Market Discipline, Capital Adequacy and Bank Behaviour: Theory and Indian Evidence

Ghosh, Saibal and Das, Abhiman

Reserve Bank of India

March 2005

Market Discipline, Capital Adequacy and Bank Behaviour: Theory and Indian Evidence

SAIBAL GHOSH
ABHIMAN DAS[1]

Policy debate with regard to financial intermediaries has focused on whether, and to what extent, governments should impose capital adequacy requirements on banks, or alternately, whether market forces could also ensure the stability of banking systems. The paper contributes to this debate by showing how market forces may motivate banks to select high capital adequacy ratios as a means of lowering their borrowing costs. If the effect of competition among banks is strong, then it may overcome the tendency for bank capitalisation that arises from systemic effects. If systemic effects are strong, regulation is required. Empirical tests for the Indian public sector banks during the 1990s demonstrate that better capitalised banks experienced lower borrowing costs. These findings suggest that ongoing reform efforts at the international level should primarily focus on increasing transparency and strengthening competition among banks.

[1] Department of Statistical Analysis and Computer Services, Reserve Bank of India, Bandra Kurla Complex, Bandra East, Mumbai 400051 and Department of Economic Analysis and Policy, Reserve Bank of India, Fort, Mumbai 400001. The views expressed and the approach pursued in the paper are strictly personal.

Market Discipline, Capital Adequacy And Bank Behaviour: Theory and Indian Evidence

Saibal GHOSH and **Abhiman DAS**

Introduction

Since the late 1980s, authorities from G-10 and other emerging economies have been engaged in regulatory reforms in their banking sector. The aim of such activity, a large part of which concentrates on bank capital adequacy ratios, has been to mitigate bank solvency problems. The motivation behind the proliferation of regulatory activity has been based on the presumption that the banks, if left alone, might remain undercapitalised relative to the socially optimal level.

The present paper explicitly evaluates the validity of the presumption. Towards this end, an analytical framework is developed to examine how banks select their capital adequacy ratios. The model seeks to explain why and how competition among banks can support high capital adequacy ratios. It suggests that 'market discipline' (competitive forces) can assist the implementation of capital adequacy regulations. The empirical evidence on the results pertaining to public sector banks in India during the 1990s shows that better capitalised banks experienced lower borrowing costs.

It is possible to draw two major conclusions from these findings. First, capital adequacy regulation may be socially desirable. And second, regulation aimed at creating and sustaining competition among banks, notably through increased transparency, can play an important role in mitigating bank solvency problems.

I. Why Capital Adequacy Requirements?

Government regulation is usually needed in the presence of market failures emanating from public goods, externalities, monopolies or information asymmetries between buyers and sellers. In case of banks, regulation is justified on the ground that depositors are unable to monitor the financial soundness of banks (asymmetric information) and that there is a risk of systemic crisis (which can engender bank runs).

Dewartipont and Tirole (1993a, 1993b), and Miles (1995) have argued that if depositors could effectively monitor the banks, this would limit socially sub-optimal bank behaviour. But monitoring is expensive and there are limits to information. Moreover, bank debt is held mainly by depositors, who account for the majority of deposits and given explicit deposit insurance, as is prevalent in most countries including India, lack the incentives to perform efficient monitoring. Thus, depositors need to be represented by a regulator who can intervene on their behalf to correct market failure.

Several possibilities have been proposed in the literature for prevention of bank runs. Salient among these include banks that invest only in riskless securities, funding banks with equity rather than demand deposits, and offering Government deposit insurance. Although these proposals may insulate banks from runs, they have drawbacks since some of them can lead to moral hazard, as is the case of the lender of last resort and deposit insurance.

Requiring banks to increase their capital seems to be an plausible regulatory response to the risk of a systemic crisis which additionally can improve the soundness and safety of the banking sector. The requirements that compel banks to hold sufficient capital may alter their attitudes towards risk. Illustratively, when a bank holds a large amount of equity capital, the bank has more to lose if it fails, and is consequently more likely to pursue less risky activities.

