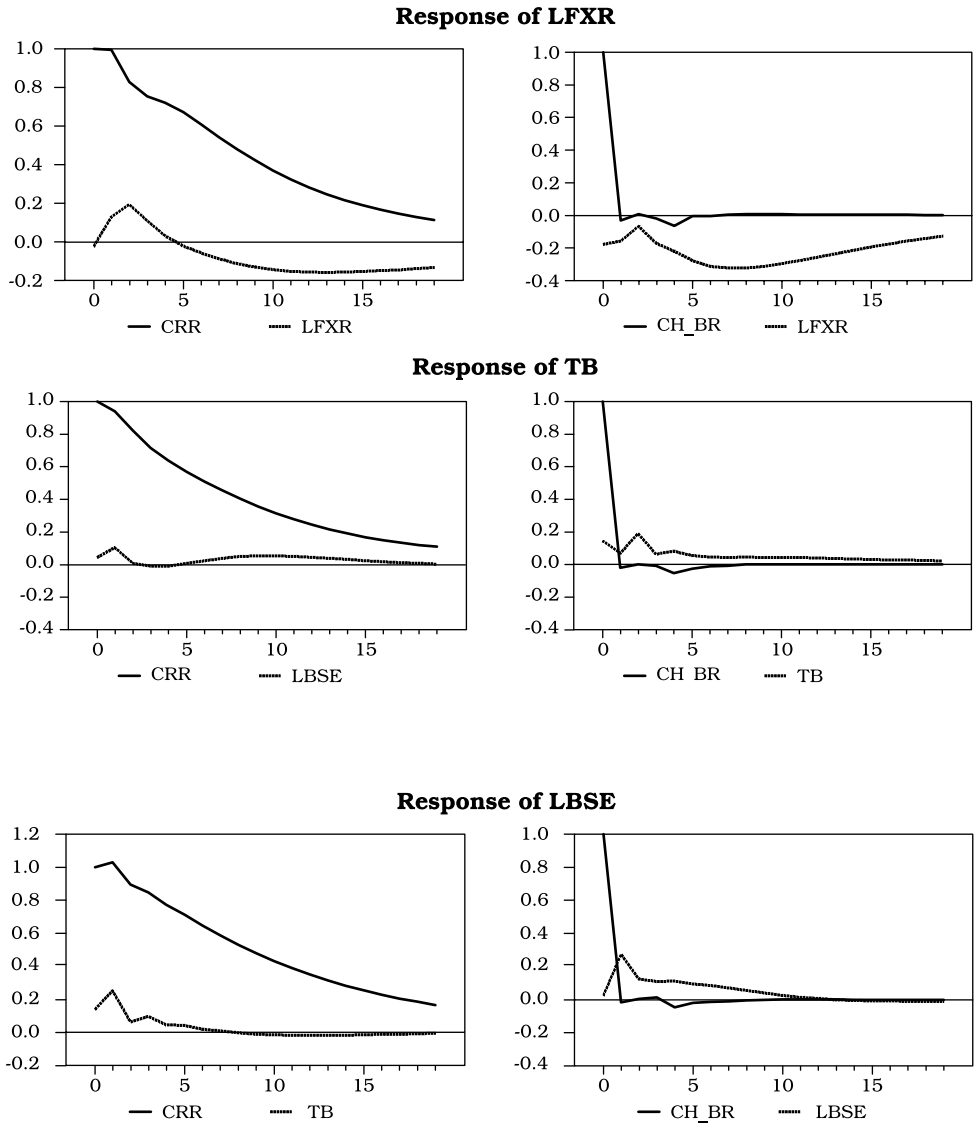
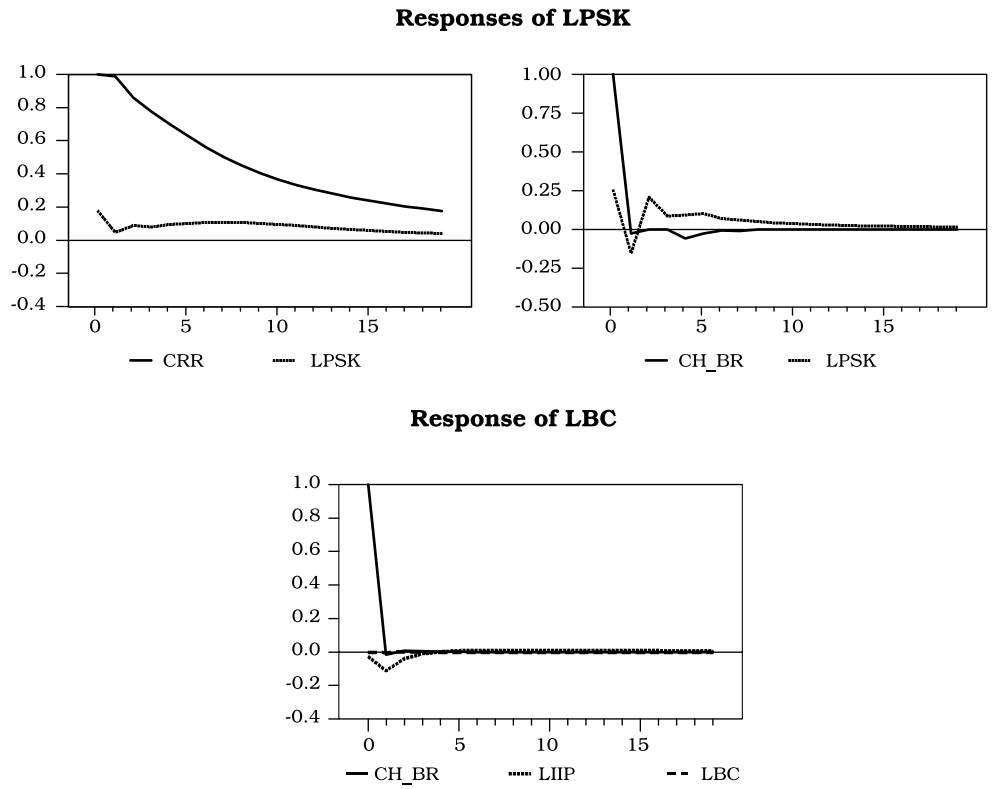


Figure 4.3 *(Concld.)*



Bank Credit (LBC): The role of banking sector in transmission mechanism can be analysed by studying the response of the economic activity to contemporaneous shocks to BC. Considering CRR as the policy instrument, a fall in CRR is accompanied by a rise in bank credit. There is a shift upwards in the economic activity parameter immediately. This can be seen in figure 4.3 that when LBC is rising along with a fall in CRR, economic activity picks up immediately with a rise in LIIP. On the other hand, in case of CH_BR as policy instrument, a positive shock fails to create any substantial response from LBC leading to an initial fall in the economic activity which returns to its normal path within four months.

4.6 Structural VAR Model – Sensitivity and Robustness

Alternative specifications of the structural VAR were estimated to arrive at the best model discussed above in this Chapter. In these

specifications, we examined the sensitivity of the chosen model to the following changes (a) using CPI in place of WPI; (b) using M1 in place of M3 and, (c) using Call Money Rate in place of CPR. In all these alternative specifications, the two model selection criteria choose the initial model over these alternative models when we compare tests of the AIC and the BIC criterion.

From the alternative specifications, it was observed that the inferences from the impulse response functions did not change qualitatively as we moved from one model to another. Hence, we can conclude that our chosen model is robust to changes in various proxies and at the same time it is the best model according to the model selection criteria. The diagnostics along with the relevant graphs are presented below.

I. CPI in place of WPI

CRR as instrument

Lag length test

Lags	AIC	BIC
1	-1023.8953	-1096.4605
2	-1094.8403	-1227.2099

Test for Over-Identification 0.52 (0.47)

This model is identified but LCPI is insignificant in both the equations (Figure 4.4 and Table 4.5).

