

Development Research Group

**Study
No. 22**

**CAPITAL ADEQUACY REQUIREMENTS
AND THE BEHAVIOUR OF COMMERCIAL
BANKS IN INDIA: AN ANALYTICAL AND
EMPIRICAL STUDY**

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September 20, 2000

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Needless to say, the views expressed in the paper are entirely my own and responsibility for errors and shortcomings rests solely with the authors.

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EXECUTIVE SUMMARY

Introduction

Over the past decade, the macroeconomic consequences of asset quality of banking institutions have been the subject matter of much attention of policy makers. As Lindgren *et.al.* (1996) have observed, since 1980, over 130 countries, comprising almost three fourths of the International Monetary Fund's member countries, have experienced significant banking sector problems, with 41 instances of crisis in 36 countries and 108 instances of significant problems. Added to this, the worldwide trend towards deregulation of financial sectors and the widespread banking problems of many countries arising largely in consequence of this trend have raised a host of questions relating to the linkages between de-regulation, risk behaviour of banks and banking crises. Consequently, the banking sector, or for that matter, the financial sector in general, in most emerging economies are passing through challenging yet exciting times.

Concerns about banking crises are hardly surprising. Bank failures generate serious negative externalities for the economy as a whole. These externalities take a wide variety of forms. The use of public money to bail-out insolvent banks can endanger efforts to rein in budget deficits. And even if budget deficits are viewed as (domestic) transfers rather than as real economic costs, such recapitalisation can compel the authorities towards less benign ways of deficit financing (e.g., an inflation tax); the rescue process itself can weaken the incentives for creditors to monitor the behaviour of banks in the future.

One of the classical measures of reducing the probability of bank failures has been recapitalisation. If recapitalisation takes the form of weak banks cutting back lending and widening spreads, the lower availability and the increased costs of bank credit can impinge seriously on an economy's real prospects by rationing credit, especially for borrowers with few avenues to alternative sources of financing. Banking problems can also create difficulties for

monetary policy. Not only can they distort the normal relation between monetary instruments and the intermediate and final targets of monetary policy, but they may also compromise the overall stance of monetary policy (Sundararajan and Balino, 1991). Banking crises can often trigger concomitant problems for balance-of-payments policy. In fact, recent theoretical advances have demonstrated that banking crises are often an important precursor of a balance-of-payments crisis (Kaminsky and Reinhart, 1995). Finally, banks in developing countries typically operate the payments system, hold the bulk of the financial assets in the economy and are significant players in the government securities market. A crisis in the banking sector therefore, often delimits the efficiency of the payments mechanism, reduces the overall quality of the asset portfolio and constrains the depth and liquidity of the securities market with damaging consequences for macroeconomic policy-making.

Banking crises in LDCs and NICs can have costly repercussions for industrial economies as well. About a quarter to a third of industrial country exports are absorbed by the developing countries. Such crises can reduce absorption by developing countries, disrupt the payments mechanism and curtail portfolio investment flows into developing countries, reducing overall growth¹. The recent crises in South-East Asia, for instance, is projected to slowdown the growth in the world economy from 4 per cent in 1997 to 3 per cent in 1998 (International Monetary Fund, 1998). In short, to the extent that banking crises depress developing countries growth and foreign trade, constrain their ability to service and to repay private capital flows, and eventually augment the liabilities of developing country governments, industrial countries are also unlikely to be immune from their after-effects.

As a consequence, a lot of discussion consequently has been generated about banking crisis prevention and crisis management. Pertinent from the point of

¹ Honohan (1997) has estimated that since 1980, the resolution costs of banking crises in all developing and transition economies have approached a quarter of a trillion dollars.

view of the present exercise is the prevention of banking distress and the forms such crisis-resolution methods should take. Several methods apropos have been suggested in the literature and their relative efficacy discussed at length, depending, to a large extent, on the differences in the legislative framework and the macroeconomic and socio-politico constraints in each individual case. These measures, broadly classified, take the form of emergency (short-term) measures and regulatory reforms (long-tem) measures. The present Study focuses on the latter.

Objectives of the Study

The introduction of prudential regulations in India since 1992-93, consequent upon the recommendations of the Committee on the Financial System (1991) has ushered in a sea change as regards the regulatory framework for the financial sector. Although the regulatory structure has gradually been tightened over the years with the avowed objective of moving towards international best practices, relatively little attention has been paid towards assessing the effectiveness of regulations. This gap cries out to be supplemented with rigorous empirical research with a view to act as a guiding force for any further modification of the existing regulatory mechanism. It is our belief that the current system of recapitalisation followed in India represents an over-reliance on the Basle norms and presents several lacunae. In particular, the 'one-cap-fit-all' theology inherent in the Basle system may introduce an unacceptable amount of inflexibility in the Indian context. While it remains that high enough capital adequacy standards may discourage gambling behaviour and provide effective cushion in an upswing, they might prove to be inadequate in downturns, as firms find it difficult to service their loans. In the face of such vicissitudes in the operating environment, as each bank attempts to satisfy their capital adequacy standard, the whole system may find itself completely undermined,

eventually resulting in a worsening of capital adequacy standards (Stiglitz, 1999 b)².

The widespread criticism in respect of the old Accord seems to have led the Basle Committee on Banking Supervision (BCBS) to propose the new Consultative Paper on Capital Adequacy Framework in June 1999 which aims to further strengthen the soundness of the financial system. The primary objectives of the new Accord are (a) the promotion of safety and soundness of the financial system, (b) the enhancement of competitive equality and (c) the constitution of a more comprehensive approach to addressing risks. These objectives are sought to be attained *via* three cardinal principles: (a) minimum capital requirements, (b) supervisory review of capital adequacy and (c) effective use of market discipline³.

The revised framework places an explicit emphasis on rating. Risk differentiation between counterparts, be they sovereigns, banks, corporates, public sector enterprises or securities firms, are to be based on either external or internal ratings. In view of its overt reliance on the ratings process, it is expected that, in the near future, the ratings mechanism will play a critical role in risk evaluation of banks.

² Stiglitz (1999a) has observed that, while capital adequacy standards are important, it is important to remember that (a) behaviour is affected by franchise value as well as standard capital, increasing capital requirements will lower franchise values and consequently encourage risk-taking and (b) high capital requirements by themselves can even increase risk-taking, especially given the crude and imperfect risk adjustments made (e.g., they do not take into account correlations between assets and do not uniformly take account of the correlation between credit and market risks). For developing countries, Stiglitz therefore advocates a "dynamic portfolio approach". This approach approaches financial sector regulation from the perspective of risk management-managing the incentives *and* the constraints which affect financial entities' exposure to and its ability to cope with risk.

³ The new Accord implies a shift away from stipulation of prescriptive capital adequacy standards (rule-based capital regulation) towards specification of capital adequacy based on quality and character of bank assets, competence of its management and the stability of the operating environment (process-oriented capital regulation) (Karacadag and Taylor, 2000). This assumes importance in the light of Greenspan's (1998) observation that a bank with a nominally high capital ratio of 12 per cent normally would be characterised as "well capitalised", given the Basle minimum CAR of 8 per cent. Yet, a 12 per cent ratio may be

The question therefore arises: if the present CAR approach is inadequate, how do we operationalise an alternative approach? Such an alternative approach would have to take cognizance of the external/internal ratings methodology or alternately, it would have to take into account the supervisory ratings and devise a framework for detecting warning signals of incipient crises. Such structured intervention, popularly referred to as Prompt Corrective Action or PCA, have been widely used in several developed economies. Keeping the Indian realities in mind, one might explore the feasibility of operationalising such a framework and its efficacy. It is also important to recognize that there might be several variables that act as a conduit for streamlining the regulatory framework. Identification of these variables (or proxies thereof) is an important element of the present Study.

Broadly defined therefore, the primary objective of the present study would be to investigate the relationship between changes in attitudes to risk and the level of capital in the banking sector, and, in particular, those of public sector banks (PSBs) in India. In a recent article, Nachane (1999) has been critical of the applicability of CAR in the Indian context. According to him, "...headlong rush along the Basle path of inflexible CRARs, which the Narasimham II Committee seems to advocate is ...inadvisable". Several reasons have been adduced for such concern. Firstly, the predominantly public sector character of banking in India implies that the incentive structure might differ significantly from those prevailing under private banking. Secondly, directed credit often constricts risk-taking activities, so that market risks are not accurately reflected in interest spreads. Thirdly, accounting norms are in a state of evolution, so that sophisticated monitoring mechanisms might pose problems. As a result, taking the cue from there and related considerations, the major contours of our study can be delineated in terms of the following set of arguments:

inadequate for the bank's operating environment and risk profile, which may warrant a capital ratio of 15 or 20 per cent in the economic sense.

- (a) Identification of the key variables (and the magnitudes thereof) that impinge upon the capital adequacy of banks;
- (b) Examination of whether there has been a shift in portfolios towards riskier assets after the introduction of the capital adequacy norms;
- (c) Implications of the New Capital Adequacy Framework with special emphasis on credit rating;
- (d) Whether alternative regulatory arrangements *viz.*, the Value at Risk (VaR) or the Pre-Commitment Approach (PA) can complement the extant regulatory framework.

Methodology of the Study

Building upon a review of the received literature and the evolution of the regulatory framework for banks in India since 1992-93, the Study would undertake an exploration of the inter-linkages between capital and risk for Indian public sector banks with a view to examining the implications on the banking system of changes in the regulatory framework (more specifically, those aspects of this framework impinging on capital adequacy). Towards this end, the Study would utilize several periods of cross-section data on commercial banks in a simultaneous equation framework to estimate the effect of capital changes on risk. An important aspect of the methodology would be its recognition of the fact that changes in both capital and risk have endogenous (i.e., discretionary) and exogenous (i.e. non-discretionary) components. Consequently, the focus would be on determining the effects of discretionary changes in capital (i.e., risk), which are induced by either endogenous or exogenous changes in risk (i.e., capital). Finally, with the new Capital Accord expected to be operational in the near future and given its emphasis on the ratings methodology, to what extent do capital levels of banks impact the ratings process? As an added exercise, an attempt will be made to address the related issue that if the CAR is inadequate as a regulatory framework, to what extent can alternative models of market risk induce banks to move from initial conditions along the learning curve to achieve desirable levels of capital provisioning for varying levels of risk.

Areas of Policy Action

The study would make an attempt to offer concrete policy suggestions in the context of

- (a) Efficacy of Capital to Risk Assets Ratio (CRAR) for the banking sector and implications of such levels of CRAR for risk-taking behaviour of banks;
- (b) The viability of alternative approaches like the Prompt Corrective Action;
- (c) Implications of the (domestic) ratings process for capital adequacy; and,
- (d) Prospects for the use of newer models like Value-at-Risk (VaR) and Pre-commitment Approach (PA) in the Indian context.

CHAPTER I

CAPITAL REQUIREMENTS AND BANK BEHAVIOUR: THEORY AND EVIDENCE

Introduction

In recent years, bank regulators have accentuated their focus on the adequacy of banking organizations capital ratios. The increased emphasis on capital regulation has raised a number of inter-related questions: is focusing on capital an efficient way of regulating banks? What is the best way to structure capital regulation? How do banks respond to different types of capital regulation? Is there any 'trigger' level of capital adequacy, below (resp. above) which banks are induced to indulge in lower (resp. higher) risk-taking behaviour? The present Chapter focuses on the last two questions, examining bank responses and the costs associated with these responses to capital requirements. The discussion draws heavily on international experiences, which serves as useful backdrop for the work on capital adequacy in the Indian context that is to follow in the subsequent Chapters.

An understanding of bank responses to capital regulation may be helpful in designing regulations that better satisfy regulators' objectives. One traditional objective of capital regulation has been to reduce bank failures and promote banking stability. Another objective has been to reduce losses to depositors and the deposit insurer when the bank fails. Regulators are especially sensitive to deposit insurance losses because the government not only often provides insurance through formal programs, but also, in the absence of *de jure* coverage, has historically been the *insurer of last resort*.

During the 'seventies, regulators were not unconcerned about bank capital, but there were no regulations that specified minimum capital ratios. At the beginning of the 'eighties, regulators became increasingly dissatisfied

with many banks' capital ratios, especially those of the larger banking organizations. As a result, regulators in U.S. specified minimum capital-to-asset ratios for all banks in 1981; the remaining banks were required to raise their capital-to-asset ratios to some pre-specified minimum by 1983 (Table 1.1).

Table 1.1: Overview of Major Changes in Capital Regulation in the US:1981-1992

Year	Measure(s) Announced
1981	The Federal Deposit Insurance Corporation (FDIC) sets numeric guidelines for all banks it regulates.
1981	The Office of the Comptroller of the Currency (OCC) and the Federal Reserve divide banks into three categories: community, regional and multinational (the seventeen largest banking organisations). Numeric guidelines are set for the community and regional banks. No standards are set for the multinational banks, but they are encouraged to raise their capital ratios.
1983	The OCC and Federal Reserve impose the regional bank numeric guidelines on multinational banks.
1985	The FDIC, OCC and Federal Reserve establish a common set of capital guidelines that all to all banking organisations.
1990	Interim risk-based capital guidelines take effect for all banking organisations. The risk-based guidelines are supplemented with leverage guidelines.
1991	The FDIC Improvement Act, which establishes five capital categories, is passed. Regulators are given a menu of mandatory and optional enforcement actions they may undertake as a bank's capital ratios decline. Regulators ultimately define the categories both in terms of risk-based and leverage ratios.
1992	Final risk-based capital guidelines take effect for all banking organisations. The risk-based guidelines are still supplemented with leverage guidelines.

