Bank Capital Structure and Monetary Policy Transmission: Evidence from India

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Abstract

The paper examines the impact of monetary policy on the capital structure of commercial banks in order to understand the transmission mechanism via bank capital channel. We use panel data of 36 banks, consisting of 21 public sector banks and 15 private sector banks. The period of analysis is 2004-05 to 2016-17. It is observed that monetary policy shocks have significant impact on the Tier-I capital of banks through its effect on interest margins and profits. An expansionary policy is found to increase the profitability of Indian banks which expands their stock of Tier-I capital. The analysis suggests that bank capital is an important channel to study the transmission mechanism for Indian economy.

Keywords: Monetary Policy, Bank Capital Channel, Capital Requirements
JEL: E520, E440, G280

1. Introduction

The theory of monetary policy and its impact on the real economy have taken a trip over different phases of economic thought. Most views on the effectiveness of monetary policy accept that monetary actions are important for the real economy, at least in the short run. Empirical studies (Schwartz (1963), Romer and Romer (1989), Bernanke and Blinder (1992)) have found that the effect of monetary policy actions on output and inflation and hence the real economy may persist for around two years. Monetary policy influences households, businesses and general economic activities like consumption and investment via interest rate channel, asset price channel, exchange rate channel, credit channel, risk-taking channel, expectations channel and many more (Mishkin (1995, 1996), Bernanke and Gertler (1995), Christiano et al. (2001), Goyal (2017)). Many of these channels have been discussed extensively in both theoretical and empirical literature. However, one channel which has gained recent attention is the bank capital channel, which works essentially through the impact of monetary policy on banks' capital structure.

The transmission process in India is not smooth and perfect. There exists empirical evidence which shows that "...monetary policy actions are felt with a lag of 2-3 quarters on output and with a lag of 3-4 quarters on inflation, and the impact persists for 8-12 quarters" (Mohanty,

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2012). Empirical analysis is, however, limited to the interest rate channel. Not much attention has been given to the role of bank capital structure in the transmission mechanism even when strong connections between bank lending and the capital structure of banks have been established (Bernanke et al. (1991), Kashyap and Stein (1995), Markovic (2006)). Emprical evidence on the effectiveness of bank capital struture on the transmission of monetary policy can be found for economies other than India. In times when Indian banking industry is struggling with enormous non-performing assets and consequent high levels of provisioning and capital erosion, it becomes even more compelling to study the impact of monetary policy on capital structure of commercial banks. The present paper is an attempt to fill in this gap.

The analysis consists of panel data of 36 banks, including 21 public sector banks and 15 private sector banks for the time period from 2004-05 to 2016-17. Various panel data models are used to check the impact of monetary policy shocks on capital structure of banks. It is observed that monetary policy shocks have significant impact on the Tier-I capital of banks through its effect on interest margins and profits. An expansionary policy is found to increase the profitability of Indian banks which expands their stock of Tier-I capital. The analysis suggests that bank capital is an important channel to study the transmission mechanism for Indian economy. The evidences from the analysis have important implications in the present context where Indian banking industry is struggling with enormous non-performing assets and consequent high levels of provisioning and capital erosion.

The paper is organised as follows. Setion 2 provides a broad overview of the challenges faced by the Indian banking industry at present and discusses the significance of the present study. Section 3 discusses the theoretical review of literature followed by empirircal evidence on monetary policy transmission in India. Time and cross-sectional dimensions, sources of data and definition and construction of different variables are discussed in Section 4. Section 5 lays down the methodolody. The estimated results are presented in Section 6. The last section concludes the paper.

2. Significance of the Study

India's banking sector has been dealing with challenges that put in doubt its strength and resilience. The primary challenge that it faces today is the burden of distressed assets[1]. In addition to this, more than 70 percent of the 'fresh capital' injections in the last three years (2015-18) was absorbed into losses suggesting that the recapitalisation amount is not sufficient to effect the credit growth (RBI, 2018). Moreover, the provisions maintained by banks themselves might not be sufficient to cover the additional requirements due to expected future loan losses, further highlighting the importance of capital buffers (Acharya, 2018). Due to such weak capital positions, banks in India have become incapable of extending credit even when they have enough funds to finance credit. One very recent example of a similar situation is the demonetisation episode of 2016 when despite substantial increase in deposits, banks were incapable to increase their loan supply as they were

[1] According to RBI's Report on Trends and Progress of Banking Sector, 2018, the gross NPAs grew by more than 30 percent in 2017-18 and touched ₹ 10397 billion in FY2018. High levels of provisioning against such overload of deterioration in asset quality has pushed the banking sector into losses in 2017-18, especially the public sector banks which accounted for a net loss of ₹ 1048697 million in the same year.

capital-constrained. Thus, it can be thought that bank capital is an important factor determining their capacity to lend. Furthermore, in a credit-driven economy, where the supply of money is no longer in the hands of the central banks and accommodates to the actual demand for it, the effect of monetary policy becomes dependent on the banking industry (Moore (1979), Beck et al. (2014)). Banks have become central to credit intermediation in modern economies making their financial soundness the deciding factor for the efficient transmission of policy (Shah, 2013). Moreover, other channels of transmission, interest rate and bank lending channel in particular, operate through the banking sector which further highlights the importance of the health of banking system (Peek et al., 1995). The current bank crises in India, with most of the banks running into losses and facing capital shortages, the capital structure of the banks is an important area to explore in order to find the missing links in justifying the weak and imperfect transmission mechanism.

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3. Monetary Policy and Bank Capital Structure: Theoretical Review

The traditional channels of monetary policy transmission, such as interest rate channel, asset price channel and credit channel, have ignored the role of bank capital and its structure. As observed by Friedman (1991), "Traditionally, most economists have regarded the fact that banks hold capital as at best a macroeconomic irrelevance and at worst a pedagogical inconvenience." This, however, is in contradiction to the importance attached to the adequacy of capital and its role in bank regulation, especially since the implementation of the Basel Accord in 1988. Capital structure, which is the distribution of equity and debt in the total capital, has strong implications for the behaviour as well as performance of the banks. Banks with lower equity and higher debt in their total capital have significantly lower levels of both return on their assets as well as return on equity (Hasan et al. (2014), Siddik et al. (2017)). The effectiveness of bank lending channel is also dependent on the level of equity of banks (Bernanke et al. (1991); Kashyap and Stein (1995)). Markovic (2006) has also discussed how health and behaviour of the banking sector can alter the way monetary policy affects inflation and output and thus, the potential role of bank capital regulation in determining bank lending decisions.

