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# Monetary policy and bank behavior: Empirical evidence from India

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*The paper develops an empirical model to explore the role that bank characteristics play in influencing the monetary transmission process. Employing data on Indian commercial banks for the period 1992-2004, the findings indicate that for banks classified according to size and capitalization, a monetary contraction lowers bank lending, although large and well-capitalized banks are able to shield their loan portfolio from monetary shocks.*

## Introduction

A vast literature has developed in recent years 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 impact of the financial system on aggregate economic activity.

Generally speaking, banks can play different roles in the transmission process. The traditional *money view* focuses on the liability side of the banks' balance sheets, where the aggregated amounts of deposits constitutes the largest part of the money supply. The central bank is assumed to be able to control this quantity of money on the banks' balance sheets through monetary policy. If the central bank manages to diminish money supply, the real interest rate is expected to rise, dampening real demand. The alternative *credit view* assumes that there are imperfections in financial markets which increase the price of bank loans – the external finance premium – and/or lower the availability of bank credit, depending on the monetary policy stance (Bernanke and Gertler, 1995; Taylor, 2000). The credit view considers two channels through which monetary policy affects the real economy. The first channel is, the balance sheet channel, which works through the balance sheets of potential borrowers. A monetary policy tightening, by increasing the interest rate, deteriorates the net worth position and credit worthiness of the private sector, prompting the banks to raise hurdle rates on loans, resulting in a rise in the external finance premium on new bank loans. The second channel, 'the bank lending channel' focuses on the asset side of the balance sheets of banks, especially on the supply of bank credit. It assumes that a monetary tightening, by draining the liquidity position of banks, forces some banks to diminish their supply of credit.

The principal focus of the present study is on the lending channel, and hence, on the reaction of loan supply to a monetary shock, particularly the differential response of certain types of banks. The idea behind this is that some banks are more capable than others to offset a

monetary policy-induced decrease in deposits (or, an increase in the cost of funding), because they can find non-deposit funding easily or draw on their buffer of liquid assets.

The present paper examines this aspect within an empirical framework. In particular, we analyze the transmission of a monetary policy shock, namely a change in the policy interest rate, allowing for the presence of banks with differential characteristics in such a setup. The rest of the discussion is structured as follows. The following section reviews the relevant literature in this area. Sections 3 and 4 discuss the empirical strategy and the results. The concluding remarks are contained in Section 5.

## **II. Related Literature**

The bank-lending channel has been theoretically analyzed 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, along with the bond rate, the bank lending rate is also introduced in the analysis, as it impacts loan demand and supply and the demand for output.

In an attempt to segregate the effect of loan demand from loan supply, Kashyap, Stein and Wilcox (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. The study found evidence that tight monetary policy leads to an increase in commercial paper issuance, while bank loans slowly declines. Oliner and Rudebusch (1995) questioned the usefulness of changes in the aggregate financing mix as an indicator of the operation of the bank lending channel. They instead 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. 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.

Kishan and Opiela's (2000) paper extended the above analysis to include bank capitalization as an important variable. Their empirical results provided 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.

Studies on the lending channel have also been explored for non-US economies. Thus, Favero *et al.* (1999) empirically investigated the existence of a lending channel for four European

countries (France, Germany, Italy and Spain) and uncovered limited evidence of a lending channel in these countries. In the context of emerging economies, Kim (1999) observed that bank lending played a significant independent role in Korea in amplifying the real effects of tightened monetary policy, which was implemented in response to the crisis. 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.

Evidence on monetary transmission mechanism for India using a vector autoregression framework revealed that a positive shock to broad money over time leads to higher output, while a shock to the call money rate produces the reverse effect (RBI, 2003). More recent evidence by Pandit *et al.* (2006) examines (a) the existence or otherwise of the bank lending channel in India, using quarterly data for 1997:1 to 2002:2 and (b) whether the transmission of monetary policy via the bank lending channel is different for big versus small banks. The findings indicate that (a) bank lending channel is operative in India and importantly, (b) the transmission process is different for big versus small banks.

The present exercise expands on the extant literature by incorporating in addition, to bank size, bank capital and liquidity as relevant bank characteristic variables. Utilizing advanced panel data techniques, the study ensures avoidance of estimation bias and specification problems.