Source: Alfriend (1988), Hall (1993) and Wagster (1993).

The banking industry in the US increasingly raised its capital ratios in the years after 1981 guidelines were adopted. However, the simplistic use of total assets as a risk measure became questionable as banks adjusted their portfolios. Given regulators' concern with preventing failure and protecting the deposit insurer, an appropriate measure of capital adequacy would measure a bank's ability to absorb losses from its portfolio without imposing substantial costs on the deposit insurance agency. During the 1980s, however, banks in the US and Western Europe reduced their investment in

high-liquidity, low return assets and increased their exposure to potentially risky off-balance sheet transactions. Thus, the ratio of capital to total assets, that may have been adequate in the early 1980s were very likely becoming less adequate later in the decade. As a result, several countries adopted the risk-based capital standards that were initiated during this period. These standards, often referred to as the Basle Agreement, established capital ratios that are dependent on the banks' overall exposure to credit risk (Appendix A1).

The primary objective of the Basle Agreement is to make capital ratios one of the primary measures for regulatory purposes for the banking sector. Banks may not respond to these regulations if the regulations are not binding or if the costs of meeting the regulations exceed the benefits. If banks do respond, they generally do so in one of two ways. A bank may increase its capital ratios, as measured under the regulatory standards, without reducing either the probability that the bank will fail or the losses to depositors and the deposit insurance agency in the event of a bank failure. This general category of response will be referred to as *cosmetic changes* in the capital ratios. One way for a bank to make cosmetic improvements would be to reduce total assets (or asset growth) so as to improve upon its capital-to-assets ratio while increasing portfolio risk by increasing the proportion of risky assets. An alternative way to do the same is to exploit differences between capital, as measured for regulatory purposes and the bank's true economic capital⁴. A bank may exploit these differences by (a) selling assets that have appreciated in value to increase capital measured by regulatory

⁴ Economic capital can be defined as the quantum of capital that a firm determines is prudent, desirable and achievable over the long-term in the absence of regulatory requirements (Berger *et.al.*, 1995). The purpose of economic capital is primarily to limit the probability of bank failure and secondarily, to finance bank activities. Regulatory capital, on the other hand, is the amount of capital that the society deems as prudent. In other words, while economic capital is concerned merely with the private costs of bank failures, regulatory capital factors into consideration the public costs of bank failure, so that regulatory capital is likely to require to require banks to maintain more capital than they would otherwise hold according to their internal capital allocation systems.

accounting; and, (b) refusing to re-organize substantial reductions in the market value of assets.

A second general response to capital regulations would be to increase measured capital ratios in a way that also reduces the probability of failure and the expected losses to depositors and deposit insurer, should the bank fail. Such changes are referred to as *effective* changes in capital ratios. Examples in this category include reducing risk exposure and increasing the capital base without taking recourse to offsetting measures that increase risks.

Studies of the theoretical determinants of bank capital levels suggest that taxes, deposit insurance, bankruptcy costs and managerial incentives may play a significant role in determining the optimal level of bank capital. Further, theory also suggests that attempts to raise new capital *via* stock issues could be costly to shareholders because such efforts act as a signal that the management has adverse news about the bank.

Internationally, banks have responded to the regulations by reducing their risk exposure and increasing their capital. Banks reduced their risk exposure *via* loan sales and perhaps by refusing to make new loans, while allowing existing loans to be repaid. Further, banks issued new equity to help meet the regulatory guidelines even though these issues often reduced the price of existing shares, as predicted by some theories.

The next section reviews the theoretical determinants of changes in capital and the effectiveness of capital regulation. The following section examines the literature of cosmetic changes in capital ratios and on responses that increase the risk cushion.

I.1 Determinants of Capital Strategy

In evaluating its capital position, a bank must consider both the static costs associated with any given capital gain and the dynamic costs associated with adjusting it. The static costs, and possibly the dynamic costs, depend in part on the penalties regulators impose for inadequate capital ratios. Banks are similar to other corporations, in that they are subject to a variety of non-regulatory costs associated with the level and changes in their capital position.

Bank regulators have long considered the maintenance of adequate capital as an important element for maintaining safety and soundness of individual banks. Banks with inadequate capital have been subject to a variety of penalties depending on the size of the deficiency, including (a) more frequent and longer examinations, (b) moral suasion, (c) denial of applications to acquire other banks, and, (d) formal agreements with the regulators to raise capital and other such actions.

The regulatory pressure on banks to maintain capital is asymmetric: regulators will protest capital ratios that are too low, but they often have little objection about capital ratios that are too high. Market forces could however, potentially impose varying costs on shareholders, based on both the level of the bank's capital and changes in the capital structure. The theoretical starting point in this context for analyzing market forces is Modigliani and Miller's (1958) demonstration that a firm's capital structure (the choice of its debt-to-equity ratio) does not affect its value in perfect markets. An implication of the model is that security prices are an unbiased estimate of their intrinsic value and hence, the timing of a sale and the type of security sold do not affect the value of the firm⁵.

⁵ In the presence of dividend tax, the value of the firm is positively related to its debt.

Building on studies analyzing non-financial corporations optimal capital, Orgler and Taggart (1983) developed a market model for optimal capital structure for banks. In their model, lower capital ratios provide banks with more favourable tax treatment. While the offsetting cost is one of (eventual) diseconomies of scale in producing deposit services and the deadweight cost of bankruptcy borne partially by banks' owners. Flannery (1994) argued that agency costs might be an important determinant of bank capital structures. Lower capital ratios impose desirable limits on management and reduce the need for shareholder monitoring. Conversely, lower ratios increase the incentives for bank shareholders to have managers undertake riskier projects and reject low-risk investments. By having the bank issue deposit with very short-term maturities, debt holders may take effective action if the bank adopts a high-risk investment strategy. Thus, he contended that banks should issue short-term debt and maintain low capital ratios (although they would necessarily be undercapitalised by regulatory standards).

Shrieves and Dahl (1992) pointed out that managerial risk aversion might influence banks' capital structure. Most individuals are thought to be risk-averse, and there is no good reason for thinking that bank managers are more risk averse than the average shareholder. However, bank managers have proportionately far more of their total wealth (including human capital) invested in their bank than do most shareholders, and, as a consequence, managers have more to lose from the bank's failure. Thus, bank managers may choose higher capital levels, given their risk exposure, than would be optimal from a shareholders' perspective.

It is interesting to note that the options pricing theory of finance arrives at a conclusion diametrically opposite to the one stated above. Several authors in this tradition (Kareken and Wallace 1978, Black *et.al.* 1978, Benston *et.al.*1986) maintain that maximising the value of bank shareholders' equity entails maximisation of the option value of deposit

insurance through increasing leverage and asset risk. The associated benefit to bank shareholders is termed as 'deposit insurance subsidy'. Bank capital regulation then acts as a check on the tendency of banks to exploit this deposit insurance subsidy and reduces the risk exposure of banks. The major problem with this view seems to be its premise that banks maximise net shareholder value. This objective may adequately describe mutual fund behaviour but banks are far more concerned with avoiding insolvency than with maximising shareholder returns. More recently, Saunders *et.al.*(1990) have provided a vindication of this view in terms of agency theory. They argue that, bank managers, as agents of stockholders, have an incentive to reduce the risk of bank insolvency well below the levels desired by stockholders, since managers have considerable sunk human capital in banks, and hence stand to lose a great deal personally in the event of bank insolvency. At best, the options pricing result can be regarded as a mitigating factor in our main conclusion of a positive association between risk and regulatory capital (Shrieves and Dahl, 1992).

Thus, theory suggests a variety of costs and benefits to shareholders associated with higher capital ratios. These benefits include a reduction in taxes, an increase in the value of deposit insurance and an increase in the incentive of the bank management to operate efficiently. The costs include increased dead-weight costs of bankruptcy, diseconomies of scale in producing deposit services and incentives to assume excessive risks. Theory also suggests that the optimal level of capital from the managers' perspective may be higher than that desired by shareholders, if managers are risk-averse. In addition, banks may not always be at their optimum level of capital if adjusting capital ratios may be viewed by the market as an adverse signal about the issuing bank's value and hence, lead to a decline in the price of the bank's stock.

I.2 Do Banks Respond to Capital Regulation?

The question of whether banks respond to capital regulation hinges on two issues: are regulatory capital requirements above those that the market would require for at least some banks? And are the penalties for falling below regulatory guidelines large enough to induce banks to raise their capital ratios?

Several studies-Peltzman (1970), Mingo (1975) and Kimball and James (1983)-examined the effectiveness of capital regulations in the period before numeric standards were adopted in 1981. These results, though mixed, tend to indicate that regulators were ineffective in influencing banks' capital ratios. A problem with interpreting these studies results from the fact that the regulatory requirements for any given bank organisation were set on a case-by-case basis and the factors used to evaluate capital adequacy were likely to be highly correlated with those used by the market. A second problem is that the regulatory penalties associated with varying levels of capital inadequacy were not transparent.

Keeley's (1988) analysis for the US banks suggests that the 1981 standards were effective in causing large bank holding companies with inadequate capital to raise their capital ratios. However, a problem with analyzing Keeley's results is that the pressure for higher capital ratios could have come also from market forces and not from regulatory requirements alone. In an attempt to separate the relative importance of the regulator and the market, Wall and Peterson (1987, 1988) estimated a pair of equations that separately allow for market and regulatory influences. The market and regulatory equations were estimated simultaneously using a disequilibrium estimation technique. Their results provided estimates of not only the equation parameters, but also the separate probability of capital responses to each set of influences. Their results suggest that the regulatory model changes in capital are better explained by the regulatory model. In order to further clarify the relative roles of the market and the regulators in the 1988-

92 period, Wall and Peterson (1995) updated their prior disequilibrium analysis of changes in capital ratios, which assumed that the leverage ratio was the binding constraint, rather than risk-based capital ratios. Their analysis demonstrated that regulatory standards were binding for the majority of bank-holding companies (BHCs).

Thus, available evidence, on balance, tends to suggest that regulators have had significant influence on the capital ratios of a large proportion of banking organisations in the period since 1981.

I.3 Cosmetic Responses to Capital Regulation

Cosmetic changes in bank capital are possible because the measures of both capital and risk are imperfect proxies for the economically relevant variables. Regulators find it difficult to construct perfect measures as long as bank managers have private information about the value or risk of their portfolios. However, even granting the impossibility of perfect measures, the crudeness of current measures offers substantial scope for cosmetic changes in capital ratios. The purpose behind the imposition of capital-to-total asset measures (leverage standards) are easily defeated by banks by reducing low-risk, high-liquidity assets and instead substituting a smaller quantity of higher risk, lower liquidity assets. The existing Basle standards are slightly more sophisticated, but numerous flaws remain. The standards (a) require that most commercial and consumer loans carry the same risk weighting and do not allow for differential asset quality within asset classes, (b) do not allow for risks other than credit risks, and, (c) do not account for diversification across different types of risk or even across credit risks. Banks can, therefore, exploit accounting conventions by accelerating the recognition of gains on assets with market value greater than book value, while slowing the recognition of losses on assets with market value less than book value.

Changing Measured Risk: Banks may effectively offset an increase in the capital ratios used by regulators by increasing their risk exposure as long

as their bank managers have private information that is unobservable to regulators about the riskiness of their credit customers or any of their other risk exposures. Whether bank shareholders would benefit from such risk-enhancing activities has been the subject of an intensive debate.

The theoretical case for higher capital standards leading to greater risk assumption and possibly, higher probability of failure is far from clear-cut. Koehn and Santomero (1980) and Kim and Santomero (1988) showed that an increase in the required equity-to-total asset ratio by regulators might induce an increase or decrease in the portfolio risk undertaken by the bank⁶. In a pair of studies, Furlong and Keeley (1989) and Keeley and Furlong (1990) argued that the framework used in prior studies took the expected cost of deposits as a constant that is independent of the bank's capital position or risk. This assumption of independence is incorrect because it ignores the states in which bank fails. When the model was adjusted so that the cost of deposits is a decreasing function of the risk of failure (because the deposit insurance agency pays depositors when the bank fails), then the results of prior studies did not hold. Banks' incentive to take more risk is greater at low capital levels, and the incentive decreases with increase in capital. Subsequently, Gennotte and Pyle (1991) incorporated an adjustment for the value of deposit insurance as suggested by Keeley and Furlong and also allowed the expected return on the asset to decrease as a bank increases its holdings. They found that if an interior optimum for size and risk exists, then a rise in capital level will lead to increased investment in the risky asset and a greater probability of failure. Avery and Berger (1991) argued that, even if Gennotte and Pyle's results for increased risk of default hold, the expected losses to the deposit insurer are decreasing in the absence of dead-

⁶ Rochet (1992), extending on the work of Koehn and Santomero has shown the following: (a) if the objective of commercial banks is maximization of the market value of their future profits (value maximizing banks), capital regulations cannot prevent banks from choosing very specialised and very risky portfolios, and (b) if, on the other hand, banks behave as portfolio managers (utility maximizing banks), regulations can be effective, but only if the weights used in the computation of the ratio are proportional to the systemic risks of the assets.

weight liquidation costs of failure or extreme assumptions about the distribution of asset returns.⁷

While the theoretical evidence is mixed, the empirical evidence generally suggests that higher capital standards may be at most partially offset by increased risk, but do not increase the probability of failure. Shrieves and Dahl (1992) in their study of US banks found that, for commercial banks with assets more than \$100 million during 1983-87 period, an increase in capital is associated with an increase in risk. This supports the work of Levonian (1991), who found that bank holding companies witnessed an increase in both asset risk and capital.