Bank equity has a direct role in the transmission process also, which has been identified as the bank capital channel. That is, monetary policy shocks can directly affect the supply of loans through its impact on the capital structure of banks. Changes in policy rates after monetary policy shocks by the central bank reflect in the interest rate margin (i.e. the markup of the lending rate over the deposit rate) of the banks as they face the cost of maturity transformation which affects its equity capital through its impact on profitability[2]. In simpler words, an expansionary monetary policy or a decline in the interest rates causes the interest margin earned by banks to increase. This happens because the interest charged on loans (lending rate) is stickier to adjust as compared to the interest paid on deposits (deposit rate) as the former have a longer maturity. For the case of India, elasticity of lending rate to WACMR (i.e weighted average call money rate which is the operating target of monetary policy) is found to be 0.30, which implies that only 30 per cent of the change in WACMR is reflected in the lending rate. The same for the 3-month deposit rate is 1.11. Moreover, lending rate takes around 8.1 months to achieve 50 per cent of the pass through; while deposit rate takes only 4.1 months (Das, 2015). The degree of lending rate stickiness is also related to structural features of the financial system. These include barriers to competition, ownership structure of the industry, and the degree of financial market development (Cottarelli and Kourelis, 1994). Such stickiness of lending rates vis-a-vis deposit rates imposes a cost on the banks due to the differences in maturity profiles of their assets (loans) and liabilities (deposits). Hence, it is called the cost of maturity transformation and it increases whenever the short-term interest rates (or policy rate) shoot up in the economy.

As interest rate margin directly influences the profits of the banks which gets added in the equity capital of the banks, a increase in the former augments the equity capital stock. Thus, an expansionary monetary policy increases the interest margin and subsequently the profits of the banks thereby raising the equity capital held by the banks. Banks, now, have more funds with them to extend advances in the economy. Contrastingly, a contractionary policy makes it more difficult for the banks to extend credit in the economy as their profits decrease after interest margins decline. A decrease in the equity capital of banks, because of low earnings, leaves the managers with options of raising fresh equity to meet the minimum threshold set by the capital adequacy norms or to shrink asset size. Generally, the bank managers chose the latter as the market for bank equity is imperfect making it both difficult and costlier to issue fresh equity. Further, interest payable on debt is tax-deductible which means that the value of the firm increases as more debt is used, even if one ignores other frictions. The additional value can be generated from the amount of tax saved by issuing debt and not equity. There are several other factors which induce firms or banks to increase their leverage. These include government guarantees against bank debts and deposits, huge transaction costs for IPOs and subsequent stock issues, and "sceptical" market perceptions about increasing equity financing by the banks[3] (Elliott, 2013). Banks, especially the poorly capitalised ones, face the risk of violating the minimum capital requirements and therefore have to cut back on their supply of loans. The small and medium sized businesses which depend more on bank credit for their operational purposes suffer due to such bank credit rationing.

The impact of monetary policy on capital structure of banks, thus, clearly stands on three pillars. They are – cost of maturity transformation which exposes them to interest rate risk, imperfect equity markets and regulatory capital requirements[4].

[2]Smaller banks which have larger maturity mismathces between their assets and liabilities bear a stronger affect on their profits and capital ratios after policy shocks (Gambacorta and Mistrulli, 2004).

[3]Increasing equity capital financing by the banks can leave the market "sceptical" about the "stupid risks" taken by the bank managers and "gaming" the system.

[4]Basel III: A global regulatory framework for more resilient banks and banking systems", released in December, 2010, is the third in the series of Basel Accords to improve the banking sector's ability to absorb shocks which arise

Developing a model incorporating mandatory capital requirements (as in Basel Accord) and imperfect markets for equity, Van den Heuvel et al. (2002) has highlighted the significance of bank capital in the transmission of monetary policy. According to the model, banks reduce lending when their equity is sufficiently low (because of losses from advancement of loans or any other adverse shock) as they face capital requirements and the cost of issuing new equity. The same holds true even when the capital requirement is not binding as low capital bank may optimally forgo profitable lending opportunities now in order to lower the risk of future capital inadequacy. Thus, capital constraints imposed by such minimum requirements lower aggregate lending by rationing credit at the equilibrium (Thakor, 1996). Capital constraints are more effective and relevant for 'peripheral' economies with larger credit market frictions (Dajcman and Tica, 2017).

3.1. Empirical evidence on Monetary Policy Transmission in India

There is a paucity of empirical evidence on the existence and effectiveness of bank capital channel for policy transmission, not only for the developing or emerging economies but even for advanced nations with well-developed capital markets. In India, extensive scholarly attention has been diverted to other channels and the overall transmission process, gaining momentum especially after the crisis years. There exists empirical evidence which shows that "...monetary policy actions are felt with a lag of 2-3 quarters on output and with a lag of 3-4 quarters on inflation, and the impact persists for 8-12 quarters" (Mohanty, 2012). Furthermore, interest rate channel is found to be the strongest amongst different channels of transmission (Acharya (2017); Goyal et al. (2017)) even though the quantity channel (i.e. the credit channel) has an indirect impact in improving the interest rate pass through. A positive shock in the policy variable (i.e. contractionary policy) associates with significant positive changes in lending rates amongst various commercial banks as well as the exchange rate. The transmission is, however, only partial for the lending rates and very weak for the exchange rates (Mishra et al., 2016). The poor transmission of policy rates to bank lending rates has been a widely discussed issue in India. The transmission is found to be not only slow and incomplete but also asymmteric in nature as it is more significant for fresh loans but not so much for outstanding loans. In fact, it is also much stronger during the tightening phase and weaker during the easing phase of the monetary policy (Acharya (2017); Bhaumik et al. (2011); (Das, 2015)). The reasons for this is that loan portfolio of banks is based on the base rate system (around 30 per cent) which is stickier to adjust than MCLR (Marginall Cost of Lending Rate) lending criterion[5]. Moreover, for the loans which are charged on MCLR basis, the spreads charged by banks are arbitrarily adjusted to offset any reduction in policy rate.

Other challenges to effective transmission of monetary policy include policy induced frictions like interest rate subventions, loan waivers to specific sectors, slow adjusting savings instruments and credit allocations (Lahiri and Patel, 2016). The presence of reserve requirements – CRR and

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from financial and economic stress while keeping in consideration the need for more sound and stable banking system (Shah (2013); Kapoor and Kaur (2017)). According to Basel III, banks are required to maintain a minimum of 7 percent of their risk-weighted assets in the form of Tier-I Capital and a maximum of 2 percent of the same as Tier-II Capital. In addition to this, a Capital Conservation Buffer of 2.5 percent is also mandated.

[5]Under the base rate system, interest rates for bank loans are determined according to the *average cost* of funds and hence become stickier to adjust than MCLR lending criterion where *marginal cost* determines the benchmark for lending rate.

SLR – to be maintained by Indian banks are also believed to be a primary reason for this. Large dominance of informal credit sector is found to be the hindrance in the process[6] Banerjee et al. (2018).

Nonetheless, little attention has been given to transmission of monetary policy via bank capital or the impact of policy changes on the capital structure of banks. This paper is an attempt to fill in this gap and check the importance of bank capital structure for the transmission of monetary policy in the Indian context.

4. Data

The study is focused on individual Indian banks for a time span of 13 years starting from 2004-05 to 2016-17. The starting point has been taken with reference to introduction of Liquidity Adjustment Facility (LAF), which has been considered as a breakpoint in the history of monetary policy study in India (Sengupta, 2014). Although, introduction of LAF as a liquidity management tool was recommended by Narasimham committee on banking sector reforms (in the year 1998), there were subsequent revisions made in the year 2001 and 2004. In 1999, when the scheme was introduced, repo auctions refered to those operations which absorbed liquidity from the system and reverse repo actions to those which injected liquidity into the system. But, it must be noted that international definitions of repo and reverse repo meant the reverse. In 2004, LAF was once again revised to follow the international usage of terms. Another important modification in LAF operations came in terms of a shift towards 'fixed rate' mode from the previously operating 'auction-based variable rate'. Thus, our study considers 2004-05 as the starting point for the analysis.