This argument has, however, not been without its critics. Benston and Kaufman (1996) and Dowd (2000) have disputed these arguments. They have, instead, argued that capital adequacy regulation is both unnecessary and incapable of improving banks' capital position *more* than the banks could do on their own. In Dowd's (2000) view, shareholders can enforce proper risk behaviour. Moreover, both studies note that the best argument for capital adequacy regulation is that it might help to counter the effects of other given interventions such as the moral hazard created by the regulatory authorities themselves.

Analysts of domestic and international banking regulation have resorted to market pressure arguments to account for this observation. Those studying domestic banking sectors have argued that banks experience opportunity costs and may face reduced profits when they increase capital adequacy ratios. Moreover, if these reasons were not enough to motivate minimal compliance or non-compliance with capital adequacy regulations, the existing ‘safety net’ should do so (Avery and Berger, 1991; Wall and Peterson, 1995; BCBS, 1999). The fact, however, that banks, on average, have capital adequacy ratios well above the regulatory minimum is not compatible with these assertions.

On the other hand, observers of international banking regulation have argued that, since capital adequacy regulations impose substantial costs on banks, preferences and behaviour of

both regulators and banks are shaped by 'level playing field' considerations. Yet, if compliance with capital adequacy regulations were very costly and therefore impinge upon the competitiveness of banks, as many authors have claimed (Wagster, 1996; Oatley and Nabors, 1998), the question remains as to why there exists large cross-national differences in capital ratios. A related issue of import is why would capital ratios for banks exceed the minimum required. If the regulatory process were strongly driven by 'level playing field' concerns, it is most likely to have resulted in convergence of capital adequacy across and within countries around the minimum Basel standards.

Some authors have drawn attention to market pressure as an explanation for the rapid acceptance and diffusion of the Basel capital adequacy standards (Genschel and Plümper, 1996). Their contention is that these standards have increased transparency, thereby enabling financial markets to 'punish' poorly capitalized banks and rewarding banking systems with higher capital levels. Rating agencies are hypothesized to have been instrumental in promoting national and international capital adequacy regulations and driving up the overall capital adequacy ratio. While this argument is *prima facie* plausible and may explain high than stipulated capital ratios, it is insufficiently specified and has not received any empirical confirmation in the literature.

Other studies suggest that capital adequacy ratios have an impact on banks' funding costs. Keeley (1990), based on a sample of 77 U.S. bank holding companies from 1984 to 1986, finds that banks paid an interest rate premium on uninsured deposits (those greater than $100,000) that was related to banks' default risk. The study concludes that a 1 percent increase in banks' capital ratio lowered their rate on certificates of deposit (CD) by 14 basis points, and that a 1 percent increase in banks' market-to-book asset ratio (an indicator for market power) reduced the average CD cost by 16-18 basis points.[2] Finally, Madura and Zarruk (1993) argue that share prices of U.S. banks with lower capital adequacy ratios were more negatively affected by the introduction of uniform capital requirements in 1987 and 1988 than banks with higher capital adequacy ratios. In summary, the above mentioned studies on market discipline suggest that banks with higher capital ratios may be rewarded by markets with lower funding costs, which motivates banks to exceed minimum capital adequacy ratio requirements set by regulators.

Most of these studies pertain to the U.S. banking industry. Exceptions to this are Nachane (1999), Ghosh *et al*. (2003), Rime (2001) and Nachane et al. (2005). Thus, Ghosh *et al* (2003) formulate a dynamic multivariate panel regression model where the independent variables include, among others, a dummy variable for regulatory pressure. The findings suggest that (a) capital regulation is effective in the sense that they influence bank behaviour and (b) the regulatory framework needs to be designed to encourage individual banks to maintain higher

capital ratios than the stipulated minimum, in order to reflect their differential risk profiles. Rime (2001), on the other hand, notes that Swiss banks holding large capital buffers beyond the regulatory minimum may have been driven by market considerations, such as volatility of capital, liquidity of markets for bank stocks, access to capital markets and the cost of raising capital.

The present paper makes an attempt has been made to examine whether market forces can act as a substitute for capital adequacy requirements by explicitly considering both market forces (interest rate on deposits) and Government intervention (deposit insurance).