Figure 4.4: Impulse response functions

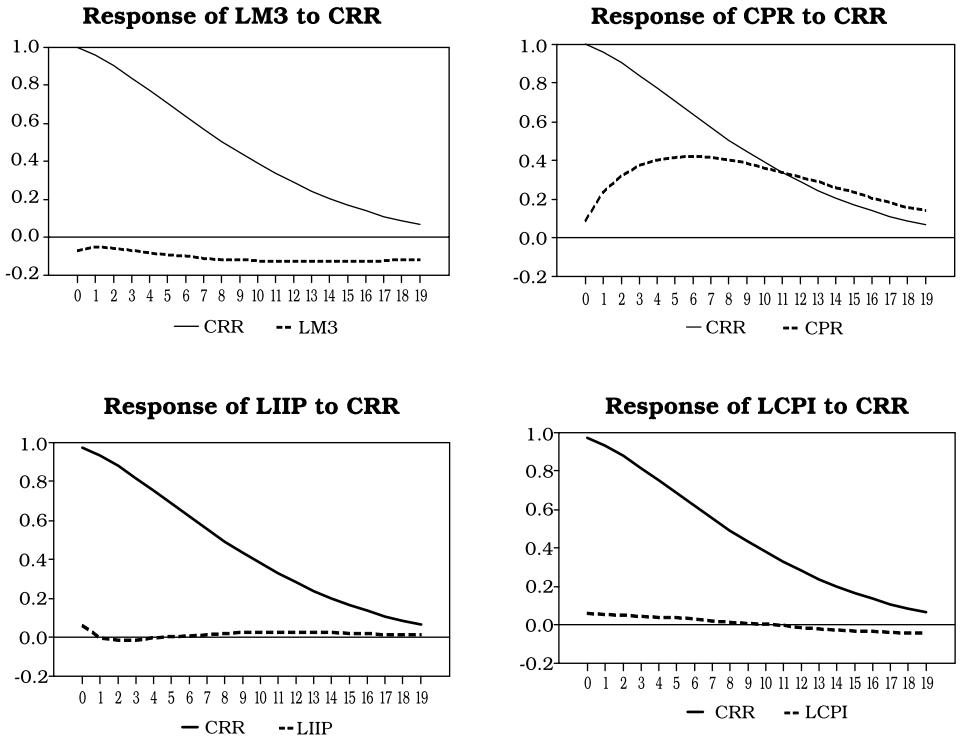


Table 4.5: Variance Decomposition with CRR as instrument

Entry	Std. Error	CRR	LM3	CPR	LCPI	LIIP
Decomposition of Variance for Series CRR						
1	0.277142	99.428	0.552	0.001	0.012	0.008
2	0.385828	98.704	0.456	0.727	0.057	0.056
3	0.465110	97.185	0.361	2.046	0.237	0.171
4	0.528470	95.149	0.288	3.665	0.575	0.322
5	0.581075	92.827	0.238	5.376	1.085	0.474
Decomposition of Variance for Series LM3						
1	0.009499	0.001	96.444	0.100	2.113	1.342
2	0.012996	0.007	89.329	0.282	2.270	8.111
3	0.015634	0.005	84.299	0.460	2.089	13.147
4	0.017800	0.013	81.167	0.628	1.803	16.389
5	0.019651	0.038	79.219	0.787	1.522	18.433
Decomposition of Variance for Series CPR						
1	0.845267	0.608	0.021	98.123	1.166	0.082
2	1.137870	2.948	1.127	90.879	1.269	3.777
3	1.321878	5.825	2.039	84.343	1.630	6.164
4	1.441738	9.067	2.572	79.158	2.159	7.045
5	1.523644	12.537	2.837	74.753	2.760	7.113
Decomposition of Variance for Series LCPI						
1	0.009321	0.003	3.274	0.455	90.149	6.119
2	0.013127	0.005	4.340	0.656	86.945	8.055
3	0.015876	0.005	5.199	0.847	84.802	9.147
4	0.018021	0.004	5.950	1.028	83.261	9.758
5	0.019758	0.004	6.643	1.193	82.069	10.090
Decomposition of Variance for Series LIIP						
1	0.037402	0.035	17.387	5.654	0.804	76.120
2	0.040625	0.134	16.795	7.171	3.574	72.326
3	0.041921	0.275	16.026	8.004	7.140	68.556
4	0.042956	0.364	15.283	8.339	10.721	65.294
5	0.043901	0.399	14.633	8.381	14.006	62.581

CH_BR as policy instrument

Lag length Test

Lag	AIC	BIC
1	-1252.7099	-1325.2751
2	-1319.5475	-1451.9171

Test for Over-Identification: 4.51(0.03)

This model is not identified, so we would not consider the inferences from impulse response functions.

II. M1 in place of M3

CRR as policy instrument

Lag length test

Lag	AIC	BIC
1	-1209.6911	-1282.2563
2	-1269.7393	-1402.1089

Test for Over-Identification 0.15 (0.73).

This model is identified, but LM3 is insignificant in both the equations (Figure 4.5 and Table 4.6).

Figure 4.5: Impulse Response Functions

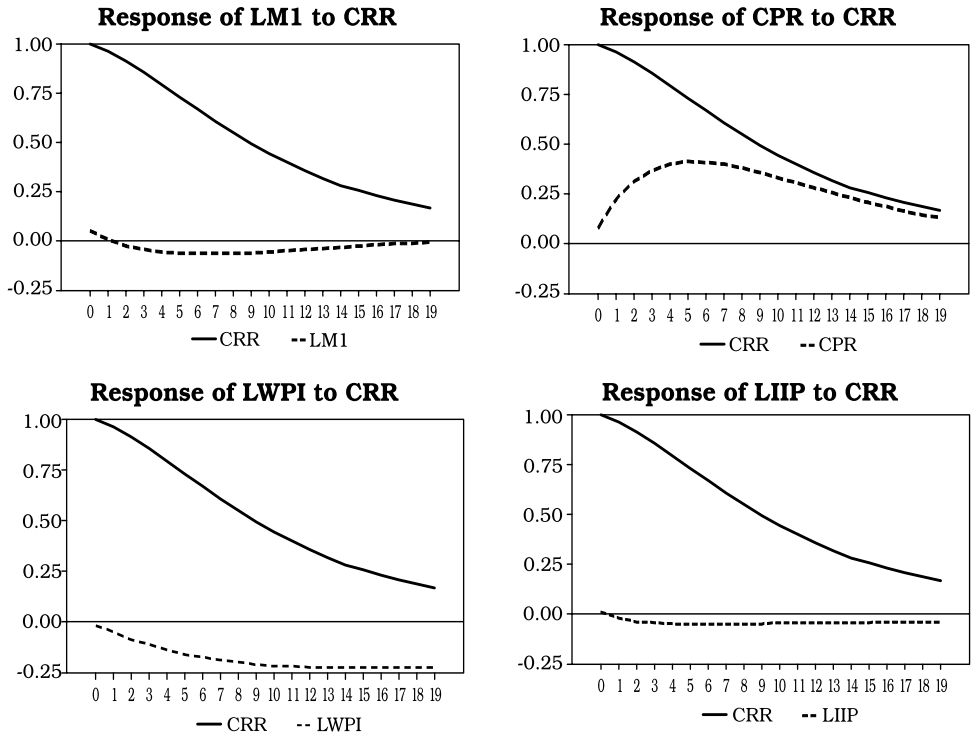


Table 4.6: Variance Decomposition with CRR as instrument

Entry	Std Error	CRR	LM1	CPR	LWPI	LIIP
Decomposition of Variance for Series CRR						
1	0.277330	99.861	0.071	0.004	0.000	0.064
2	0.387020	98.747	0.489	0.692	0.009	0.063
3	0.468203	96.597	1.112	2.021	0.038	0.232
4	0.534030	93.879	1.815	3.666	0.095	0.546
5	0.589356	90.940	2.504	5.414	0.186	0.956
Decomposition of Variance for Series LM1						
1	0.910105	0.019	50.779	3.088	0.008	46.105
2	1.254658	0.052	55.506	3.615	0.005	40.821
3	1.501225	0.151	57.773	4.226	0.006	37.844
4	1.695004	0.275	58.650	4.884	0.017	36.174
5	1.854331	0.401	58.746	5.558	0.041	35.255
Decomposition of Variance for Series CPR						
1	0.847080	0.623	0.033	98.831	0.479	0.036
2	1.139675	3.063	1.202	91.548	0.392	3.795
3	1.331388	6.177	1.824	84.059	0.389	7.552
4	1.461860	9.615	1.842	77.987	0.437	10.119
5	1.553695	13.144	1.657	73.044	0.512	11.643
Decomposition of Variance for Series LWPI						
1	0.005590	0.003	4.643	0.530	86.905	7.918
2	0.007583	0.090	3.246	0.321	90.395	5.947
3	0.009018	0.267	2.426	0.235	92.387	4.685
4	0.010186	0.521	1.918	0.250	93.484	3.827
5	0.011194	0.829	1.588	0.350	94.018	3.215
Decomposition of Variance for Series LIIP						
1	0.039544	0.029	27.053	4.576	0.029	68.313
2	0.044637	0.052	24.081	5.526	0.512	69.830
3	0.046476	0.147	22.310	6.321	1.294	69.928
4	0.047587	0.283	21.360	6.975	2.197	69.185
5	0.048491	0.433	20.853	7.530	3.107	68.077

CH_BR as policy instrument

Lag length test

Lags	AIC	BIC
1	-973.0742	-1045.6395
2	-1036.4049	-1168.7745

Test for Over-Identification: 0.32 (0.57)

The model is identified but the coefficients of LM1 are insignificant in all the equations. We would prefer the initial model on the basis of AIC and BIC criterion (Figure 4.6 and Table 4.7).

Figure 4.6: Impulse Response Functions

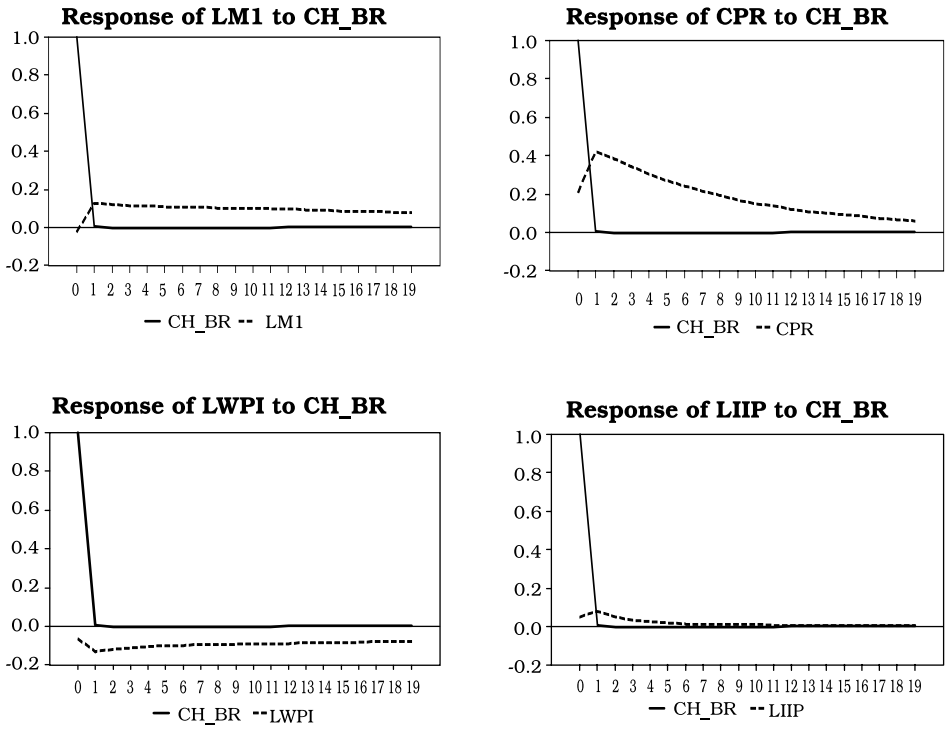


Table 4.7: Variance Decomposition with CH_BR as instrument

Entry	Std Error	CH_BR	LM1	CPR	LWPI	LIIP
Decomposition of Variance for Series CH_BR						
1	4.079529	99.823	0.111	0.002	0.000	0.064
2	4.088152	99.407	0.135	0.016	0.004	0.439
3	4.091256	99.262	0.135	0.023	0.004	0.575
4	4.092765	99.194	0.142	0.028	0.004	0.632
5	4.093816	99.146	0.158	0.032	0.004	0.660
Decomposition of Variance for Series LM1						
1	0.906984	0.042	62.893	0.872	0.000	36.193
2	1.259104	1.447	65.623	0.900	0.001	32.029
3	1.510288	1.940	67.813	0.940	0.001	29.306
4	1.707116	2.201	69.309	0.990	0.001	27.499
5	1.868067	2.374	70.312	1.046	0.003	26.265
Decomposition of Variance for Series CPR						
1	0.898584	4.626	0.000	95.267	0.087	0.020
2	1.261444	11.199	0.522	86.640	0.060	1.579
3	1.496938	13.161	0.863	82.591	0.103	3.282
4	1.662591	14.041	1.013	80.072	0.167	4.708
5	1.782926	14.532	1.040	78.357	0.238	5.833
Decomposition of Variance for Series LWPI						
1	0.005606	0.009	3.691	0.185	88.427	7.688
2	0.007634	0.345	2.548	0.139	91.871	5.097
3	0.009118	0.431	1.906	0.109	93.870	3.685
4	0.010344	0.456	1.521	0.089	95.066	2.868
5	0.011411	0.463	1.272	0.075	95.831	2.359
Decomposition of Variance for Series LIIP						
1	0.039625	0.095	16.790	1.956	0.003	81.156
2	0.045103	0.555	14.368	2.188	0.480	82.409
3	0.047003	0.741	13.231	2.347	1.373	82.307
4	0.048085	0.838	13.008	2.444	2.478	81.232
5	0.048946	0.896	13.285	2.497	3.637	79.685