A total of 36 banks have been included in the study, which consists of 21 public sector banks and 15 private sector banks. Although India has a large number of banks with foreign ownership operating within its boundaries, we have deliberately excluded foreign banks from the analysis on account of three reasons. First, it is hard to believe that the foreign banks change their operations post changes in Indian monetary policy. We can expect the foreign banks to be more in line with the monetary actions in their respective home countries. Second, the capital structure of foreign banks is very diverse and alike from that of Indian banks, in a sense that the former have significantly large amounts of equity component in their capital structure. Third, data on foreign banks operational in India is not easily available. We, thus, have a balanced panel data set – with 36 cross-sectional units, i.e. banks; and 13 time periods.

The study is exclusively based on secondary data, which comes from two sources. For macroeconomic variables like output gap and call money rate, information is obtained from RBI's Handbook of Statistics on Indian Economy. Along with this, information about banks' consolidated balance sheets and income statements for variables like interest margins, profitability, NPA ratios, advances and deposits, size of bank and equity ratios has also been obtained from RBI's handbook. Daily returns from stock price movements are used to calculate asset risk borne by banks. BSE historical

[6] According to the 2017 Global Findex Reportof the World Bank, India has the second largest share of the unbanked population in the world, with over 190 million adults still having no bank accounts.

database on equity markets provides information on the same.

4.1. Definition and Construction of Variables

Table (1) Definition and Construction of variables

Legend	Definition	Construction
K	Tier-I capital asset ratio	Tier-I Capital/RWA
CMR	Call Money Rate (Policy Rate)	Annual averages of $WCMR$
Δi	Interest Differential	Return on Advances–Cost of Deposits
RoE	Return on Equity	Net Profit/Total Equity
$\ln size$	Natural log of balance sheet size	ln(Book Value of Assets)
LR	Liquidity Risk	FGR = (loans – deposits)/total assets
AR	Asset Risk	$SPV^*(MVE/MVB)$
NPA	Non-Performing Assets ratio	Net NPA/Net Advances
Y_{gap}	Output gap	$Y - Y^*$

Note: RWA: Risk-Weighted Assets; $WCMR$: Weighted Call Money Rate; FGR: Financing Gap Ratio; SPV: Stock Price Volatility (Annualised Standard Deviation of Daily Stock Price Returns); MVE: Market Value of Equity; MVB: Market Value of Bank (or Market Value of Assets); Y: Output; Y^*: Potential Output

Table 1 provides a summary of all the variables used.

CMR_t has been used to capture policy shocks or changes in policy rate at t^{th} time period. CMR, or the call money rate, can be defined as the rate at which commercial banks borrow or lend funds in the overnight money market. Central bank in its operating framework aims to align CMR with its policy rate through active management of liquidity, in consistence with the stance of monetary policy (RBI, 2018). Thus, CMR has been explicitly accepted as the operating target of monetary policy and is thus used as a proxy for policy shock (Mohanty, 2012). Annual averages have been calculated from the available quarterly data. Next, the division of capital structure, as outlined by the Basel norms for the capital adequacy requirements, has been used. Capital of banks, as per Basel norms, is divided into two components depending on the characteristics/qualities of each qualifying instrument. Tier-I capital (primarly equity and reserve capital) indicates the primary capital of the bank and absorbs the profits and losses of the banks. Hence, changes in profits as a result of monetary policy will directly affect the Tier-I capital of banks. Tier-II capital (primarly debt capital), on the other hand, is supplementary in nature. It remains unaffected by monetary policy as interest rate changes do not affect value of debt or its servicing. The absolute amounts of Tier-I or Tier-II capital is not available from the annual accounts of banks. Only the respective capital to risk-weighted assets ratio (CAR) are reported. Therefore, to capture the impact of policy announcements, Tier-I CAR (K_{it}) is used as the dependent variable. We expect the Tier-I ratio to increase (decrease) after expansionary (contractionary) monetary policy.

Δi_{it}, or interest differential, represents the cost of maturity transformation borne by banks due to maturity profile of its assets and liabilities. Since data on lending rates and deposit rates is not readily available from the annual bank statements, Δi_{it} is measured as the difference between the return on advances earned by banks and the corresponding cost of deposits. Lower the interest differential, higher is the cost of maturity transformation incurred by the banks and lower is the profitability, which is reflected by RoE_{it}. There are different measures available in the literature to assess the profitability of banks like return on equity, return on assets, net interest margin etc. For our purpose, return on equity (which is the ratio of net profits to amount of equity held by the bank) is used as a measure to capture the profitability of individual banks. The data for return on advances, cost of deposits and return on equity is available from the RBI's handbook. Thus, call money rate (CMR_t), interest differential (Δi_{it}) and return on equity (RoE_{it}) represent our core explanatory variables.

We also use certain control variables in our analysis. These include both bank-specific control variables - bank size ($\ln size_{it}$), liquidity risk (LR_{it}), asset risk (AR_{it}), non-performimg assets (NPA_{it}); and macroeconomic control variable - output gap (Y_{gap_t}). These variables have been considered exogenous in nature since they do not get affected by monetary policy changes but do affect the capital structure of banks.

Bank size measures the size of its operations and is captured by taking the total size of its asset base on a logarithmic scale. It can have both positive or negative relation with its capital. On one hand, larger banks can choose to maintain higher levels of capital with them since they are more complex and hence more prone to costs of asymmetric information in the capital markets. On the other hand, they can also afford to keep a smaller capital base as they are better known to the capital markets (Gropp and Heider, 2010).

Liquidity risk measures the inability of bank either to fund an increase in its assets or to accommodate an increase in its liabilities or both (Shen et al., 2009). For the calculation of liquidity risk, literature provides us with different measures like liquidity ratios, loans to total assets ratio and so on. We have used the *financing gap ratio* to calculate the liquidity risk of an individual bank. Financing gap is the excess of loans advanced by a bank over the amount of deposits that it holds. This standardised by the total assets of the bank measures the financing gap ratio (FGR). A higher FGR implies that a bank has advanced more loans to public compared to the amount of deposits that it holds, thereby, indicating that it is more prone to liquidity risks in future. To fund this gap, the bank must either use its cash or sell off its liquid assets or use external funding, whenever required. Liquidity risk is also a measure to capture general public's confidence on the bank.[7] Asset risk, on the other hand, describes the shareholders' confidence about the performance of the bank. It is calculated as the product of annualised standard deviation of daily returns on stock prices for individual banks and the ratio of market value of equity to market value of bank[8] (Gropp and Heider, 2010). Lesser volatility in the market value of equity implies more confidence among the shareholders about the bank's future performance and hence the bank is less risky. Higher volatility in its stock prices contributes to higher asset risk borne by the bank which can further increase the cost of issuing fresh equity in the market. Hence, asset risk can also be used as a proxy to measure the cost of raising equity capital for a bank. Both liquidity risk and asset risk measures are expressed in percentage terms.

[7]Higher FGR implies higher chances of bank runs by depositors.