II. Theoretical Framework

The banks in the model are entities that intermediate funds between lenders (depositors) and borrowers. They make loans, at exogenously given interest rates, and finance them with deposit and own capital. Each bank selects the interest rate it offers on its deposits in order to maximize profits. For purposes of tractability, it is assumed that all banks are identical. As a starting point, we first discuss a benchmark case in which banks operate without any restrictions on borrowing and lending activities and subsequently introduce Government deposit insurance.

What role does bank capital play in this environment? First, bank capital is a direct source of funding for loans. Second and more importantly, capital matters for the *perceived* riskiness of bank deposits. An undercapitalised bank is more likely to turn insolvent in the face of adverse developments on the asset side of its balance sheet than a sufficiently capitalized one. If deposits are less than fully insured, bank failure inflicts losses on the depositors. Banks with higher capital adequacy ratios are, consequently, perceived as safer managers of borrowed funds and will be able to attract deposits on more favourable terms (lower rates) than inadequately capitalized banks. A bank can use its capital adequacy ratio as a means of establishing a cost advantage against its competitors. At the same time, an individual bank's interest rate depends also on the perceived safety of the banking system as a whole (systemic risk). A highly capitalized banking industry makes bank deposits relatively safer in comparison to other investments (from the investor-depositor's point of view), thereby exerting positive externalities on all banks. When an individual bank selects its preferred level of capital, it takes into account the fact that the more its own capital increases, the greater is the relative attractiveness of its deposits *vis-à-vis* competing banks (substitution effect). From a micro standpoint, this behaviour on the part of an individual bank typically ignores the fact that the higher capital level also contributes to the overall safety of the banking system (the systemic effect), lowering risk premia on deposit rates across the board. Such lack of internalization of spillover effects is quite common in markets characterised by externalities.

The profits (Π) of an individual bank are given by equation (1)

$$\Pi = R^L L - R^D(k-k^*, k^*)*q - c(k) \quad \textbf{(1)}$$

where R^L and R^D are the loan and deposit interest rates, k is the level of own capital, k* is the average capital level of the banking sector, L and q are the quantum of loans and deposits, respectively and c is the cost of raising own capital (where $\delta c/\delta k>0$ and $\delta^2 c/\delta k^2>0$). We assume, purely for tractability, that the quantity of deposits received by each bank is fixed.[3] Furthermore, it is assumed that:

$$\frac{\partial R^D}{\partial k} < 0; \ \frac{\partial^2 R^D}{\partial k^2} < 0 \ \frac{\partial R^D}{\partial k^*}|_{d(k-k^*)=0} < 0; \ \frac{\partial R^D}{\partial k^*}|_{dk=0} \ ? \quad \textbf{(2)}$$

The first two inequalities indicate that if a bank selects a higher capital adequacy ratio, then it can lower its funding cost (but at a decreasing rate). The third inequality states that a uniform (across banks) increase in the capital adequacy ratio reduces the borrowing cost of all banks (lower systemic risk).

The significance of the last inequality stems from the fact that it examines the cost impact on individual bank's borrowing when competitors increase their capital, while the bank's own capital position is unaltered. A negative sign on this variable indicates that an individual bank can 'free-ride' on the healthiness of other banks: the benefits from a reduction in systemic risk more than offset the losses from the increase in relative riskiness (the general effect dominates the substitution effect). If, on the other hand, the sign is positive, then a bank loses (the substitution effect dominates the general effect).

Finally, the balance sheet constraint dictates that:

$$L = k+q \quad \textbf{(3)}$$

The choice variable of the bank is the level of own capital (or equivalently, given the fixity of q, the capital adequacy ratio). Following from (1), the first order condition for profit maximization, after invoking (3), is given by (4).

$$\frac{\partial \Pi}{\partial k} = R^L - q\frac{\partial R^D}{\partial k} - \frac{\partial c}{\partial k} = 0 \quad \textbf{(4)}$$

In a symmetric equilibrium, k* = k. The optimal level of k, (say k^P) is given by (4). In other words, the bank builds capital up to the point where the marginal cost of loan equals the marginal benefit. The benefit is composed of two elements: the increase in lending capacity consequent upon the reduction in funding costs, and the reduction in borrowing costs.