III. Call Money Rate in place of CPR

CRR as policy instrument

Lag length test

Lags	AIC	BIC
1	-1164.2814	-1236.8466
2	-1221.1964	-1353.5659

Test for Over-Identification: 0.416 (0.52)

The model is identified but AIC and BIC criteria choose initial model over this one (Figure 4.7 and Table 4.8).

Figure 4.7: Impulse Response functions

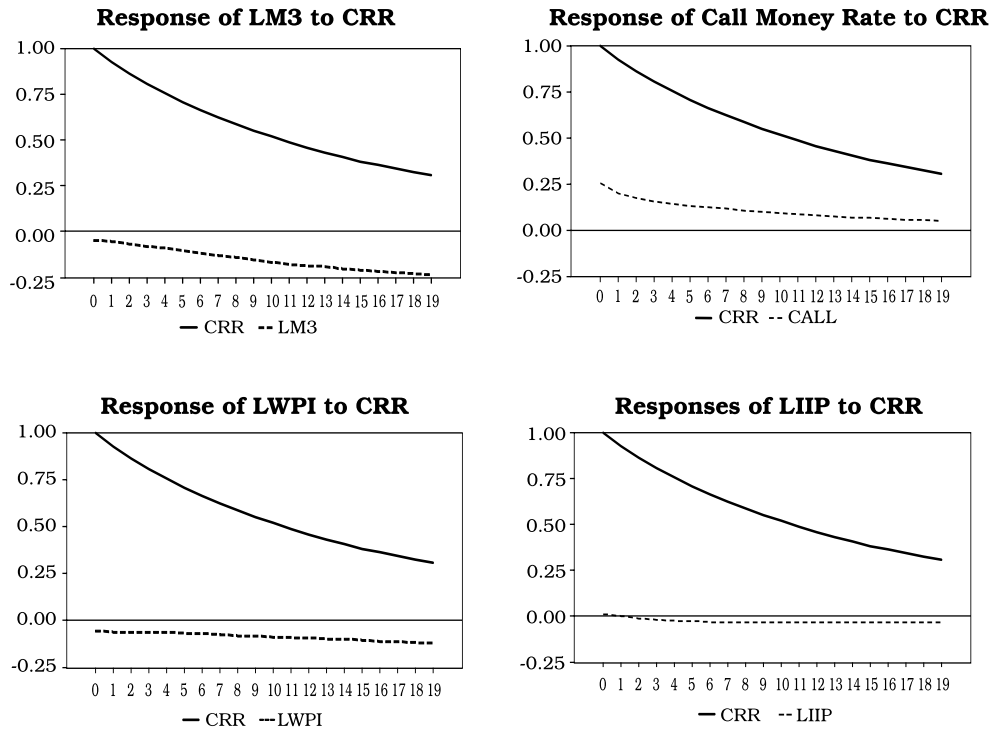


Table 4.8: Variance Decomposition with CRR as instrument

Entry	Std Error	CRR	LM3	CALL	LWPI	LIIP
Decomposition of Variance for Series CRR						
1	0.288868	99.980	0.009	0.001	0.000	0.010
2	0.396118	97.846	0.100	1.565	0.031	0.458
3	0.472922	95.537	0.252	3.094	0.128	0.989
4	0.532888	93.621	0.398	4.241	0.300	1.440
5	0.581467	92.108	0.524	5.050	0.539	1.779
Decomposition of Variance for Series LM3						
1	0.009295	0.401	45.535	5.374	0.036	48.655
2	0.012870	0.384	57.924	3.990	0.330	37.371
3	0.015664	0.393	65.990	2.859	0.655	30.103
4	0.018077	0.427	71.250	2.151	0.939	25.232
5	0.020236	0.484	74.790	1.727	1.171	21.829
Decomposition of Variance for Series Call Money Rate						
1	4.221601	6.926	0.001	92.872	0.158	0.043
2	4.465792	9.990	0.103	89.365	0.396	0.145
3	4.541586	12.381	0.141	86.707	0.615	0.156
4	4.595262	14.231	0.146	84.701	0.762	0.159
5	4.641539	15.702	0.144	83.116	0.842	0.196
Decomposition of Variance for Series LWPI						
1	0.005543	0.139	0.044	1.859	81.126	16.832
2	0.007222	0.154	1.286	2.943	81.481	14.135
3	0.008251	0.174	3.112	3.192	80.800	12.722
4	0.008972	0.202	5.290	3.143	79.459	11.906
5	0.009520	0.238	7.709	3.005	77.648	11.400
Decomposition of Variance for Series LIIP						
1	0.039611	0.526	28.582	7.051	0.001	63.840
2	0.045028	0.487	27.937	11.139	0.333	60.104
3	0.046647	0.457	27.830	12.528	0.900	58.284
4	0.047251	0.450	27.874	12.861	1.529	57.287
5	0.047560	0.460	27.932	12.872	2.107	56.629

CH_BR as policy instrument

Lag length test

Lags	AIC	BIC
1	-940.6514	-1013.2166
2	-997.3825	-1129.7521

Test for Over-Identification: 0.38 (0.53)

The model is identified but AIC and BIC criterion choose initial model over this one (Figure 4.8 and Table 4.9).

Figure 4.8: Impulse Response functions

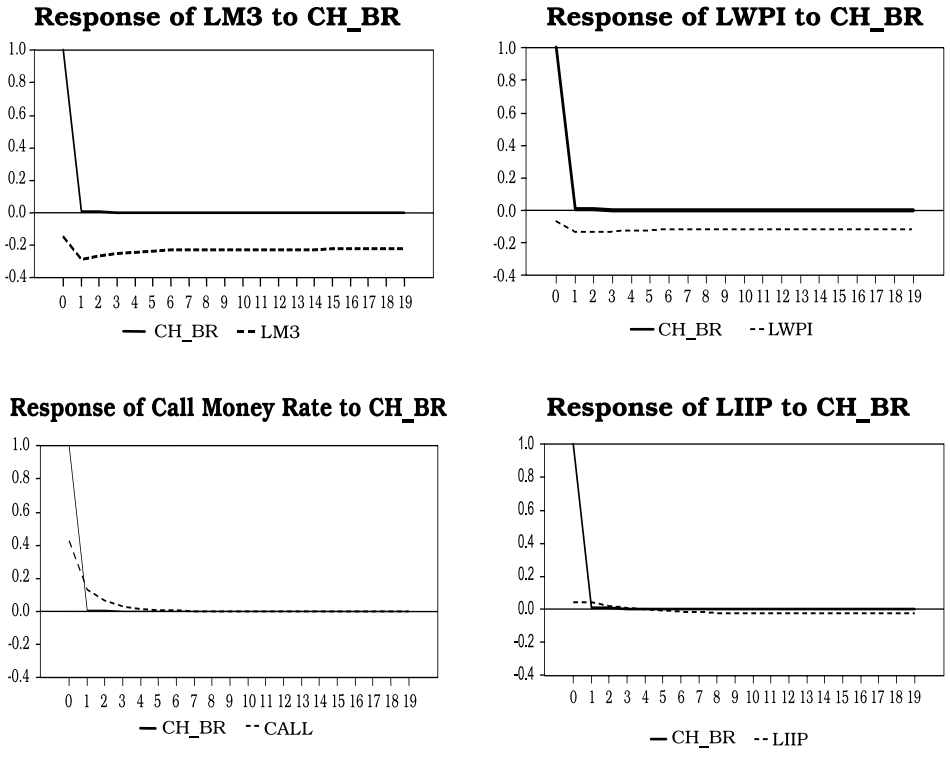


Table 4.9: Variance Decomposition with CH_BR as instrument

Entry	Std Error	CH_BR	LM3	CALL	LWPI	LIIP
Decomposition of Variance for Series CH_BR						
1	4.233786	99.741	0.085	0.011	0.002	0.161
2	4.253216	98.832	0.302	0.298	0.005	0.564
3	4.257231	98.647	0.354	0.328	0.008	0.663
4	4.258163	98.604	0.366	0.331	0.012	0.688
5	4.258422	98.592	0.368	0.331	0.015	0.694
Decomposition of Variance for Series LM3						
1	0.009190	0.914	32.604	4.393	0.590	61.499
2	0.012922	3.023	45.028	2.884	0.396	48.670
3	0.015832	3.336	54.286	2.001	0.282	40.095
4	0.018351	3.308	60.695	1.489	0.213	34.295
5	0.020608	3.203	65.159	1.198	0.169	30.271
Decomposition of Variance for Series CALL						
1	4.458401	17.199	0.038	82.651	0.112	0.000
2	4.913296	15.548	0.167	84.009	0.246	0.029
3	5.012795	15.248	0.289	84.032	0.392	0.039
4	5.037774	15.168	0.392	83.876	0.524	0.041
5	5.046214	15.133	0.473	83.719	0.634	0.041
Decomposition of Variance for Series LWPI						
1	0.005542	0.250	3.362	1.203	78.344	16.840
2	0.007221	0.805	2.012	1.717	80.488	14.977
3	0.008254	1.085	1.840	1.949	81.275	13.851
4	0.008985	1.273	2.449	2.001	81.070	13.206
5	0.009545	1.419	3.604	1.964	80.156	12.857
Decomposition of Variance for Series LIIP						
1	0.039838	0.812	39.646	3.901	1.037	54.605
2	0.045204	0.978	39.044	5.751	1.865	52.363
3	0.046773	1.027	38.688	6.658	2.742	50.885
4	0.047355	1.027	38.480	6.980	3.546	49.967
5	0.047648	1.016	38.338	7.048	4.218	49.379

4.7 Concluding Observations

Structural VAR was estimated for the monthly data for all Indian scheduled commercial banks for the period April 1993 to April 2002. The vector includes the variables log IIP, log WPI, log M3, CPR and the chosen policy instrument. Two policy instruments considered are Cash Reserve Ratio (CRR) and Change in Bank Rate (CH_BR).

