Bank response to capital requirements: Theory and Indian evidence

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Introduction

It has been widely observed that throughout the 1970s, the capital ratios of many banks throughout the world declined significantly[2]. In an attempt to reverse this decline, the bank regulators in several countries issued explicit capital standards for banks (and bank holding companies, as in the United States in December 1981). These standards required banks to hold a fixed percentage of their total assets as capital. Although these minimum regulatory standards have been given credit for increasing bank capital levels, the '1980s also witnessed a number of bank failures. Several authors, including Lindgren *et al.* (1996) have observed that, since 1980, over 130 countries, comprising almost three fourths of IMF's member countries have experienced significant banking problems. Research by Alfriend (1988) has also confirmed the fact that a weakness of the minimum capital standards was that they failed to acknowledge the heterogeneity of bank assets and, as a result, banks had an incentive to shift their portfolios from low-risk to high-risk assets.

In response to the widespread criticism about declining capital standards of banks and the consequent bank failures, in 1989, the Basle Committee on Banking Supervision (BCBS) announced the adoption of risk-based capital standards. The primary purpose of these standards was to make bank capital requirements responsive to the risk in the asset portfolio of banks. Although capital ratios at commercial banks have increased since the risk-based standards have been introduced, the question arose as to what degree these increases were a response, specifically to risk-based capital standards.[3] Furthermore, although the adoption of risk-based standards has focused attention on capital levels and bank lending, insufficient attention has been devoted to the related issue of how the adoption of the risk-based standards may have impacted bank-portfolio risk levels.[4] In general, at least some theoretical and empirical research have raised

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[2]Evidence in support of this for US, UK and Canadian banks has been provided by Saunders and Wilson (1999), while Jackson *et al.* (1999) have adduced evidence to support this for banks in the G-10 countries.

[3] As observed by Jackson *et al.* (1999), 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.

[4] For recent studies addressing the impact of risk-based capital standards on bank lending and the credit crunch, see Berger and Udell (1993), Shrieves and Drew (1995) and Berger (1995).

the possibility that increasing regulatory capital standards might have caused banks to increase, rather than decrease, portfolio risk. Furthermore, greater amounts of capital, *per se*, are no guarantee that banks are adequately capitalised. Rather, from a public policy perspective, what is important is the amount of capital a bank holds relative to the level of risk in its portfolio.

2. Received Literature

In recent years, a number of theoretical and empirical studies have examined the impact of regulatory capital standards on bank portfolio risk. For example, using the mean-variance framework, Kim and Santomero (1980) and Koehn and Santomero (1988) have shown that increasing regulatory capital standards may have the unintended effect of causing utility (shareholder value) maximising banks to increase portfolio risk. Under these conditions, changes in capital and portfolio risk would be positively correlated. In contrast, studies such as Benston *et al.* (1986) have observed that bank capital and portfolio risk may be negatively correlated, as banks maximize the option value of deposit insurance by reducing capital and increasing risk. Furthermore, Furlong and Keeley (1989) have argued that the mean-variance approach is inappropriate because it ignores the option value of deposit insurance. Using a contingent claims model, their results suggest that increased capital standards will not cause banks to increase portfolio risk. This occurs because an increase in capital reduces the value of the deposit insurance put option, thereby reducing the incentive for banks to increase portfolio risk levels. However, one important limitation of the study is that banks continue to have an incentive to maximise risk in the model; an increase in capital merely reduces the magnitude of the gains from risk-taking activity. Gennotte and Pyle (1991) incorporated an adjustment for the value of deposit insurance as suggested by Keeley and Furlong (1990) and also allowed for the expected return on an asset to decrease as a bank increases its holdings. They found that even if an interior optimum for size and risk exists, then a rise in the capital level would lead to increased investment in the risky asset and a greater probability of failure.