Having examined the individual bank's profit maximisation, it is important to examine the industry's maximization problem. The inclusion of k* in the R(.) function implies an

externality: the individual bank's choice of a capital adequacy ratio has implications for the level of systemic risk for the banking sector as a whole. This externality was not internalized in the decision-making process of the individual bank. Therefore, for a social planner, the choice of capital would need to explicitly incorporate the externality that higher capital position for individual banks would raise the *overall* capital position of the banking industry as well. Accordingly, the socially optimal level of capital, say k^S, is given by the solution to the following equation:

$$\frac{\partial \Pi}{\partial k} = R^L - q\frac{\partial R^D}{\partial k} - q\frac{\partial R^D}{\partial k^*}\frac{\partial k^*}{\partial k} - \frac{\partial c}{\partial k} = 0 \qquad \textbf{(5)}$$

A comparison of (4) and (5) reveals that a bank is undercapitalised relative to the society's preferred level ($k^P<k^S$) if $\partial R^D/\partial k^*<0$. In this case, there is a 'free-riding' problem as the positive spillover from a reduction in systemic risk outweighs any losses arising from deterioration in the bank's *relative* position. If, on the other hand, $\partial R^D/\partial k^* > 0$, then a bank cannot rely on other banks' higher capitalization in order to bring its borrowing costs down. On the contrary, if the other banks strengthen their capital position and she does not follow suit then she has to pay higher rates on deposits to compensate her depositors for the higher relative risk they face.

The immediate question of relevance is: the determinants of the sign on $\partial R^D/\partial k^*$. When an individual decides on opening a bank account, two immediate decisions assume importance. First, whether to place the money in a bank account vis-à-vis a competing non-bank asset. Second, assuming bank deposit to be the preferred choice, which one of the banks to select for opening a deposit account? While systemic risk in the banking sector plays an important role in the first decision, it is individual (idiosyncratic) bank risk that tends to be a dominant concern in case of the second. If the depositors are more concerned about the first decision than about the second, then $\partial R^D/\partial k^*$ is likely to be negative. Investors consider deposits offered by different banks that differ in terms of capital adequacy ratios as close substitutes. In this case, a bank will not have a strong incentive to select a high capital adequacy ratio to distinguish itself from its competitors. As a result, banks will tend to choose low levels of capital relative to the socially optimal level. Banks rely on other banks to keep their borrowing cost low.

If, on the other hand, depositors care more about idiosyncratic than about systemic bank risk, then capital adequacy ratio can be a powerful instrument for improving relative bank attractiveness and gaining a cost advantage over its rivals. In this case, $\partial R^D/\partial k^*>0$ and competition among banks will drive capital adequacy ratios upward, perhaps to levels that exceed

the socially optimal level, removing the need for Government mandated minimum capital requirements.

Deposit Insurance

The earlier discussion would suggest that deposit insurance is a source of externality and may engender a moral hazard problem. The maximization problem faced by the individual bank with deposit insurance is given by (6)

$$\Pi = R^L(k+q) - R^D(k-k^*,k^*)(q-m) - R^I m - c(k) \qquad \textbf{(6)}$$

where *m* is the fraction of deposits that are insured, q-m those that are uninsured[4] and R^I is the interest rate offered on insured deposits (which, in equilibrium, must be the same for all banks). The first order condition for profit maximization is given by (7):

$$\frac{\partial \Pi}{\partial k} = R^L - (q-m)\frac{\partial R^D}{\partial k} - \frac{\partial c}{\partial k} = 0 \qquad \textbf{(7)}$$

Comparison of (4) and (7) reveals that the capital adequacy ratio selected in the presence of partial deposit insurance falls short of that selected without deposit insurance. In other words, the incentive on the part of banks in the presence of deposit insurance to improve the relative safety of their deposits is lower than otherwise.

