Basel II and bank lending behavior: Some likely implications for monetary policy in India

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The new Basel Accord is slated to be effective in India sometime around 2007. This raises the questions of how the revised standards will influence the bank behaviour. Using a simple theoretical model, it is shown that the revised Accord will result in asymmetric differences in the efficacy of monetary policy in influencing bank lending. This will, however, depend on a number of factors, including whether banks are constrained by the risk-based capital standards, the credit quality of bank assets and the relative liquidity of banks' balance sheets. The basic model is empirically explored using data on Indian commercial banks for the period 1996-2004. The analysis indicates that the effect of a contractionary monetary policy will be significantly mitigated provided the proportion of unconstrained to constrained banks in the system is significantly high.

I

Introduction

Ever since its publication in June 1999, the New Capital Adequacy Framework (or Basel II as it is popularly called) has generated intense debate among policymakers and academia alike.[1] As is by now well known, the new Accord incorporated three major elements or "pillars": (a) minimum capital requirements, based on weights intended to be more closely aligned to economic risks than the 1988 Accord; (b) supervisory review, which set basic standards for bank supervision to minimise regulatory arbitrage; and, (c) market discipline, which envisages greater levels of disclosure and standards of transparency for the banking system. The revised standards are intended to be applicable to large, internationally active banks in both U.S. and elsewhere (BIS, 2004; Caruana, 2004).

Recognising that the risk-based capital standards need to evolve along with changes in financial markets and improvements in risk measurement and management by banks, one of the primary purposes of the revised Accord is to align regulatory capital requirements more closely with the underlying credit risks in the activities of banks, thereby reducing distortions existing in the current Accord.[2] This is sought to be accomplished, in part, by incorporating credit ratings into the regulatory capital standards and allowing the risk-based capital requirements on certain assets to vary as the credit ratings of the underlying borrowing entities change (Nachane and Ghosh, 2004; Monfort and Mulder, 2000).

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The likely impact of the Accord on the behaviour of banks has occasioned much discussion. In particular, it has been argued that the behaviour of banks could be different depending on whether they are capital-constrained or not – an issue fraught with significant implications for monetary policy. This question forms the main focus of this paper. To this end, we engage in an analytical exercise designed to capture certain basic features of the Indian environment supplemented by a preliminary empirical analysis.

The rest of the paper is organised as follows. A brief discussion of the relevant literature is contained in Section II. The basic framework of the model along with the implications of Basel II for constrained and unconstrained banks is detailed in Section III. The subsequent section presents some preliminary empirical results. Certain policy concerns and concluding observations emanating from the study are addressed in Section V.

II

Received Literature

Existing theory suggests a number of ways in which regulatory capital may alter bank lending behaviour and correspondingly, the efficacy of monetary policy, often with conflicting results. Models such as those by Chami and Cosimano (2001) and Van den Heuvel (2002) emphasize the relationship between monetary policy and bank capital, tracing the impact of changes in monetary policy on bank capital and lending via the altering of bank profitability. Alternately, under the bank lending channel hypothesis, monetary policy has a direct effect on the supply of bank loans as banks fund loans, at least in part, with reservable deposits. Van den Heuvel (2002) notes that a binding regulatory capital requirement, limits the ability of capital-constrained banks to increase lending in response to an expansionary monetary policy, and thereby, to an extent, reducing the potency of monetary policy. In contrast, Stein (1998) notes that bank capital might mitigate adverse selection problems. In the event of a contractionary monetary policy, capital-constrained banks are less likely to increase their issuance of reservable deposits and more likely to decrease lending, thus making monetary policy more potent. One possible explanation for these seemingly conflicting findings is that important cross-sectional differences exist in how banks respond to monetary policy shocks (Kashyap and Stein, 1994; Peek and Rosengren, 1995a; Kishan and Opiela, 2000). However, central to all these theories is the notion that monetary policy affects, either directly or indirectly, the supply of bank loans, and that the strength of this relationship can be influenced, at least in part, by regulatory capital standards.