Addressing the issue of risk-based capital regulations, Kim and Santomero (1988) examined how the design of risk-based capital standards influences the level of risk in bank portfolios. The results are particularly interesting, because they found that a risk-based rule designed to minimize the probability of bank failure would lead banks to choose high-risk assets. Empirical evidence on the issue presents conflicting conclusions. The study by Haubrich and Watchel (1993) shows how the implementation of the Basle risk standards caused poorly-capitalised banks to reconfigure their portfolios away from high-risk and towards low-risk assets. This result, however, runs contrary to that of Hancock and Wilcox (1992) who found that, banks

that had less capital than required by the risk-based standards, shifted their portfolios towards high-risk assets.

3. Risk-based capital standards

In July 1988, the BCBS approved the adoption of a risk-based capital standard for banks in member countries.[5] Prior to the implementation of these risk-based capital standards, banks in the G-10 were subject to leverage requirements which mandated banks to hold a flat percentage of their assets as capital, irrespective of the level of risk in their portfolio.

Beginning December 31, 1990, the risk-based capital standards supplemented the existing leverage requirement. Although the risk-based capital standards were designed to make capital standards similar across all countries on the Basle Committee, their primary purpose was to require banks to hold capital in accordance with the *perceived* risk in their portfolio. To accomplish this, the risk-based capital standards explicitly linked capital to risk by assigning risk weights to broad categories of on- and off-balance sheet assets. After assigning assets to the appropriate risk category, the bank calculated its total risk-weighted assets as the sum of the value of each asset multiplied by the corresponding risk weight.[6] As a final step, banks were required to hold capital equal to a certain percentage of the total risk-weighted assets. Under the risk-based standards, capital consists of two parts: tier-I capital (comprising of equity capital and published reserves from post-tax retained earnings) and tier-II capital (comprising of hybrid debt capital instruments, loan loss reserves, sub-ordinated debt, *etc*.).

4. Limitations of risk-based capital standards

Under an ideal risk-based capital system, any increase in the bank's portfolio risk would be accompanied by an increase in capital to act as a buffer against possible losses arising from the additional risks. This implies that the risk-based capital standards should explicitly link changes in required bank capital with changes in earnings exposure risk. However, conceptual weaknesses in the risk-based standards may undermine the relationship between changes in portfolio risk and changes in required capital. One reason for this is that the current risk-based capital standards account primarily for credit risk. Thus, a capital deficient bank can, at the margin, improve its risk-based capital ratio by substituting interest-sensitive, low credit risk assets, such as

[5] The 10 countries are Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, United Kingdom and the United States (plus Luxembourg and Switzerland).

[6] The risk-based capital standards also incorporated off-balance sheet activities. This is done by converting the value of the off-balance sheet item to an on-balance sheet credit exposure equivalent. The on-balance sheet equivalent is then multiplied by the corresponding risk weight and added to the bank's total risk-weighted assets.

Government bonds, for shorter term, higher interest-sensitive assets, such as commercial loans. Furthermore, other types of risks, such as interest rate risks, credit concentration risks *etc*., are not explicitly recognized by the risk-based standards.

In addition, as Keeton (1989), Avery and Berger (1991b), and Kaufman (1992) have observed, if the risk weights used in the risk-based capital standards do not accurately reflect the true risk of an asset, then banks may actually have an incentive to increase portfolio risk. This situation occurs, in part, because the risk-based standards use simplified risk classifications, which create an incentive for banks to arbitrage both between and within risk categories. Evidence that the risk weights used in risk-based capital differ from actuarially fair premiums has been provided by Bradley *et al.* (1991) and Avery and Berger (1991a). Furthermore, by ignoring the benefits of portfolio diversification, the risk-based capital standards may not accurately differentiate between changes in asset composition which hedge portfolio risk and those that increase portfolio risk. It must also be recognised that the minimum risk-based capital standards, by themselves, do not limit the amount of risk in a bank's portfolio. Rather, the risk-based standards dictate how much capital a bank must hold, conditional upon the estimated level of primarily credit risk in a bank's portfolio. In fact, as discussed in previous Sections, the risk-based capital standards may actually cause banks to increase portfolio risk. Last, but not the least, the risk-based capital standards overlook potential interactions between individual assets. The standards establish the relative risk weights based on the asset's risk in isolation of other assets. Portfolio theory suggests that the relevant risk of an asset depend not only on its own variability, but also its covariance with other assets in the portfolio. The risk-based standards unfortunately fail to incorporate the latter.