The social planner needs to internalize these two externalities - the one pertaining to systemic risk and the one associated with Government provided deposit insurance - when selecting the socially optimal capital adequacy ratio of banks. Assume that the function L(k) denotes the social cost resulting from expected bank failures, then the function that evaluates the contribution of any bank's actions to social welfare takes the form as given by (8), i.e.,

$$\Pi = R^L(k+q) - R^D(k-k^*,k^*)(q-m) - R^I m - c(k) - L(k) \qquad \textbf{(8)}$$

where, $\partial L(.)/\partial k < 0$, that is, the more capitalized the bank the less likely it will fail and the less likely that insurance payments will be made. The maximization of (8) produces the socially optimal level of bank capital, k^S

$$\frac{\partial \Pi}{\partial k} = R^L - (q-m)\frac{\partial R^D}{\partial k} - (q-m)\frac{\partial R^D}{\partial k^*}\frac{\partial k^*}{\partial k} - \frac{\partial c}{\partial k} - \frac{\partial L}{\partial k} = 0 \qquad \textbf{(9)}$$

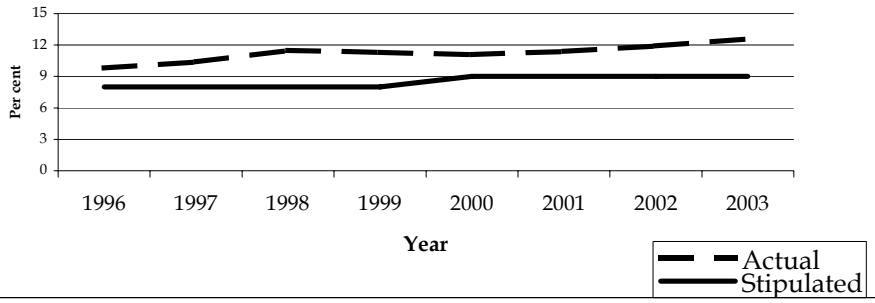
As in the case without deposit insurance, the sign of $\partial R^D/\partial k^*$ plays a critical role in determining whether competition among banks can be an efficient alternative to Government mandated capital adequacy regulations. It must be noted, though, that the probability of an

undercapitalised banking system is higher because of the presence of the last term in (9). The social planner would prefer banks to hold sufficient capital in order to reduce the occurrence of bank failures. The banks, however, fail to internalize this social loss while selecting their capital adequacy ratios.[6]

III. Empirical Specification

The present section examines whether the borrowing costs of banks are affected by idiosyncratic and industry-wide capital adequacy ratios. A plot of stipulated and actual capital adequacy ratios of public sector banks in India since the mid 1990s clearly demonstrates that capital adequacy ratios that exceed the stipulated requirements (Chart 1).

Chart I: Actual and Stipulated CRAR of Commercial Banks- 1996 to 2003



Following from (9), the empirical strategy comprises of estimating the following reduced-form specification as given by (10)[5]:

$$R_{i,t} = a_1(k_{it} - k_{it}^*) + a_2\, k_t^* + a_3 x_{it} + u_{it} \qquad \textbf{(10)}$$

where R_{it} measures the funding cost of bank i in period t; k_{it} is that bank's capital adequacy ratio; k^*_t is the average capital adequacy ratio of the bank group; and $\mathbf{x}_{it}$ is a vector of bank-specific control variables. Economically, if a_1 is negative (and statistically significant), a bank can lower its funding costs by increasing its capital adequacy ratio. And secondly, if a_2 is non-negative, bank competition can help to reduce the free-riding problem.

Towards this end, in the first step, we estimate the following baseline specification (without the average capital adequacy ratio):

$$R_{i,t} = w_1\, k_{it} + w_2 x_{it} + u_{it} \qquad \textbf{(11)}$$

Specifically, we test whether $w_1 < 0$. If this hypothesis is rejected, this indicates that an individual bank cannot reduce its borrowing costs by raising its capital adequacy ratio. Consequently, the hypothesis that market forces may drive capital ratios upwards has limited relevance from an empirical standpoint.

The data set consists of yearly observations on the Indian public sector banks for the period 1996 through 2003, the highest periodicity with which data on the concerned variables is available on a consistent basis. Owing to lack detailed information on interest rates offered by each bank on the various types of deposits, in consonance with the literature, the implicit cost of deposits has been employed. Accordingly, the variable $\mathbf{R_{it}}$ is measured in terms of the implicit cost of deposits (COST), defined as the ratio of interest expended on deposits by the bank to its total deposits (Martinez Peria and Schmukler, 2001). The variable $\mathbf{k_{it}}$ is *Tier-1ratio* (Tier-1 capital divided by total risk weighted assets); $\mathbf{x}_{it}$ denotes a vector of bank-specific *control variables* which include the natural logarithm of total assets (**SIZE**) and other bank-specific characteristics - *return on equity* **(RoE),** non-performing loan to total asset (**NPA)** and off-balance sheet activities to total asset (**OBS**). We also include quadratic terms in the regressions to capture possible non-linearities in the relationship underlying bank capital adequacy and borrowing cost. The summary statistics for the data employed in the regression in Table 1. Table 2 (column 2) reports the estimation results without control variables, whereas Table 2 (column 3) includes control variables.