An alternative way to address the issue of how regulatory capital standards influence bank lending and monetary policy is to examine empirical studies of the 1988 Accord. Studies such as those by Hall (1993), Haubrich and Watchel (1993), Wagster (1996), Jackson et al. (1999), Furfine (2000), Aggarwal and Jacques (2001), Rime (2001) and Ghosh et al. (2003) suggest that banks altered the composition of their balance sheets in response to the risk-based capital standards, generally migrating to assets of higher credit risk. If the composition of banks' assets has an influence on the efficacy of monetary policy, as is subsumed under the credit view of monetary policy, then asset substitution resulting from a revised Accord may impact the transmission process. Other studies, such as those by Kashyap and Stein (1994) and Thakor (1996) have demonstrated that risk-based capital standards alter the relationship between money and bank lending, with implications for the effectiveness of monetary policy. In addition, Hancock and Wilcox (1993), Berger and Udell (1994) and Peek and Rosengren (1995b) have examined the role played by capital standards during the credit crunch of the 1990s. While prior research is a pointer to the fact that the 1988 Accord had a significant influence on bank portfolio composition and monetary policy, the existing research is limited in its applicability to the revised Accord as some key elements of the forthcoming revised standards differ significantly from the old Accord.

The present study contributes to the literature on bank capital regulation by examining how the forthcoming revisions to the risk-based capital standards are likely to alter bank lending and the efficacy of monetary policy. Resorting to a modification of recent work by Peek and Rosengren (1995a) and Kishan and Opiela (2000), an asymmetric response is shown to emerge in banks' reaction to monetary policy under the revised Accord. Specifically, systematic differences are shown to exist in the effectiveness of monetary policy, depending not only on whether banks are constrained by the revised risk-based capital standards, but also on the credit quality and relative liquidity of the assets held in the portfolio of the capital-constrained banks. In addition, it is demonstrated that under a revised Basel Accord, changes in credit ratings is also a likely influence on the efficacy of monetary policy.

III

A Theoretical Model

The preceding sections raise the issue of how the imposition of a revised risk-based capital standards (i.e., one where capital requirements are based on credit rating and can migrate as the credit ratings on asset change), will influence bank lending and the transmission mechanism of monetary policy.

The model described is akin to Peek and Rosengren (1995a) and Kishan and Opiela (2000), with one major exception: it explicitly recognises that banks are subject to a risk-based capital requirement and as a result, includes, in addition, equations (11), (12) and (13). Peek and Rosengren (1995a) examine the model under the assumption that the leverage ratio is binding, while Kishan and Opiela (2000) assume that the regulatory capital standards are not binding.[3]

The following assumptions lie at the core of the analytical set up:

- In the spirit of Bernanke and Blinder (1988), reserve requirement are supposed to apply only to demand deposits.
- There is a mark-up interest rate pricing of deposits, loans and securities (with reference to the policy rate);
- Non-interest incomes/off-balance sheet incomes are ignored for analytical tractability; and
- The risk-weights on loans and securities are specified in terms of a single security.

Banks are assumed to hold three assets: reserves (R)[4], securities (S) and loans (L) and two types of liabilities: demand deposits (DD) and time deposits (TD). They are subject to the traditional balance sheet constraint:

(1) $R+S+L=DD+TD+K$, where K denotes capital.

We first model the liability side and subsequently turn to the asset side. On the liability side of the balance sheet, bank capital is assumed to be fixed in the short run, since both theoretical considerations (Stein, 1998) and empirical evidence (Cornett and Tehranian, 1994) suggests that raising capital can be costly for banks, more so, if they are constrained by risk-based capital standards (Jacques and Nigro, 1997). Demand deposits are assumed to be related inversely to the Bank Rate (r_{BK}), and the amount of time deposits depends on the spread between the rate banks pay on time deposits (r_{TD}) and the mean rate on term deposits in the market (r_{TDM}). Therefore,

(2) $DD = a_0 - a_1 r_{BK}$

(3) $TD = f_0 - f_1(r_{TD}-r_{TDM})$

On the asset side, given the level of demand deposits, banks are required to hold reserves (R), such that,

(4) $R = \alpha DD$ with α being the reserve requirement ratio.[5]

In addition, banks are assumed to hold securities in fixed proportion to the level of demand deposits, netted for the quantum of reserves,

(5) $S = h_0 + h_1 DD - R$; $h_0>0$, $1>h_1>0$[6]

Furthermore, the loan market is assumed to be imperfectly competitive, with banks possessing some market power. Thus, effectively an inverse relationship is postulated between the demand for loans and the differential between the interest rate offered on loans (r_L) relative to some mean rate in the market (r_{LM}).