5. Capital adequacy standards: The Indian experience

Capital adequacy has traditionally been regarded as a sign of strength of the financial system in India. In terms of Section 17 of the Banking Regulation Act, 1949, every banking company incorporated in India is required to create a reserve fund and transfer a sum equivalent to not less than 20 per cent of its disclosed profits, to the reserve fund every year. The Reserve Bank has advised banks to transfer 25 per cent and if possible, 30 per cent to the reserve fund.

Consequent upon the recommendations of the Committee on Financial Sector Reforms (Chairman: Shri M.Narasimham), a capital to risk-weighted assets system was introduced for banks in India since April 1992, largely in conformity with international standards, under which banks were required to achieve a 8 per cent capital to risk-assets ratio. Indian banks with branches abroad were given time till March 31, 1994 (subsequently extended to March 31, 1995) to

achieve the norm of 8 per cent CRAR; the capital was to comprise of tier I plus tier II capital, of which tier II should not exceed 100 per cent of tier I. Accordingly, the pattern of assigning risk weights and credit conversion factors were also delineated, broadly in line with those in the original Accord.[7] Although the switchover to stringent prudential regime did affect the banking system in the initial years, the system exhibited adequate resilience to record substantial improvements in financial strength through higher CRAR over the period. Data for PSBs reveal that as on March 1996, while only 19 banks satisfied the CRAR of 8 per cent and above, the number increased to 26 in 1999.

6. The model framework

In order to assess how banks responded to the capital requirements, we first note the following simple identity:

$$Capital = \left(\frac{Capital}{Total\ risk\ weighed\ assets}\right)\left(\frac{Total\ risk\ weighed\ assets}{Total\ Assets}\right) Total\ Assets$$

$$or, \qquad C = R * P * TA,$$

where C=capital, R=risk-weighted capital ratio, P=portfolio factor, and TA=total assets.

Using the superscript notation for proportionate changes (e.g., $Z^0=\Delta Z/Z$), we obtain, after some rearrangement,

$$R^0 = C^0 - P^0 - TA^0 \qquad \textbf{(1)}$$

Because the risk-adjusted capital requirements are a constraint on R, we see from the above equation that the relation descriptively allocates the adjustment of banks to three possible courses of action: raise capital (increase C), adjust the portfolio factor (lower P) or shrink total assets (lower TA).

Using the Basle standards as a benchmark for providing a basic framework of minimum capital standards, regulators in different countries have supplemented them with a range of other requirements designed to suit the country-specific requirements. Table 1 summarises the papers which examine this issue.

As is evident from Table 1, most of the studies on capital adequacy and the concomitant portfolio shifts have been with regard to the US experience. The early literature covering US bank behaviour prior to the introduction of formal requirements in that country in 1981 confirms the fact that capital requirements implemented by supervisors on banks were merely indicative in nature. Peltzman (1970) and Mingo (1975) regressed percentage growth in capital on a range of

[7] Keeping the realities of the Indian situation in mind, the risk weights on several on- and off balance sheet items were adjusted to reflect market realities.

conditioning variables, including the bank's lagged ABC ratio. Peltzman (1970), using state-wide averaged data found insignificant effects of ABC ratios on subsequent bank capital changes. Mingo (1975) using bank-level data found strong and statistically significant positive effects. Although the methodology used in these studies was quite naïve, they however, put in place the basic framework that most subsequent analyses followed: regressing a capital change variable on conditioning variables describing the financial state of the bank and the nature of its business (see also, Furfine, 2000).