Off-balance sheet items are relevant to the issue of how banks respond to higher capital levels because the 1981 capital standards, as prescribed in the US, did not incorporate off-balance sheet items. Banks seeking to offset the 1981 standards *via* higher risk could do so by substituting off-balance sheet items for on-balance sheet ones. Jagtiani *et.al.* (1995) found that changes in capital requirements for banks have no consistent impact on the diffusion of off-balance sheet activities. One caveat in interpretation of off-balance sheet items is that these activities may themselves create countervailing pressure for better capitalisation. That is, in almost all cases, banks create a contingent liability to their customers that is valuable to the customers only if the bank can meet any obligation that arises from the off-balance sheet transaction. Given that off-balance sheet items are not covered *de jure* by deposit insurance, bank customers have an incentive to price their off-balance sheet transactions in a way that reflects the risk in any ultimate shortfall of the bank's capital.

⁷ Calem and Rob (1996) developed a model of changes in bank's asset choice and capital ratios and simulated the model using parameters estimated over the 1984-93 period. They found that while severely undercapitalised banks take more risks in response to higher capital requirements, banks with minimally adequate capital reduce their risk exposure, whereas well-capitalised banks increase their risk exposure to offset the increase in capital.

Recognising Changes in the Market Value of Assets: At any given time, a bank is likely to have some assets that have appreciated in value from their original acquisition cost and others that have declined in value. Yet, Generally Accepted Accounting Principles (GAAP) record assets at book value rather than current market value. Thus, regulatory capital may differ substantially from the economic capital available to support the long-run viability of a bank and reduce losses in the event of its failure. A bank can boost its regulatory capital by accelerating the recognition of gains or losses for assets by selling them, achieving the effect of marking these assets to market. Further, banks have some discretion in the timing of provisioning for bad loans. Thus, a seemingly low-cost way for the banking system to maintain or increase their regulatory capital ratios is to avoid recognising losses on depreciated assets and to accelerate recognition of gains on assets that have appreciated in time.

Yet another cosmetic response to capital regulation has been noted by Slovin *et.al.*(1991) who recognised the potential for increasing regulatory capital through banks' sale and leaseback transactions (for example, selling their headquarters building to outside investors and simultaneously leasing back the building) and divestitures. They argued, however, that these transactions might also send a negative signal to the financial markets about the value of the existing assets and the bank's future earnings prospects. Banks with favourable information about future prospects can, at least within certain ranges of regulatory capital ratios, signal their good news by not selling assets, but rather waiting for future earnings to boost their capital. Banks with unfavourable information may find the do-nothing strategy too costly and be forced to engage in these transactions or take other action to boost capital.

One potentially instructive case of banks deferring recognition of reductions in asset values involves banks' loans to Latin America. Slovin and Jayanthi (1993) examined banks excess stock returns around the time of the

Mexican debt moratorium (August 1982) and Bolivian debt moratorium (May 1984). The set of banks with exposure to each of these countries was segregated into two groups: those with inadequate capital ratios and those with adequate ratios. They found that the former set of banks suffered significant adverse stock return reactions than the latter set. Musumeci and Sinkey (1990) reached a similar conclusion for the announcement of the Brazilian experience (February 1987).

We now turn to bank responses to changing capital requirements that are more substantial rather than merely cosmetic in nature.

I.4 Effective Increase in the Capital Cushion

A bank may provide an effective increase in its capital cushion when that is the cost-effective alternative or when regulatory prescriptions require them to do so. The increase may stem from reduction in the bank's risk exposure or increasing capital levels.

Reducing Risk Exposure: Banks may reduce their actual risk exposure in a variety of ways, including reducing the volume of risky financial activities and investing in financial instruments with low or negative correlation with their existing portfolios (i.e., engaging in diversification or hedging). Risk reduction through greater diversification and hedging is not explicitly incorporated into the capital standards.

Loan Sales Loan sales have the potential for improving banks' regulatory capital ratios. Potential loan buyers must worry however, that the selling bank will sell loans that are of lower quality than the buyer expects and will not adequately monitor the loan after it has been sold. One way of alleviating buyers' concerns is for the seller to retain the risk exposure *via* a recourse agreement or by having the seller retain a junior claim on a fraction of the loan. The regulatory capital requirements are structured however so

that a selling bank's capital requirement is not reduced to the extent that the sale of a loan does not reflect a reduction in the seller's credit exposure.

Gorton and Pennacchi (1995) suggested that the incentive for sellers to deceive loan buyers may be reduced if the seller retains a fractional interest in the loan and desires to maintain a good reputation so that it can engage in future loan sales. Sellers will face reduced capital requirements if the credit risk that is transferred is proportionate to the amount of the loan, for example, if a bank sells 80 per cent of a loan with a buyer assuming 80 per cent of each Rupee of credit losses, then the selling bank needs only include the remaining 20 per cent of the loan amount in its regulatory capital ratio calculations⁸.

Reducing the Amount of New Loans Most analyses of reduction in bank lending have focused on the period in the late 1980s and early 1990s. A major issue in this period was whether binding capital requirements (induced by higher standards or weakened capital base) resulted in a reduction in bank lending, especially to customers with limited non-bank alternatives. Early analyses identified, and in some cases tested, a variety of possible explanations for the decline in lending, including a reduction in loan supply due to (a) adverse shocks to capital combined with binding regulatory requirements, (b) adverse shocks to capital combined with market pressure for higher capital (c) an increase in regulatory capital, and, (d) less favourable treatment of loans for purpose of calculating regulatory capital requirements. Other explanations for the lending declines might be (a) perceived decrease in expected loan repayments, (b) weaker economy, (c) secular decline in bank's market share, and, (d) banks' higher capital levels⁹.

⁸ Empirical evidence from Pavel and Philis (1987) suggested that banks subject to binding capital requirements are likely to sell loans.

⁹ Recent theoretical advances (Blum, 1999) have shown that capital adequacy rules may increase a bank's riskiness. The intuition behind the result is that under binding capital requirements, an additional unit of equity tomorrow is more valuable to the bank. If raising equity is excessively costly, the only possibility to increase equity tomorrow is to increase risk today.

Determining which of the above factors contributed to the credit decline is impossible *a priori* because all of them were to some extent prevalent in the changed economic environment of the early 1990s. One complication for empirical analysis is that the explanations are not mutually exclusive, so the real question is not which explanations are true, but rather what were their relative contributions to the decline¹⁰. While studies by Shrieves and Drew (1995) and Hancock and Wilcox (1993) found bank portfolios more sensitive to these shocks in the early 1990s than in the late 1980s, those by Berger and Udell (1991) found little support for a drop in lending related to risk-based capital. Evidence that the regulatory pressure was dominant for at least some banks comes from the work of Peek and Rosengren (1995), who, in their study, found that banks in New England, subject to a formal regulatory mandate to increase their capital ratios, reduced their loan portfolios significantly faster than banks not subject to such restriction, even after allowing for differences in capital ratios. The same conclusion finds support in the work of Wall and Peterson (1995).

The hypothesis that common stock issues may signal adverse private information is supported by Slovin *et.al.*(1991) who analyzed the effect of issuance announcement on stock returns of issuing bank holding companies (BHCs) during 1975-88 for money centre banking organisations, regional banking organisations and investment banking firms. They found that all three groups of competitors showed significantly negative abnormal returns in the wake of the securities issuance announcements. Subsequently, Cornett and Tehranian (1994) compared abnormal stock returns of issuing BHCs that have capital below regulatory requirements vis-à-vis those with adequate regulatory capital ratios. BHCs with capital ratios above regulatory minimum are likely to be voluntary issuers that could avoid issuing new

¹⁰ One complication for empirical analysis is that the explanations are not mutually exclusive, so the real question is not which explanations are true, but rather what were their relative

capital, if their managers thought that their stock was undervalued. In contrast, BHCs with capital levels below regulatory requirements may have been involuntary issuers of capital in the sense that regulatory costs of not issuing new capital would exceed any losses from issuing stock that management believed was undervalued.

Increasing Capital Levels: The other way that banks may effectively increase their capital cushion is by increasing their regulatory capital. Banks can do so by increasing retained earnings or issuing new securities. An understanding of the banks' decision to increase regulatory capital comes from two types of studies: (a) those that examine bank's decision to increase their capital and (b) those that focus on stock market reactions to banks' announcement plans to issue new capital.

Dahl and Shrieves (1990) analyzed 753 equity capital issues between 1986 and 1987. They classified banks as adequately capitalised (CRAR of 7 percent or above) versus undercapitalised (CRAR below 7 per cent) ones. Their conclusion was that, not surprisingly, undercapitalised banks were more likely to issue capital vis-à-vis undercapitalised banks. Thereafter, Dahl and Spivey (1995) examined banks during the 1981-88 period that were undercapitalised according to standards used to implement the prompt corrective action (PCA) provisions of FDICIA. Their goal was to determine which actions were most likely to result in bank reaching an adequate capital level by the end of 1989. The study found that less than one-quarter of undercapitalised banks, pre-FDICIA, paid dividends and that dividend payments were not statistically significantly related to the probability of recovery. Their results suggested that that expense control (salary and interest expense) is significantly related to whether, but not how quickly, a bank becomes adequately capitalised.

contributions to the decline. In this context, Hancock *et.al.*(1995) showed that capital shocks for their sample of banks were twice as large in the early 'nineties.

A slightly different sort of evidence comes from the work of Ediz *et.al.* (1998), who, in their study of UK commercial banks found that capital requirements affected bank behaviour over and above the influence of the banks' own internally generated capital targets. Banks achieved such adjustments in their capital ratios by directly boosting their capital rather than through systematic substitution away from high-risk and towards low-risk assets. Essentially, banks in UK are subject to a 'trigger' ratio, which is the minimum capital ratio that banks must comply with and a 'target' ratio, set above the trigger ratio. Such a gap between the target and the trigger acts as a buffer in the sense that regulatory pressure is initiated when the capital ratio falls below the target, which becomes increasingly severe as the ratio approach the trigger level. Our brief survey, while far from conclusive, does underscore the main point that the ability to vary a bank's capital requirement administratively provides regulators with a useful lever with which they can influence the actions of the bank management.

I.5 Concluding Observations

Bank capital ratios have become a primary measure of banks' financial condition as a result of international efforts to achieve a degree of harmony in bank supervisory rules across countries. If the focus on banks' capital is to continue, then a better understanding of banks' responses to binding capital regulation would be valuable.

Given that banks may respond to capital regulation in a variety of ways, regulators need to consider what response they want to elicit when formulating new regulations. Presumably, the regulations are being imposed to reduce the risk of a systemic problem. If so, the regulations arising from cosmetic changes are unlikely to accomplish regulatory goals. What is required for banks is to achieve effective increases in the capital cushion so as to ensure stability of the banking system as a whole.

CHAPTER II

THE IMPACT OF CAPITAL REQUIREMENTS ON BANK BEHAVIOUR: AN EMPIRICAL ANALYSIS OF INDIAN PUBLIC SECTOR BANKS

Introduction

It has been widely observed that throughout the seventies, the capital ratios of many banks throughout the world declined significantly¹¹. 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 'eighties 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. Recent researches by Alfriend (1988) have 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.¹² Furthermore, although the adoption of risk-based standards have 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.¹³ In general, at least some theoretical and empirical research have raised 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.

II.1 Previous 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

¹¹ 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.

¹² 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.

¹³ For recent studies addressing the impact of risk-based capital standards on bank lending and the credit crunch, see Berger and Udell (1994) and Shrieves and Drew (1995).

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 will 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 will 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.

II.2 Risk-Based Capital Standards

In July 1988, the BCBS approved the adoption of a risk-based capital standard for banks in member countries.¹⁴ Prior to the implementation of these risk-based capital standards, banks in the G-10 were subject to a

¹⁴ The 12 countries are Belgium, Canada, France, Germany, Italy, Japan, Luxembourg, Netherlands, Sweden, Switzerland, United Kingdom and the United States.

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.¹⁵ 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 perpetual preferred stock, loan loss reserves, sub-ordinated debt, etc.) (Appendix A2).

II.3 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

¹⁵ 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.

margin, improve its risk-based capital ratio by substituting interest-sensitive, low credit risk assets, such as 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 (1991), 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 have been provided by Bradley *et al.* (1991) and Avery and Berger (1991). 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.