(6) $L = g_0 - g_1 (r_L - r_{LM})$; $g_0>0$, $g_1>0$

Finally, interest rates on time deposits, loans and securities are assumed to be a mark-up on the Bank Rate (the policy variable) as follows[7]:

(7) $r_{TDM} = b_0 + \varphi\, r_{BK}$

(8) $r_{LM} = c_0 + \varphi\, r_{BK}$

(9a) $r_S = e_0 + \varphi\, r_{BK}$

(9b) $r_{SD} = q_0 + \varphi\, r_{TD}$

Given (1) to (9b), banks are assumed to maximise profits, such that:

(10) $\pi = (r_L - \theta)\, L + r_S\, S - r_{DD}\, DD - r_{TD}\, TD$

where the first term is the interest income on loans netted for loan losses, the second term is the interest income on securities and the third and fourth terms are the interest expense on demand and time deposits, respectively. In their attempt to maximise profits, banks face a regulatory constraint:

(11) $K \geq \gamma_S S + \gamma_L L$

Equation (11) recognises that banks are subject to risk-based capital requirements, where γ_i (i=S, L) measure the risk-based capital requirements for securities and loans, respectively.

In order to explicitly incorporate credit ratings, the risk-based capital requirements for bank loans and securities can be written as:

(12a) $\gamma_L = \rho\, \Omega_L$

(12b) $\gamma_S = \rho\, \Omega_S$

where ρ is the specified regulatory minimum capital ratio.[8] Furthermore, the risk-weights on loans and securities Ω_L and Ω_S are both variable and a function of the credit rating of the underlying entity such that:

(12c) $\Omega_L = \Omega_L(c_L)$ such that $\partial\Omega_L/\partial c_L < 0$

(12d) $\Omega_S = \Omega_L(c_S)$ such that $\partial\Omega_S/\partial c_S < 0$

Under an external ratings approach, Ω_L varies inversely with the credit rating of the borrowing entity in the loan contract, c_L and Ω_S varies inversely with the credit rating of the borrowing entity underlying the security, c_S.[9, 10]

Constrained and Unconstrained Banks

It is useful to distinguish between constrained and unconstrained banks in this set-up. Substituting (12a) through (12d) into (11), and using equations (1) to (9), the Lagrangian so obtained is maximised with respect to loans (L). The first-order conditions are employed to solve for L in the unconstrained case; by a similar method, other key variables are solved for.

Unconstrained Banks

Assuming banks are not constrained by the risk-based capital standards, a change in the Bank Rate can be shown to influence banks' portfolio composition such that:

(13) $\partial L/\partial r_{BK} = [-g_1 a_1 (1-h_1)/(f_1+g_1)] < 0$

(14) $\partial S/\partial r_{BK} = [-a_1 (h_1 - \alpha)] <=> 0$

(15) $\partial R/\partial r_{BK} = -a_1 \alpha < 0$

(16) $\partial TD/\partial r_{BK} = [f_1 a_1 (1-h_1)/(f_1+g_1)] > 0$

(17) $\partial DD/\partial r_{BK} = -a_1 < 0$

(18) $\partial (DD+TD)/\partial r_{BK} = [-a_1 (g_1+f_1 h_1)/(f_1+g_1)] < 0$

The results of (13) through (18) demonstrates that an increase in the policy rate will increase banks' issuance of time deposits, as banks seeks to replace funds lost as a result of a decrease in demand deposits; the increase in the former however, being insufficient to offset the fall in the latter, there would be an overall decrease in deposits (see 18). Given the contraction of liabilities, banks will reduce assets in response to the increase in the Bank Rate. Specifically, the decrease in demand deposits will lead to a contraction of reserves, with the impact on securities being uncertain. Kishan and Opiela (2000) argue that for banks that are unconstrained by the regulatory capital standards or alternately, hold large portfolio of securities relative to reserves, $(h_1 - \alpha)$ will be positive, resulting in a decline in securities holding in response to a rise in the Bank Rate. Despite the changes in securities and the increase in time deposits, banks will reduce loans in response to a contractionary monetary policy, the magnitude of the decline being determined by the interest sensitivity of demand deposits (a_1), time deposits (f_1) and loans (g_1).

Constrained Banks

Alternately, banks may be constrained by the revised risk-based capital standards. Under this condition, differentiating the Lagrangian and using the first-order conditions to solve for the key results yields:

(19) $\partial L/\partial r_{BK} = [\rho\Omega_S a_1 (h_1 - \alpha)]/ \rho\Omega_L <=> 0$

(20) $\partial S/\partial r_{BK} = [-a_1 (h_1 - \alpha)] <=> 0$

(21) $\partial R/\partial r_{BK} = -a_1 \alpha < 0$

(22) $\partial TD/\partial r_{BK} = [a_1 (1-h_1) \rho\Omega_L + a_1 (h_1 - \alpha) \rho\Omega_S]/ \rho\Omega_L <=> 0$

(23) $\partial DD/\partial r_{BK} = -a_1 < 0$

(24) $\partial(DD+TD)/\partial r_{BK} = [a_1 (h_1 - \alpha) \rho\Omega_S - a_1 h_1 \rho\Omega_L]/ \rho\Omega_L < 0$[11]

The results are fundamentally different from the unconstrained case in that the risk-based capital requirements on both loans and securities play a critical role in how assets and liabilities respond to changes in monetary policy. Specifically, not only do $\rho\Omega_L$ and $\rho\Omega_S$ influence how loans, time deposits and total deposits change as monetary policy changes, but the relative magnitude of the risk weights ($\rho\Omega_S/\rho\Omega_L$) is an important factor. We refer to this as the *relative risk* parameter.

As a point of comparison between the 1988 Accord and the new Accord, capital requirements on loans and securities under the 1988 Accord were fixed (footnote 10). Under a situation where bank portfolios are comprised on securities slotted in the 20% risk bucket (Ω_S=0.2) and commercial loans, which have 100% risk weight (Ω_L=1.0), then the relative risk parameter would be 0.2. In contrast, under the revised Basel Accord, owing to the dependence of risk weights on credit ratings, the 'relative risk' parameter will be variable within a certain magnitude.[12] Given the greater granularity of risk-weights for commercial loans under the revised Accord, the efficacy of monetary policy will vary depending on the credit quality of the borrowing entities. Assuming $(h_1 - \alpha)<0$, if the relative risk parameter is 0.13, as would occur if banks had portfolios comprised of commercial loans rated below BB-, then monetary policy would be less effective under the revised Accord than under the 1988 Accord. Alternately, if the relative risk parameter is unity, as would be the case if the portfolio is comprised of loans rated AA- or better, then monetary policy would be more effective under the revised Accord vis-à-vis the 1988 Accord.

From the preceding example, and the results obtained from (19) and (20), it can be seen that $(h_1 - \alpha)$ also differentiates the response of capital constrained banks to changes in monetary policy. As such, three cases merit attention.

Case 1: $(h_1 - \alpha) > 0$: In this case, banks have a large securities portfolio relative to their holding of reserves (a more liquid balance sheet). This might be the case if securities are a substitute for external debt financing, and in the event of a contractionary monetary policy, banks cannot switch costlessly between demand and time deposits, thus making external debt financing costly (Kashyap and Stein, 1997). In this case, a rise in Bank Rate increases time deposits but lowers demand deposits, thereby leading to an overall decline in deposits. This view is in consonance with the lending view of monetary policy which argues that banks do not fully insulate their lending activities from shocks by switching between types of deposits (Kashyap and Stein, 1994).