Table 1: Capital ratios and bank regulation

Author/Year	Country/ Period	Issue
Peltzman (1970)	US banks 1963-65	ABC ratios[a]
Shrieves and Dahl (1992)	US banks 1984-86	1981 standards
Jacques and Nigro (1997)	US banks 1990-91	Basle Accord
Ediz, Michael and Perraudin (1998)	UK banks 1989-95	Basle Accord plus extra capital requirements set on bank-specific basis
Rime (2001)	Swiss banks 1989-95	Basle Accord with more stringent risk weights

a. The "ABC" ratio was the ratio of actual bank capital to the capital desired by the regulator.

Subsequent research has mainly focused on changes in capital ratios (either leverage ratios or ratio of equity to total risk-weighted assets) rather then merely changes in capital growth rates. Second, early literature made no distinction between the short and the long-run effects of capital requirements (since capital growth was regressed only on conditioning variable and not on lagged capital or capital growth). Most subsequent research has employed a partial adjustment specification in which if Y(t) is the actual capital ratio of the bank and YD(t) is the bank's target capital ratio at time t, then Y(t) is assumed to be of the form

$$Y(t) - Y(t-1) = \alpha\ [YD(t) - Y(t-1)] + u(t) \qquad \textbf{(2)}$$

In this case, u(t) is a random error term and α is a positive parameter. When Y(t-1) exceeds (resp., is less than) YD(t), the sign of α implies than Y(t)-Y(t-1) is, on average, negative (resp., positive). Hence, in the long run, Y(t) will tend to converge towards YD(t) and the magnitude of α reflects the rate at which such convergence occurs. Since the bank's desired capital ratio YD(t) is unobservable, researchers have employed a proxy, typically replacing YD(t-1) in equation (1.2) with a weighted sum, $\Sigma_i \beta_i X_i(t)$, where X_i are lagged conditioning variables

describing the state of the economy and the bank's financial situation and the β_i are the parameters to be estimated.

The main papers which have investigated the impact of capital requirements using partial adjustment model are those of Shrieves and Dahl (1992) and Jacques and Nigro (1997). The former study, using data on 1,800 FDIC insured banks for the period 1983-87 found that banks with CRAR of less than 7 per cent (applied by the US authorities at that time), increased their ratio on average by 140 basis points per annum more as compared to other banks. Subsequently, Jacques and Nigro (1997) using a 3SLS method of estimation for US banks for the period 1990-91, found that capital regulation had a significant impact on risk and vice versa.

As evident, most of the papers have examined the issue of capital regulation with regard to US banks for different points of time. Recent studies, in regard to the UK (Ediz *et al.*, 1998) and Switzerland (Rime, 2001) provide some useful evidence from non-US countries. Ediz *et al.* (1998) employed quarterly data on 94 UK banks over the period Q4 1989 to Q4 1995, while Rime (2001) looks at annual data on 154 Swiss banks between 1989 and 1995. Both these papers adopt a broadly similar specification. In particular, both introduce among the X_i variables dummies for capital pressure which equal unity when a bank's capital ratio falls into a zone starting above the regulatory minimum. The gap between the starting point of the zone and the regulatory minimum varies across banks and is taken to be proportional to the time-series standard deviation of the banks' own capital ratio. The specification captures the idea that (a) banks prefer to maintain a buffer level of capital over and above the regulatory minimum and (b) the width of the buffer will reflect the variability of the banks' ratio[8]. Both these papers find that regulation is effective in the sense that the dummy variables described above have statistically significant coefficients. In the case of Rime (2001), the impact of regulation (i.e., of a dummy for the capital ratio, which is less than one standard deviation above the regulatory minimum) is statistically significant at the 1 per cent level, while in the case of Ediz *et al.*(1998), the ratio of capital to risk adjusted assets increased by 44 basis points per quarter more for banks in the regulatory pressure zone compared to adequately capitalised banks.