The results, reported in Table 2 (column 2), indicate that well capitalized banks face lower average interest expenses on their deposits. This finding validates an important premise of the model, *viz*., that market forces influence banks' choices of individual capital adequacy ratios. Moreover, this function is convex: the coefficient for the quadratic term, k_i^2, is positive. This suggests that while additional capital lowers borrowing costs, it does so at a decreasing rate. Well-capitalized banks benefit less than inadequately capitalised banks when they increase their capital adequacy ratios.

Table 1: Summary Statistics for the Regression

Variable	Mean	Std. Deviation	Minimum	Maximum

COST	7.154	0.62	4.598	9.348
Tier 1	6.397	4.739	-18.810	18.457
SIZE	9.613	0.912	7.531	12.761
RoE	1.264	6.349	-3.553	32.127
OBS	24.580	12.061	2.516	73.032
NPA	6.866	2.790	2.105	17.273

Additionally, when the control variables are introduced, the results (Table 2 - column 3) indicate that banks with higher return on equity encounter lower borrowing costs. On the other hand, banks with a larger non-performing assets face higher interest expense ratios. The latter finding provides additional evidence that depositors are concerned about the riskiness of their investments. Banks that are perceived as riskier because they hold larger amounts of non-performing loans are 'punished' by the market with higher borrowing costs (Ghosh and Das, 2003; see also, Yeyati et al., 2004 for evidence for emerging markets). And finally, banks, which have greater fee-based income, as reflected in higher off-balance sheet activity, are perceived to be well diversified and consequently, face lower borrowing cost. Bank size, as measured by total assets has limited relevance for banks cost of borrowings.

Table 2: Market Discipline and Capital Adequacy: Preliminary Results
Dependent Variable: Implicit Deposit Interest Rate

Variable	Coefficient	Coefficient
(1)	(2)	(3)
Constant	7.371 (0.069)***	8.294 (0.894)*
k_i	-0.027 (0.009)*	-0.081 (0.010)*
k_i^2	-0.0007 (0.006)	0.0003 (0.0006)
Control variables		
SIZE		-0.091 (0.086)
RoE		-0.007 (0.001)*
NPA		0.061 (0.022)*
OBS		-0.015 (0.003)*
Diagnostics		
No of bank-year observations	216	216
R-square	0.13	0.21
Time period	1996-2003	1996-2003

Standard errors in brackets. *, ** and *** indicate significance at 1, 5 and 10 percent.

The elasticity[6] of the interest rate with regard to the capital adequacy ratio is around 0.1. In other words, an increase in the capital adequacy ratio by 10 per cent lowers the average interest rate paid on bank deposits by about 1 per cent. In other words, there is a significant effect of capital adequacy ratios on borrowing costs.

The aforesaid results suggest that competition among banks contributes to higher levels of bank capitalization. However, to examine the basic premise: 'does the desire to lower

borrowing costs is strong enough to override the tendency for undercapitalisation that arises from free riding and moral hazard', we estimate the original specification (equation 10):

$$R_{i,t} = a_1 (k_{it} - k_t^*) + a_2 k_t^* + w x_{it} + u_{it}$$

where $\mathbf{k_t^*}$ is the average capital adequacy ratio at time t. Table 3 reports the results.

Table 3: Market Discipline and Capital Adequacy: Adjusting for Average Capital Adequacy Ratio
Dependent Variable: Implicit Deposit Interest Rate

Variable	Coefficient	Standard Error
Constant	8.621*	0.872
(k_i-k^*)	-0.038**	0.010
k^*	-0.151*	0.060
$(k^*)^2$	0.009*	0.003
Log (Asset)	-0.109	0.101
RoE	0.0004	0.001
NPA	0.053*	0.022
OBS	-0.014*	0.004
No of bank-year observations	216	
R-square	0.36	
Time period	1996-2003	

*, ** and *** indicate significance at 1, 5 and 10 percent.