Case II: (h_1 - α) < 0 : In this case, banks do not hold a large securities portfolio relative to their holding of reserves, thereby making their balance sheet less liquid. In this case, the impact of a monetary policy shock on time deposits is indeterminate and depends on the relative magnitude of certain parameters (h_1, α, Ω_S, Ω_L). In the event of a contractionary monetary policy, while the response of time deposits is not clear, a priori, the decline in total deposits is greater and less deposit are available to support loans. This, in essence, is supportive of the bank lending channel that the decrease in demand deposits is not fully offset by the rise in time deposits consequent upon a contractionary monetary policy action. With shrinkage in liabilities, total assets decline as well. Given the fact that these banks are constrained by the risk-based capital standards and have a relatively small holding of securities portfolio, banks respond to the decline in total deposits by liquidating some loans. Because the risk-based capital standards place a capital requirement on both loans and securities, liquidating loans frees up some capital which banks can use to acquire interest bearing securities.

Case III: (h_1 - α) = 0 : In this case, banks holding of securities portfolio is evenly matched by their holding of reserves. A contractionary monetary policy leads to an unambiguous decline in deposits, shrinking overall asset base. Since these banks are constrained by the risk-based capital standards, banks respond to the decline in total deposits by lowering their reserve holding, whilst keeping their portfolio of securities unaltered.

Equations (19) to (24) provide an analysis of the impact of changes in Bank Rate on various components of banks' balance sheets under the assumption that securities have a non-zero risk weight. In case the assumption is relaxed and it is assumed that securities have a zero risk weight (Ω_S=0), the results for time deposits, total deposits and loans change significantly.[13] To see this, note that an expansionary monetary policy would lead banks to substitute demand deposits for time deposits, with the change in total deposits being positive. On the asset side, part of the increase in deposits would result in an increase in reserves, depending on the relative response of securities *vis-à-vis* reserves (i.e., the sign of $h_1 - \alpha$). Regardless of what happens to securities, banks keep their loan portfolio unaltered. This is the Kashyap and Stein (1994) result: monetary policy is not effective in changing bank lending. In the case where h_1 exceeds α, banks choose to increase their securities holdings, but not their loans, because, at the margin, an increase in loans would require already capital-constrained banks to add additional capital, while increasing government securities (because of the zero risk-weight), entails no additional capital, but yet allows banks to increase profits.

Collectively, the results for capital constrained banks concur with Kishan and Opiela (2000) in finding that bank capitalisation is critical to explaining cross-sectional differences in the response of banks to changes in monetary policy. Explicit incorporation of the risk-based capital standards into the framework, shows that this response is asymmetric: the relative liquidity of constrained banks' balance sheets and the credit quality of the banks' loans and securities are also critical components towards understanding how banks respond to changes in monetary policy.

IV

Empirical Strategy

The theoretical model, while highly simplified, indicates that constrained and unconstrained banks are likely to exhibit differential response to changes in monetary policy. The loans, reserves and deposits of unconstrained banks would respond negatively to Bank Rate changes, while the response of their time deposits would be in the same direction as the Bank Rate changes. The response of constrained banks would be similar as far as reserves and deposits were concerned, but neither the response of loans nor that of time deposits is clear cut *a priori*. Thus, the theoretical model indicates that *a priori* the response of securities, reserves and demand deposits is likely to be identical in both instances.

To explore the proposition, we employ annual data on commercial banks for the period 1993-2004. The data are culled from the yearly RBI publication, *Statistical Tables Relating to Banks in India*, which provides annual data under major heads of assets and liabilities as well as the income and expenditure profile of banks. Information on the monetary policy indicators viz., Bank Rate and yield on 364-day treasury bills is sourced from the Handbook of Statistics on Indian Economy (RBI, 2004).