[8]Market value of bank is equivalent to market value of its total assets, which is nothing but market value of equity plus book value of its outside liabilities.

The ratio of net non-performing assets to net advances is used as a measure to capture the amount of bad assets held by the Indian banks. NPAs in the balance sheets of banks can also be seen as realised risk borne by them at the end of each financial year. An increase in NPA ratio for a bank has severe consequences on its performance since it reduces the confidence of investors, lenders, depositors as well as the general public. Further, higher NPA ratios have direct impact on the profitability and normal business of the banks[9].

Output gap, i.e. the difference between the actual output of an economy (Y) and its potential ($Y*$), has been taken as a measure to control the macroeconomic performance of Indian economy. It has been calculated using the Hamilton (2018) filter. A positve output gap implies that the economy is outperforming its potential and this may exert inflationary pressures in the economy.

Levin-Lin-Chu and Fisher-type unit-root tests are performed to check the stationarity of variables. All variables are found to be stationary at levels.

5. Methodology

We shall be using three different econometric models to study the first leg of monetary transmission via bank equity channel that constitutes the objective of this paper. Each of these models is explained below.

5.1. Static Linear Panel Model

First, the impact of monetary policy shocks on the the capital structure (i.e. Tier-I CAR here) is analysed using a static linear panel model. The following equation depicts our model:

$$K_{it} = \beta_0 + \beta_1 Y_{gap_t} + \beta_2 CMR_t + \beta_3 \Delta i_{it} + \beta_4 RoE_{it} + \beta_5 \ln size_{it} + \beta_6 LR_{it} + \beta_7 AR_{it} + \beta_8 NPA_{it} + \epsilon_{it} \quad (1)$$

where K_{it}, i.e., Tier-I capital asset ratio, is our dependent variable. The core explanatory variables which explain the bank capital channel are CMR_t, Δi_{it} and RoE_{it}, i.e. call money rate, interest differential and return on equity, respectively. Size of bank ($\ln size_{it}$), liquidity risk (LR_{it}), asset risk (AR_{it}) and NPA ratio (NPA_{it}) are bank-specific control variables and output gap (Y_{gap_t}) is the macroeconomic control variable. ϵ_{it} is the typical error term.

Assuming one-way error component model for the disturbance terms[10] (Baltagi, 2008), the error term can be written as:

$$\epsilon_{it} = \mu_i + e_{it} \quad (2)$$

[9] Non-performing assets earn no interest income for the bank and banks have to increase the lending rates vis-a-vis deposit rates to maintain the interest margins, as a result of which banks face probllems of liquidity management. Also, NPAs have a direct impact on banks' ability to lend and hence their asset size.

[10] A two-way error component regression model also includes a time effect, ϕ_t, which is invariant amongst the cross-sections. Hence,

$$\epsilon_{it} = \mu_i + \phi_t + e_{it}$$

where μ_i is a scalar (time-invariant) term and is accounted for any unobserved individual effect that is not included in the regression. This can be used to depict the bank-specific characteristics which are unique to individual banks and remain fixed over-time. These can be history of the bank, managership or ownership, motives of its operations and so on. As it is nearly impossible to capture such characteristics, panel data analysis helps us to analyse their impact of the dependent variable using the term μ_i. The remainder error term e_{it} can be thought of as the usual disturbance, and it varies over i and t.

In our study, we can expect these bank-specific unobserved characteristics to be correlated with other explanatory variables in the equation. For instance, profitability of the bank will be dependent on its operational and managerial history. Thus, fixed-effect model is used for the analysis and μ_i is a parameter to be estimated for each i. It can also be included with the intercept term resulting in each individual having different intercepts but same slope parameters. The remainder e_{it} is independent of other variables and is identically distributed with zero mean and constant variance. The following assumptions hold true for a fixed-effect model:

$$Cov(X_{it}, \mu_i) \neq 0; Cov(X_{it}, e_{it}) = 0 \text{ and } ; e_{it} \sim I.I.D.(0, \sigma_e^2) \tag{3}$$

where, X_{it} can be thought of a general representation of explanatory variables.

Thus, the final model for fixed-effect estimation is as follows:

$$\begin{aligned} K_{it} = \beta_0 + \beta_1 Y_{gap_t} + \beta_2 CMR_t + \beta_3 \Delta i_{it} + \beta_4 RoE_{it} \\ + \beta_5 \ln size_{it} + \beta_6 LR_{it} + \beta_7 AR_{it} + \beta_8 NPA_{it} + \mu_i + e_{it} \end{aligned} \tag{4}$$

Since individual effect (i.e. μ_i) is unobservable, we cannot directly control for it. Due to the its correlation with the other exogenous variable(s), it becomes a source of endogeneity and needs to be eliminated. Fixed-effect estimation, thus, transforms the model equation by *demeaning* the variable, eliminating the time-invariant term (μ_i). An OLS regression of the transformed (or demeaned) dependent variable on the transformed explanatory variables gives the fixed-effect parameters. Hausman specification test is used to validate the choice of this methodology.

5.2. Dynamic Linear Panel Model

The static model, however, fails to capture the time dynamics or the lagged impact of dependent variable in the system. We, thus, consider a dynamic panel model - a model with (atleast one) lagged values of the dependent variable as one of the regressors - in order to better understand the dynamics of adjustment (Baltagi, 2008). However, there are various problems which emerge while estimating a dynamic panel model. The presence of lagged dependent variable ($K_{i,t-1}$) as a regressor in the system violates strict exogeneity, as it is necessarily correlated with the time-invariant component of the error term (μ_i). The fixed-effect OLS estimation, thus, becomes biased and inconsistent. Random effect GLS estimation is also biased even if the e_{it} are not serially correlated.

Anderson and Hsiao (1981) first proposed a solution to this by utilising instrumental variables (IV) estimation. There have been various other attempts to find appropriate instrument variables for dynamic panel models (Arellano, 1989; Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998).

For our study, we will be using a system generalised method of moments (GMM) estimator developed by Blundell and Bond (1998). It uses moment conditions where lagged differences are used as instruments for the level equation in addition to the moment conditions of lagged levels as instruments for the differenced equation (as in the differenced GMM of Arellano and Bond (1991)). The use of additional moment conditions helps in improving the precision and reducing the sample bias thereby improving the small sample performance of the differenced GMM estimator by. Also known as the *Arellano-Bover/Blundell-Bond* estimator, the system GMM is designed for datasets with large panels and small number of time periods. It controls for the endogeneity caused due to the lagged dependent variable and the presence of unobserved panel heterogeneity (μ_i). The method assumes that there exists zero autocorrelation in the idiosyncratic errors. It also requires the panel-level effects to be uncorrelated with the first difference of the first observation of the dependent variable. i.e. $E(\mu_i \Delta K_{i,2}) = 0$, for all i.

The following equation (eq. (5)) represents our dynamic panel:

$$K_{it} = \beta_0 + \gamma K_{i,t-1} + \beta_1 Y_{gap_t} + \beta_2 CMR_t + \beta_3 \Delta i_{it} + \beta_4 RoE_{it} + \beta_5 \ln size_{it} + \beta_6 LR_{it} + \beta_7 AR_{it} + \beta_8 NPA_{it} + \mu_i + e_{it} \quad (5)$$

where γ, the coefficient of K_{it-1}, represents the speed of adjustment of Tier-I capital asset ratio, our dependent variable. The rest of the variables remain same as above.