Empirical insights from these studies can provide useful policy guidance to regulators in other countries to design their policy stance in accordance with the nature of the banking system in their countries. The regulatory authorities in the UK, for instance, earlier used to set two sets of capital requirements, a "trigger" ratio, which is the minimum ratio with which banks must comply and a "target" ratio, set above the trigger ratio. The purpose of having these dual capital standards serves two purposes: firstly, the gap between them acts as a "buffer" in the sense that regulatory

[8] A description on trigger and target ratios in the UK is provided in Richardson and Stephenson (2000).

pressure is initiated when the actual capital to risk assets ratio (CRAR) falls below the target. If the CRAR falls even below the trigger level, supervisory authorities initiate even more drastic action. An important feature of such a practice is the specification of bank specific capital requirements[9]. Given the wide heterogeneity in terms of products and customer preferences among PSBs as well as the adjustment response of the PSBs, the regulatory framework should be designed so as to encourage individual banks to maintain higher CRAR than the stipulated minimum to reflect their differential risk profiles. Such adoption of bank-specific capital requirements has gained currency in recent times in view of the movement towards Risk-Based Supervision (RBS), which envisages inspection of institutions based on their risk profiles. Given that supervisory resources are scarce and different institutions have differential risk profiles, it would be useful if institutions were monitored according to their respective risk profiles. Riskiness, in such a situation would reflect supervisors' evaluation of the banks' loan book or possibly their perception about weaknesses in systems and controls. For most UK banks, for instance, capital requirements exceed the Basle minimum of 8 per cent. The ability to vary a bank's capital requirements administratively provides the regulators with a useful tool for influencing the actions of the bank management.

In the light of the aforesaid discussion, the present chapter seeks to address the following two issues: firstly, it seeks to examine, in the Indian context, whether capital requirements have been able to influence bank behaviour. The fact that capital requirements affect bank behaviour does not imply that the impact is undesirable. It is left to the discretion of bank supervisors to judge whether the induced levels of capital are adequate or not, given the broad goals of regulation. A second objective of the paper is to examine whether, consequent upon the introduction of the capital adequacy standards, there have been any discernible shifts within each asset category towards riskier assets (or otherwise). Given that the two standard avenues of capital augmentation *i.e.,* securitisation and shifting from banking book to trading book-is not available for banks in India[10], it therefore follows that banks would have either moved away from riskier assets in order to boost their capital adequacy levels or alternately, would perforce have to access the market so as to maintain prescribed levels of capital[11] (equation 1).

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[9] The Report of the Committee on Banking Sector Reforms (Chairman: Shri M.Narasimham) which submitted its Report in 1998 had observed that, "the RBI should also have the authority to raise [the minimum capital to risk assets ratio] further in respect of individual banks if in its judgement the situation with respect to their risk profile warrants such an increase" (pp.21, para 3.15).

[10] Another way of capital augmentation is by raising average spreads (popularly termed as net interest margin). However, spreads have shown a decline in recent times for all bank groups.

[11] The trading book comprises both the short-term proprietary position taken by the bank in financial instruments for its own account, and its exposures relating to the provision of financial services to

The present paper employs supervisory data for Indian PSBs over the period 1997 Q1 to 1999 Q4 to address the issues outlined above. The data is made available by the Off-Site Monitoring and Surveillance Division (OSMOS) of the Reserve Bank. Several points about the data are in order. Firstly, consequent upon the introduction of off-site returns for banks since 1997, banks have been directed to submit data on mandated aspects of liquidity, solvency and asset quality on a quarterly basis[12]. The range and extent of disclosures have gradually been enhanced over the years so as to give a clearer picture of bank behaviour to the regulators. To the extent that the data have to be submitted within a stipulated time frame (typically 1-month of the close of the quarter), the timeliness of the information obtained enables the authorities to monitor and understand trends in important banking variables, It however needs to be recognised that the data for all quarters (except end-March) is unaudited. Notwithstanding the shortcoming, the short span of time (i.e., the close of banking business in every quarter) after which such data is obtained enables one to decipher, with a reasonable degree of accuracy several broad features of bank behaviour.