### III. Empirical Strategy and Database

The econometric exercise tests whether bank characteristic matters for monetary transmission. Accordingly, we specify a framework which incorporates the following features: first, output, prices and the monetary policy indicator are interacted with the relevant bank characteristic variable to enable banks with differing characteristics to exhibit differential response to macroeconomic and monetary developments. Second, dynamics are introduced by including lags of the dependent variable and estimating the model in lagged differences.

Towards this end, we estimate the following specification:

$$Advgr_{kt} = f(\text{lagged } Advgr_{kt}, GDPGR_b, PR_t, YLD364_b, Opexp_{kt}, BCh_{kt} * GDPGR_t, BCh_{kt} * PR_t, BCh_{kt} * YLD_t) \quad (1)$$

where subscript  $k$  (cross section) is a bank indicator and  $t$  (time series) denotes year indicator. Among the dependent variables, we include the real GDP growth and the inflation rate. Bank intermediation costs, defined as the ratio of operating expense to total assets ( $Opexp$ ), is explicitly included among the bank-specific variables, since this is likely to affect the cost of funds and with that, the quantum of loan advanced.

The primary focus of the study is on the coefficient of the monetary policy indicator and its interaction with the relevant bank characteristic (denoted as, *BCh*) variable. The monetary policy indicator is captured by the yield on 364-day treasury bills (YLD364). We employ the primary market cut-off yield as compared to secondary market yield since changes in the latter could be due to short-term demand-supply changes in the inter-bank market and not related to any fundamental shift in the monetary stance. The use of T-bill yield as a monetary policy indicator has gained prominence in the literature of late, both internationally (Calvo and Reinhart, 2002) as well as in the Indian context (Prasad and Ghosh, 2005). The coefficient on this variable is therefore directly interpretable as the *overall effect* of monetary policy.

On the other hand, the coefficient on the interaction of the bank characteristic variable with YLD364 can be interpreted as the *indirect effect* of monetary policy operating through the concerned bank characteristic variable. To the extent that large, liquid and well-capitalised banks are able to shield their loan portfolio from monetary shocks by drawing on their liquid holdings of securities and/or by attracting non-deposit funding, the coefficient on this variable is expected to be positive.

Bank-characteristic variables are required to measure the susceptibility of a bank's lending activity to changes in the monetary policy stance. The literature on the lending channel suggests several bank characteristic variables:

*The size of the bank.* Small banks encounter more asymmetric information problems in the capital market than large banks and therefore, they may find it difficult to raise uninsured (i.e., non-deposit) funds in response to monetary tightening (Kashyap and Stein, 1995).

*The degree of liquidity.* Liquid banks can draw on their reserves of cash and securities to protect their loan portfolio, while this is less possible for illiquid banks (Kashyap and Stein, 2000).

*The degree of capitalization.* Poorly capitalized banks have less access to non-deposit funds and therefore, are forced to cut back their loan supply by more than well-capitalised banks (Peek and Rosengren, 1995; Kishan and Opiela, 2000).

The three bank characteristics variables are adopted in this study. The measures for size, liquidity and capitalization (*Size*, *Liq* and *Cap*) are defined as follows:

$$Size_{it} = Log A_{it} - \frac{\sum_i Log A_{it}}{N}$$

$$Liq_{it} = \frac{L_{it}}{A_{it}} - \left( \sum_i \frac{L_{it} / A_{it}}{N} \right) / T$$

$$Cap_{it} = \frac{C_{it}}{A_{it}} - \left( \sum_i \frac{C_{it} / A_{it}}{N} \right) / T$$

The natural logarithm of total assets,  $A_{it}$  measures bank size. Liquidity is defined as the ratio of liquid assets  $L_{it}$  (cash and balances with central bank plus call money plus investment in government and approved securities) to total assets. Capitalisation is given by the ratio of capital and reserves,  $C_{it}$  to total assets. These three criteria are normalized with respect to their averages across all banks, so that they sum to zero over all observations.<sup>1</sup>

#### *Econometric Issues*

Owing to the inclusion of a lagged dependent variable, ordinary least squares estimation cannot be applied, since the errors would be correlated with the regressand, resulting in biased estimates. The generalised method of moments (GMM) estimation is widely used for dynamic panel data models. If there are no unobserved bank effects, we can apply the GMM technique to (1) by using lagged right hand side variables as instruments.