The coefficients for variables (k_i- k*) and k*, respectively, are statistically significant and negative. This result implies that provided a bank increases its capital adequacy ratio relative to the average, it is able to reduce its borrowing costs. On the other hand, an increase in the industry-wide capital adequacy ratio, holding individual bank capital constant also reduces the bank's borrowing costs. Given that the (absolute value of) coefficient for the average capital adequacy ratio, k* far exceeds that for the individual capital adequacy ratio (k_i - k*), the latter effect dominates. In other words, competition among banks is by itself not sufficient to eliminate the free-rider problem.

5. Concluding Remarks

The present analysis demonstrates that competitive forces may, in principle, motivate banks to select high capital adequacy ratios as a means of lowering their borrowing costs. If the effect of competition among banks is strong, then it may enable to overcome the tendency for bank undercapitalisation that arises from systemic effects. If such systemic effects are strong, capital adequacy regulation assumes prominence.

To understand the behaviour of market discipline on capital adequacy, we examined the behaviour of Indian public sector banks in the 1990s. Two main findings emerged. Better-capitalised banks experienced lower borrowing costs. Second, bank competition could not have substituted for capital adequacy regulation because of substantial systemic effects (free riding). These findings offer a plausible explanation for the observed over-compliance with stipulated capital adequacy requirements. In other words, over-compliance may have been driven by the fact that competition motivates banks to select higher capital adequacy ratios than otherwise. The ongoing progress towards adoption of Basel II with its focus on risk sensitive capital requirements and market discipline through greater transparency are efforts in this direction. Clearly, this would need to be tempered with country-specific considerations since the structure of the banking industry varies markedly across countries (Reddy, 2004).

References

Avery, R.B. and A.N.Berger (1991). 'Risk-based Capital and Deposit Insurance Reform', *Journal of Banking and Finance*, 15: 847-874.

Basel Committee on Banking Supervision (1999). 'Capital Requirements and Bank Behaviour: The Impact of the Basel Accord', *Working Paper No.*1, BIS: Basel.

Benston, G. and G.Kaufman (1996). 'The Appropriate Role of Bank Regulation', *Economic Journal*, 106: 688-697.

Berger, A.N., R.J.Herring and G.P.Szego (1995). 'The Role of Capital in Financial Institutions', *Journal of Banking and Finance*, 19:393-430.

Dewartipont, M. and J.Tirole (1993a). *The Prudential Regulation of Banks*. Cambridge: MIT Press.

---- (1993b). 'Efficient Governance Structure: Implications for Banking Regulation, in C.Mayer and X.Vives (*eds*.) *Capital Markets and Financial Intermediation*, Cambridge: Cambridge University Press.

Diamond, D.W and P.H.Dybvig (1993). 'Bank Runs, Deposit Insurance and Liquidity', *Journal of Political Economy*, 91:401-419.

Dowd, K. (2000). 'Bank Capital Adequacy versus Deposit Insurance', *Journal of Financial Services Research*, 17: 7-15.

Genschel, P and T.Plumper (1997). 'Regulatory Competition and International Cooperation', *Journal of European Public Policy*, 4: 626-642.

Ghosh, S. D.M.Nachane, A.Narain and S.Sahoo (2003). 'Capital Requirements and Bank Behaviour: An Empirical Analysis of Indian Public Sector Banks', *Journal of International Development*, 15: 43-54.

Ghosh, S. and A. Das (2003). 'Market Discipline in Indian Banking: An Empirical Exploration', *NSE Research Initiative No.* 82, NSE: Mumbai.

Keeley, M.C. (1990). 'Deposit Insurance, Risk and Market Power in Banking', *American Economic Review*, 80:1183-1200.

Madura, J and E.R.Zarruk (1993). 'Market Reaction to Uniform Capital Adequacy Guidelines in the Banking Industry', *Journal of Economics and Finance*, 17: 59-72.

