Basel II and bank lending behavior: some likely implications for monetary policy

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18 March 2006

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Abstract

The Basel Committee on Banking Supervision is in the process of revising the 1988 Accord with a new Accord slated to be effective sometime around 2006. Such changes raise the questions of how the revised standards will influence the ability of the monetary authority to conduct monetary policy. Using a simple theoretical model, it is shown that the revised Accord will result in asymmetric differences in the efficacy of monetary policy in changing bank lending depending 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.

JEL Classification: C33, G21

Key words: new capital Accord, credit rating, relative risk

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Introduction

The structure and operations of banks have been evolving rapidly during the last two decades. The increasing competition combined with difficult financial conditions in the early 1980s, put downward pressure on banks' profit margins and capital ratios (measured as the ratio of capital to total assets) in both developed and developing countries. Concerns about international competitiveness of commercial banks' compelled the regulatory community to respond with an international agreement, which was the genesis of the Basel Capital Adequacy Risk-related Ratio agreement of 1988.

It is in this context that the Basel Accord of 1988 of the Bank for International Settlements (BIS, 1988) was initiated. The primary purpose of he Accord was not only to strengthen the international banking system, but also to promote convergence of national capital standards, thereby ironing out competitive inequalities among banks across countries. The major success of these regulatory standards was to raise the capital levels in banking systems, especially in G-10 countries. In fact, the average ratio of capital to risk-weighted assets of major banks in the G-10 countries increased from 9.3 per cent in 1988 to 11.2 per cent in 1996 (Jackson *et al.,* 1999).

From the very beginning, the 1988 Accord was subject to criticism, which was hardly surprising in view of the fact that the Accord had to accommodate banking practices and regulatory regimes in countries with varied legal systems, business norms and prevalent institutional structures. Criticisms were mainly directed at its failure to make adequate allowance for the degree of reduction in risk exposure achievable through diversification and at its arbitrary and non-discriminatory calibration of certain credit risks. The uniform weight attributed in almost all circumstances to private borrowers (regardless of their creditworthiness) was considered an incentive to regulatory arbitrage, under which banks were tempted to exploit the opportunities afforded by the Accord's classification of risk exposure to increase their holding of high-yielding, but also high-risk assets for a given level of regulatory capital.

In view of these and other concerns emerging in the light of significant technological advances in the banking sector, the Basel Committee proposed a *New Capital Adequacy Framework* in June 1999 incorporating 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 by the banking system. Ever since its publication, the Basel II has generated intense debate among policymakers and academia alike.[2]

Against the light of the historical backdrop of the 1988 Accord, the present paper focuses on the analytics of Basel II. A brief discussion of the relevant literature is contained in Section 2. The basic framework of the model is detailed in Section 3. Section 4 examines the implications of Basel II for banks which are constrained or otherwise by the capital standards. The subsequent section focuses on the impact of monetary policy on credit ratings. Certain policy concerns are highlighted in the following section, followed by the concluding observations, which are gathered in the final section.

II. Received literature

The Basel Committee on Banking Supervision (BCBS) has put forth a revised version of the 1988 Accord, with the revised standards 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 more closely regulatory capital requirements with the underlying credit risks in the activities of banks, thereby reducing distortions existing in the current Accord. 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'. This is 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 changes (Nachane and Ghosh, 2004; Monfort and Mulder, 2000). An issue that has not been adequately addressed is how Basel II would affect the monetary transmission mechanism. The present paper seeks to address this shortcoming.

Existing theory suggests a number of possible ways in which regulatory capital may alter bank lending behaviour and 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, finding that the changes in monetary policy alter bank profitability, which, in turn, impinges on bank capital and lending. Alternately,

[2] A discussion on the Basel Accord and its rationale and implications for emerging economies is contained in Nachane *et al*. (2005a, b).

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, 1995; 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 substituting high credit risk assets with 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, Berger and Udell (1994), Hancock and Wilcox (1994) and Peek and Rosengren (1995b) have examined what role the capital standards played in the during the credit crunch of the 1990s, often with conflicting results. 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 alter bank lending and the efficacy of monetary policy. Modifying recent work by Peek and Rosengren (1995a) and Kishan and Opiela (2000), an asymmetric response is shown in how banks react to monetary policy under the revised Accord. Specifically, symmetric differences exist in the effectiveness of

monetary policy, depending not only on whether banks are constrained by the revised risk-based capital standards, but also 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, migration in credit ratings also influences the efficacy of monetary policy.