The consistency of the GMM estimator depends on whether the lagged values are valid instruments in the regression procedure. A necessary condition for the validity of such instruments is that the error term be serially uncorrelated. To address these issues, we present two specification tests suggested by Arellano and Bond (1991). The first is the Sargan test of over-identifying restrictions, which tests for the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. The second test examines the hypothesis that the error term differenced regression is not second-order serially correlated, which implies that the error term in the level regression is not serially correlated. The failure to reject the null hypotheses in both cases provides support to the model. We present only the two-step GMM estimates, since they are more efficient than one-step estimates and additionally, the Sargan test of overidentifying restrictions is heteroskedasticity-consistent only if based on the two-step estimates.

### *The Database*

The data are culled from the yearly RBI publication, *Statistical Tables Relating to Banks in India*, which provides annual data on major heads of assets and liabilities and income and expenditure profile of banks. The sample in the study covers the period 1992 to 2004 and covers 50 banks, comprising 27 public sector banks, 15 old private banks and 8 foreign banks, accounting for, on average around 80 per cent of the total assets of the banking system over the sample period. In order to build a balanced panel, *de novo* private banks, which came into operation in 1996, have been excluded from the sample. This omission is of minor importance, since these banks accounted for, *on average*, around 7 per cent of the total banking sector assets since their existence.<sup>2</sup>

### **IV. Results and Discussion**

It needs to be recognized that during most of the period monetary policy was loose, i.e., short-term interest went down. In general, it is easier for banks to expand lending when interest rates are low than to cut lending when monetary conditions are tight. Therefore, the presented evidence of the response of lending to interest rate changes may entail some sample bias, as the interest rate changes during the period were mostly downwards.

The descriptive statistics of the relevant variables presented in Table 1 are consistent with this fact. Illustratively, the 364-day T-bill yield witnessed a marked decline over the period from 13.12 per cent to 4.40 per cent: its high range (maximum *less* minimum) being perhaps indicative of the secular decline in interest rates over the sample period. Real GDP exhibited moderate fluctuation over the sample period, while prices witnessed high variability. This is in consonance with the widely documented which shows that prices declined from an average of 10% in the first half of the 1990s to about 5% in the latter half of the 1990s and even lower thereafter.

The number of lags for the instruments was chosen on empirical grounds and set not too high in order to preserve as many observations as possible. The Sargan test indicates that the instruments are valid. The AR2 tests indicate that no second-order autocorrelation in the residuals. These tests, taken together, suggest that the model is well specified.

**Table 1: Descriptive Statistics of the Variables**

Notation	Variable	Mean	Std. Devn.	Minimum	Maximum
<i>Macroeconomic</i>					
GDPGR	Rate of growth of real GDP	5.754	1.826	1.300	8.500
PR	Annual percent change in WPI	6.972	3.321	3.270	13.840
<i>Bank-specific</i>					
<i>Advgr</i>	Growth rate of real advances	7.955	1.383	3.740	11.970
<i>Size</i>	Natural logarithm of total asset	8.803	1.403	4.743	12.919
<i>Liquidity</i>	Cash in hand plus balances with RBI <i>plus</i> call money <i>plus</i> investment in government and approved securities/total asset	0.461	0.083	0.105	0.901
<i>Capitalisation</i>	Equity capital <i>plus</i> reserve/total asset	0.059	0.032	0.009	0.246
<i>Opexp</i>	Operating expenses/total asset	2.637	0.685	0.800	7.270
<i>Monetary policy indicator</i>					
YLD 364	Yield on 364-day T-bills	9.312	2.462	4.400	13.120

The columns denoted *Size*, *Liquidity* and *Capitalization* give the results of the estimation including the three different bank-characteristic variables, bank size, liquidity and capitalization, respectively. For comparison sake, the first column also presents the results of estimation without interacting with any of the bank-characteristic variables. The message emanating from the analysis can be summarized as follows.

The lagged dependent variable is positive and significant at conventional levels, signifying that there is persistence in the dependent variable. At the *macro* level, real GDP growth and raises lending, which is suggestive of pro-cyclicality in banks' credit extension behavior. At the *bank-specific* level, across all specifications, higher intermediation cost negatively affects bank lending by raising the cost of funds.

Our primary interest is the coefficient on the interest rate variable as given by YLD364. The estimates reveal that, in the baseline model, the coefficient on this variable is negative and statistically significant, which suggests that a contractionary monetary policy leads to a decline in advances growth. In terms of magnitude, an increase in interest rate by 1 percentage point in the long run leads to a decrease in the amount of advances by nearly 0.4 per cent in the baseline regression.