II.4 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 (Appendix A3). Accordingly, the pattern of assigning risk weights and credit conversion factors were also delineated, broadly in line with those in the original Accord.¹⁶ 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 public sector banks 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.

II.5 The Model Framework

¹⁶ 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.

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, $C = R * P * TA,$

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,

$$R^0 = C^0 - P^0 - TA^0 \tag{2.1}$$

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 2.1 summarises the papers which examine this issue.

As is evident from Table 2.1, 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 conditioning variables, including the banks'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

Table 2.1: Capital Ratios and Regulation

Author/Year	Country/ Period	Issue
Peltzman (1970)	US banks 1963-65	ABC ratios ^a
Mingo (1975)	US banks 1970	ABC ratios
Shrieves and Dahl (1992)	US banks 1984-86	1981 standards
Hancock and Wilcox (1993)	US banks 1990-91	Basle Accord
Wall and Peterson (1995)	US banks 1989-92	Basle Accord
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 (1998)	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.

b. In December 1981, the Federal Reserve and the Office of the Comptroller of Currency (OCC) announced a common set of standards to apply to all banks which they regulate. The Federal Deposit Insurance Corporation (FDIC) adopted these standards in 1985. The 1981 standards set a minimum capital ratio of 7 per cent for community banks and 6.5 per cent for regional banks. No formal standards were set for the multinational banks.

variables describing bank’s financial state and the nature of its business. Subsequent research has mainly focused on changes in capital ratios (either leverage ratios or ratio of equity to total risk-weighted assets) rather than 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

$$Y(t) - Y(t - 1) = \alpha [YD(t) - Y(t - 1)] + u(t) \quad (2.2)$$

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 that $Y(t) - Y(t-1)$

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 (3.1) with a weighted sum, $\sum_i \beta_i X_i(t)$, 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.

Among the main papers which investigated the impact of capital requirements using partial adjustment models are those of Shrieves and Dahl (1992) and Jacques and Nigro (1997). Shrieves and Dahl, 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, 1998) 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 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' ratio¹⁷. 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 (1998), 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, 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 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 requirements¹⁸. 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

¹⁷ A detailed background on trigger and target ratios in the UK is provided in Richardson and Stephenson (2000).

¹⁸ The Report of the Committee on Banking Sector Reforms (Chairman: Shri M.Narasimham) had observed that, "the RBI should also have the authority to raise [the minimum capital to

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 paper 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 regime, there are 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 India¹⁹, 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

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).

¹⁹ 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.

market so as to maintain prescribed levels of capital²⁰ (equation 2.1). The paper focuses on the first of these two questions.

In this paper, we employ supervisory data for Indian public sector banks 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 basis²¹. 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 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 stretching from 1997 Q1 to 1999 Q4 on 27 public sector banks (PSBs). To the extent that PSBs constitute a sufficiently heterogeneous sample and comprise the bulk of the banking system in India²², a study confined to PSBs, in our view, suffices to draw broad

²⁰ 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 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.

²¹ The second tranche of DSB returns covering the aspect of asset liability management has been introduced in July 1999.

²² 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.

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?

II.6 Empirical Estimation

Towards achieving our objective, a formal regression analysis is performed towards understanding the impact on capital changes of regulatory pressure, 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 without intervention by regulators (Hancock and Wilcox, 1993). We, therefore, formulate a dynamic, multivariate panel regression model in which changes in capital ratios depend on the lagged level 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:

$$Y_{n,t+1} - Y_{n,t} = \mathbf{a}_0 + \sum_{j=1}^N \mathbf{a}_j X_{n,t,j} + \mathbf{b} Y_{n,t} + \mathbf{e}_{n,t} \quad (2.3)$$

where $E(\varepsilon_{n,t})=E(X_{n,t,j}\varepsilon_{n,t})=0$, t indicates the time period and where $X_{n,t,j}$ ($j=1,2,\dots, N$) are a set of regressors.

$$\mathbf{e}_{n,t+1} = \mathbf{r} \mathbf{e}_{n,t} + \mathbf{z}_{n,t} \quad \forall n,t \quad (2.4)$$

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, $E(\zeta_{n,t}^2) = \sigma_n^2$.

Our conditioning variables are designed to proxy the bank's own internal capital target and include the following: net interest income over

total risk-weighted assets (NIIRWA), fee income over total risk-weighted assets (FIRWA), bank deposits over total risk-weighted assets (BDRWA), total off-balance exposures over total risk-weighted assets (OBSRWA), profits over total risk-weighted assets (PFRWA), provisions over total risk-weighted assets (PVRWA) and 100-percent risk-weighted assets over 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.

The variables and their expected signs is presented in Table 2.2

Table 2.2: Important Variables and their Expected Signs

Variable	Expected Sign	Rationale
NIIRWA	+	Reflects increased operating efficiency
FIRWA	+	Reflects income generated from other sources
BDRWA	-	Reflects a vulnerability of run on deposits
OBSRWA	+	Reflects degree of financial sophistication
PVRWA	-	Reflects financial health
PFRWA	+	Reflects financial health

HRRWA	-	Reflects riskiness of bank operations
Trigger Dummy	-	Reflects degree of regulatory pressure

Before embarking on a formal analysis, we present the correlation matrix of the variables of interest in the analysis. This is presented in Table 2.3.

Table 2.3 : Matrix of Correlation Coefficients

	CAR	NIIRWA	FIRWA	OBSRWA	PVRWA	PFRWA	HRRWA	GNPA	BDRWA
CAR	20.89								
NIIRWA	1.11	0.51							
FIRWA	0.21	0.12	0.09						
OBSRWA	-25.18	-1.02	0.16	353.34					
PVRWA	-0.45	0.02	0.07	0.49	0.63				
PFRWA	3.59	0.36	0.09	-4.74	-0.39	1.92			
HRRWA	10.34	2.20	0.49	-19.09	0.05	4.09	91.67		
GNPA	-23.04	-1.48	-0.34	42.44	0.65	-6.44	-15.37	60.01	
BDRWA	0.85	0.49	0.08	-10.69	0.21	-0.37	2.72	8.73	12.59

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.²³ This we refer to as the “trigger” variable (TRIGD). The second dummy variable we employ is referred to as “target” variable (TARGD). This dummy variable equals unity if the CRAR falls close to the regulatory minimum. As we argue above, the degree that a bank is close to the “trigger” 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 in such a way that it is unity if the CRAR is less than one bank-specific standard deviation

²³ Note that, our data begins from 1997 Q1 and therefore, for fixing the dummy “trigger” variable for the first and second quarters of 1997, we consider the capital adequacy position of the respective bank as on March 31, 1995 and March 1996, respectively, since quarterly data for earlier periods is not available. Similar is the procedure adopted for fixing dummy “target” variables.

(s.d.) 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 is comparable to Jacques and Nigro (1997).²⁴

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. 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.

II.7 Results and Discussion

Table 2.4 reports the regression results for the case in which the dependent variable is the CRAR. Our 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 decrease their CRAR by more than 100-percentage points per quarter when the capital ratio approaches the regulatory minimum. In addition, we find that banks raise their CRAR by roughly 60 percent per quarter following an increase in the trigger ratio by the supervisors.

²⁴ 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 $(1/RBC_j - 1/8)$ 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 behaviour of these two sets of banks in terms of capital requirement and risk-taking activity is affected by the regulatory stipulations.

In Column 3 of Table 2.4, 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 only significant coefficient is the off-balance sheet activity, suggesting the possibility that increasing diversification by public sector banks into off-balance sheet activity is engendering a significant change in 100- percent risk weighted

Table 2.4: CRAR and 100-percent Weighted Assets Regression Results²⁵

	CRAR	HRRWA
Change in trigger dummy	0.59 (1.60)#	-0.24 (0.026)
FIRWA	-0.54 (-0.63)	2.33 (1.08)
NIIRWA	0.36 (1.13)	1.04 (1.30)
BDRWA	0.12 (1.28)	0.03 (0.14)
CRAR trigger (<than 1 s.d.)	-2.73 (-4.64)*	1.44 (0.96)
OBSRWA	0.012 (0.84)	0.06 (1.74)#
PFRWA	0.44 (2.58)*	0.18 (0.43)
PVRWA	-0.09 (-0.35)	0.15 (0.26)
HRRWA	-0.023 (-0.99)	
Lagged Dependent Variable	-1.09 (-21.05)*	-1.09 (-16.32)
R ²	0.63	0.57
Hausman Ho:RE vs FE	$\chi^2(10)=55.2$	$\chi^2(10)=39.6$

Figures in brackets indicate t-ratios.

*significant at 1 per cent

significant at 10 per cent

assets. However, in general, t-statistics are low, suggesting that 100-percent weighted asset ratio does not behave in a statistically stable way over time and across public sector banks. In summary, it seems fair to conclude that banks do not significantly rely on asset substitution away from high-risk-

²⁵In the rest of the Chapter, TRIGD is the trigger dummy and TARGD is the CRAR trigger (less than 1 s.d.)

weighted assets to meet their capital requirements as they approach the regulatory minimum.

Table 2.5 reports results similar to the CRAR regressions, but using tier-I and tier-II capital ratios. As the table reveals, banks lower both the tier-I and the tier-II ratios when they come close to their triggers, the decline being significant in case of the latter. In addition, we find that banks raise their tier-I ratios by around ½ per cent per quarter following an increase in trigger ratios.

The second and more interesting question would be to understand how exactly banks achieve changes in their capital ratios if they are subject to regulatory pressure. The most obvious possibilities are either they adjust the asset side of their balance sheet, thereby substituting low-risk government securities for high-risk loans, or alternately raise additional capital from the market by issuing securities or by means of retained earnings (equation 2.1 and the earlier discussion on securitisation).

Table 2.5: Tier I and Tier II Regression Results

	Tier I	Tier II
Change in trigger dummy	0.53 (1.48)	0.09 (0.86)
FIRWA	-0.016 (-0.019)	-0.41 (-1.57)
NIIRWA	0.32 (1.06)	0.007 (0.07)
BDRWA	0.04 (0.39)	0.08 (2.67)#
CRAR trigger (< 1 s.d.)	-2.22 (-3.84)	-0.47 (-2.61)**
OBSRWA	0.02 (1.02)	-0.002 (-0.53)
PFRWA	0.45 (2.67)#	-0.003 (-0.05)
PVRWA	-0.08 (-0.34)	-0.02 (-0.27)
HRRWA	-0.01 (-0.62)	-0.007 (-1.04)
Lagged Dependent Variable	-1.02 (-20.59)	-0.80 (-1.03)
R ²	0.64	0.52

Hausman Ho:RE vs FE	$\chi^2(10)=49.5$	$\chi^2(10)=33.9$
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Figures in brackets indicate t-ratios.

** significant at 5 per cent

significant at 10 per cent

Table 2.6 shows regressions of changes in 100 per cent weighted assets as a ratio of total risk-weighted assets on the lagged level of this ratio and on the same set of conditioning variables as those included in the CRAR regressions. Although the parameter on the regulatory intervention dummies have the right sign, they are insignificant. The magnitude of the point estimates is fairly small when the level of 100 per cent risk-weighted assets is above the threshold²⁶, but is quite substantial, vice versa. However, the lagged level of the variable is fairly significant, suggesting that higher level of hundred per cent weighted assets might be inducing banks to lower the same, both above and below the threshold value of the variable. In general, however, t-statistics on all the conditioning are fairly small, suggesting that this ratio does not behave in a statistically significant way, both over time and across banks. Based on the available data, it appears that banks have not resorted to asset substitution in a significant degree to meet their capital requirements.

The Table also reports results for the case in which the coefficients on all the conditioning variables are allowed to change when the CRAR is greater than or less than one bank-specific standard deviation above the trigger. Not surprisingly, the variables which are significant in the simple model are also important in the switching regression case. While the net interest income and off-balance sheet activity variables are significant, the magnitude of the point estimates are fairly small. In contrast, the estimate on the regulatory pressure dummy is positive, significant and of a reasonable magnitude, indicating that the response of banks to changes in regulatory pressure is more significant when their capital ratios are above the threshold.

²⁶ The threshold level of 100 per cent risk-weighted assets is selected as the mean level of the variables across all banks across all quarters. Removing the 7 outlier observations (with hundred per cent risk weighted of 100 and above), does not substantially alter the results.

Another variable which appears to have an important bearing on bank capital ratios is profits. It may be recalled from our earlier discussion that

Table 3.6: Switching Regression Results: CRAR and HRRWA

	CRAR		HRRWA	
	>trig+ 1 SD	<trig+ 1 SD	>trig+ 1 SD	<trig+ 1 SD
Change in trigger dummy	0.46 (3.15)*	0.72 (0.25)	0.19 (0.19)	-2.77 (-0.68)
FIRWA	-0.24 (-0.71)	-6.99 (-0.63)	3.06 (1.33)	-6.31 (-0.42)
NIIRWA	0.35 (2.04)#	0.74 (0.31)	0.55 (0.47)	3.22 (0.97)
BDRWA	0.01 (0.29)	0.63 (0.67)	0.05 (0.19)	0.22 (0.17)
OBSRWA	0.01 (2.22)#	-0.009 (-0.09)	0.02 (0.62)	0.04 (0.24)
PFRWA	0.30 (3.58)*	1.16 (0.95)	0.66 (1.17)	-0.39 (-0.23)
PVRWA	0.03 (0.25)	0.86 (0.54)	0.03 (0.03)	-0.44 (-0.21)
HRRWA	-0.004 (-0.37)	-0.09 (-0.78)	--	--
Lagged Dependent Variable	-0.84 (-23.3)*	-1.34 (-8.1)*	-1.20 (-13.1)*	-1.06 (-6.7)*

Figures in brackets indicate t-ratios.