To test the validity of the comparative static results, following from the theoretical exercise, we conduct a simple pooled regression to examine the response of the basic bank balance sheet variables to a change in the Bank Rate, the monetary policy indicator. It may be mentioned that the Bank Rate was activated as a signalling rate in April 1997, and was therefore dormant for a major part of the sample period. Therefore, to judge the robustness of the results, we also employ the primary market yield on 364-day treasury bills as the alternate monetary policy indicator (Prasad and Ghosh, 2005).

We adopt two methodologies for classifying banks as unconstrained. First, we compute the leverage ratio (defined as capital plus statutory reserves to total assets) and classify banks as unconstrained (resp., constrained) depending on whether their leverage ratio exceeds (resp., falls short of) the median leverage ratio of banks in the sample. This variable is computed across all the banks (public, private and foreign banks) for the period 1993-2004.[14] Given that the new private banks became operational in 1995 and 1996, this provides us with an unbalanced panel of banks ranging from a low of 56 for the years 1993 and 1994 to a high of 64 banks for the period 1996-2004; with 63 banks being operative in the year 1995.[15]

An alternate way to classify banks as unconstrained is based on their risk-based capital (RBC) standards. Specifically, if the RBC of a bank is equal to or above the regulatory capital ratio, the bank is classified as unconstrained (otherwise it is constrained). Since the RBC standards for banks are reported from the period beginning 1996 onwards, this sample encompasses a balanced panel of 64 banks for a reduced time span beginning 1996 through 2004.

We therefore have four sets of panel observations comprising two sets of banks: the first set of banks which comply with the regulatory minimum capital standards, defined in terms of either their leverage ratio or their risk-based capital ratio (unconstrained banks) and the second set of banks which did not comply with such standards (constrained banks). The primary purpose of the empirical exercise is to examine the response of a change in the monetary policy indicator on (a) loans, (b) investment, (c) reserves, (d) time deposits and (e) aggregate deposits, for the entire sample as also for the unconstrained and constrained banks separately. Tables 1 and 2 report the relevant results.

Table 1 : Effects of Monetary Policy on Constrained and Unconstrained Banks
(Based on RBC Ratio)

Variable	Unconstrained Banks		Constrained Banks		All Banks	
	Bank Rate	YLD-364 (Yield on 364-day TBS)	Bank Rate	YLD-364 (Yield on 364-day TBS)	Bank Rate	YLD364 (Yield on 364-day TBS)
1.1 Loans	-0.104	-0.101	-0.064	-0.061	-0.100	-0.098
	(0.013)*	(0.012)*	(0.031)**	(0.025)**	(0.011)*	(0.011)*
R-square	0.119	0.122	0.086	0.103	0.127	0.125
1.2 Investments	-0.123	-0.117	-0.083	-0.073	-0.121	-0.114
	(0.013)*	(0.014)*	(0.038)**	(0.033)*	(0.012)*	(0.013)*
R-square	0.155	0.139	0.095	0.099	0.156	0.142
1.3 Reserves	-0.054	-0.060	-0.036	-0.037	-0.053	-0.058
	(0.013)*	(0.013)*	(0.034)	(0.029)	(0.011)*	(0.012)*
R-square	0.035	0.042	0.024	0.034	0.035	0.043
1.4 Demand	-0.092	-0.091	-0.064	-0.058	-0.092	-0.089
Deposits	(0.014)*	(0.014)*	(0.035)***	(0.029)**	(0.013) *	(0.013)*
R-square	0.086	0.083	0.063	0.069	0.088	0.087
1.5 Aggregate	-0.104	-0.104	-0.076	-0.070	-0.103	-0.101
Deposits	(0.013)*	(0.013)*	(0.034)**	(0.028)*	(0.012)*	(0.012)*
R-square	0.119	0.118	0.101	0.116	0.122	0.122
N. Observations	535	535	41	41	576	576
Time period	1996-2004	1996-2004	1996-2004	1996-2004	1996-2004	1996-2004

*, ** and *** indicates significance at 1, 5 and 10%, respectively
Robust standard errors in parentheses

It is clear from Table 1 that the response of constrained and unconstrained banks to a monetary policy shock is significantly different, whether judged in terms of the Bank Rate or the yield on 364 day T-bill rate. Specifically, as predicted by the theoretical model, constrained banks exhibit a more pronounced (negative) response to the monetary shock *vis-à-vis* unconstrained banks. A bank experiencing a lack of equity is constrained to supply a volume of loans determined by its regulatory capital; a monetary contraction drains demand deposits and to the extent that such a loss is not offset by an increase in time deposits, the magnitude of the contraction in loan supply is far higher than for unconstrained banks.