III. Model framework

The preceding sections raise the issue of how the imposition of a revised risk-based capital standard, 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. To examine this issue, a simple theoretical model on the lines of Peek and Rosengren (1995a) and Kishan and Opiela (2000) is modified to incorporate the revised standards. A much richer setting would necessitate a multi-period model (Kopecky and Van Hoose, 2004; Ghosh, 2005a, b); the present model, however, confines itself to the short-run adjustment by banks to changes in monetary policy.

Banks are assumed to hold three assets: reserves (R)[3], 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:

$$R+ S+L=DD+TD+K, \quad \textbf{(1)}$$

where K denotes capital.

On the liability side of the balance sheet, bank capital is assumed to be fixed in the short run, as theoretical (Stein, 1998) and empirical (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 deposits (r_{TD}) and the mean rate on time deposits in the market (r_{TDM}). Therefore,

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

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

On the asset side, banks hold reserves, securities and loans. Given the level of demand deposits, banks are required to hold reserves, such that,

$$R = \alpha\, DD \quad \textbf{(4)}$$

with α being the reserve requirement ratio.[4] In addition, banks are assumed to hold securities in fixed proportion to the level of demand deposits, netted for the quantum of reserves,

[3] Comprising of cash in hand and balances with monetary authorities

[4] Banks are assumed to hold no excess reserves. This assumption can be easily relaxed without altering the basic results of the model.

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

Furthermore, the loan market is assumed to be imperfectly competitive, with banks possessing some market power. Thus, bank loans are influenced by the interest rate offered on loans (r_L) relative to some mean rate in the market (r_{LM}) such that:

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

The higher the interest rate a bank sets on its loans relative to the market, the more loans decrease.

Finally, market interest rates on time deposits, loans and securities are assumed to be related to the Bank Rate according as:

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

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

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

$r_{SD}=q_0+\varphi\, r_{TD}$

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.

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

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

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, fourth and fifth terms are the interest expense on demand, time deposits and uninsured deposits, respectively. λ is the deposit insurance premium on insured deposits. In their attempt to maximise profits, banks face a regulatory constraint such that:

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

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 in the framework, the risk-based capital requirements for bank loans and securities can be written as:

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

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

where the risk-weights on loans and securities Ω_L and Ω_S are both variable and a function of the credit risk of the underlying entity such that:

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

[5]The fact that h_1 is less than one signifies that banks do not invest their entire demand deposits in securities; otherwise, it would be akin to some form of 'narrow banking' (see, Litan, 1987)

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

In the aforesaid specification, ρ is the specified regulatory minimum capital ratio.[6] Furthermore, under the 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.[7]

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, equations (12a) and (12b) can be rewritten as:

$\gamma_L = \rho\ \Omega^*_L, \quad \partial\Omega^*_L/\partial c_L = 0$ **(13a)**

$\gamma_S = \rho\ \Omega^*_S, \quad \partial\Omega^*_S/\partial c_S = 0$ **(13b)**

where ρ is fixed and Ω^*_L and Ω^*_S are independent of changes in credit risk.

The model described above is identical to Peek and Rosengren (1995a) and Kishan and Opiela (2000) with one major exception: the model explicitly recognises that banks are subject to a risk-based capital requirement and as a result, includes 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.

IV. Constrained *versus* unconstrained banks

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:

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

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[6] The ratio is currently fixed at 9 per cent for Indian scheduled commercial banks (except RRBs).

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

$\partial(DD+TD)/\partial r_{BK} = [-a_1 (g_1+f_1h_1)/(f_1+g_1)] < 0$ **(19)**

The results of (14) through (19) 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 offsetting the fall in the latter, leading to an overall increase in deposits. 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:

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

$\partial(DD+TD)/\partial r_{BK} = [a_1 (h_1 - \alpha) \rho\Omega_S - a_1 h_1 \rho\Omega_L]/ \rho\Omega_L < 0$[8] **(25)**

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, recall from (13a) and (13b) that capital requirements on loans and securities under the 1988 Accord were fixed.

[8]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.

Under a situation where bank portfolios are comprised on securities slotted in the 20 per cent risk bucket (Ω_S=0.2) and commercial loans, which have 100 per cent 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.[9] 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 (20) and (21), 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: $(h_1 - \alpha)<0$ – 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 deposits 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

[9]To see this, note that for commercial loans, Ω_L varies between 20 and 150 per cent. 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

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: $(h_1 - \alpha)=0$ - 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 (20) to (25) 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 ($\Omega_S=0$), the results for time deposits, total deposits and loans change significantly.[10] 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, and depend on the relative response of securities *vis-à-vis* reserves (i.e., $h_1 - \alpha$). Regardless of what happens to securities, banks keep their loan portfolio unaltered. This is the Kashyap and Stein (1994) result that 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.