The equation has been estimated in two different ways. First, all explanatory variables have been taken as exogenous in nature, i.e. the present values of these variables have been assumed to be uncorrelated with the error terms for all time periods. The instruments, here, include second, third and fourth lags of dependent vraiable (i.e. K_{it}) and first differences of other explanatory variables in the differenced equation; and lagged differences of K_{it} as instruments for the level equation.

Second, return on equity (i.e. profitability of banks) is considered to an endogenous variable since it is expected to be effected by errors/shocks in the current time-period or by the capital structure of the bank itself. The system GMM method treats endogenous variables similar to the other lagged variables in the equation and takes their lagged values as instruments. In addition to the instruments in the first equation, second and third lag of our endogenous variable (i.e. RoE_{it}) for the differenced equation and lagged differences of RoE_{it} as instruments for the level equation, are also used.

5.3. Panel Vector Auto Regressive (PVAR)

One must note that both static as well as dynamic linear model explain only the partial impact of our core variables. The interdependencies between them, or the effectiveness of complete bank capital channel, remains undetermined. We, thus, shift to Panel Vector Auto-Regressive model, for analysing both direct and indirect relations among our variables. VAR models are claimed to be better alternative to the “incredible identification restrictions” as they provide a theory-free method to explain the economic relationships between variables (Sims, 1980). The structure of panel VAR remains similar to that of the VAR models and “all variables are assumed to be endogenous and interdependent”. The only difference is the inclusion of a cross sectional dimension to account for different panels.

A panel VAR has three characteristic features. First, lags of all endogenous variables are included in the model for each panel i, accounting for the *‘dynamic interdependencies’*. Second, the error terms ϵ_{it} are correlated across i accounting for *‘static interdependencies’*. Third, the intercept, the slope and the variance of the shocks ϵ_{it} may be unit specific accounting for *‘cross sectional heterogeneity’* in the model. Panel VARs are particularly helpful in analysing the transmission of idiosyncratic shocks across units and time which wxplains the rcent boom in empirical research in the fields of macroeconomics, banking and finance, and international economics using panel VARs (Canova and Ciccarelli, 2013).

PVAR models can be modified according to the purpose of the analysis. For instance, Holtz-Eakin et al. (1988) use the panel VAR model assuming certain time-invariant panel characteristics ignoring the typical interdependencies. On the contrary, Cushman and Zha (1997) have used a set of predetermined or exogenous variable in their model to examine the impact of monetary shocks in Canada. Such a model which includes certain exogenous or predetermined variables in addition to the endogenous variables is called “block recursive VARX structure". Jimborean and Mésonnier (2010) have used a different version of VAR model - known as the Factor-Augmented Vector Autoregression (FAVAR) model - to estimate how banks’ financial conditions influece the monetary policy transmission in the case of French economy. Canova et al. (2012) have used PVAR models to study the transmission of policy shocks in US to European countries.

The following equation (Eq. 6) depicts our PVAR model:

$$\begin{bmatrix} K_{it} \\ CMR_t \\ \Delta i_{it} \\ RoE_{it} \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \\ \beta_{30} \\ \beta_{40} \end{bmatrix} + \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} & \beta_{14} \\ \beta_{21} & \beta_{22} & \beta_{23} & \beta_{24} \\ \beta_{31} & \beta_{32} & \beta_{33} & \beta_{34} \\ \beta_{41} & \beta_{42} & \beta_{43} & \beta_{44} \end{bmatrix} \begin{bmatrix} K_{it-1} \\ CMR_{t-1} \\ \Delta i_{it-1} \\ RoE_{it-1} \end{bmatrix} + \begin{bmatrix} \beta_{15} & \beta_{16} & \beta_{17} \\ \beta_{25} & \beta_{26} & \beta_{27} \\ \beta_{35} & \beta_{36} & \beta_{37} \\ \beta_{45} & \beta_{46} & \beta_{47} \end{bmatrix} \begin{bmatrix} \ln size_{it} \\ AR_{it} \\ NPA_{it} \end{bmatrix} + \begin{bmatrix} \mu_{1i} \\ \mu_{2i} \\ \mu_{3i} \\ \mu_{4i} \end{bmatrix} + \begin{bmatrix} e_{1it} \\ e_{2it} \\ e_{3it} \\ e_{4it} \end{bmatrix} \quad (6)$$

The aim, here, is to capture the bank capital channel using our *core variables*, i.e. CMR_t, Δi_{it}, RoE_{it} and K_{it}. Each of these variables is taken as dependent on their own lagged values, the lagged values of each other and the error terms. In this way, the policy transmission through the bank capital as a channel can be studied by checking the effect of call money rate (policy variable) on the interest differential of individual banks; effect of interest differential on the profitability and the final impact of profitability on the Tier-I capital. The coefficients β_{32}, β_{43} and β_{14} in equation 6 need to be significant for the above three links to explain the bank capital channel. The other bank-specific variables have been assumed to be exogenous here and are represented in the second 3x3 matrix on the right side of eq.6. The equation also includes the unobserved bank-specific fixed effects (μ_{1i}, μ_{2i}, μ_{3i} and μ_{4i}) in order to capture the panel heterogeneity for each equation. The corresponding error/disturbance terms are represented by e_{1it}, e_{2it}, e_{3it} and e_{4it}.

Generalised moment of conditions (GMM) estimation is used to estimate the model and first four lags of the endogenous variables are taken as instruments. Using the model and moment selection criteria (MMSC) for GMM models based on Hansen's J statistic of over-identifying restrictions (Hansen (1982); Andrews and Lu (2001)), the optimal lag order is one.[11].

The results of all models are presented in the next section.

6. Estimation and Results

6.1. Static Linear Model

Table 2 shows the results of the linear model estimated in the fixed-effect panel framework. While call money rate (i.e. our monetary policy variable) has a negative and significant effect on the Tier-I CAR, both interest rate differential and profitability significantly effect the same in a positive way. This implies that our main channel variables for the bank capital channel work as expected in the corresponding theory. An expansionary monetary policy by reducing the interest rates in the market and hence increasing the interest and profit margins of the individual banks augments their equity capital stocks (Model 1).

[11] Both MMSC-Bayesian Information Criterion(MMSC-BIC) and MMSC-Hannan-Quinn information criteria (MMSC-HQIC) give the smallest statistic at lag order one.