** significant at 5 per cent

significant at 10 per cent

Section 17 of the Banking Regulation Act, 1949 stipulates that every banking company incorporated in India transfer a sum equivalent to not less than 20 per cent of its disclosed profits to a reserve fund created for the said purpose. Clearly, banks with higher capital ratios could be taking recourse to this measure to shore up their capital adequacy standards.

Finally, Table 2.7 provides results for regressions similar to the above, but using different capital ratios. In particular, referring to the discussion on the switching regression estimate pertaining to CRAR above (Table 2.6), it would be interesting to understand which of tier I capital or tier II capital is relatively more important for effecting changes in the capital of banks. The

results, as evidenced from the table (Table 2.7) seems to suggest that the response of banks to increases in their triggers is much higher for tier I capital than tier II capital, suggesting that bulk of the adjustments comes through increases in the former. Also, while profits play a critical role in impacting tier I ratios, especially at higher levels of the ratio, bank deposits appear to be more prominent in the case of tier II capital. In other words, banks with higher levels of core capital could have been ploughing back their profits into reserves, which has been instrumental in raising overall capital levels. This evidence runs contrary to the recent belief of a high amount of cross-holdings of sub-ordinated debt among banks. In view of the above, it seems fair to conclude that, in view of the importance of core capital, profits does seem to have an important role in determining adjustments in the same.

Table 2.7: Switching Regression Results: Tier I and Tier II Capital

	Tier I		Tier II	
	>trig+ 1 SD	<trig+ 1 SD	>trig+ 1 SD	<trig+ 1 SD
Change in trigger dummy	0.35 (2.58)*	-1.02 (-4.77)*	0.24 (2.04)**	0.09 (0.91)
FIRWA	0.32 (1.04)	-17.34 (-.091)	-0.43 (-1.57)	0.56 (1.29)
NIIRWA	0.05 (0.47)	5.03 (0.87)	-0.03 (-0.23)	0.05 (0.59)
BDRWA	-0.04 (-1.13)	2.30 (0.88)	0.04 (1.22)	0.04 (1.21)
OBSRWA	0.01 (2.31)**	0.11 (0.68)	-0.003 (-0.61)	-0.01 (-3.03)*
PFRWA	0.25 (3.42)*	0.16 (0.09)	-0.009 (-0.13)	-0.09 (-2.16)**
PVRWA	-0.05 (-0.56)	1.19 (0.54)	0.009 (0.10)	-0.06 (-1.15)
HRRWA	-0.009 (-1.02)	-0.12 (-0.86)	0.004 (0.54)	-0.002 (-0.37)
Lagged Dependent Variable	-1.03 (-38.39)*	-1.02 (4.77)\$	-0.87 (-10.97)*	-1.66 (-21.6)*

Figures in brackets indicate t-ratios.

*significant at 1 per cent;

** significant at 5 per cent;

significant at 10 per cent

II.8 Concluding Observations

The purpose of the present exercise is to empirically analyse the impact of bank capital dynamics on the capital ratio choices of public sector banks in India. Towards this end, we use quarterly supervisory data including detailed information about the balance sheet and profit and loss account of public sector banks stretching 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 we reach 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.

Our 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 importance in view of the growing concerns about banking stability. Simply put, higher levels of capital can be useful in preventing systemic distress, which is an 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.

CHAPTER III

PROMPT CORRECTIVE ACTION, BANK CAPITAL AND RISK: AN EMPIRICAL ANALYSIS OF PUBLIC SECTOR BANKS

Introduction

Managing a banking crisis is one of the most difficult tasks confronting a policy maker. Often measures need to be decided on quickly, sometimes in the eye of a crisis. Almost inevitably, decisions have to be guided by imperfect information. This is an intrinsic problem because the very business of banking is built on the possession of information not available to others. Because banks lie at the hub of modern economies, targeted policies can have far-reaching implications. The global dimensions also assume importance currently, when so many emerging market economies are simultaneously grappling with banking crises.

III.1 Rules versus Discretion

Therefore, if banks are not to be allowed to fail, it is essential that corrective action be taken while the bank still has a manageable cushion of capital. This is particularly crucial since low or negative capital often tempt bank managers to try desperate remedies such as offering high rates of interest on deposits to fund credit to high-risk borrowers or “gambling for resurrection”, to use a phrase coined by Dewatripont and Tirole (1994). Even the Basle Committee has strongly endorsed the need for supervisors to take timely corrective action when banks fail to meet capital adequacy ratios or other prudential requirements. Yet, one of the commonest complaints about

bank supervisors is that they intervene too late in problem banks.²⁷ This has led many observers to suggest that interventions should be guided by rules rather than be left to the discretion of the supervisors. A recent study by Jones and King (1995) applies the definition of Basle Accord to a confidential data set of US banks in the 'eighties and finds that a number of institutions which would have exceeded the 8 per cent hurdle would, in fact, with a high probability, have been insolvent within two years.

The case for automatic rules rests on the premise that they lead to prompter action, which is important as the costs of restructuring a bank are likely to rise, the longer the action is delayed. Several arguments can be advanced to support this case. Forbearance, or expecting that the problem will solve itself, is always a tempting option, especially given the usual lack of precise information about the extent of a bank's problem. If a large number of banks are simultaneously in trouble, political economy considerations might prevent contemplating the short-run costs of radical action. Alternately, supervisors may fear that intervention in one bank could spark a run on others, as occurred in Indonesia in November 1997 (Sheng, 1996). As a consequence, rule-based methods of intervention, especially if enshrined in legislation, may be particularly helpful for supervisors to take decisions based on established procedures and principles.

The best-known examples of rules are the compulsory quantitative triggers (in relation to bank capital levels) for action by the supervisors set in the 1991 US Federal Deposit Insurance Corporation Improvement Act (FDICIA) (Table 3.1). Studies by Shrieves and Dahl (1992), and more recently, Peek and Rosengren (1997) find that excessive risk-taking among undercapitalised banks is, at least, partially constrained by regulation, while

²⁷ Jordan (1998) suggests that the banking crisis in New England (defined as the First District of the Federal Reserve System) was resolved at far less cost because action was taken quickly and strict regulatory oversight prevented bankers increasing the riskiness of their operations.

Gilbert (1992) finds that the length of time a bank is undercapitalised prior to its failure does not affect its ultimate resolution cost.

Table 3.1: United States FDICIA System

Capital Level Trigger (per cent)	Mandatory and Discretionary Actions
10 > CAR > 8	Cannot make any capital distribution or payments that would leave the institution undercapitalised.
5 > CORE > 4	
CAR < 8 or CORE < 4	Must submit a restoration plan; asset growth restricted; approval required for new acquisitions, branching and new lines of business.
CAR < 6 or CORE < 3	Must increase capital; restrictions on deposits' interest rates and asset growth; may be required to elect new Board of Directors.
CAR < 4 or CORE < 2	Must be placed on conservatorship or receivership within 90 days; approval of the FDIC for: entering into material transactions other than usual core business, extending credit for any highly leveraged transaction; changes in accounting methods; paying excessive compensation or bonuses.

CAR: Capital Adequacy Ratio
CORE: Core Capital

Similar rules have been adopted in some industrial economies and in a number of emerging economies (Table 3.2). Once capital falls below 8-9 per cent, such rules typically require banks to draw up plans for recapitalisation, limit or prohibit dividends and impose limits on risk-taking. Restrictions often involve limiting new acquisitions or restricting interest rates on deposits. When capital falls to very low levels, the authorities can force mergers or acquisitions, or proceed to closure. Such rules, however, would be rarely applied to a large bank-in such an eventuality, some observers believe that greater discretion would inevitably condition supervisors' responses (the "too-big-to-fail" argument).

Table 3.2: Structured and Discretionary Intervention Frameworks

Country	Capital Level Trigger (per cent)	Mandatory & Discretionary Actions
<i>Structured Intervention</i>		
Argentina	CAR<11.5	Bank is fined, must submit a recapitalisation plan, limit deposit raising, pay no dividends or bonuses and is restricted in branch opening.
Chile	CAR<8 or CORE<3	Bank has to raise new capital; if unable, supervisors prohibit extension of new credit and restrict the acquisition of securities (those issued by Central Bank).
	CAR<5 or CORE<2	Bank has to prepare credit restructuring agreement (expanding debt maturity, capitalisation of credits and sub-ordinated bonds, forgiveness of debt). If the agreement is not approved by the supervisors (first) and bank creditors (second), the bank is declared under liquidation.
Colombia	CAR<9	Recapitalisation plan agreement with supervisors to be carried out in one year. Discretionary application of sanctions.
	CAR<50% of tier-I	Supervisors take immediate possession after approval of Finance Ministry.
Czech Republic	CAR<5.3 ¹	Plan to increase capital; restrictions on acquisition of new assets, interest rate on deposits, credit to related parties.
	CAR<2.6 ¹	Revoke banking license.
Korea	8>CAR>6	Issue management improvement recommendations, including rationalisation of branch management and restrictions on investments, new business areas and dividends.
	CAR<6	Issue management improvement measures, including freezing new capital participation, disposal of subsidiaries, change management, draw up plan for merger, take-over by a third party.

	Distressed Institution	Issue management improvement order, including cancellation of stocks, suspension of Board of Directors; merger, take-over or request the Finance Ministry to revoke the banking license.
<i>Discretionary Intervention</i>		
Brazil	Illiquidity, insolvency, large losses due to bad management, serious violation of laws and regulations	Intervention: suspension of normal activities, removal of Directors. After 6 months, either return to normal activities or extra-judicial liquidation or bankruptcy; Temporary special management regime. The authority can authorise the merger, take-over or transfer of stock-holding control or decree extra-judicial liquidation. Extra-judicial liquidation: cancellation of office of the managers and Audit Committee members.
Hong Kong	CAR falls below the minimum (in practice, HKMA sets an informal 'trigger' ratio above the minimum capital ratio).	HKMA may take control of the bank. It will first discuss remedial action or give directions (e.g., to stop taking deposits). It can appoint an Adviser or Manager.
Hungary	Minor infringement	Higher reporting obligations; negotiate plan of action
	More serious infringement	On-site examination; revise internal regulation; may prohibit payment of dividend or earnings to managers supervisory commissioners on site.
	CAR<4 (for 90 days)	Prescribe sale of certain assets. Proscribe attainment of certain CAR.
Indonesia	Earlier, bank Indonesia would put pressure on banks whose CAR fell below 8 per cent. Presently, banks with CAR below 4 per cent may participate in re-capitalisation programme.	Banks required to implement plan to raise capital; may replace management.
Mexico	Irregular operations affecting the stability or solvency of the institution or the public interest.	Can declare receivership-intervention.

Peru	Non-compliance with a set of restrictions (liquidity, forex exposure, etc.) Suspension of payments or non-compliance with recovery plan; or loss of half risk-based capital.	Regular inspection of the bank and recovery plan, possibly through a Board of Creditors. Intervention by authorities for one day, then bankruptcy procedure.
Poland	Imminent loss (or danger of insolvency)	Bank has one month to draft acceptable programme of action, implemented under Curator's supervision; extraordinary meeting of shareholders, possible replacement of management, take-over or liquidation, if situation does not improve in 6 months.
Singapore	Banks unable to meet obligations, doing business detrimental to depositors or creditors, affecting the public interest or not complying with (minimum) 12 per cent CAR.	Monetary Authority of Singapore (MAS) could restrict or suspend operations, after ring-fencing banks and instructing them to take necessary action.
Venezuela	CAR<8	If recapitalisation plan fails, new lending and dividends can be prohibited, directors removed and supervisors appointed.

1. Based on current minimum CAR of 8 per cent.

2. CAR: Capital Adequacy Ratio.

Source: Hawkins and Turner (1999)

After examining country experiences, one can surmise that supervisory authorities in different countries incorporate a blend of discretion and rules. For example, the less rigid criteria under some discretionary regimes are accompanied by some quantitative 'triggers', with the actions taken often similar to those in a rule-based system. Also, some of the rule-based systems are yet to be tested in a banking crisis: some more discretion may have to be used in practice. Finally, there is also the broader issue of what can be done to strengthen the political incentives to implement banking reforms. A banking crisis itself should lead to the adoption of an improved incentive or supervisory framework. Caprio and Klingebiel (1996) while

detailing a number of success cases (Chile, Argentina and Hong Kong), observe that out of the 64 cases of bank restructuring, such success stories were few and far between.²⁸

In view of the above considerations, various actions are being contemplated by the regulators to detect early warning signals of crisis. One such measure which has been widely discussed in the literature has been Prompt Corrective Action (PCA). The major focus of PCA is to detect incipient signals of distress and promptly undertake remedial measures. In developed countries, the major focus of PCA is on capital ratios and this is not without justification. As Dahl and Spivey (1995) have observed, PCA (a) enables to reduce the losses for deposit insurers by discouraging healthy banks from becoming undercapitalised, and, (b) enables to reduce the number of failures among undercapitalised banks.