The panel data used in the above study comprises quarterly balance sheet and income data str*etc*hing from 1997 Q1 to 1999 Q4 on the 27 PSBs. To the extent that PSBs constitute a sufficiently heterogeneous sample and comprise the bulk of the banking system in India[13], a study confined to PSBs, in our view, suffices to draw broad inferences about shifts in the asset portfolio of the banking system as a whole. In particular, the two questions in which we are interested are (a) does pressure from supervisors affect bank capital dynamics when capital ratios approach their regulatory minimum, and (b) which items of their balance sheets bear the bulk of adjustment pressure when banks are subject to regulatory pressure?

7. Empirical estimation

The primary focus is towards understanding the impact of regulatory pressure on changes in capital, holding other influences on capital constant. This latter aspect is important because when a bank falls into financial distress, it might seek to adjust its capital in line with its own internally generated capital targets, even in the absence of intervention by regulators (Hancock and Wilcox, 1993). In line with the work of Ediz *et al.* (1998), we formulate a dynamic, multivariate panel regression model in which changes in capital ratios depend on the lagged level

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customers-for example, agency business. On the other hand, banking book comprises all other transactions, for example, lending and other types of credit activities and long-term investments.

[12] The second tranche of DSB returns covering the aspect of asset liability management has been introduced in July 1999.

[13] As at end-March 1997, end-March 1998 and end-March 1999, PSBs accounted for 80, 82 and 81 per cent, respectively, of the total assets of Scheduled Commercial Banks.

of the ratio, a range of conditioning variables describing the nature of the bank's business and its current financial health (these proxy for the bank's internal capital target), and variables that may be regarded as measuring regulatory pressure. Formally, our model may be stated as:

$$Y_{n,t+1} - Y_{n,t} = \alpha_o + \sum_{j=1}^{N} \alpha_j X_{n,t,j} + \beta Y_{n,t} + \varepsilon_{n,t} \quad \textbf{(3)}$$

where $E(\varepsilon_{n,t})= E(X_{n,t,j}\varepsilon_{n,t})=0$, t indicates the time period, n the cross-Sectional unit (bank) and where $X_{n,t,j}$ (j=1,2,…, N) are a set of regressors. Further,

$$\varepsilon_{n,t+1} = \rho \varepsilon_{n,t} + \zeta_{n,t} \quad \forall n,t \quad \textbf{(4)}$$

where $E(\zeta_{n,t})=0$ for all n,t and $E(\zeta_{n,t}\, \zeta_{m,s})=0$ for all t, s, n, m except when t=s and n=m. To include random effects, we suppose that for any bank, $E(\zeta^2_{n,t})=\sigma_n^2$.

First differencing of (1.3) introduces a correlation between the error term and the differenced lagged dependent variable. Therefore, OLS or ordinary panel estimation of (3) would produce biased results, even when the set of variables X is strictly exogenous. Such a scenario implies a set of moment restrictions can be used in the context of Generalised Method of Moments (GMM) to generate consistent and efficient estimates of the parameters of interest.

The consistency of the GMM estimator depends on whether the lagged values of capital and other explanatory variables are valid instruments A necessary condition of the validity of such instruments is that the error term be serially uncorrelated. To address this issue, we present the Sargan test of over-identifying restrictions as suggested by Arellano and Bond (1991): it tests the overall validity of the instruments by analysing the sample analog of the moment conditions used in the estimation process. Under this test, failure to reject the null hypothesis provides support to the model.