Table (2) Results of Fixed-Effect Estimation

Variable	Model 1	Model 2	Model 3	Model 4
CMR	-0.1582***	-0.1540**		
	(0.0590)	(0.0593)		
Δi	0.3403**		0.3746***	
	(0.1342)		(0.1312)	
RoE	0.0245*			0.0343***
	(0.0125)			(0.0123)
$\ln size$	0.4159***	0.4500**	0.2862**	0.2791**
	(0.1423)	(0.1436)	(0.1325)	(0.1327)
LR	0.1033***	0.0962***	0.0943***	0.0951***
	(0.0130)	(0.0131)	(0.0129)	(0.0130)
AR	-0.4739**	-0.3930**	-0.4609***	-0.4553**
	(0.1688)	(0.1696)	(0.1702)	(0.1701)
NPA	0.0978	-0.0358	0.0146	0.0994
	(0.0613)	(0.0406)	(0.0435)	(0.0616)
Y_{gap}	0.0098	0.0235	0.0352	0.0355
	(0.0344)	(0.0346)	(0.0338)	(0.0338)
$Constant$	-0.0413	0.7188	2.5836	3.7224
	(3.8984)	(3.9206)	(3.7784)	(3.7668)
ρ	0.6147	0.6374	0.5738	0.6219
F (overall)	16.56***	19.31***	19.61***	19.54***
(df1,df2)	(8, 424)	(6, 426)	(6, 426)	(6, 426)
F ($\mu_i = 0$)	11.84***	14.62***	11.29***	14.44***
(df1, df2)	(35, 424)	(35, 426)	(35, 426)	(35, 426)
Corr(μ_i, X_{it})	-0.2438	-0.3127	-0.099	-0.2459
Hausman χ^2	52.51***	23.95***	33.32***	19.80***

Note: ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively. Standard errors are reported in parenthesis.

If we take the channel variables individually, i.e. Model 2,3 and 4, we find that the channel variables are still significant with similar signs of the coefficients but the statistical significance improves for the interest margin and profitability.

The results also show that as size of the banks grow, they tend to hold more equity capital with them. This provides support to the argument that as Indian banks grow in size, it becomes easier for them to raise equity capital from the markets perhaps on account of lower information costs. Further, both liquidity risk and asset risk are significant variables effecting the capital structure of the banks. As banks face higher liquidity risks, they add to their capital stocks to provide for the unforeseen events. Asset risk, on the other hand, has a negative impact indicating that higher volatility in the stock prices and subsequently in the market equity of the banks makes it costlier for the banks to raise equity. Non-performing asset ratio does not seem to have any significant effect on the Tier-I CAR of banks. The same holds true for the output gap which measures the macroeconomic impact.

For all the estimated models, the proportion of variance explained by the unobserved individual effect (ρ in Table 2) is very high, highlighting the importance of bank-specific heterogeneity in explaining differences in capital structure of Indian banks. Factors like bank ownership, history, management etc. which cannot be observed directly also influence the capital decisions of Indian banks to a great extent.

Two F-test statistics are also provided in the table. The first one gives the overall significance of the individual models, with corresponding degrees of freedom. The second F-test tests the null hypothesis if the individual effect (μ_i) is significant or not. We can see that for all the models, time-invariant bank-specific individual effect is significant.

6.2. Dynamic Linear Model

The results of the dynamic linear model (GMM estimation) are presented in Table 3. As anticipated, the first lag of the Tier-I capital turns out to be siginificant in determining its current level implying that banks do not adjust their capital structures significantly in the short-run. Output gap again turns out to be an insignificant factor.

The second column in the table (Model 1) shows the results when all variables, other than the lagged value of the dependent varible, are taken as exogenous in nature. Call money rate has a negative impact on the Tier-I CAR but the effect is significant at 10 percent significance level only. Interest rate differential has a positive and highly significant effect. Although the profit margin also positively adds up to the Tier-I capital stock, the effect is very small and significant only at 10 percent level. Liquidity risk still remains significant while asset risk as well as the size of the banks lose their significance after including the lagged dependent variable as one of the regressors. The non-performing asset ratio, which was insignificant in the static models, has a positive and significant effect on the Tier-I CAR in the dynamic model. This explains that banks with higher amounts of stressed assets in their balance sheets tend to maintain higher equity capital with them further stressing on the importance of capital buffers. In the third column (Model 2), we take profitability (RoE_{it}) as an endogenous variable, as explained in the section above. We observe that its coefficient improves in strength as well as significance. The coefficient of liquidity risk also

Table (3) Results of System GMM Estimation

Variable	Model 1	Model 2
K_{t-1}	0.4192***	0.4055***
	(0.1175)	(0.1045)
Y_{gap}	-0.0299	-0.0293
	(0.0189)	(0.0208)
CMR	-0.0949*	-0.0940*
	(0.0526)	(0.0543)
Δi	0.7367***	0.7789***
	(0.1578)	(0.1418)
RoE	0.0299*	0.0415***
	(0.0179)	(0.0146)
LR	0.0591***	0.0803***
	(0.0193)	(0.0184)
AR	0.1009	0.0362
	(0.2156)	(0.1962)
$lnsize$	0.0632	0.3401
	(0.1830)	(0.0761)
NPA	0.2939***	-0.0892***
	(0.0740)	(0.1904)
$Constant$	2.0900	6.5215
	(5.3869)	(5.3999)
Wald χ^2	187.61***	190.80***
AR(1)	-3.2421***	3.3111***
AR(2)	0.9363	0.8441

Note: ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively. Standard errors are reported in parenthesis.

improves. The other vaiables, howver, show similar results as before.

Wald χ^2 statistics, for both Model 1 and Model 2, gives significant results implying that the overall significance of the respective models. The Arellano–Bond test statistic is also reported in the table. The last two rows in the table state the AR(1) and AR(2) test statistics, respectively, based on the Arellano-Bond test for serial correlation in the first-differenced residuals (which is a necessary condition for the moment conditions to be valid). The null hypothesis for the test is zero autocorrelation in the first-differenced residuals. The results show that there exist serial autocorrelation in the first differenced errors terms at order one, but not at the second order. The null hypothesis is not being rejected at order two which implies that moment conditions are valid and the models are correclty specified.

One must notice that in all the above models, only the direct and partial impact of our channel variables on the dependent variable can be studied. The real channel effect of the policy variable on the Tier-I CAR through interest rate differential and profit margin cannot be determined in the estimated models. Nonetheless, these results, albeit partial and inadequate to claim anything, do encourage us to take a further look at the estimation framework. We, thus, will be now using the Panel Vector Auto-Regressive method to estimate the various links of the bank capital channel.

6.3. Panel Vector Autoregressive Model

Table (4) Results of PVAR

Variables\Eq	K	CMR	Δi_{t-1}	RoE
K_{t-1}	0.3981***	0.0465	-0.0499	-1.6401***
	(0.0797)	(0.1375)	(0.0373)	(0.6342)
CMR_{t-1}	-0.1185***	0.5192***	-0.0867***(β_{32})	-0.6957**
	(0.0444)	(0.0640)	(0.0169)	(0.3102)
Δi_{t-1}	0.3939**	0.1592	0.5185***	6.1963***(β_{43})
	(0.1680)	(0.3190)	(0.0804)	(1.7202)
RoE_{t-1}	0.0349**(β_{14})	-0.0535**	0.0221***	0.3762*
	(0.0162)	(0.0220)	(0.0056)	(0.1947)
$\ln size$	0.4394	-0.7616	-0.4054***	-1.7605
	(0.3489)	(0.5359)	(0.1290)	(2.5836)
AR	0.0837	-0.5919**	-0.0777	-5.7110***
	(0.1409)	(0.2292)	(0.0705)	(1.4459)
NPA	0.1635***	-0.2571***	0.0479**	-1.0200
	(0.0611)	(0.0891)	(0.0229)	(0.6576)

Note: ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively. Standard errors are reported in parenthesis.