While the adoption and implementation of PCA focused attention on bank capital ratios, two issues merit further attention. First, did PCA cause banks to increase their capital ratios, or is the increase attributable to some other factors such as bank income levels in the early 1990s? Second, a number of theoretical and empirical studies suggest that increasingly stringent capital standards in general, and PCA in particular, may have the unintended effect of causing banks to increasing their level of portfolio risk.

III.2 Prompt Corrective Action: The Indian Experience

The world-wide phenomenon of building a safe and sound banking system, backed by a stronger supervisory regime, in accordance with one of the *Core Principles of Banking Supervision*²⁹, which mandates that banking

²⁸ In a detailed examination of 29 systemic banking crises, Caprio and Klingebiel (1996) concluded that political factors (government interference and connected lending) were important in at least one-third of the crises, volatility factors (primarily, terms-of-trade deterioration and recession) in one-half to two-thirds of them and deficient bank management and poor regulation and supervision-broadly defined-in two-third to four-fifths of all cases.

²⁹ Principle 22 of the *Core Principles* dealing with Supervisory Intervention observes that "banking supervisors must have at their disposal adequate supervisory measures to bring

supervisors must have at their disposal adequate supervisory measures, backed by legal sanctions to bring about timely corrective action, has prompted the supervisory authorities in India to consider the possibility of introducing a system of Prompt Corrective Action (PCA) in India. Such a response has been dictated by two major considerations. The first is the responsibility of bank supervisors to identify problem banks. The other is to monitor the behaviour of troubled banks in an attempt to prevent failure or to limit losses. More so, if a bank is not allowed to fail, it is essential that corrective action be taken well in time.

In view of the above considerations, a system of PCA with various trigger points and mandatory and discretionary responses by the supervisors, is envisaged for the banking system in India. In contrast to the framework prevalent in other countries (Table 3.2 above), which focuses on a single trigger point (i.e., CRAR), a broader PCA regime is envisaged for India so as to delineate rule-based actions not only for shortfall in capital, but also for other indicators of deficiency “so that a seamless paradigm for corrective actions can be put in place for major deficiencies in bank functioning”. Accordingly, in addition to capital adequacy (CRAR), two additional indicators, viz., Net NPA and Return on Assets, as proxies for asset quality and profitability, respectively, have been included under the broader PCA regime. Trigger points have been set under each of the three parameters, taking into the practicality of implementation of certain measures in the Indian context³⁰.

about timely corrective action when banks fail to meet prudential requirements such as minimum capital adequacy ratios when there are regulatory violations or where depositors are threatened in any other way. In extreme circumstances this should include the ability to revoke the banking licence or recommend its revocation”.

³⁰ The trigger points are as under: for CRAR, three trigger points have been proposed—CRAR of greater than or equal to 6 per cent, but less than 9 per cent, greater than or equal to 3 per cent but less than 6 per cent and less than 3 per cent. For Net NPAs, two trigger points have been proposed—greater than or equal to 10 per cent but less than 15 per cent and greater than 15 per cent. For ROA, the trigger point has been set at less than 0.25.

Once a bank's performance falls below certain thresholds which activates the trigger point, a certain set of mandatory actions addressing critical areas of the bank's weakness will follow. In addition to the above, supervisors can initiate certain discretionary actions, if need be, to pre-empt any deterioration in the soundness of banks.

In the light of the aforesaid discussion and keeping in view the broad PCA regime envisaged by the Reserve Bank, the present exercise examines the feasibility of a PCA for the Indian public sector banks using capital as the trigger. To recapitulate a bit, 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.

III.3 The Methodology

In order to achieve our objective, we use a simultaneous equation model along the lines developed by Shrieves and Dahl (1992), and later modified by Jacques and Nigro (1997) to examine the possible consequences of PCA on bank capital and portfolio risk levels. However, unlike prior studies on this topic, by using a simultaneous equation model, the endogeneity of both bank capital and risk is explicitly recognised in our approach, and as such, the impact of possible changes in bank capital ratios on risk in a bank's portfolio can be examined. Table 3.3 summarises the major papers that examine this issue.

III.4 The Prompt Corrective Action Standards

For purposes of tractability, we classify banks into two zones, zone 1 and zone 2, depending on how well they meet the capital requirements, as detailed below. Banks falling in Zone 1 are classified into two capital categories: adequately capitalised and well capitalised. Zone 2 is that of undercapitalised banks. If a bank falls into one of the undercapitalised categories, mandatory restrictions are placed on its activities that become

increasingly severe as the bank's capital ratios deteriorate. For example, undercapitalised banks are subject to restrictions that include the need to submit and implement a capital restoration plan, limits on asset growth and restrictions on new lines of business, while significantly undercapitalised banks face further restrictions on interest rates paid on deposits, limits on transactions with

Table 3.3: Prompt Corrective Action and Capital Ratios

Author/Year	Country/ Period	Issue
Gilbert, R.A. (1991)	US banks 1985-89	Constraints on Asset Growth and dividend payment of undercapitalised banks
Gilbert, R.A. (1992)	US banks 1985-90	Effect of PCA legislation on Bank Insurance Fund losses resulting from commercial bank failure
Dahl and Spivey (1995)	US banks 1980-88	Likelihood and timing of bank recovery from undercapitalisation
Jones and King (1995)	US banks 1984-89	Efficacy of PCA
Wall and Peterson (1995)	US banks 1989-92	Basle Accord
Jacques and Nigro (1997)	US banks 1990-91	Impact of risk-based standards on capital and risk
Peek and Rosengren (1997)	New England banks 1989-92	Supervisory Intervention under PCA
Aggarwal and Jacques (1998)	US banks 1991-93	PCA and bank capital
Jordan (1998)	New England banks 1987-96	Crisis resolution policies

affiliates and affiliated banks and others. Finally, once a bank is critically undercapitalised, it faces not only more stringent restrictions on activities, but also the appointment of a conservator (receiver) within ninety days of becoming critically undercapitalised³¹.

³¹ The mandatory actions will be directed against those areas of the banks' weakness, such as inadequacy of capital funds vis-à-vis risk weighted assets, high level of non-performing assets or a low level of operating income. The mandatory actions are in the nature of restriction on expansion of risk-weighted assets, submission and implementation of capital restoration plan, prior approval of the Reserve Bank for opening new branches and new lines of business, paying off costly deposits and certificate of deposits, pruning of overheads, special drive to reduce stock of NPAs, review of loan policy, etc The discretionary actions will be at the discretion of the Reserve Bank depending on the profile of each bank.

It needs to be recognised that the ratio of 8.0 percent for the Capital to Risk Asset Ratio (CRAR) is recommended as a minimum ratio and there is a view that higher capital adequacy ratio may be necessary in select cases and in select markets. Therefore, in our judgement, while banks with CRAR of 8.0 percent may be considered as sufficiently capitalised, banks with a CRAR of 10.0 percent or above and tier-I capital not below 6 per cent may be considered as adequately capitalised. The FDIC Improvement Act of 1991 in the US considered banks with risk-weighted capital of 10.0 percent and a tier-I capital of 6.0 percent and above as well capitalised, while adequately capitalised institutions have minimum thresholds of 8 per cent and 4 per cent, respectively. Banks that do not meet the BIS capital adequacy criteria and have risk weighted capital less than 8 per cent and tier-I capital below 4 per cent can be considered as undercapitalised. Banks with even lower CRAR may be classified as “significantly undercapitalised”. Although there is not much to distinguish between significantly undercapitalised and critically undercapitalised banks, we prefer to make a distinction between the two.³² Table 3.4 summarizes the information.

Table 3.4: Categorisation of Banks According to Capital Status

Capital Status	Risk weighted capital (per cent)	Tier-I capital (per cent)	Leverage ratio (per cent)
ZONE 1			
Absolutely Capitalised	10 and above	6 and above	5 and above
Well Capitalised	[8, 10)	[4, 6)	[4,5)
ZONE II			
Under Capitalised	[6, 8)	Less than 4%	Less than 4%
Significantly Undercapitalised	[4, 6)	Less than 3 %	Less than 3%
Critically Undercapitalised	Less than 4	Tangible equity less than or equal to 2 per cent	

Table 3.5 shows the number of public sector banks by PCA zone over the period 1997 to 1999. The choice of the period is dictated by two

³² Note that the Leverage Ratio is the ratio of tier-I capital to total assets. In the present framework, we use the following transformation to arrive at this ratio $LEV = (\text{Tier-I capital} / \text{Total Assets}) = (\text{Tier-I Ratio}) * (\text{Total Risk-weighted Assets} / \text{Total Assets})$.

considerations. The first was the availability of data for the same. More importantly however, since the introduction of prudential norms pertaining to capital adequacy standards, in 1992-93, banks were initially in a state of flux, adjusting their balance sheets in response to the new guidelines. Consequent upon the introduction of off-site returns data in 1997, it is now possible to check the feasibility of implementation of a framework for PCA in the Indian context.

Table 3.5: Categorisation of PSBs according to capital status: 1996-99

PCA Zone	1996	1997	1998	1999
Zone I				
Absolutely Capitalised	6	16	23	23
Well Capitalised	13	9	3	3
Zone II				
Under Capitalised	1	0		
Significantly Undercapitalised	5	1		
Critically Undercapitalised	2	1	1	1
Total	27	27	27	27

As Table 3.5 reveals, at year-end 1996, 19 public sector banks were classified as absolutely/well capitalised. In 1997, the number increased to 25. By 1998, only one bank was in the undercapitalised category; the capitalised banks, numbering 26, by contrast, accounted for 76 per cent of total assets of SCBs. The figure has remained at 26 for 1999, with these banks accounting for 78 per cent of total assets.

It seems reasonable to assume that the introduction of capital adequacy standards have, in general, been effective in increasing the capital ratios of banks. This position has however, not been without its critics. For one, it has been argued that regulatory capital standards may have led banks to increasing levels of portfolio risk. Research by Koehn and Santomero (1980) and Kim and Santomero (1988) have shown, using the mean variance framework, that regulatory capital standards cause leverage and risk to

become substitutes and that as regulators require banks to meet more stringent capital standards, banks respond by choosing assets with greater risk.³³ Thus, increases in minimum capital standards by bank regulators cause banks to increase not only their capital ratios, but also have the unintended effect of causing them to increase their level of risk.

While one primary purpose of early liquidation/closure is to prevent banks from taking increasing levels of risk as they approach insolvency, research by Davies and McManus (1991) demonstrates that early closure may fail to protect the deposit insurance fund from losses because it creates incentives for banks to increase portfolio risk by increasing their holdings of high-risk assets. An even more recent study by Dahl and Spivey (1995) on undercapitalised banks regarding identification of factors that influenced bank recovery to a position of adequate capitalisation notes that (a) there appears to be only a limited capacity for banks to 'correct' positions of undercapitalisation by growth limitations or dividend restrictions and (b) the impact of profitability on recovery is greater, the longer a bank remains undercapitalised. As such, the design of the PCA standards has important implications not only for optimal capital levels, but also for the level of risk, and ultimately, the safety and soundness of the banking system as a whole.

III.5 Model Specification

To examine the possible impact of the PCA standard on bank capital ratios and portfolio risk levels, a simultaneous equation framework is developed, on the lines of Shrieves and Dahl (1992) and is modified to incorporate PCA zones. In their model, observed changes in bank capital ratios and portfolio risk levels are decomposed into two components, a discretionary adjustment and a change caused by an exogenously determined random shock, such that

³³ The mean-variance framework has been criticized by some because it fails to incorporate the effects of deposit insurance (See, for instance, Keeley and Furlong, 1990).

$$\Delta CAP_{j,t} = \Delta^d CAP_{j,t} + E_{j,t} \quad (3.1)$$

$$\Delta RISK_{j,t} = \Delta^d RISK_{j,t} + U_{j,t} \quad (3.2)$$

where ΔCAP and $\Delta RISK$ are observed changes in capital ratios and risk levels for bank j in period t , $\Delta^d CAP$ and $\Delta^d RISK$ represent discretionary adjustments in capital ratios and risk levels and E and U are exogenous shocks. Recognising that banks may not be able to adjust their desired capital ratios and risk levels instantaneously, the discretionary changes in capital and risk are modeled using a partial adjustment framework. As a result:

$$\Delta CAP_{j,t} = \mathbf{a}(CAP_{j,t}^* - CAP_{j,t-1}) + E_{j,t} \quad (3.3)$$

$$\Delta RISK_{j,t} = \mathbf{b}(RISK_{j,t}^* - RISK_{j,t-1}) + U_{j,t} \quad (3.4)$$

Thus, observed changes in bank capital ratios and portfolio risk in period t are functions of the target capital ratio $CAP_{j,t}^*$ and target risk level $RISK_{j,t}^*$, the lagged capital ratio CAP_{t-1} and risk levels $RISK_{t-1}$ and any random shocks. The target capital ratio and risk levels are not observable, but are assumed to depend upon some set of observable variables, including the size of the bank ($SIZE$), bank's net income to total assets in period $(t-1)$ ($TOTINC$), changes in portfolio risk ($\Delta RISK_{j,t}$) and capital ratios ($\Delta CAP_{j,t}$), while the exogenous shock that could affect bank capital ratios or risk levels is the regulatory pressure brought about by PCA.