The results show that on the basis of variance decompositions, there is not much difference as between CRR and CH_BR as alternative policy instruments. However, on the basis of plausibility of relationships as given by the impulse response functions, CRR seems to perform relatively better *vis-à-vis* Bank Rate.

Alternative specifications of the structural VAR model have been examined. The sensitivity analysis indicates that the chosen model is the best on the basis of model selection criteria. Since qualitatively impulse responses do not vary much, it indicates robustness of the chosen model.

Having looked into the plausibility of the two chosen policy instruments, we examine the impact of monetary policy transmission through these instruments. This is done with a view to focus on the impact of policy changes primarily through bank lending. This is taken up in the following chapters.

Chapter 5

BANK LENDING CHANNEL AND MONETARY POLICY TRANSMISSION IN INDIA: A PANEL DATA ANALYSIS

5.1 Introduction

Banks in India have historically played a dominant role in channelling financial savings from surplus to deficit economic units, whereas the relative importance of other financial institutions, such as mutual funds and insurance companies, was very limited until recently. The special role of banks in financial intermediation has been further enhanced following extensive reforms in the banking and the financial sector. Given the predominant position of the banking system in India and the fact that banks are the conduits for monetary policy, banks would naturally play a major role in the monetary policy transmission mechanism.

5.2 Literature Overview

The bank lending channel has two distinct parts. First, bank credit is special. There is no close substitute for bank loans, both on the asset side of banks' balance sheets and on the liability side of borrowers. Especially, households and small firms lack access to forms of credit other than bank loans. Second, monetary policy changes have a direct effect on money supply. Following a monetary tightening which drains deposits from the banking system, banks have to readjust their portfolio by reducing their supply of loans, given the imperfect substitutability between loans and other assets. Loan supply being reduced, banks increase lending rate or reduce their loans. Therefore, a reduction in the supply of loans leads to a rise in the external finance premium for bank-dependent borrowers whose activity is reduced. As a result, credit allocated to bank-dependent borrowers may fall causing these borrowers to curtail their spending.

Following from the seminal work of Kashyap and Stein (1995) on the bank lending channel, there have been several country case studies

examining the existence or otherwise of a bank lending channel. A study on the existence of the bank lending channel for Germany by Kakes *et al* (1999) suggests that banks respond to a monetary contraction by adjusting their securities holdings, rather than reducing their loan portfolios. The main implication of the result is that a bank lending channel is not an important transmission mechanism. Subsequently, a study for the Greek banking sector indicates that monetary policy has a significant impact on the supply of bank loans and, through shifts in supply, on aggregate economic activity in Greece (Brissimis *et al*, 2001). Using quarterly data for the period 1900-1997 for Portugal, Farinha and Marques (2001) discern the existence of a bank lending channel with the importance of this channel being larger for the less capitalised banks. Studies on the bank lending channel for the Spanish banking sector, however, fail to detect the existence of a bank lending channel during the period 1991-98 (Hernando and Martinez-Pages, 2001). Nilsen (2002) observes that small US banks increase trade credit, a substitute credit, in response to a contractionary policy, indicative of the operation of a bank lending channel. A recent empirical assessment of the bank lending channel for the Netherlands for the period 1990:4 to 1997:4 is supportive of the existence of the bank lending channel (de Haan, 2003).

Most studies based on aggregate data suffer from severe identification problem: the inability to establish whether the decrease in credit that is observed after a monetary contraction is induced by bank supply or driven by a fall in borrowers' demand. In the latter case, the lending channel would not be relevant. In this respect, recent studies based on disaggregated data are much more informative. The advantages of disaggregated data are that the response of credit variables can be analysed in combination with other hypotheses that follow from the theoretical literature underlying the credit view. Information asymmetries, for instance, are presumably more relevant for specific categories of borrowers which suggests that banks may attempt to adjust their loan portfolio following a monetary contraction, substituting high-quality loans for low-quality loans, known as 'flight to quality'.

5.3 Empirical Methodology

The model framework in the present study closely follows Altunbas *et al* (2002) adjusted to incorporate certain regulatory and open economy features on the lines of Peek and Rosengren (1995) and Kishan and Opiela (2000). This follows from the fact that the post-reform era, which is the focus of the period of study, has witnessed an increasing focus on regulatory prescriptions like capital adequacy ratios even as the economy has become more integrated with the rest of the world.

The results arising from such analysis have important implications for the overall success or failure of monetary policy and also for the debate on the existence of a 'bank lending channel' of monetary policy transmission. With the trend towards consolidation among banks gaining momentum in recent years, such an exercise can provide important insights about the likely impact of bank mergers and their resultant effect on 'big' banks.

The model is tested using panel data. Panel data applications have been steadily increasing in the field of banking and finance. The advantages of using such a methodology can be stated as follows:

(a) by controlling for individual heterogeneity, panel data minimise bias in the results;

(b) as balance sheet data are highly correlated amongst each other, panel data provide more information on variability, facilitate less collinearity among variables, increase degrees of freedom and overall can produce better statistical fits;

(c) panel data are often able to explain the dynamics of change in a better way as compared to purely time-series or pure cross-sectional analysis. Pooling of data opens up the possibility of observing simultaneous differences in cross-sectional behaviour and through time for a given unit (firm). This should lead to more efficient estimation of common parameters (Judge *et al,* 1980).

In order to optimise statistical use of available data, the panel approach accounts for the combination of cross-sectional and time-series effects:

$$y_{it} = \alpha + X_{it}\beta + u_{it} \qquad i=1,2,...,N(cross-section); t=1,2,...,T\ (time\ series)$$

$$u_{it}=\mu_i+\upsilon_i$$

where α is a scalar, β is a K * 1 matrix, X_{it} is the i th banking firm with K explanatory variables, μ_i is unobservable individual specific effect and υ_i denotes the remainder of the disturbance.

Panel data models are grouped into FE (fixed effects) and RE (random effects) models. In the FE model, υ_i are assumed to be fixed parameters to be estimated and the remainder disturbances stochastic with υ_i i.i.d. for all i and t. The FE model may be a suitable specification if one is comparing changes across N banking firms and the model assumes the slopes are the same for all firms, but the intercepts are different.

An important feature of the FE model is that it utilises the variation of variables in each firm (unit) and ignores the variation among the industry means. As a result, the FE model wastes some information contained among the firm means and, therefore, may not be fully efficient. Improvements sought with the use of the FE model led to the development of the RE (random effects) model. The RE model addresses the problem of missing information in the FE model by making assumptions about the distribution of μ_i. The RE specification treats the μ_i as random disturbances with the ith individual or group. The RE model can be written as:

$$y_{it}=X_{it}\beta + \eta_{it}$$

where the error term, η_{it} is composed of two statistically independent components, one associated with cross-sectional units and another, ν_{it}, is the remainder.

The Hausman test statistic is employed to distinguish between fixed effect (FE) and random effects (RE) models. The random effects model requires the assumptions that the individual error components are uncorrelated with each other and with the explanatory variables in

the model. However, the fixed effects model required none of such assumptions. The Hausman test, which tests for simultaneity, indicates that if simultaneity is present, one or more of the explanatory variables will be endogenous and, therefore, will be correlated with the disturbance term. No simultaneity would favour random effect models against fixed effect model.

5.4 The Data and Variables

The focus on the role of banks in the monetary transmission mechanism has increased significantly in the post-reform era. This assumes relevance in view of the fact that India is essentially a bank-based economy (Barth *et al*, 2001). Towards this end, the study first does a panel data analysis of the scheduled commercial banks (SCBs), excluding regional rural banks and foreign banks, in India.[12] Deleting the outlier observations and banks for which consistent data set over the entire time span is not available, leaves us with 51 banks, comprising of 27 public sector banks, 16 old private sector banks and 8 new private sector banks. To ascertain the existence of a bank-lending channel, the study employs quarterly confidential supervisory data on balance sheet of banks for the period 1997:1 through 2002:2. The data are made available by the Off-Site Monitoring and Surveillance Division (OSMOS) of the Reserve Bank.

Several salient aspects of the data may be mentioned. Consequent upon the introduction of off-site returns for banks since 1997, banks have been directed to submit data on mandated aspects of liquidity, solvency and asset quality on a quarterly basis. The range and extent of disclosures have gradually been enhanced over the years so as to give a clearer picture of bank behaviour to the regulators. The data typically have to be submitted within a stipulated time frame (typically within one month of the close of the quarter). The data are unaudited for all the quarters except March.

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[12] One factor that might have a significant bearing on the response of banks to changes in monetary policy is the ownership pattern. Foreign banks are usually a part of a large banking company; therefore, their lending decisions might not be entirely autonomous. This might, on the one hand, translate into a more stable supply of loans, even during crisis periods, as the parent banks may act as 'backup' facilities for their subsidiaries. On the other hand, however, foreign banks may react pro-cyclically to changes in the host market, the intuition being that during the economic slowdown, the parent bank may decide to reallocate available funds from a domestic market to more profitable regions (de Haas and van Lelyveld, 2003). In view of the above, foreign banks have been excluded from the analysis.

The data employed in the study are divided into following categories:

Bank balance sheet data: We employ the following variables of banks' balance sheet, *viz*., loans advanced by commercial banks, funds (defined as the aggregate of deposits and borrowings) with commercial banks and commercial banks' investments in government securities. These variables have been scaled by transforming them in terms of logarithms. Finally, the natural logarithm of total asset (SIZE) is included to control for bank size.