**Table 2: Bank Lending and Monetary Policy:  
Evidence according to Bank Characteristics**

Variable	Bank characteristic							
	Baseline model		Size		Liquidity		Capitalisation	
	Coeff..	Std.Err	Coeff..	Std. Err	Coeff..	Std. Err	Coeff.	Std. Err
First lag of dependent variable	0.312***	0.021	0.284***	0.016	0.274***	0.024	0.262***	0.022
Second lag of dependent variable	0.038***	0.012	0.021*	0.012	0.016	0.017	0.008	0.016
YLD 364	-	0.197	-0.506**	0.208	-0.298	0.215	-0.504***	0.197
	0.442***							
Bank characteristic*YLD364			0.173**	0.099	0.140***	0.028	0.289***	0.076
GDPGR	0.008	0.135	0.506***	0.115	-0.289**	0.132	0.009	0.136
Bank characteristic*GDPGR			-0.646***	0.098	0.127***	0.028	0.451***	0.059
PR	0.144	0.109	0.191	0.144	0.164	0.117	0.089	0.139
Bank characteristic*PR			-0.709***	0.122	-0.040**	0.018	-0.076*	0.043
Bank characteristic			0.479***	0.039	0.516**	0.229	0.822*	0.455
Opexp	-	0.012	-0.082***	0.012	-	0.014	-0.129***	0.012
	0.139***				0.135***			
Constant	-	0.215	-7.174***	0.543	-	0.214	-1.591***	0.267
	1.089***				1.557***			
<i>Diagnostics</i>								
Time period	1992-2004		1992-2004		1992-2004		1992-2004	
Sargan test, AR2 (p-values)	0.121, 0.679		0.146, 0.729		0.144, 0.703		0.147, 0.711	
Number of banks, observations	50, 450		50, 450		50, 450		50, 450	

\*\*\*, \*\* and \* indicates statistical significance at 1, 5 and 10%, respectively.

We next turn to the columns focusing on bank characteristics. Most of the variables are unaltered in sign and significance *vis-à-vis* the baseline specification. Focusing specifically on the monetary policy indicator, the coefficient on the interest rate is negative in all three cases, although not significant in the equation with liquidity. More specifically, the coefficient for the interest rate equals  $-0.506$  in the advance equation with size and  $-0.504$  in the equation with capitalization, which means that an increase in interest rate by 1 percentage point leads to a decline in loan growth by nearly 0.5 per cent in both cases. In the equation without the bank characteristic variable, the coefficient is smaller.

Turning to the coefficients of the interaction terms, the expected positive coefficients are observed for across all cases. Combining with the earlier point, this indicates that in the equations pertaining to size and capitalization, the coefficients on the interest rate and its interaction term with the concerned bank characteristic variable are *both* significant and have the signs that are in consonance with the lending channel.

## V. Concluding Remarks

The study presents empirical evidence on the lending channel in India, using annual bank-level data covering the period 1992-2004. The analysis focuses on the differential response of loan supply to monetary policy changes across bank categorized in terms of their size,

capitalization and liquidity. The analysis indicates that for banks classified according to size and capitalization, a monetary contraction lowers bank lending, although large and well-capitalized banks are able to shield their loan portfolio from monetary shocks.

Two important implications flow from the analysis. First, the analysis indicates that prudential regulations play an important role in influencing lending decisions of banks (Nachane *et al.*, 2001; Pandit *et al.*, 2006). More specifically, the institution of capital adequacy ratios has made banks more concerned with the risk-return profile of loans, since additional lending warrants additional capital in order to adhere to the stipulated capital adequacy norms. Second, the analysis indicates that bigger banks are able to protect their loan portfolio from monetary contraction. This assumes prominence in view of the discussion on mergers and consolidation presently underway in India.

### **Endnotes**

The views expressed and the approach pursued in the paper reflects the personal opinion of the author. I would like to thank, without implicating, an anonymous referee for the observations on an earlier draft.

1. In the case of size, the normalization is not just over the sample mean over the whole sample period, but over the means per year as well, so that trends in bank size are removed.
2. A major merger was witnessed in the private sector bank category in 2001, which significantly raised the share of *de novo* private banks in total banking sector assets. However, given that the database encompasses a time period much before their operations and a much smaller time span consequent to the merger, this omission would not affect the results significantly, since, on average, the share of *de novo* banks in total banking sector assets increased to around 8-10% over the sample period.

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