Specifically, $SIZE$ is measured as the natural log of total assets. As noted by Shrieves and Dahl (1992), size may have an impact on a bank's capital ratios and the level of portfolio risk because larger banks have greater access to capital markets. Following Dahl and Shrieves (1990), the ratio of net interest income to total assets in period $(t-1)$, $TOTINC$, is included to recognise the ability of profitable banks to increase their capital ratios by using retained earnings. In addition, as noted by the partial adjustment model, lagged capital ratios and risk levels are included to measure the fact that banks adjust their capital ratios and risk levels to their target levels over time.

To recognize the possible simultaneous relationship between capital and risk, $\Delta CAP_{j,t}$ and $\Delta RISK_{j,t}$ are included in the risk and capital equations, respectively. Shrieves and Dahl (1992) note that a positive relationship between changes in capital and risk may signify, among other possibilities, the unintended impact of minimum regulatory capital requirements or even managerial risk aversion, while Jacques and Nigro (1997) note that a negative relationship may result because of methodological flaws in the capital standards underlying PCA.³⁴ Empirical estimation of the simultaneous equation system requires measures of both bank capital and portfolio risk. Following previous research, portfolio risk is measured in two ways: using the ratio of total risk weighted assets to total assets (RISK) and gross non-performing loans as percentage of total assets (GNPA)³⁵. Avery and Berger (1991) have shown that RISK correlates with risky behaviour, while other studies (Berger, 1995, Shrieves and Dahl, 1992) using non-performing loans (GNPA).

Since regulatory influence is a cornerstone of the hypotheses involving regulatory costs and minimum capital standards, a binary variable (PCAA) reflecting the degree of regulatory pressure is also included as a determinant of target capital and risk levels. This variable is defined as follows:

PCAA=1, if a bank is adequately/well capitalised; otherwise=0.

These variables allow banks across different PCA zones to respond differently, both in capital ratios and portfolio risk. A priori, banks in undercapitalised group would be expected to have the strongest response because PCA imposes penalties on their activities. Furthermore,

³⁴ Shrieves and Dahl (1992) note that a positive relationship between changes in capital ratios and portfolio risk may also occur because of regulatory costs, bankruptcy cost avoidance and managerial risk aversion.

³⁵ Loans made in a given year will not be recognised as non-performing until a future period, we use non-performing loans in the following year, although in the Indian case it would be more than a year. Thus, GNPA variable is the ratio of gross non-performing loans to total assets for September 1999.

adequately/well capitalised banks, PCAA, may increase their capital ratios or reduce their portfolio risk if they perceive a significant penalty for not being considered well capitalised, or if they desire to hold a buffer stock of capital as a cushion against shocks to equity (Wall and Peterson, 1995). Besides being included as a separate variable, PCA is included in an interaction with the lagged capital ratios. The use of this term allows banks in different PCA zones to have different speed of adjustment to their target capital ratios. As such, banks in the undercapitalised PCA zones would be expected to adjust their capital ratios at faster rates than well/adequately capitalised banks. An alternative method of accounting for the 'regulatory effect' is to stratify the sample relative to the regulatory benchmark total capital, tier-I capital and the leverage ratio levels, and estimate the model separately for each subset of banks. This approach has the advantage of allowing all model coefficients to differ across the capital strata, and provides additional insights as to the role of regulatory influence as a determinant of the observed relationship between changes in risk and capital.

Given these variables, equations 3.1 and 3.2 can be written as³⁶:

$$\begin{aligned} \Delta CAP_{j,t} = & m_0 + m_1 SIZE + m_2 TOTINC + m_3 \Delta RISK_{j,t} + \\ & + m_4 PCAA + (m_5 + m_6 PCAA) CAP_{j,t-1} + m_7 GNPA + x_{j,t} \end{aligned} \quad (3.5)$$

$$\begin{aligned} \Delta RISK_{j,t} = & g_0 + g_1 SIZE + g_2 \Delta CAP_{j,t} + g_3 RISK_{j,t-1} + g_4 PCAA + \\ & g_5 GNPA + z_{j,t} \end{aligned} \quad (3.6)$$

where $\xi_{j,t}$ and $\zeta_{j,t}$ are error terms, and $PCAA * CAP_{j,t-1}$ is the interaction term, which allows a bank's speed of adjustment to be influenced by the PCA zone in which the bank is in³⁷.

Since the right hand side of both equations include endogenous variables, simultaneous estimation of equations (3.5) and (3.6) is carried out by two-stage least squares. Under the null hypothesis that changes in risk

³⁶ Using GNPA as the other explained variable, we also estimate equation (4') defined as

$$GNPA_{j,t} = I_0 + I_1 SIZE + I_2 \Delta CAP_{j,t} + I_3 GNPA_{j,t-1} + I_4 PCAA + x_{j,t} \quad (3.6')$$

³⁷ The equations have been checked for simultaneity bias.

and capital do not influence one another, the coefficients μ_3 , μ_5 , γ_2 and λ_2 will not be significantly different from zero.

III.6 Empirical Estimation

It has been stated earlier that data set for the present study spans from 1997:Q1 to 1999:Q4. In this present context, the analysis for a particular year needs to take into account the data for the year as well as those for the previous as well as the subsequent year. In view of the above, the present exercise focuses on 1998 (which uses data for 1997, 1998 and 1999). With greater availability of data, it is possible to carry out the analysis for other years as well. As noted earlier, a significant decline occurred in the number of all types of undercapitalised institutions post introduction of capital adequacy norms. Alternately, in studying the impact of risk based capital standards, Haubrich and Watchel (1993) note that because the composition of bank portfolios can be changed quickly, and because banks appear to have experienced a period of learning, the impact appears more clearly after the implementation date. The same argument may be true for PCA, although learning by banks may be less significant with regard to PCA because all of the capital ratios defined in the PCA standards had been in effect since at least December 1990.³⁸

III.7 Results and Discussion

The study examines 27 public sector banks using year-end data for 1998. In carrying out the above exercise, the paper uses confidential supervisory data for Indian public sector banks to address some of the issues addressed above. The non-performing assets and capital adequacy are obtained from the Report on Trend and Progress of Banking in India (various years). The procedure used for estimation is the two-stage least squares method, which recognises the endogeneity of both bank capital ratios and risk

³⁸ A word of caution is necessary because the analysis may be complicated by other factors present during this time period, such as the predominance of public sector ownership of banks, directed credit lending and accounting norms.

levels, and unlike ordinary least squares, provide consistent parameter estimates.

The results of estimating the simultaneous equation system is presented in Tables 3.6 and 3.7. Table 3.6 uses the ratio of risk-weighted assets to total assets to measure portfolio risk (RISK), while table 3.7 measures risk using the ratio of gross non-performing loans to total assets (GNPA).

Table 3.6: Two Stage Least Squares Estimates of Prompt Corrective Action (PCA) on Risk (RWA) and Capital

Variable/Year	1998	
	Δ CAPITAL	Δ RISK
Constant	18.64 (3.44)*	0.06 (0.64)
Size	-0.75 (-1.54)	-0.001 (-0.11)
Total Income	1.11 (0.04)	0.08 (0.16)
Capital (t-1)	-0.72 (-7.73)*	--
Risk (t-1)	--	-0.09 (-1.15)
Δ Capital	--	-0.004 (-1.47)
Δ Risk	-66.73 (-4.2)*	--
PCAA	-8.75 (-2.24)#	0.005 (0.29)
PCAA*Capital(t-1)	0.87 (2.67)*	--
R ²	0.87	0.54

Figures in brackets indicate t-ratios.

* significant at 1 %

significant at 10 %

Table 3.7: Two Stage Least Squares Estimates of Prompt Corrective Action (PCA) on Risk (GNPA) and Capital

Variable/Year	1998	
	Δ CAPITAL	GNPA
Constant	11.50 (2.07)#	3.79 (0.82)
Size	-0.57 (-1.21)	-0.16 (-0.33)
Total Income	-36.01 (-1.23)	46.21 (2.17)#
Capital (t-1)	-0.61 (-5.58)*	--
Risk (t-1)	--	10.83 (3.49)*
Δ Capital	--	0.39 (4.36)*
GNPA	0.19 (0.75)	--
PCAA	-2.26 (-0.65)	-2.15 (-2.53)*
PCAA*Capital(t-1)	0.35 (1.21)	--
R ²	0.85	0.90

Figures in brackets indicate t-ratios

* significant at 1 %

significant at 10 %

All the variables used to explain variations in capital ratios and risk levels are statistically significant in some of the equations. Bank size (SIZE) had a negative and significant impact on capital ratios. The total income (TOTINC) variable, had a positive and significant impact on capital ratios, suggesting that one reason for increasing capital ratios by banks in 1998 was the increase in their income levels. The parameter estimate on lagged risk ($RISK_{j,t-1}$) in the risk equation was -0.09, while the parameter estimate on lagged capital ($CAP_{j,t-1}$) in the capital equation was 0.72. These results imply that in 1998, banks adjusted their capital ratios significantly but their risk positions relatively slowly to the respective target levels. Finally, the results of table 3.6 and 3.7 suggest that changes in capital and risk are negatively related, which is consistent with the recent work of Jacques and Nigro (1997)³⁹. This result is not surprising because an undercapitalised bank can meet the risk-based requirement by raising capital, reducing portfolio risk or both, while a bank with a ratio above the risk-based minimum may decrease capital or increase risk.

III.8 Impact of PCA on Capital

In examining the impact of PCA, the results of Table 3.6 and Table 3.7 provide some interesting insights. In the capital equation of each table, the impact of the regulatory pressure variable are captured by an intercept term PCAA and a speed of adjustment term $PCAA * CAP_{t-1}$. For adequately and well-capitalised banks (PCAA), regulatory pressure had a negative impact on capital ratios in 1998, with a parameter estimate of -8.75. Furthermore, the coefficient on the speed of adjustment term for capitalised banks is statistically significant. These results, taken together, suggests that banks classified as adequately capitalised decrease their capital ratios and the speed with which they adjust their capital ratios in response to PCA. Furthermore, this result is consistent with the hypothesis that banks held capital above the regulatory minimum as a buffer against shocks that could cause their capital ratios to fall below the adequately capitalised thresholds.

³⁹ The results of Jacques and Nigro (1997) are for the year 1990-91.

III.9 Impact of PCA on Risk

With respect to portfolio risk, the results of Table 3.6 and 3.7 provide some evidence that the regulatory pressure brought about by PCA led both adequately capitalised to decrease their level of portfolio risk. The result with respect to risk in Table 3.6 is significant, when portfolio risk is measured using RWA, the results suggests that adequately capitalised banks (PCAA) significantly decreased their portfolio risk in 1998, when risk is measured using GNPA.

III.10 Concluding Observations

The purpose of this exercise has been to investigate the impact of PCA standards on bank capital ratios and portfolio risk. The results suggest that in 1998, capitalised banks and undercapitalised banks increased their capital ratios and the rate at which they adjusted the same in response to the PCA standards. In addition, the study finds evidence that PCA standards led to significant reductions in portfolio risk. While the results do not guarantee that bank capital levels are adequate relative to the risk in bank portfolios, they suggests a framework for operationalising the concept of PCA in the Indian context.

CHAPTER IV

IMPLICATIONS OF THE NEW CAPITAL ACCORD FOR BANK BEHAVIOUR

(With special focus on credit rating)

Introduction

The Capital Adequacy framework of the Basle Committee on Banking Supervision (BCBS) which was adopted by the G 10 countries in 1990 and by the rest of the world thereafter, has been the single most successful attempt in the move towards convergence of international standards in banking, enabling cross-country assessments and comparisons of internationally active banks. The results of a 1996 survey conducted by the BCBS indicated that 92 percent of the 140 participating countries had put in place a risk-weighted framework along the lines of Basle approach (Musch, 1997). Yet, despite being acknowledged as a valuable framework for comparing risk associated with assets and allocating capital accordingly, it has been criticized for, among others, the broad-brush approach and its failure to provide disincentives for riskier exposures within the same broad asset class.

Under the framework, all corporate borrowers in the non-financial sector are risk weighted uniformly at 100 percent despite the widely differing perception of the associated risks and all banks were risk weighted at the same 20 percent despite there being wide variation in their financial strengths. Again, the framework placed a more favourable risk weight on a weak bank than on a very strong non-banking company. This lack of risk-differentiation in credit risk weights has been cited as a cause for banks to enter into transactions, specifically with a view to arbitrage such anomalies and was also seen as providing an incentive for banks to shift to lower quality and higher risk assets in the same asset class. Table 4.1 lists a few papers that deal with this issue.