Table 1 also presents the response of all banks (aggregate of constrained and unconstrained) to a contractionary monetary policy. What is interesting however is the fact that the overall response of banks is more akin to the response of unconstrained banks. This finding is a straightforward application of the Haltiwanger-Waldman (1991) proposition (number 6), which observes that one group of agents (in this case, the unconstrained banks), which have a disproportionate importance-relative to its own share over the total number of agents-is influential in shaping the aggregate equilibrium.

Table 2 : Effects of Monetary Policy on Constrained and Unconstrained Banks
(Based on Leverage Ratio)

Variable	Unconstrained Banks		Constrained Banks		All Banks	
	Bank Rate	YLD-364 (Yield on 364 day TBs)	Bank Rate	YLD-364 (Yield on 364 day TBs)	Bank Rate	YLD-364 (Yield on 364 day TBs)
2.1 Loans	-0.117 (0.012)*	-0.112 (0.013)*	-0.170 (0.014)*	-0.144 (0.015)*	-0.144 (0.009)*	-0.127 (0.009)*
R-square	0.206	0.196	0.279	0.178	0.242	0.181
2.2 Investments	-0.131 (0.014)*	-0.127 (0.015)*	-0.188 (0.014)*	-0.160 (0.016)*	-0.159 (0.010)*	-0.142 (0.011)*
R-square	0.208	0.200	0.307	0.197	0.257	0.194
2.3 Reserves	-0.066 (0.014)*	-0.072 (0.016)*	-0.119 (0.013)*	-0.103 (0.015)*	-0.093 (0.010)*	-0.086 (0.011)*
R-square	0.055	0.067	0.165	0.109	0.102	0.084
2.4 Demand Deposits	-0.108 (0.014)*	-0.105 (0.015)*	-0.147 (0.015)*	-0.125 (0.016)*	-0.128 (0.010) *	-0.114 (0.011)*
R-square	0.142	0.139	0.199	0.127	0.171	0.130
2.5 Aggregate Deposits	-0.110 (0.013)*	-0.112 (0.014)*	-0.173 (0.014)*	-0.147 (0.015)*	-0.141 (0.009)*	-0.128 (0.010)*
R-square	0.162	0.170	0.292	0.188	0.225	0.174
N. Observations	374	374	376	376	750	750
Time period	1993-2004	1993-2004	1993-2004	1993-2004	1993-2004	1993-2004

*, ** and *** indicates significance at 1, 5 and 10%, respectively
Robust standard errors in parentheses

Table 2 reports the case where unconstrained is defined with reference to banks' leverage ratio. In this case, given that the proportion of unconstrained banks to total banks is of the same order as the proportion of constrained to total banks, the results weakly support the theoretical premise that the response of investment, reserves and in particular, demand deposits of unconstrained banks is more or less matched by those of constrained banks.

Not surprisingly therefore, the overall equilibrium, as defined by the response of all banks in the sample, is 'in between' those of constrained and unconstrained banks. What is clear in this case is that, in several instances, unconstrained banks exhibit a greater response to monetary contraction *vis-à-vis* constrained banks. This is consistent with the analytical framework which predicts that the interest sensitivity of demand and loans as also the 'relative risk parameter' will dictate the response of these two categories of banks.