Martinez Peria, M.S. and S.Schmukler [2001]. Do Depositors Punish Banks for Bad Behaviour: Market Discipline, Deposit Insurance and Banking Crises. *Journal of Finance.* 56, pp.1029-1051.

Miles, D (1995). 'Optimal Regulation of Deposit-taking Financial Intermediaries', *European Economic Review*, 39: 1365-1384.

Nachane, D.M. (1999), 'Capital Adequacy Ratios: An Agnostic Viewpoint', *Economic and Political Weekly*, January Special Nos. 3&4 on Money, Banking and Finance, 155-160,

Nachane, D.M., P.Ray and S.Ghosh, 'The New Basel Capital Accord: Rationale, Design and Tentative Implications for India', *INDIA Development Report* (forthcoming).

Oatley, T and R.Nabors (1998). 'Redistribute Cooperation: Market Failure, Wealth Transfers and the Basel Accord, *International Organisation,* 52: 35-54.

Rime, B (2001). 'Capital Requirements and Bank Behaviour: Empirical Evidence for Switzerland', *Journal of Banking and Finance*, 25: 143-159.

Reddy, Y.V. (2004), 'Banking Sector in Global Perspective', Inaugural Address at the Bankers Conference, New Delhi.

Santos, J.A.C. (2000). 'Bank Capital Regulation in Contemporary Banking Theory: A Review of the Literature', *Working Paper No.* 90, BIS: Basel.

Wagster, J.D (1996). 'Impact of the 1988 Basel Accord on International Banks', *Journal of Finance*, 51: 1321-1346.

Wall, L.D and D.R.Peterson (1995). 'Bank Holding Company Targets in the Early 1990s: The Regulators versus the Markets', *Journal of Banking and Finance*, 19: 563-574.

Yeyati, E.L., M.Soledad Martinez Peria and S.Schmukler (2004), 'Market Discipline under Systemic Risk: Evidence from Bank Runs in Emerging Economies', *World Bank Policy Research Working Paper* No. 3440, Washington DC.

Endnotes

1. The views expressed and the approach pursued in the paper reflects the personal views of the authors.

2. Keeley (1990) also claims that banks with high capital adequacy ratios have a lower default probability and a lower incentive to increase asset risk and thus should pay lower rates for certificates of deposit (CD).

3. We could alternatively assume q=q (k), with q'(.)>0, without affecting the qualitative properties of the model.

4. This specification is based on Indian practice. The Deposit Insurance and Credit Guarantee Corporation insures individual deposits up to Rs.1 lakh.

5. Consider a simple parametric example to highlight the main results. Assume
$R(k-k^*, k^*) = a_o - a_1(k-k^*) - a_2 k^*$
$c(k)=k^2/2$ and $L(k) = b_o - b_1 nmk$

where a_1 and a_2 are related to depositors' evaluation of idiosyncratic and systemic bank risk, respectively and n is the number of banks.
Using the aforesaid specification and that in a symmetric equilibrium, k=k*, (7) and (9) can be written as:
$k^P = R^L + (q-m)*a_1$
$k^S = R^L + (q-m)*a_1 - (q-m)*(a_1-a_2)+b_1 nm$
A necessary condition for banks to hold capital at least as much as social planners would require is that depositors care about idiosyncratic risk more than systemic bank risk (i.e., $a_1>a_2$). A sufficient condition is that $[b_1 nm - (q-m)*(a_1-a_2)]<0$ or equivalently, $(a_1-a_2)>[(b_1 nm)/(q-m)]$. In other words, depositors concern about idiosyncratic risk *vis-à-vis* systemic risk must exceed a threshold limit.

6. In the theoretical model, banks were assumed to be identical. As a result, they ended up selecting the same capital adequacy ratio and paying the same interest rate on deposits. It is straightforward to allow for differences across banks (for instance, in the **c** function). This would produce a non-degenerate distribution of capital adequacy ratios and interest rates and would hence justify the use of this regression specification.

7. Given the form of the regression equation, $R = b1*k_1 + b2*k_i^2$, the elasticity (e) is defined as
$e = (b1+b2*k_i)*(k_i/R_i)$. Using the values of the estimated coefficients b_1 and b_2 at the mean values of k and R (k =6.4 and R =0.0.071) results in e = - 0.08.