Monetary Policy Variable: While there is no consensus on the best indicator of monetary policy stance, we consider two variables: one on the quantity front, (i.e., the Cash Reserve Ratio or CRR) and one on the price front (i.e., the Bank Rate or BR). Over the sample period, there was a significant scaling down of the CRR from over 10 per cent in January 1997 to 5 per cent in June 2002. At the same time, the Bank Rate was activated as a signalling rate in 1997 and all other rates were linked to it. Given the quarterly nature of the data and the continuous refinements in the CRR and the Bank Rate over the period, these two variables, in our perception, are best suited to capture the stance of monetary policy.

Securities are included to control for demand factors, bearing in mind that tests of the bank lending channel aim only to identify supply side effects. We include a number of lagged variables for two reasons. First, it distinguishes between contemporaneous and lagged responses. Second, the balance sheet data is available only on a quarterly basis. This contrasts with the case in several Latin American and developed countries, where such data are available on a higher frequency. Given that banks' balance sheet structure may respond to changes in the stance of monetary policy with higher frequency, we believed it best to include both current and lagged variables to be able to identify the relevant portfolio adjustments.

As the earlier discussion suggests, the panel comprises 51 SCBs stretching over the period 1997:1 to 2002:2. Since our aim is to identify the impact of monetary policy shocks in the form of a change in Bank Rate and CRR on bank portfolios, we have specified equations (1) to (3) accordingly.

This yields the following loan functions for loans, investments and funds for bank i at time t:

$$LOAN_{i,t} = \alpha_o + \alpha_1 MYP_t + \alpha_2\ MYP(1)_t + \alpha_3 SECU_{it} + \alpha_4 FUND_{it} + \alpha_5 CRAR_{it} + \alpha_6 SIZE_{it} + \alpha_7 LOAN(1)_{it} + u_{it}$$

$$SECU_{i,t} = \beta_o + \beta_1 FUND_{it} + \beta_2 FUND(1)_{it} + \beta_3 SIZE_{it} + \beta_4\ SECU(1)_{it} + \beta_5 MYP(1)_t + \beta_6 MYP(1)_t + v_{it}$$

$$FUND_{i,t} = \gamma_0 + \gamma_1 FUND(1)_{it} + \gamma_2 SIZE_{it} + \gamma_3 MYP_t + \gamma_4 MYP(1)_t + w_{it}$$

In the aforesaid specification, LOAN is total loans, SECU is total investments in government and other approved securities, FUND is aggregate of deposits and borrowings, CRAR is the capital adequacy ratio, SIZE is logarithm of total assets and MYP is the monetary policy indicator. The figure in brackets is the one period lag of the variable.

5.5 Results and Discussion

Before proceeding with the analysis, Table 5.1 presents the summary statistics of the variables in logarithms. It is observed from the Table that average size of the bank was 8.99, while the average advances level over the period was 8.14. The average CRAR of scheduled commercial banks over the sample period was 11.45 per cent.

Table 5.1: Summary Statistics of the Variables

Variable	Mean	Std. Devn.	Minimum	Maximum
SIZE (in log)	8.991	1.249	5.551	12.674
Advances (per cent)	8.141	1.238	4.825	11.660
Investment (per cent)	7.607	1.288	4.070	11.768
Funds (per cent)	8.835	1.248	5.373	12.501
CRR (per cent)	8.942	1.640	5.500	11.000
CRAR (per cent)	11.449	4.547	-22.760	30.730

We now proceed to analyse the econometric estimation of the above model. The results of the estimation are presented in Table 5.2 (A). Table 5.2 (A) illustrates the responsiveness of total advances, total investments and total funds to changes in the monetary policy stance over the sample period, as proxied by the CRR. It can be observed that bank lending does appear to be statistically significant to changes in the contemporaneous

Table 5.2(A): Testing the Existence of Bank Lending Channel of Monetary Policy

Independent Variables	Dependent Variables		
	Advances	**Investment**	**Funds**
Bank-specific			
Lagged (Advances)	0.319 (0.017)*		
Investment	-0.234 (0.017)*		
Lagged (Investment)		0.544 (0.025)*	
Funds	0.264 (0.042)*	0.309 (0.064)*	
Lagged (Funds)		-0.172 (0.042)*	0.234 (0.015)*
CRAR	-0.002 (0.0008)*		
SIZE	1.214 (0.043)*	0.343 (0.059)*	0.753 (0.016)*
Bank-Industry specific			
Loan Rate	0.010 (0.040)		
Monetary Policy Indicator			
CRR	-0.012 (0.003)*	-0.015 (0.004)*	0.023 (0.020)
Lagged (CRR)	-0.002 (0.003)	0.031(0.044)*	-0.038 (0.021)***
Adjusted R-square	0.98	0.97	0.94
Number of Observations	1071	1071	1071
Hausman test [p-value]	0.00	0.00	0.00

Monetary policy shock approximated by CRR.
Figures in brackets indicates standard errors.
* Indicates significance at conventional levels.

(but not the lagged) indicator of monetary policy. The same estimates also reveal that there is a positive relationship between total lending and total funds and a negative association between lending and investments. Overall, this suggests that banks adjust their investments as loan supply changes more in favour of advances.

The remaining models examine changes in total securities and total funds. Total securities exhibit a negative response to current change in policy, but reacts positively to a lagged policy change. Total funds, on the other hand, respond negatively to lagged policy change, but does not show any response to a current policy shock. This would suggest that consequent upon a policy change, on the asset side, banks rearrange their investment-advances mix in favour of the latter, while on the liability side, they decrease total funds with a lag. These results provide significant testimony to the existence of a bank lending channel in the Indian context.

The model was also augmented to include an important regulatory feature. In particular, in line with the work of Peek and Rosengren (1995) and, more recently, Kishan and Opiela (2000), bank capital was included as an additional variable in the lending equation. Bank capital serves a two-fold purpose: first, it acts as a proxy for the soundness of the bank and, second, it directly alters the composition of bank asset portfolios. The implication of the first is that it provides leverage to the bank to raise funds from alternative avenues during periods of contractionary policy. The second aspect on the other hand serves to moderate the balance sheet effects of a contractionary policy for well-capitalised banks. In the empirical analysis, bank capital was proxied by the capital adequacy ratio (CRAR), or the ratio of capital to the bank's risk-weighted assets.

The results run contrary to the findings of Kishan and Opiela (2000). In other words, a contractionary monetary policy forces adequately capitalised banks to cut back on lending. One can advance two possible reasons for the same. First, the relative attractiveness of investments *vis-à-vis* loans (in terms of risk weights) would suggest that well-capitalised banks might be holding back their lending activity. Second, the sample period was characterised by relatively low economic activity. In such a scenario, the borrower profile could have been adverse; increasing lending by well-capitalised banks might, consequently, have been put on hold.

The results were re-estimated using the Bank Rate as an indicator of monetary policy stance [Table 5.2(B)]. The results virtually mimic the earlier results, with the additional feature that in this case, both the contemporaneous as well as lagged policy stance negatively impinge on lending. The remaining results are not altered in any substantive manner.

A third aspect of importance was to account for the greater openness of the economy. In tandem with the increasing opening up of the economy, the model was augmented with certain open economy features. Illustratively, the investment equation attempted to examine the impact of spread (SPRD), defined as the interest differential on 5-year G-sec yield *less* yield on 5-year AAA-rated corporate paper and the fund equation attempted to capture the interest differential (DIFF), defined as the Prime Lending Rate *less* comparable LIBOR rate. The idea inherent in these augmentations was to

Table 5.2(B): Testing the Existence of Bank Lending Channel of Monetary Policy

Independent Variables	Dependent Variables		
	Advances	**Investment**	**Funds**
Bank-specific			
Lagged (Advances)	0.346 (0.017)*		
Investment	-0.214 (0.017)*		
Lagged (Investment)		0.562 (0.025)*	
Funds	-0.308 (0.043)*	0.302 (0.066)*	
Lagged (Funds)		0.193 (0.042)*	0.208 (0.016)*
CRAR	-0.002 (0.0008)*		
SIZE	1.212 (0.044)*	0.355 (0.061)*	0.739 (0.015)*
Bank-Industry specific			
Loan Rate	0.042 (0.048)		
Monetary Policy Indicator			
Bank Rate	-0.027 (0.006)*	-0.023 (0.005)*	0.0009 (0.002)
Lagged (Bank Rate)	-0.012 (0.003)*	0.007 (0.004)***	-0.014 (0.002)*
Adjusted R-square	0.97	0.94	0.94
Number of Observations	1071	1071	1071
Hausman test [p-value]	0.00	0.00	0.00

Monetary policy shock approximated by Bank Rate
Figures in brackets indicates standard errors.
* Indicates significance at conventional levels.

ascertain whether the greater opening up of the economy has had any effect on the bank lending channel of monetary transmission.

The results exhibit two important features: first, in the investment equation, it is observed that greater spread has led to increased investments and, second, in the funds equation, higher interest rate differential between international and domestic markets have implied greater augmentation of deposits. In sum, greater openness significantly impacted upon both the asset and liability sides of banks' balance sheet.