The conditioning variables as employed in the study designed to proxy the bank's own internal capital target and include the following ratios: (i) net interest income to total risk-weighted assets (NIIRWA), (ii) fee income to total risk-weighted assets (FIRWA), (iii) bank deposits to total risk-weighted assets (BDRWA), (iv) total off-balance exposures to total risk-weighted assets (OBSRWA), (v) profits to total risk-weighted assets (PFRWA), (vi) provisions to total risk-weighted assets (PVRWA) and (vii) 100-percent risk-weighted assets to total risk-weighted assets (HRRWA). The net interest income, fee income and 100-percent risk weighted asset variables reflect the nature and riskiness of the banks' operations. Bank deposits and off-balance sheet exposures reflect the vulnerability to runs on deposits, although they may also reflect the degree of financial sophistication of the bank and its consequent ability to economise

on capital. Total profits and loan loss provisions variables indicate the bank's state of financial health.

Intuitively, while higher NIIRWA is expected to raise the capital adequacy ratio, similar is the case with FIRWA. Likewise, higher OBSRWA is also expected to raise the capital adequacy standards and the same is the case with PFRWA. Provisions, on the other hand, to the extent it represents an outflow, would lower the capital adequacy ratio. Finally, higher the level of deposits, higher would be capital required to sustain an eventuality of a run on deposits.

Of particular interest for the present exercise are the regulatory pressure variables. We measure regulatory pressure in two ways. First, we incorporate a dummy variable that equals one if the bank has experienced an upward adjustment in its trigger ratio (the minimum CRAR that a bank must comply with) in the previous three quarters. This we refer to as the "trigger" dummy variable (TRIGD). The second variable we employ is referred to as "target" dummy variable (TARGD). The degree of proximity to the "trigger" CRAR depends not just on the absolute percentage difference between the current CRAR and the trigger, but also on the volatility of the CRAR. Hence, we calculate this dummy variable (TARGD) in such a way that it is unity if the CRAR is less than one bank-specific standard deviation above the bank's trigger. Thus, our hypothesis is that there exists a zone above the trigger in which the bank's capital ratio choices are constrained by regulatory pressure. In this sense, our study has elements of similarity to Jacques and Nigro (1997). [14][15]

The dummy variable associated with one-standard deviation above the trigger may be regarded as introducing a simple regime switch in the model for low levels of the CRAR. In order to generalise this regime switch, we also estimate a switching regression model in which all the parameters on the conditioning variables (and not just the intercept) are allowed to change when the CRAR is less than one-standard deviation above the trigger. This specification allows for the possibility that all the dynamics of the capital ratio change when the bank is close to its regulatory minimum level of capital.

[14] The idea of bank-specific capital requirement is also observed in the Report of the Committee on Banking Sector Reforms (Chairman: Shri M.Narasimham). As observed in the Report, "the RBI should also have the authority to raise [the minimum capital to risk assets ratio] further in respect of individual banks if in its judgement the situation with respect to their risk profile warrants such an increase" (pp.21, para 3.15).

[15] In Jacques and Nigro (1997), the regulatory pressure variables are defined in relation to the 8 per cent risk-based capital ratio. Since banks with total risk-based capital ratios above and below the 8 per cent regulatory minimum may react differently, the study partitioned regulatory pressure into two variables: RPG and RPL. RPL equals (1/RBCj-1/8) for all banks with a total risk-based capital ratio less than 8 per cent, and zero otherwise. A second regulatory pressure variable, RPG equals (1/8-1/RBC_j) for all banks with total risk-based ratio greater than or equal to 8 per cent, zero otherwise. The econometric exercise then seeks to examine how the behavior of these two sets of banks in terms of capital requirement and risk-taking activity is affected by the regulatory stipulations.