[10] Several studies in the literature, notably, Kashyap and Stein (1994) and Blum and Hellewig (1995) employ this assumption.

V. 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. Banks that are unconstrained would change loans, reserves and deposits in the opposite direction as the change in the Bank Rate, while the response of their time deposits would be in the same direction as that of change in Bank Rate. On the other hand, banks that are constrained by the capital requirements would change their reserves and deposits in the direction opposite to the change in Bank Rate, while the response of loans is not clear cut *a priori*. Even the response of their core deposits could go either way. What the theoretical model indicates is that *a priori* the response of securities, reserves and demand deposits is likely to be identical in both instances.

To test our 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 on major heads of assets and liabilities and income and expenditure profile of banks. Information on the monetary policy indicators v*iz*., Bank Rate and yield on 364-day treasury bills is culled out from the *Handbook of Statistics on Indian Economy* (RBI, 2004).

Following from the theoretical model, to test the validity of our comparative static results, 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 of banks (defined as capital *plus* statutory reserves to total assets) and classify banks as unconstrained if their leverage ratio exceeds the median leverage ratio of banks in the sample, and else zero. This variable is computed across all the banks (public, private and foreign banks) for the period 1993-2004.[11] Given that the *de novo* 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.[12]

[11] The expanded sample comprises of 27 public sector banks, 15 old private banks, 8 de no private banks and 14 foreign banks.

[12] This unbalancedness for the year 1995 and the later years arises because one new private banks became operational in 1996 although most others became operative in 1995.

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 and else, zero. 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 period beginning 1996 through 2004.

Therefore, we have four sets of panel observations comprising of 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 empirics 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 only the relevant coefficients.

Table 1: Effects of Monetary Policy on Constrained and Unconstrained Banks defined in terms of RBC Ratio

	Unconstrained Banks		Constrained Banks		All Banks	
	Bank Rate	YLD-364	Bank Rate	YLD-364	Bank Rate	YLD-364
Loans	-0.104 (0.013)*	-0.101 (0.012)*	-0.064 (0.031)**	-0.061 (0.025)**	-0.100 (0.011)*	-0.098 (0.011)*
R-square	0.119	0.122	0.086	0.103	0.127	0.125
Number of observations	535	535	41	41	576	576
Investments	-0.123 (0.013)*	-0.117 (0.014)*	-0.083 (0.038)**	-0.073 (0.033)*	-0.121 (0.012)*	-0.114 (0.013)*
R-square	0.155	0.139	0.095	0.099	0.156	0.142
Number of observations	535	535	41	41	576	576
Reserves	-0.054 (0.013)*	-0.060 (0.013)*	-0.036 (0.034)	-0.037 (0.029)	-0.053 (0.011)*	-0.058 (0.012)*
R-square	0.035	0.042	0.024	0.034	0.035	0.043
Number of observations	535	535	41	41	576	576
Demand deposits	-0.092 (0.014)*	-0.091 (0.014)*	-0.064 (0.035)***	-0.058 (0.029)**	-0.092 (0.013) *	-0.089 (0.013)*
R-square	0.086	0.083	0.063	0.069	0.088	0.087
Number of observations	535	535	41	41	576	576
Aggregate deposits	-0.104 (0.013)*	-0.104 (0.013)*	-0.076 (0.034)**	-0.070 (0.028)*	-0.103 (0.012)*	-0.101 (0.012)*
R-square	0.119	0.118	0.101	0.116	0.122	0.122
Number of 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 is significantly different to a monetary policy shock, judged in terms of either 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. Economically, 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 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.[13]

Table 2: Effects of Monetary Policy on Constrained and Unconstrained Banks defined in terms of Leverage Ratio

	Unconstrained Banks		Constrained Banks		All Banks	
	Bank Rate	YLD-364	Bank Rate	YLD-364	Bank Rate	YLD-364
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
Number of observations	374	374	376	376	750	750
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
Number of observations	374	374	376	376	750	750
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
Number of observations	374	374	376	376	750	750
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
Number of observations	374	374	376	376	750	750
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
Number of 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 in terms of 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 in line 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.

[13] See Ghosh (2005b) for an application of this proposition to banking.

VI. Policy concerns

The results of the study have implications for the conduct of monetary policy. In particular, it demonstrates 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 of this study 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 complicate monetary policy formulations.

VII. Closing remarks

Existing research on the Basel Accord has raised the question of how revisions to the Accord to 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 to influence bank lending under the revised capital standards. The findings reveal that the effectiveness of monetary policy to influence bank lending differs according to whether banks are constrained by the risk-based capital standards or not. In addition, the effectiveness of monetary policy to influence 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.

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