A final feature for consideration was the Liquidity Adjustment Facility (LAF). In June 2000, the Reserve Bank introduced the LAF as an operating instrument of monetary policy. The LAF enables the Reserve Bank to modulate short-term liquidity under varied financial market conditions in order to ensure stable conditions in the overnight (call) money market. The LAF operates through daily repo and reverse repo auctions, thereby

Table 5.2 (C): Testing the Existence of Bank Lending Channel of Monetary Policy-Incorporating Open Economy Features

Independent Variables	Dependent Variables		
	Advances	**Investment**	**Funds**
Bank-specific			
Lag (Advances)	0.319 (0.017)*		
Investment	-0.234(0.017)*		
Lagged (Investment)		0.544 (0.025)*	
Funds	-0.264 (0.042)*	0.333 (0.065)*	
Lagged (Funds)		-0.173(0.042)*	0.231 (0.016)*
CRAR	-0.003 (0.0008)*		
SIZE	1.214 (0.043)*	0.332 (0.059)*	0.754 (0.016)*
Bank-Industry specific			
Loan Rate	0.010 (0.032)		
Monetary Policy Indicator			
CRR	-0.012 (0.003)*	-0.015 (0.004)*	0.002 (0.021)
Lagged (CRR)	-0.002 (0.003)	0.002 (0.044)	-0.004 (0.002)**
Open Economy Features			
SPRD		0.014 (0.006)**	
DIFF			0.002 (0.001)***
Adjusted R-square	0.98	0.95	0.96
Number of Observations	1071	1071	1071
Hausman test [p-value]	0.00	0.00	0.00

Monetary policy shock approximated by CRR
Figures in brackets indicates standard errors.
* Indicates significance at conventional levels.

setting a corridor for the short-term interest rate consistent with policy objectives. Following the operationalisation of LAF, the repo rate has emerged as an important variable in signalling the stance of monetary policy (RBI, 2004). To ascertain the importance of LAF and, in particular, the repo rate, we introduced a dummy variable (DUM_REPO) for the June 2000 quarter onwards. The idea inherent in this specification was to examine whether the repo rate has emerged as an important instrument of monetary policy. The results, presented in Table 5.3, confirm that repo rate has emerged as an important variable in signalling the stance of monetary policy as evidenced from the sign and magnitude of the coefficient on DUM_REPO.[13]

[13] Since the results pertaining to other variables are unaltered in sign and significance, only the results pertaining to advances are presented in Table 5.3.

Table 5.3: Testing the Existence of Bank Lending Channel of Monetary Policy - Ascertaining Importance of Repo Rate

Independent Variables	Dependent Variable: Advances
Bank-specific	
Lagged (Advances)	0.322 (0.018)*
Investment	-0.232(0.017)*
Lagged (Investment)	
Funds	-0.270 (0.042)*
Lagged (Funds)	
CRAR	-0.002 (0.0008)*
SIZE	1.213 (0.043)*
Bank-Industry specific	
Loan Rate	0.008 (0.041)
Monetary Policy Indicator	
CRR	-0.013 (0.002)*
Lagged (CRR)	-0.001 (0.003)
DUM_REPO	-0.017 (0.009)***
Adjusted R-square	0.98
Number of Observations	1071
Hausman test [p-value]	0.00

Monetary policy shock approximated by CRR.
Figures in brackets indicate standard errors.
* Indicates significance at conventional levels.

The next obvious question of relevance is whether such effects are different for different bank groups. The reason for this can be stated as follows. Public sector banks, on average, comprised around 80 per cent of the banking sector assets and roughly 75 per cent of the loans advanced over the sample period. It is, therefore, important to determine whether the overall effects are overwhelmed by the presence of public sector banks. Towards this end, we insert a dummy variable for the public sector and old private sector banks to ascertain the response of these bank groups to a change in the monetary policy stance. For identification purpose, the dummy variable for new private sector banks has not been entered, so that the dummies for public and old private sector banks discern the response of these two bank groups relative to the omitted category. The result of the revised estimation is presented in Table 5.4. The analysis suggests that, with regard to advances, the response of public sector banks is higher relative to new private sector banks; the response of the old private sector banks, on the contrary, does not exhibit any discernible trend as evidenced from the observed levels of significance.

Table 5.4: Testing the Existence of Bank Lending Channel of Monetary Policy: Bank Group-wise Dummy Variables

Independent Variables	Dependent Variables		
	Advances	**Investment**	**Funds**
Bank-specific			
Lag (Advances)	0.321 (0.018)*		
Investment	-0.234(0.017)*		
Lagged (Investment)		0.545 (0.025)*	
Funds	-0.266 (0.042)*	0.309 (0.064)*	
Lagged (Funds)		-0.172 (0.041)*	0.234 (0.016)*
CRAR	-0.002 (0.0008)*		
SIZE	1.213 (0.041)*	0.343 (0.059)*	0.753 (0.016)*
Bank-Industry specific			
Loan Rate	0.010 (0.030)		
Monetary Policy Indicator			
CRR	-0.012 (0.002)*	-0.015 (0.004)*	0.002 (0.021)
Lagged (CRR)	-0.002 (0.003)	0.003 (0.004)	-0.003 (0.002)***
DUM_PUB	0.098 (0.007)*	0.008 (0.021)	0.012 (0.015)
DUM_OPVT	0.028 (0.26)	-0.021 (0.021)	0.014 (0.013)
Adjusted R-square	0.98	0.96	0.96
Number of Observations	1071	1071	1071
Hausman test [p-value]	0.00	0.00	0.00

Monetary policy shock approximated by CRR.
Figures in brackets indicate standard errors.
* Indicates significance at conventional levels.

5.6 Concluding Observations

In sum, the results are supportive of the existence of a bank lending channel in India. Several features of the results deserve a mention. First, the response of advances to a change in the policy variable turns out to be significant at conventional levels, irrespective of whether the policy instrument is a price (Bank Rate) or a quantity (CRR) variable. In particular, banks tend to cut back lending and adjust their funds in response to a policy shock. Second, the results also indicate that prudential norms, as proxied by banks' capital adequacy ratios, exert a significant influence on bank lending. Third, the gradual opening up of the economy has been making a perceptible impact on banks' lending behaviour. Finally, the differential response of bank groups suggests that it is primarily the public sector banks that are more reactive to the policy shocks.

EFFICACY OF BANK LENDING CHANNEL: POLICY IMPLICATIONS

A POSTSCRIPT TO CHAPTER 5

Banks are an integral part of the financial system in the country. Apart from carrying out the important savings-investment function (mopping up of public savings and allocation amongst competing productive investment avenues) and providing a host of other banking services to public, banks are the backbone of the payments settlement infrastructure and work as an important channel for transmission of monetary and credit policy. The banking channel has also been used for transmitting other public policy measures in terms of fulfilling targeted credit and development needs of certain sectors in India in line with national economic priorities. From the standpoint of policy, we have analysed the empirical evidence on the efficacy of bank lending channel in the monetary policy transmission process. Although, the study is essentially confined to the data period 1997-2002, we have also analysed the credit trends up to September 2003.

A Subtle Shift in the Paradigm

During 2000-2003, it was observed that despite the continuing low interest rates (between the period July 2000 and April 2003, there was a reduction of 200 basis points in the Bank Rate) and CRR (it was brought down by 4 percentage points from 8.5 per cent in April 2000 to 4.5 per cent in June 2003) there was no corresponding increase in the bank lending to commercial sector. On the contrary, there was a slight contraction in the bank lending during the period March 2003 to September 2003. This happened despite the favourable macroeconomic environment and sustained industrial recovery. On the liabilities side, however, banks were not short of funds - both with regard to deposit, and also on account of easy liquidity conditions prevailing in the market. It was observed that banks' investment portfolio, for the first time in recent history, overtook their loan and advances portfolio. This clearly underscored the trend (on part of the banks) towards investment in low-risk government securities rather than lending to commercial sector. As a result, despite repeated

rate cuts and lowering of CRR, bank lending failed to pick up upto September 2003.

Trends in Loans and Advances

A few clear trends have emerged in the recent times in the bank fund deployment behaviour. There is a flight towards quality and safety. This is reflected in the sharp uptrend in the government securities prices during 2001-03. The dividing line between financial products, types of financial institutions and their geographical locations have become less relevant than in the past. While the traditional banking activity (borrowing and lending) has continued to be the mainstay of banking business, the greater globalisation of banking operations, liberalisation of financial markets and the consequent increase in international capital flows could perhaps have weakened the efficacy of the bank lending channel.

Why bank lending did not pick up in response to monetary policy changes?

Credit trends observed during the period beginning 2000 and upto 2003 suggest that sometimes monetary policy actions may have only a very limited countercyclical impact on the real sector. Conventional wisdom would suggest that investment spending should increase (*albeit* with a reasonable lag) in response to lower interest rates combined with easy liquidity in the system. However, starting from late 'nineties and upto 2003, as interest rates declined sharply, banks displayed reluctance to increase their lending.

In part, the underlying reason was that many banks had made large loans in the early and mid-'nineties, especially to finance huge build-up of capacities in sectors like textiles, steel, cement and petrochemicals. The reversal of business cycle from 1997 onwards was accompanied by severely curtailed economic activity, and banks were therefore faced with prospects that a significant portion of their existing borrowers could not repay in full. Hence, banks instead preferred to lend to the government by buying securities. Even though this entailed lower yield, it was compensated by the fact that they are completely risk-free (in the credit default sense).

Consequently, an important part of transmission mechanism between RBI's monetary policy and an increase in aggregate demand and output could have been circumscribed.

Factors Influencing Bank Lending

Changes in the quantum of bank lending as also allocations to sub-sectors within the overall loan portfolio are also influenced (and very significantly) by factors other than interventions through monetary policy instruments.

Prudential regulations issued by the Reserve Bank on capital adequacy, asset quality, income recognition and provisioning, single/group borrower exposure, and other such norms influence the credit decisions of the banks, depending on the individual banks' business profile and its risk appetite. The current boom in the housing finance is a case in point. Continued increase in the housing loans is a result of government policy of fiscal incentive to borrowers. Also, Reserve Bank's favourable treatment of housing loans for the purpose of capital adequacy (housing loans attract lower risk weight of 50 per cent[14] as opposed to 100 per cent on other loans and advances) has enabled banks to expand their portfolio without having to set aside a large capital cushion. The credit route is thus found to be more significant in the housing and construction sectors.

Demographic changes and changes in customer tastes also play a vital role in defining credit requirements in the system. Recent thrust by banks on retail loans is a result of marked shift in spending preference in favour of consumer goods by the burgeoning middle class.

Conversely, despite the lower interest rates, credit off-take by the corporates did not pick up much during 2000-2003, while the banks' investment portfolio grew by leaps and bounds. This can be attributed partly to risk aversion on part of the banks together with the zero risk weight assigned to such investments for capital adequacy purposes. Also, the desire for higher income from dealing in government securities with

[14] The risk-weight on housing loans has since been raised to 75 per cent, while that on commercial real estate exposure has been raised to 125 per cent.

the continuing expectations of lower interest rates contributed to this phenomenon.

Last, but not the least, level of economic activity has an overall impact on the credit demand in the system. This explains why the bank lending remained sluggish in the period since 1997 till 2002 despite an expansionary monetary policy pursued during the major part of the period. So, to predict what share of monetary resources would eventually become transmitted to the real sector via the bank lending channel is a complex puzzle involving a host of factors including, but not just, monetary policy instruments.