V

Concluding Observations

The results demonstrate that whether monetary policy can be made more or less effective in influencing bank lending depends on more than just whether banks are constrained under the revised Basel Accord. More importantly, the analysis indicates that the effect of a contractionary monetary policy will be significantly mitigated provided the proportion of unconstrained to constrained banks in the system is significantly high. From a macro standpoint, consistent with Bliss and Kaufman (2002), the implications are that if the goal of the monetary authority is to simultaneously provide credit to the economy and manage interest rates, the revised Basel Accord could pose challenges for monetary policy formulation.

Existing research on the Basel Accord has raised the question of how revisions to the Accord are likely to influence the efficacy of monetary policy. To explore this issue, the paper extends the basic framework of Peek and Rosengren (1995a) and Kishan and Opiela (2000) to examine the efficacy of monetary policy (*via* the bank lending channel) under the revised capital standards. The findings reveal that the effectiveness of monetary policy to influence bank lending differs according to whether banks are, or are not, constrained by the risk-based capital standards. In addition, the effectiveness of monetary policy in influencing bank lending is also dependent on the credit quality of banks' loans and securities and the liquidity of banks' balance sheets. In addition, the findings indicate that the response is asymmetric: the relative liquidity of constrained banks' balance sheets and the credit quality of the banks' loans and securities are also critical components towards understanding how banks respond to changes in monetary policy.

Notes

1. A discussion on the Basel Accord and its rationale and implications for emerging economies is contained in Nachane *et al*. (2004; 2005).
2. As observed by the BIS (2004), '…the Committee has sought to arrive at significantly more risk-sensitive capital requirements that are conceptually sound and at the same time

pay due regard to particular features of the present supervisory and accounting systems in individual member countries'.

3. Clearly, a much richer setting would necessitate a multi-period model (Kopecky and Van Hoose, 2004); the present model, however, confines itself to the short-run adjustment by banks to changes in monetary policy.

4. Comprising of cash in hand and balances with monetary authorities

5. Banks are assumed to hold no excess reserves.

6. The fact that h_1 is less than one signifies that banks do not invest their entire demand deposits in securities.

7. In contrast, Peek and Rosengren (1995a) and Kishan and Opiela (2000) assume all these interest rates respond equally to changes in the policy (Bank Rate) variable.

8. The ratio is currently fixed at 9% for Indian scheduled commercial banks (except RRBs).

9. For commercial loans, Ω_L varies between 20 and 150% with the capital requirement, at the margin, on AAA-rated loans equal to 1.8% (0.9*20%) and for loans rated BB- or lower, equal to 13.5% (0.9*150%). This occurs because, under the external ratings approach, while ρ remains fixed at 9%, Ω_L varies inversely with the external credit rating of the borrowing entity, with Ω_L (in percentage) equaling 20, 50, 100 or 150.

10. By way of comparison, under the 1988 Accord, the risk-based capital requirements on loans and securities are invariant with respect to changes in credit ratings. In that case, (12a) and (12b) can be expressed as: $\gamma_L = \rho\ \Omega^*_L$ with $\partial\Omega^*_L/\partial c_L = 0$; $\gamma_S = \rho\ \Omega^*_S$ with $\partial\Omega^*_S/\partial c_S = 0$; where ρ is fixed and Ω^*_L and Ω^*_S are independent of changes in credit risk.

11. We assume $\Omega_L > \Omega_S$. Economically, this would mean that the risk-weight on loans exceeds that on securities. This is in line with the risk-weights as advocated by regulators.

12. To see this, note that for commercial loans, Ω_L varies between 20 and 150%. Accordingly, the *relative risk* parameter $(\rho\Omega_S/\rho\Omega_L)$ = (0.9*0.20/0.9*1.5)=0.13 for commercial loans rated BB- or lower. For commercial loans rated AA- or better, $(\rho\Omega_S/\rho\Omega_L)$ = (0.9*0.20/0.9*0.20)=1.0

13. Several studies in the literature, notably, Kashyap and Stein (1994) and Blum and Hellwig (1995) employ this assumption.

14. The expanded sample comprises of 27 public sector banks, 15 old private banks, 8 *de novo* private banks and 14 foreign banks.

15. This unbalancedness for the year 1995 and the later years arises because one new private bank became operational in 1996 although most others became operative in 1995.

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