8. Results and discussion

The result of the regression analysis is presented in Table 2. In the table, we report the regression results for the case in which the dependent variable is the CRAR. The analysis suggests that the capital requirements significantly affect banks' capital ratio decisions. The coefficient on the regime dummy is positive and significant. The point estimate implies that banks increase their CRAR by about 40-percentage points per quarter when the capital ratio approaches the regulatory minimum. In addition, we find that banks raise their CRAR by roughly 50 percent per quarter following an increase in the trigger ratio by the supervisors. Ediz *et al.*'s (1998) study revealed that, banks in the UK raised their CRAR by roughly 1/3 per quarter following an increase in the trigger ratio by the supervisors.

In Column 3 of the table, we present the results for the regressions of changes in 100-per cent weighted assets as a ratio of total risk-weighted assets on a lagged level of this ratio and on the same conditioning variables as those included in the CRAR regressions. Although the parameter on the trigger dummy has the expected sign, it is insignificant. The NIRWA coefficient is significant, suggesting the possibility that increasing diversification by PSBs is engendering a significant change in 100-percent risk weighted assets. Among others, the coefficients on both profits and provision variables are significant, which is a pointer to the possibility that both higher profits and provisions lead banks to rely on asset substitution away from high risk-weighted assets to meet their capital requirements as they approach the regulatory minimum.

9. Concluding remarks

The observations have important implications for policy. Firstly, capital ratios seem to have an influence on bank's decision-making. This fact assumes all the more relevance in view of the growing concerns about banking stability. Simply put, higher levels of capital can be useful in preventing systemic distress, which is a useful lever in the hands of policy makers. Secondly, the widespread belief of a movement away from loans and into Government securities seems unfounded. While some adjustments in a bank's portfolio seem reasonable in the face of vicissitudes in the operating environment, such a phenomenon is not of a large magnitude. This observations gains prominence in view of the fact that the economy seems to be entering a high growth trajectory, which would necessitate a higher demand for loans. Combining the two aforesaid points, it seems fair to state that the Indian evidence makes capital requirements an attractive regulatory instrument since they serve to reinforce the stability of the banking system without apparently distorting the lending choices of banks.

Table 2: CRAR and 100-percent Weighted Assets Regression Results

Variable	CRAR	HRRWA
Constant	6.37	44.07
	(2.70)*	(3.49)*
Change in trigger dummy	0.48	-0.27
(TRIGD)	(3.19)*	(0.29)
FIRWA	-0.72	-4.70
	(-0.68)	(1.79)#
NIIRWA	0.57	2.58
	(1.15)	(2.80)**
BDRWA	0.08	0.02
	(1.59)#	(0.15)
CRAR trigger (<than 1 s.d.)	0.36	-0.55
(TARGD)	(-3.72)*	(1.26)
OBSRWA	-0.02	0.003
	(-1.58)#	(0.12)
PFRWA	1.02	1.18
	(2.79)*	(2.13)**
PVRWA	-0.03	1.23
	(-0.07)	(1.81)**
HRRWA	-0.004	
	(-0.30)	
Lagged Dependent Variable	-0.72	-0.55
	(-3.50)*	(-3.67)*
Adjusted R^2	0.43	0.26
Test of GMM consistency (p-values)		
Sargan test	0.62	0.51
No. of observations	324	324

Figures in brackets indicate t-ratios.
*, ** and # indicate significance at 1, 5 and 10 per cent, respectively.

The purpose of the present exercise is to empirically analyse the impact of bank capital dynamics on the capital ratio choices of PSBs in India. Towards this end, we use quarterly supervisory data including detailed information about the balance sheet and profit and loss account of PSBs str*etc*hing over the period 1997 through 1999. Although such work has been carried out for several developed economies, *viz*., the UK, US and Switzerland, little work on this front appears to have been done for countries like India.

The conclusions reached are reassuring in that capital requirements do seem to affect bank behaviour over and above the influence of the banks' own internally generated capital targets. More importantly, such adjustments by banks in their capital ratios are effected primarily by boosting their capital rather than through systematic substitution away from high-risk loans.

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