Chapter 6

THE ASYMMETRIC RESPONSE OF BIG AND SMALL BANKS TO MONETARY POLICY SHOCKS

6.1 Introduction

Given the asymmetry in resource base, assets and expected income among other features as between big and small banks, would their response to monetary policy shocks be different? This is an important question. If the balance of evidence suggests that the impact of monetary policy shocks on small banks is more severe *vis-à-vis* big banks, this would lend additional support to the existence of a bank lending channel for monetary transmission in a set-up where small banks are sizeable in number. In this chapter, we try to categorise banks on the basis of total assets and try to see if there is any asymmetry in the response of 'big' and 'small' banks, defined later in this chapter, to a given contractionary monetary policy shock . It is possible that after a contractionary monetary policy shock, big banks are able to maintain the existing loan supply, given the size of their assets. Big banks have a larger resource base, higher expected income from investments, larger spread and have larger expected income from stock and foreign exchange markets. All this may allow big banks to circumvent the problems of liquidity crunch. Big banks differ from small banks in a variety of ways. This multifaceted asymmetry in the selected panel has been exhibited in Tables 6.1, 6.2 and 6.3. The asymmetric response of the big and small banks to contractionary monetary policy shocks has important implications for its transmission through the bank lending channel.

6.2 Select Evidence from Literature

Using US data, Kashyap and Stein (1995) tested the hypothesis that, after a monetary contraction, the lending volume of small banks declines more rapidly than that of large banks. Their empirical results are consistent with this hypothesis, as the estimated coefficient on the monetary policy variable, which gives an indication about the operation of the lending channel, declines with size. However, the coefficient for large banks was positive and

Table 6.1: Asymmetry between Big and Small Banks in terms of Major Items of Liabilities

(figures as percentage share)

Year	Deposits		Total Borrowings		Borrowings from RBI		Capital		Total Assets	
	Small	Big	Small	Big	Small	Big	Small	Big	Small	Big
1996	5.24	94.76	5.64	94.36	9.00	91.00	3.23	96.77	5.55	94.45
1997	5.72	94.28	8.03	91.97	22.00	78.00	3.23	96.77	5.67	94.32
1998	6.21	93.79	7.70	92.30	16.43	83.57	2.92	97.08	6.76	93.24
1999	6.23	93.77	9.76	90.24	19.41	80.59	3.81	96.19	6.85	93.15
2000	6.59	93.41	15.27	84.73	17.27	82.73	4.15	95.85	6.04	93.96
2001	6.49	93.51	11.76	88.24	22.84	77.16	3.82	96.18	5.87	94.13
2002	5.12	94.88	4.64	95.36	19.84	79.16	4.10	95.90	4.92	95.80

Source: Annual Accounts of Scheduled Commercial Banks
Data covers Scheduled Commercial Banks excluding foreign and Regional Rural Banks.

Table 6.2: Asymmetry between Big and Small Banks in terms of Major Items of Assets

(figures as percentage share)

Year	Loans		Investments		Call Money		Cash in Hand		Spread*	
	Small	Big	Small	Big	Small	Big	Small	Big	Small	Big
1996	6.51	93.49	4.75	95.25	4.59	95.41	14.09	85.91	5.40	94.60
1997	6.82	93.18	4.99	95.01	1.49	98.51	12.76	87.24	5.40	94.60
1998	6.62	93.38	5.65	94.35	2.28	97.72	12.59	87.41	5.65	94.35
1999	6.71	93.29	5.95	94.05	2.49	97.51	11.97	88.03	5.06	94.94
2000	8.08	91.92	5.97	94.03	1.05	98.95	11.73	88.27	5.99	94.01
2001	7.99	92.01	5.81	94.19	1.09	98.91	11.10	88.90	5.85	94.15
2002	5.42	94.58	4.38	95.62	2.04	97.06	9.45	89.55	5.64	94.36

Source: Annual Accounts of Scheduled Commercial Banks
Data covers Scheduled Commercial Banks excluding foreign and Regional Rural Banks.
* Spread has been defined as the difference between Interest Earned and Interest Paid.

Table 6.3: Relative Liquidity of Big and Small Banks

Year	Cash in Hand (Rs. Crore)		Money at call and short notice (Rs. Crore)		Investment in G-Secs (Rs. Crore)		Liquidity (per cent)	
	Small	Big	Small	Big	Small	Big	Small	Big
1996	174909	28967	1107147	30131	7594425	335285	24.80	20.98
1997	200825	34826	1894302	10586	9099056	488037	28.30	21.99
1998	206425	34946	2000159	33654	18398657	638060	51.94	22.75
1999	227155	37423	3309470	71906	22481170	818794	53.95	24.40
2000	263457	39195	2724622	23816	16874986	1018751	30.09	26.01
2001	302984	43368	3719805	30034	20791553	1194753	31.99	26.94
2002	378603	58765	4428284	43339	25860035	1425315	33.43	25.36

Liquidity = (Cash in Hand + Money at Call and short notice + Investment in Govt Securities) / Total assets
Source: Annual Accounts of Scheduled Commercial Banks
Data covers Scheduled Commercial Banks excluding foreign and Regional Rural Banks.

insignificant, indicating that, for this group of banks, the lending channel may not be important. Large banks were defined as those representing the top 1 per cent of all banks and their assets accounted for 55 per cent of total system assets. The estimation results are not presented for another part of the sample (the 99th percentile of bank distribution) accounting for roughly 8 per cent of the system's assets. This, in turn, would cast doubts on the importance of the lending channel for aggregate lending activity.

One problem with the above test lies in the fact that banks with a large buffer stock of liquid assets can partly, if not completely, insulate their loans from the effects of monetary policy. For a bank of a given size, a tightening of monetary policy would cause loans to decline less, the more liquid the bank is. In this case, the bank would have a large buffer stock of cash and securities, which it can draw down to shield its loan portfolio. Kashyap and Stein (2000) reported that small banks in the US are, on average, more liquid than large banks and this mitigates the effectiveness of the bank lending channel for these banks. By separating banks by asset size and liquidity, Kashyap and Stein found that small banks with the least liquid balance sheet were the most responsive to policy.

Data on the liquidity of Indian 'big' and 'small' banks given above in Table 6.3 however invalidate the Kashyap and Stein (2000) hypothesis about the higher liquidity of small banks. The data show that "big" banks hold more liquid portfolios than "small" banks. This fortifies our hypothesis about the possible asymmetric response of big and small banks to given contractionary monetary policy shocks and also the existence of a bank-lending channel in India.

6.3 Panel Data Regression: Econometric Methodology

All the 57 Scheduled Commercial Banks have been identified on the basis of the size of their total assets. To arrive at a demarcation between 'big' and 'small' banks, top 60 percentile of banks, when ranked according to total assets, have been taken as 'big' banks, while bottom 20 percentile constitutes the 'small' bank group. Therefore, from 57 banks, 46 figure in the panel analysis, out of which 26 are 'big' banks. The analysis is based on annual data and spans the time period from 1996-2002. As in the earlier

chapters, the two policy instruments considered in this chapter are CRR and BR. In this regression, we try to gauge the effect of changes in policy instruments on lending behavior across different size-classes of banks.

There are two ways of pooling a time-series of cross-section, namely,

(1) Error Component Procedure;

(2) Time-Wise Autocorrelated and Cross-Sectionally Heteroscedastic Procedures (Kmenta, 1986).

The two procedures differ in respect of assumptions imposed on the disturbances. The error component model has homoscedastic variances, whereas the Kmenta technique has heteroscedastic disturbances. Both techniques allow for serial correlation, but in the error component case this serial correlation is constant across time, whereas it decays over time with the Kmenta technique. If the number of time periods is large and number of panels is small, then the Kmenta technique is expected to perform better. Since we have 57 banks and only 7 years, we have based our analysis on the error component procedure. Under this specification,

$$y_{it} = \alpha + \beta x_{it} + u_{it}$$

Here i denotes the scheduled commercial banks and t denotes the time period. X denotes the set of explanatory variables in the equation. Here the disturbances take the form:

$$u_{it} = v_i + e_{it}$$

Here the v_i 's are cross-section specific components and e_{it} are remainder effects.

As mentioned in Chapter 5, within this technique we have two approaches:

a) The Fixed Effects Model and

b) The Random Effects Model.

The study conducts the Hausman specification test to choose among the fixed and random effects models and on this basis the random effects model has been chosen.

6.4 Empirical Analysis

To test our hypothesis of potential asymmetry in lending behaviour between small and big banks, the loan offer function is specified in such a way so that only supply side factors are included on the right hand side. This ensures that the loan supply function is properly distinguished from loan demand function.

Loan Supply = f (TD, TB, GS, POLICY, DUMMY, DUMMY * POLICY)

where TD: total deposits

TB: total borrowings

GS: Investment in government securities

POLICY: monetary policy variable (CRR or Bank Rate, taken as monthly average in this annual data analysis.)

DUMMY: dummy variable, which assumes value 1 for small banks, and 0 for large banks

Expressed in logarithmic terms, this can be expressed as:

Ln (Loan supply) = a + b ln (TD) + c ln (TB) + d ln (GS) + e (CRR or BR) + f (DUMMY) + g (D*CRR or D*BR) + u

The policy instruments are CRR and BR. The co-efficient of the intercept dummy is the differential intercept and slope dummy is the differential slope indicating by how much the slope co-efficient for large banks differs from the small banks. Introduction of a dummy in multiplicative form enables us to differentiate between slope coefficients of large and small banks, while the intercept dummy enables us to differentiate between the intercept terms of two bank categories. This single regression is very useful to test a variety of hypotheses. For example, if the co-efficient of intercept dummy (f) is significant while co-efficient of multiplicative dummy (g) is not, we can conclude that loan supply functions are parallel, with the policy instrument having equivalent impact on the loan supply of big and small banks. On the other hand, if the multiplicative dummy is significant and the coefficient dummy is insignificant, one can infer that, the two loan supply functions have same intercept, but the effect of policy instrument is asymmetric.

The estimation procedure gives the following results for CRR as the policy instrument, as set out in Table 6.4. The Hausman Specification Test chooses random effects model over fixed effects model. To investigate for autoregression in our static panel, we performed Sargan's test for over-identifying restriction in a dynamic panel. This test is rejected in all cases lending support to our initial static panel model framework.