In table 4, the first column represents all explanatory variables (both exogenous and lagged variables) for different equations in our PVAR model, while the endogenous equations are represented in the rest of the columns. For instance, the second column represents the equation where Tier-I CAR is being determined by the first lag of itself, call money rate, interest differential and the profit; and the other exogenous variables in the system - size, asset risk and NPA ratio.

As explained above, for the bank capital channel of policy transmission to work properly, we require the coefficients β_{32}, β_{43} and β_{14} to be significant. In our results, we find all these to be significant and the coefficient signs also match the theoretical expectations. A change in the policy variable, i.e. call money rate, has a negative impact on the interest differential of the banks (β_{32}). Hence, whenever the central bank announces an expansionary monetary policy and the interest rates in the economy fall, it exerts a downward pressure on the deposit rates of banks but the lending rates do not adjust immediately by the same amount, as a result of which the interest differntial of the banks increase. This hike in the interest margin increases the profitability of the banks by around six times (β_{43}). Since Tier-I capital is maintained at on-going basis, it reflects any change in the profits and losses of the banks. The coefficient of profit on the capital (β_{14}) shows the positive relation between the two.

Thus, we can say that all the links of the bank capital channel work accurately for the Indian banks and monetary policy shocks after policy announcements by RBI have significant impact on the capital structure of the banks. Moreover, the lagged values of the endogenous variables significantly affect the corresponding current values stressing on the short-run dynamics of change for these variables.

Other exogenous variables in the system of PVAR equations can be interpreted as follows. Bank size has a direct negative impact on the interest differential (or interest rate risk) of Indian banks. Results show that as banks grow larger in size, their interest marfins decrease (or interest rate increases). It doesnot have a significant effect on capital directly. Similarly, asset risk does not have any significant direct impact on Tier-I CAR. The former affects the latter only through profitability. As asset risk borne by banks increase, or as their equity prices become more volatile in the capital markets, it affects their profitability negatively and significantly. Another important finding is that non-performing ratio has a positive and direct impact on Tier-I capital-asset ratio of individual banks. This implies that banks maintain more equity capital with them as and when they face higher distress in their balance sheets owing to high levels of stressed assets. We can, thus, say that bank-specific control variables affect the main dependent variable (Tier-I CAR) through various direct and indirect routes.

Overall, the results of PVAR estimation indicate that the bank capital channel of monetary policy transmission is active for the Indian banks and all the links for the channel work well. This implies that whenever central bank changes its stance on the monetary policy, the banks in India have to alter their capital structure which can have considerable impact on their lending capabilities. The next chapter studies this second leg of the monetary policy transmission via bank capital.

6.4. Post-Estimation Tests for PVAR

Granger-Causality Wald Test

After fitting a panel VAR, we check whether one variable "Granger-causes" another, which means that the latter can be predicted based on its own past values and on the past values of the former, and these predictions would be better that those based on only its own past values. The

Granger (1969) Wald test has been used and the results for each equation of the underlying panel VAR model are presented in table 5. The null and alternate hypothesis for the test is as follows:

H_0 - Excluded variable does not Granger-cause dependent variable of the i^{th} equation
H_a - Excluded variable Granger-causes equation dependent variable of the i^{th} equation

Table (5) Results of Granger Causality Wald Test

Ex \ Eq	K	CMR	Δi	RoE
K	...	0.115	1.79	6.689***
CMR	7.143***	...	26.224***	5.031**
Δi	5.495**	0.249	...	12.974***
RoE	4.627**	5.936**	15.541***	...
All	16.989***	6.281*	42.842***	16.461***

Note: ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively.

The results show that the policy changes, as captured by changes in the call money rate, have a causal impact on the interest differential and profitability of the banks. And these, in turn, cause the changes in Tier-I capital asset ratio which indicates that monetary policy does have a causal impact on the equity capital and hence the capital structure of banks in India.

Eigenvalue Stability Condition

The stability condition of panel VAR calculates the modulus of each eigenvalue of the estimated model and requires all moduli to be strictly less that one for the estimated model to be stable. If the stablity condition is satisfied, the panel VAR is said to be invertible and has a moving-average representation of infinite-order, providing known interpretation to estimated impulse-response functions and forecast-error variance decompositions. Table 6 and Figure 1 depict the results of the stability test. Because the modulus of each eigenvalue is strictly less than 1, the estimates satisfy the eigenvalue stability condition.

Forecast Error Variance Decomposition

The forecast-error variance decomposition (FEVD) of the residual covariance matrix of the estimated PVAR model is shown in Table 7. Based on Cholesky decomposition, the FEVD estimates show that around 23 percent of variation in interest differential and around 12 percent variation in banks' profitability can be explained by the policy shocks (i.e. change in call money rate). On the other hand, channel variables (i.e. CMR_t, Δi_{it}, RoE_{it}) explain close to 40 percent of the variation in the Tier-I capital asset ratio of the banks. One, however, needs to be careful while concluding the FEVD results since it disregards the contributions of the exogenous variables in the model.

Impulse Response Function

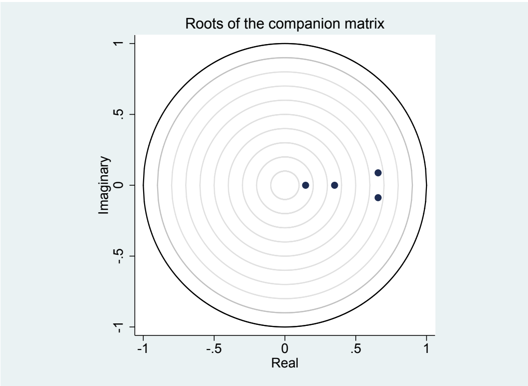

Figure (1) Eigenvalue Stability Condition

Table (6) Eigenvalue Stability Result

Real	Imaginary	modulus
0.6577	-0.0876	0.6635
0.6577	0.0876	0.6635
0.3506	0.00	0.3506
0.1459	0.00	0.1459

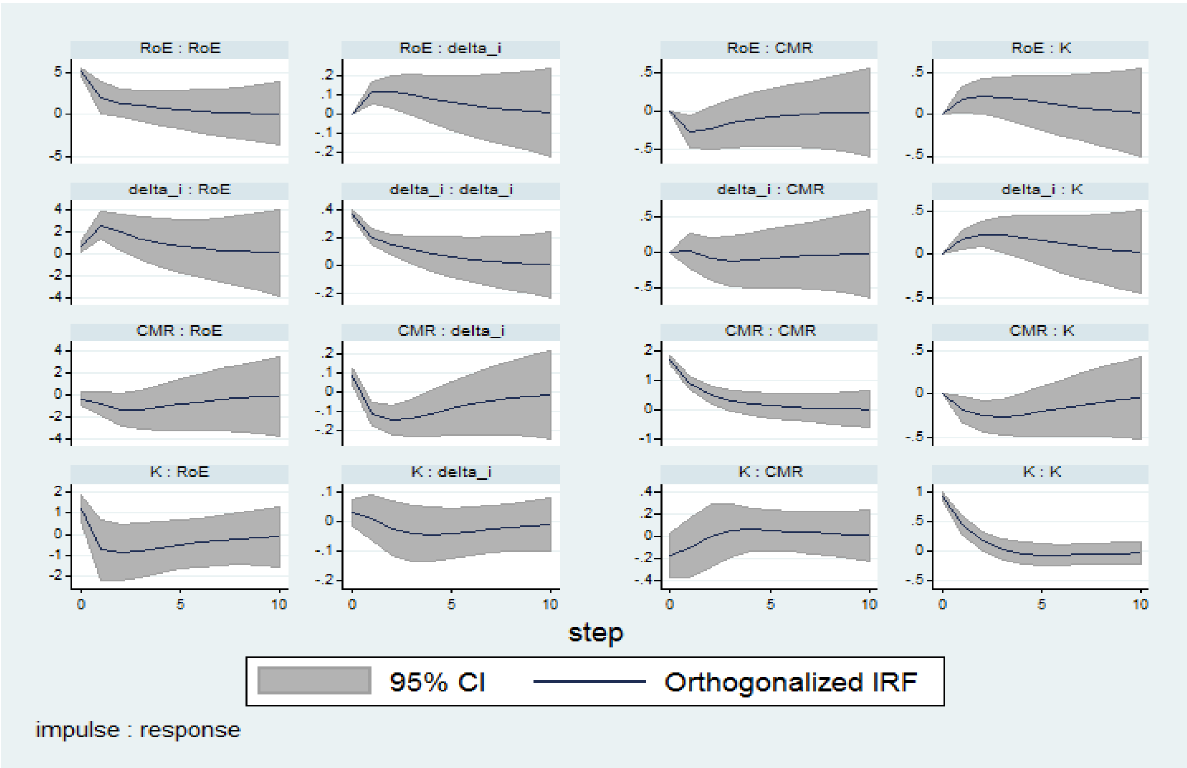

Figure (2) Impulse Response Function

The orthogonalized impulse response curves based on Cholesky decomposition are shown in Figure 2. The IRF confidence intervals are computed using 200 Monte Carlo draws based on the estimated model. The plot shows that a positive shock on the call money rate leads to a decreased interest differential as well as profits for the banks. On the other hand, return on equity which is our profitability measure, responds positively to a positve shock in interest rate difference. It, also, has a positive impact on the Tier-I CAR. The effects are small in magnitude yet persistent in nature.

Table (7) Forecast-error Variance Decomposition

Response	Forecast	Impulse Variable				Response	Forecast	Impulse Variable			
Variable	Horizon	K	CMR	Δ_i	RoE	Variable	Horizon	K	CMR	Δ_i	RoE
K	0	0	0	0	0	Δ_i	0	0	0	0	0
	1	1	0	0	0		1	0.0068	0.0437	0.9495	0
	2	0.9190	0.0285	0.0250	0.0274		2	0.0054	0.0886	0.8474	0.0586
	3	0.8078	0.0718	0.0628	0.0576		3	0.0061	0.1474	0.7520	0.0945
	4	0.7201	0.1097	0.0917	0.0785		4	0.0102	0.1847	0.6937	0.1113
	5	0.6646	0.1360	0.1089	0.0905		5	0.0147	0.2057	0.6606	0.1190
	6	0.6328	0.1522	0.1181	0.0969		6	0.0183	0.2170	0.6422	0.1225
	7	0.6154	0.1616	0.1228	0.1002		7	0.0208	0.2229	0.6323	0.1241
	8	0.6063	0.1668	0.1250	0.1019		8	0.0223	0.2259	0.6270	0.1248
	9	0.6017	0.1696	0.1261	0.1026		9	0.0231	0.2273	0.6244	0.1251
	10	0.5994	0.1710	0.1266	0.1030		10	0.0236	0.2280	0.6231	0.1252
CMR	0	0	0	0	0	RoE	0	0	0	0	0
	1	0.0105	0.9895	0	0		1	0.0541	0.0049	0.0149	0.9261
	2	0.0111	0.9691	0.0002	0.0197		2	0.0523	0.0204	0.1764	0.7510
	3	0.0103	0.9579	0.0018	0.0299		3	0.0588	0.0546	0.2268	0.6597
	4	0.0107	0.9497	0.0048	0.0348		4	0.0635	0.0830	0.2394	0.6140
	5	0.0114	0.9443	0.0071	0.0371		5	0.0667	0.1005	0.2422	0.5906
	6	0.0121	0.9411	0.0086	0.0383		6	0.0687	0.1101	0.2425	0.5787
	7	0.0125	0.9393	0.0093	0.0388		7	0.0700	0.1150	0.2423	0.5727
	8	0.0128	0.9385	0.0097	0.0390		8	0.0707	0.1174	0.2421	0.5697
	9	0.0129	0.9380	0.0099	0.0392		9	0.0711	0.1186	0.2420	0.5683
	10	0.0130	0.9378	0.0099	0.0392		10	0.0713	0.1191	0.2419	0.5677

7. Concluding Remarks

This paper provides evidence on the first leg of monetary policy transmission in India through bank capital channel. The impact of monetary policy shocks on the capital structure of banks is studied for a set of 36 Indian banks (21 public and 15 private sector banks) for the time period 2004-05 to 2016-17. The estimation includes static and dynamic linear panel data methods and PVAR models.

The results of all the models indicate that there is significant relation between monetary policy shocks and Tier-I capital of banks and hence their capital structure.

An expansionary monetary policy (or a decrease in the call money rate, which is its operating target) has a negative and significant impact on the Tier-I capital asset ratio of banks. In addition to such partial impact, policy shocks also affect the capital structure indirectly through interest margins and profitability. There exists a negative relation between call money rate and interest differential as well as profitability of the banks. This implies that the profits of Indian banks increase after expansionary policy shocks and vice versa. These profit movements get reflected in equity capital of the banks thereby changing the structure of capital that a bank holds. Hence, it can be concluded that any deviation in monetary policy by the Reserve Bank of India has a significant impact on the capital structure of commercial banks.

Besides monetary policy, bank capital structure is also affected by the other bank-specific characteristics which were controlled for in the estimated models. Size of the bank (which is the book value of its total assets) has a mixed impact on the Tier-I capital. In the linear model, it has a positive and significant impact. However, in the dynamic panel model, it shows a negative contemporaneous affect but a positve lagged impact. Further, larger the liquidity risk (measured by financing gap ratio) borne by banks, higher is the equity capital maintained by it suggesting that they prepare for unforeseen events (such as bank runs) while making their capital decision. Higher asset risk, on the other hand, makes it more difficult for the banks to raise equity capital. Banks also prepare for greater realised risk in their balance sheets as they increase their equity capital with increase in non-performing assets. This is in line with the minimum capita requirements imposed by Basel norms, where banks are required to maintain increased equity capital as the risk profile of their assets increase.

Hence, it can be concluded that an expansionary monetary policy changes capital structure of banks by increasing the proportion of equity capital (i.e. Tier-I capital) vis-a-vis its debt counterpart. This may enable banks to increase their supply of credit increasing the potential levels of investment, consumption and aggregate output in the economy. Bank equity can, thus, act as a seperate channel for monetary transmission amplifying (or condensing) the strength of other traditional channels. Despite this, the effectiveness of bank capital channel has been neglected in academic or policy discussions in India, especially today, when the poor financial strength of commercial banks is a matter of deep concern. The present study made an attempt to fill this gap.

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