Table 6.4: Response of Big and Small Banks to a Monetary Policy Shock using CRR

Ln (loans)	Coefficient	Std. Err.	Z	p>z	95 per cent Confidence Interval	
Ln (TD)	0.533	0.039	13.36	0.000	0.455	0.611
Ln (TB)	0.070	0.011	6.24	0.000	0.048	0.092
Ln (GS)	0.211	0.037	5.80	0.000	0.140	0.284
CRR	-0.012	0.013	-0.91	0.036	-0.038	0.014
D	-0.327	0.093	-3.51	0.000	-0.509	-0.144
D*CRR	-0.017	0.019	-0.85	0.039	-0.056	0.022
Constant	1.489	0.216	6.88	0.000	1.067	1.914

All variables are significant, with CRR having a negative impact on the loan supply. The dummy intercept is negative and significant, implying that the loan supply curve has a smaller intercept for small banks. The reaction function for small and big banks can be written as follows:

Small Banks:

Ln (loan supply) = (1.48 – 0.33) + 0.53 ln (TD) + 0.07 ln (TB) + 0.2 ln (GS) - (0.01 + 0.02) CRR

Big Banks:

Ln (loan supply) = 1.48 + 0.53 ln (TD) + 0.07 ln (TB) + 0.2 ln (G) - 0.01 CRR

Since all the variables are significant, it is apparent that small banks are more severely affected by policy shocks as compared to big banks. This shows that there is asymmetrical impact of monetary policy changes on big and small banks.

When BR is the policy instrument, Hausman specification test chooses random effects model over fixed effects, and the estimation results are presented in Table 6.5.

Table 6.5: Response of Big and Small Banks to a Monetary Policy Shock using BR

Ln (loans)	Coefficient	Std. Err.	Z	p>z	95 per cent Confidence Interval	
Ln (TD)	0.518	0.039	13.14	0.000	0.441	0.595
Ln (TB)	0.073	0.011	6.58	0.000	0.052	0.095
Ln (GS)	0.186	0.036	5.10	0.000	0.114	0.257
BR	-0.039	0.015	2.65	0.008	0.010	0.068
D	-0.473	0.101	-4.67	0.000	-0.671	-0.275
D*BR	-0.052	0.019	-2.60	0.009	-0.090	-0.013
Constant	1.889	0.249	7.57	0.000	1.399	2.378

Using the aforesaid specification, the reaction functions for small and big banks can be written as follows:

Small Banks:

Ln (loan supply) = (1.88 – 0.47) + 0.52 ln (TD) + 0.07 ln (TB) + 0.2 ln (GS) - (0.04 + 0.052) BR

Big Banks:

Ln (loan supply) = 1.88 + 0.52 ln (TD) + 0.07 ln (TB) + 0.2 ln (GS) - 0.04 BR

Similar evidence is reflected in the case where Bank Rate is employed as the monetary policy instrument. The intercept of loan supply curve for the small banks lies below that for big banks. Also the loan supply curve of the former is steeper implying asymmetric effect of changes in Bank Rate for small and big banks.

The impact of investment in government securities in the loan offer functions is not as we would have expected, considering that these are close substitutes of the loans supplied. When we run the regression without investment in government securities, the results are not affected qualitatively (Tables 6.6 and 6.7).

Empirical results using panel data regression techniques clearly show the differential response of the big and small banks to policy shocks. This is in line with the results of Kashyap and Stein (1995) for the US economy to the extent that volume of lending by small banks declines more rapidly following a contractionary policy shock. In another study, Kishen and Opiela (2000) found that the effect of bank capital on loan supply by

Table 6.6 : Estimation Omitting Investment variable - CRR as the Policy Instrument

Ln (loans)	Coefficient	Std. Err.	Z	p>z	95 per cent Confidence Interval	
Ln (TD)	0.697	0.028	24.85	0.000	0.642	0.752
Ln (TB)	0.078	0.012	6.47	0.000	0.055	0.102
CRR	-0.265	0.074	-3.56	0.000	-0.411	-0.119
D	-1.417	0.242	-5.85	0.000	-1.892	-0.942
D*CRR	-0.447	0.100	4.46	0.000	0.250	0.643
Constant	2.244	0.352	6.38	0.000	1.555	2.934

Table 6.7: Estimation Omitting Investment variable - Bank Rate as the Policy Instrument

Ln (loans)	Coefficient	Std. Err.	Z	p>z	95 per cent Confidence Interval	
Ln (TD)	0.654	0.029	21.99	0.000	0.595	0.712
Ln (TB)	0.083	0.012	6.92	0.000	0.059	0.107
BR	-0.381	0.079	-4.81	0.000	-0.536	-0.226
D	-1.498	0.243	-6.17	0.000	-1.974	-1.023
D*BR	-0.448	0.102	4.38	0.000	0.248	0.649
Constant	2.859	0.378	7.56	0.000	2.117	3.600

banks is positive. Another important consideration is that small banks may face increasing cost of raising non-deposit finance relative to large banks in the event of a contractionary policy. Our results broadly conform to this line of reasoning. Banks with more assets and a wider resource base can more successfully insulate their loan supply from contractionary policy shocks than the small banks with lesser resources.

6.4 Concluding Observations

In view of the observed asymmetry in their resource base, and in major items of their assets, liabilities, and liquidity, big and small banks are expected to differ in significant ways. The analysis in this chapter indicates that on the basis of the relative strength of these differing characteristics, the lending behaviour of big and small banks also differs in response to a policy shock. In particular, small banks are more acutely affected by contractionary monetary policy shocks as compared to big banks. This implies that given their limited ability to fund lending activity under a contractionary policy shock, the response of small banks is more

pronounced as compared to the big banks, which have adequate liquid balances and/or are able to easily access non-deposit sources of funds. This differential feature of the transmission process – on big versus small banks – would indicate that since banks are conduits for the central bank's monetary transmission – larger the proportion of small banks in the system, the more responsive is bank lending expected to be to a contractionary monetary policy shock.

Chapter 7

MAIN FINDINGS AND POLICY IMPLICATIONS

7.1 Main Findings

At the outset, the study draws attention to some stylised facts which have a bearing on the relevance of monetary policy intervention in an emerging, predominantly bank-based economy such as India. In particular, it focuses attention on some of the factors, which influence the monetary policy transmission mechanism in the Indian context. These are the actual policy instruments used: correlation between the policy instruments like Bank Rate on the one hand and other interest rates and the exchange rate on the other; terms to maturity of financial assets determining how quickly monetary policy transmits its influence; growth of the financial sector and its increased competitiveness in funds deployment and finally the impact of opening up of the economy (Chapter 2).

A brief review of the received literature with primary focus on the bank lending channel is contained in Chapter 3. In particular, it needs to be recognised that the majority of the studies on the bank lending channel pertain to the US economy, although more recently, some studies for European countries and certain other Asian countries have also emerged in this area.

Following the survey of literature, a VAR framework is employed to examine the monetary policy transmission mechanism. The vector Z_t includes Index of Industrial Production (IIP), Wholesale Price Index (WPI), Commercial Paper Rate (CPR) and broad money (M3) apart from the policy instruments. Vector $D_{t,}$ on which the monetary policy shocks are assessed includes Nominal Effective Exchange Rate (NEER), Net Foreign Institutional Inflows (NFII), Bombay Stock Exchange Market Capitalisation (BSE), New Capital Issued by Public Limited Companies (PSK), Foreign Exchange Reserves, Bank Credit and Trade Balance (TB). Using VAR, Cash Reserve Ratio and changes in Bank Rate turn out to be plausible instruments of monetary policy. The results demonstrate that Cash Reserve Ratio seems to have greater potency as an instrument of monetary policy, as compared to the Bank Rate, in the medium-term, which is the horizon of the study (Chapter 4).

The next chapter conducts a detailed econometric exercise of the existence of a bank lending channel of monetary policy. Using quarterly data on a panel of banks covering the period 1997 to 2002, the results support the existence of a bank lending channel. The effects of a contractionary policy like a rise in CRR and a rise in BR are found to negatively impact the bank lending process. In addition, bank lending is also seen to be influenced by prudential ratios such as their capital adequacy position and certain other open economy features. The analysis also supports the growing importance of the RBI Repo rate, particularly since June 2000, which marks the beginning of Liquidity Adjustment Facility for banks' short-term resource mismatches (Chapter 5).

Chapter 6 delves into the asymmetry of response of big and small banks to a monetary policy shock. Preliminary data analysis indicates that in respect of their major items of assets and liabilities, there exists significant divergence between these two categories of banks. It seems likely that this asymmetry in their resource base would impinge differentially on these two classes of banks, consequent upon a monetary policy shock. The analysis demonstrates that big and small banks also differ in respect to their response to given monetary policy shocks. Illustratively, contractionary monetary policy administered through a rise in CRR or changes in Bank Rate – both affect small banks more severely as compared to big banks (Chapter 6).

7.2 Policy Inferences

First, the study suggests the existence of a bank lending channel in the Indian context. The analysis based on econometric techniques seems to validate this point. This would suggest that the central bank, while operationalising monetary policy, is likely to encounter independent shifts in the loan supply. These changes in bank loan supply would also induce changes in bank portfolios.

Second, evidence seems to point to the fact that the response of big banks to monetary policy shocks differs from that of small banks, with the latter being more compliant. In particular, large banks with a wider resource base can more successfully insulate their loan supply from

contractionary policy shocks *vis-à-vis* the small banks with limited opportunities to access markets for resources in a contractionary monetary policy regime. This would imply that bank mergers and other moves towards consolidation in the banking sector, which are likely to lead to creation of bigger banks, have implications for the efficacy of monetary policy.

Third, the study is indicative of the fact that despite the scaling down of the Cash Reserve Ratio and the Bank Rate over the period of financial reforms, quantitative instruments like the CRR continue to be important along with the price instrument Bank Rate. This is primarily so in a medium-term framework, adopted in the present study. The change in RBI Repo Rate, which has emerged as an important signalling rate in the short-term, has implications for short-term portfolio choice of banks.

Fourth, prudential regulations have an important role to play in influencing lending decisions of banks. In particular, the institution of capital adequacy ratios has made banks more concerned with the risk-return profile of loans, since additional lending warrants additional capital-base in order to adhere to the regulatory capital standards.

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