Table 4.1 : Impact of New Capital Adequacy Accord

Author/Year	Country/ Period	Issue
Dietrich and James(1983)	US banks 1971-75	Capital adequacy standards and banks' capital decision
Keeley (1988)	US banks 1981-86	Regulatory regime and capital ratios
Swindle (1995)	US banks 1984-86	Impact of CAMEL rating
Monfort and Mulder (2000)	20 Emerging Market Economies July 96-January 99	Impact of Sovereign rating

A recent paper released by the Basle Committee in January 2000 on the 'Range of Practices in Banks' Internal Ratings Systems' summarizes the practices followed by large, diversified international banks in this regard.⁴⁰ Though banks generally take into account the same set of issues in assigning internal ratings, the approaches followed by them can differ broadly. Ratings are seen as embodying an assessment of the risk of loss due to the default of the counter-party and are based on both quantitative and qualitative information. Exposures in each internal grade are treated as having specific and measurable loss characteristics which are (a) the borrowers probability of default (PD), (b) the facility's loss given default (LGD), (c) level of exposure at the time of default (EAD), (d) the credit's expected loss which is a function of (a), (b) and (c) above (PD, LG., EAD), and (e) the unexpected loss associated with the above.

The paper finds that the differing approaches are due to different degree of reliance on quantitative vs. qualitative factors, different judgements regarding the risks associated with each transaction etc. Also, data constraints remain a major challenge. The Models Task Force of the BCBS is engaged in developing the basic architecture of an Internal Rating Based (IRB) approach. To be eligible to use this approach, banks will be

⁴⁰ Swindle (1995) attempted to separate the relative roles of the market and regulators using the latter's private capital adequacy ratios. His analysis suggests that banks with lower regulatory capital ratings have higher expected increases in their primary capital ratios.

expected to demonstrate that their IR systems meet the minimum standards and sound practice guidelines that would be set out by the BCBS. The banks would provide to the supervisor exposure amounts and estimates of key loss statistics by IR grade and supervisors would, in turn, develop the risk weights so as to reflect the intrinsic risk of the asset or exposure. Although Indian banks do use their own credit rating systems even at present, a lot more would have to be done to achieve the proposed standards for the IRB approach. The very first challenge would be to build data on default probabilities either by using internal data on default incidences or by customising public databases to local conditions. With external ratings not available for most borrowers, the focus area for future work will be development of models to facilitate internal ratings.

At another level, the preferential risk weights assigned to the OECD countries over non OECD countries was also seen as discriminatory towards emerging economies and as a possible impediment to capital flows to their institutions. At the same time, the more sophisticated banks had put in place more accurate models to evaluate economic risks and found a significant gap between regulatory capital and the economic risks associated with their asset portfolio.

IV.1 The New Capital Adequacy Framework

In order to refine the Accord to address these anomalies, the BCBS proposed a revised Capital Adequacy Framework in 1999 (Bank for International Settlements, 1999) which uses a three pillar approach - (i) a standardised approach based on External Credit Assessments (ECA) and / or Internal Ratings Based (IRB) Approach which seek to align more finely the risk weights with actual credit risks (ii) a supervisory review pillar to ensure that the bank's capital is aligned to its actual risk profile and (iii) a market discipline pillar to enhance the role of the other market participants in ensuring that appropriate capital is held by prescribing higher disclosure.

The revised capital accord is still being discussed and is likely to be formalised sometime next year.

While the approach itself is certainly being viewed improvement over the simple standardised approach followed at present, it poses enormous practical difficulties in implementation for both the banks and their supervisors in the emerging economies, which lack both the sophistication and the skills required or even the background data, which is an essential prerequisite. There is no evidence as yet as to whether the benefits of more efficiently allocating capital to risk will outweigh the costs of implementing the new Accord either for the banks or for the supervisors in developing economies. Further, the sophistication of the revised framework could well divert resources from supervision to capital regulation and monitoring, leading supervisors into a false sense of security that capital adequacy is an all-encompassing indicator of financial soundness, to the exclusion of other (and perhaps, even more significant) indicators.

At the heart of the revised framework is its explicit reliance on rating. Risk differentiation between counterparts, be they sovereigns, banks, corporates, public sector enterprises or securities firms, will be either on the basis of external or internal ratings. Risk dispersion is achieved by ranging the possible risk weights from 20 per cent to 150 per cent, depending upon the rating of the counter-party instead of the flat-rate 20 per cent (for banks) or an uniform 100 per cent (for others) as at present. The rating is to be either by an external rating agency or by the bank's own (reliable) internal rating process. For corporate borrowers, for example, only 3 buckets are proposed: 20 per cent for the triple A rated, 150 per cent for the very low quality and 100 per cent for all others, including un-rated ones. This reliance on external ratings agencies poses a problem given the low penetration of these agencies in most developing economies. Leaving aside the issue of penetration, it remains that banks in most emerging markets have already invested substantial resources in the credit management function, and are

thus relatively better informed than external rating agencies to evaluate proposals. Abrogating this function to the rating agencies may not yield the desired results. In India, even the vast majority of corporate borrowers are unrated. Since unrated borrowers are given the benefit of a risk weight of 100 per cent, which is lower than that proposed for the lowest rated borrowers, there is no real incentive to move towards rating for this vast majority. For the banks, this would mean a status quo in risk weight at 100 per cent as applicable now⁴¹. There is, however, an incentive for those borrowers who could get a premium rating from the agencies as well as the banks who lend to them, as this would make claims on them entitled to a preferential risk weight of 20 per cent and hence an ability to negotiate a finer rate from the banks and for the banks to discharge capital held against them now. An additional capital requirement could however arise for Indian banks from the high NPA levels, for the unprovided portion of these assets could qualify for a risk weight of 150 per cent associated with the lowest quality credits, raising the Basle minima by an estimated 4 per cent on the capital to be allocated (Table 4.2).

Table 4.2 : Proposed Risk Weights based on External Risk Assessment

	Sovereigns	Banks		Corporates
		Option 1	Option 2	
AAA to AA-	0	20	20	20
A+ to A-	20	50	50*	100
BBB+ to BBB-	50	100	50*	100
BB+ to B-	100	100	100*	100
Below B+	150	150	150	150
Unrated	100	100	50*	100

* Claims on banks of short-term maturity, e.g., less than 6 months would receive a weighting that is one category more favourable than usual risk weight on the bank's claim.

Option 1: Based on risk weighting of sovereign where bank is incorporated

Option 2: Based on assessment of the individual bank.

⁴¹ This raises the possibility of a 'shadow' credit rating for banks. Since the sovereign rating acts as a ceiling in any rating exercise, for banks/corporates in sovereigns with ratings in the BB+ to B- category, for instance, obtaining a rating is the same as being unrated, since in both cases, the risk weight is 100 per cent.

As far as claims on banks go, two options have been offered, of which one links the bank's rating to that of the sovereign in which it is incorporated. This option is not likely to find favour since location cannot be a true indicator of financial strength, a point in case being the Japanese banks. The more acceptable proposal is the second option, which proposes to assign risk weights from 20 per cent to 150 per cent depending on the rating, with unrated banks being given the benefit of a lower weight of 50 per cent. Not all banks in India have gone in for rating, and only a few have had their short / long term borrowings rated by the agencies⁴². Even if the banks continue to be unrated, then the 50 per cent risk weight on claims on them (up from 20 per cent as at present) would more than double the capital allocation required by them on this account. And, if the banks do get themselves rated, then it is very likely that several will receive ratings, which qualify them for even higher risk weights.

In view of the aforesaid discussion, the purpose of the present Chapter is to understand whether credit rating is expected to significantly impact the capital adequacy ratio of banks. Put alternately, if banks were to approach the rating agencies in the near future with a view to raising capital from the market, then would the ratings profile of these institutions have implications for their capital adequacy behaviour. Towards this end, within our existing framework, we examine whether the credit rating behaviour impinge upon bank's capital decisions. For this purpose, we have selected those banks that have been assigned both long-term and short-term ratings by domestic rating agencies⁴³. Since we cannot predict with certainty whether capital adequacy

⁴² Some international rating agencies also assign financial strength ratings for banks which reflect the agency's opinion of the institution's intrinsic safety and soundness and, as such, exclude certain external credit risks and credit support elements that are addressed by traditional debt and deposit ratings. Moody's, for example, has financial strength rating which can be interpreted as a measure of the likelihood that a bank will require from third parties, such as its owners, its industry group, or official institutions.

⁴³ Long-term ratings are those assigned to Bonds/Debentures, medium-term ratings are those assigned to Fixed Deposits and short-term ratings are those assigned to Commercial Paper/CDs.

ratio would affect bank ratings, we estimate the probability that capital adequacy will impinge on ratings and hypothesize that this probability is a function of a vector of explanatory variables.

IV.2 Empirical Estimation

The econometric approach used is the logit model, which is designed to identify the conditions under which is designed to identify the conditions under which one observes one or another set of (n+1) discrete outcomes (Greene, 1990). Such frameworks have been widely used in understanding the determinants of banking crises (See, for example, Hardy and Pazarbasioglu, 1998, Demircic-Kunt and Detragiache, 1998). Formally, the model's dependent variable is an indicator y that can take on values 0, 1, 2, ..., n that identifies n possible outcomes. The binomial model is a special case of this general formulation with n=1. The explanatory variables \mathbf{x} determine the 'utility' of each outcome according to

$$U(\text{alternative}) = \mathbf{b}_i' \mathbf{x} + \mathbf{y}_i \quad (4.1)$$

These 'utilities' can be interpreted as the probabilities of observing the different outcomes, given the realization of the explanatory variables. Note that the model allows the parameters β_i to differ across outcomes. For each observation, one obtains outcome i if it offers the maximum 'utility'; in other words,

$$U(\text{alternative } i) > U(\text{alternative } j) \quad \forall j \neq i \quad (4.2)$$

One can interpret this approach as assuming that the realized outcome for each observation is that with the highest probability of occurrence under those conditions. A positive coefficient on a particular

⁴⁴ Kamin and von Kleist (1999) have employed a linear mapping of ratings to risk with Aaa (of Moody's) and AAA (of Standard and Poor's) being assigned a value of 1, and the lowest value being 16 for B3 (of Moody's) and B- (of Standard and Poor's). Their analysis reveals that in cases where ratings are assigned by both Moody's and Standard and Poor's, they were identical for 58 per cent of the issues and differed by one notch for 36 per cent of the issues. A similar methodology of linear mappings has been used by Karacadag and Taylor (2000). In the Indian situation, given the non-availability of quarterly data on external ratings for PSBs and the lack of dispersion across ratings of PSBs (with the rated PSBs being assigned a sovereign rating in most cases), it is not very meaningful to use external ratings for determining capital adequacy standards of these banks.

explanatory variable for some outcome i indicates that the greater is the realization of that variable, the more probable is the occurrence of i rather than one of the alternatives. As a normalisation, the parameters β_0 for alternative $i=0$ are set to zero, and the logistic functional form is assumed, such that,

$$U(\text{alternative } i) = \frac{\exp(\mathbf{b}'_i \mathbf{x})}{\sum_{j=0}^n \exp(\mathbf{b}'_j \mathbf{x})} \quad (4.3)$$

The model can then be estimated by Maximum Likelihood procedure. Once the parameters are estimated, it is possible to calculate the probabilities of occurrence of each possible outcome, both within-the-sample and out-of-sample. For each observation, the 'predicted' outcome is the one with the highest conditional probability.

Formally, let $P(i, t)$ be the dummy variable that takes a value of one when a bank's rating indicates highest/high safety, and zero, otherwise. β is a vector of n unknown coefficients and $F(\beta'X(i, t))$ is the cumulative probability distribution function evaluated at $\beta'X(i, t)$. Then the log likelihood function of the model is:

$$\ln L = \sum_{t=1,2,\dots,T} \sum_{i=1,2,\dots,n} \{P(i, t) \ln[F(\beta'X(i, t))] + (1 - P(i, t)) \ln[1 - F(\beta'X(i, t))]\} \quad (4.4)$$

When interpreting the regression results, it is important to remember that the estimated coefficients do not indicate the increase in the probability of higher safety (indicated by better ratings), given a one-unit increase in the corresponding explanatory variables. Instead, in the above specification, the coefficients on the RHS reflect the effect of a change in an explanatory variable on $\ln[P(i, t)/(1-P(i, t))]$. Therefore, the increase in the probability depends on the original probability and thus upon the initial values of the independent variables and their coefficients. While the sign of the coefficient does indicate the direction of change, the magnitude depends on the slope of the cumulative distribution function at $\beta'X(i, t)$. In other words, a change in the explanatory variable will have different effects on the probability of

rating, depending on the bank's initial rating status. Under a logistic specification, if a bank has an extremely high (or low) initial probability of safe rating, a marginal change in the independent variable has little effect on its prospects, while the same marginal change has a greater effect if a bank's initial rating is in an intermediate range.

In the binomial case, it is possible to introduce 'fixed effects', which are meant to capture certain permanent, non-variable differences between individuals in a panel of data, using the conditional likelihood procedure introduced by Chamberlin in the early 'eighties. In particular, the methodology deals with data that has a group structure. The simple specification that is employed is as follows:

$$E(y_{it} | X, \mathbf{b}, \mathbf{w}) = \mathbf{b}' X_{it} + w_i \quad (i = 1, 2, \dots, N; t = 1, 2, \dots, T) \quad (4.4)$$

where there are T observations within each of N group (banks). The w_i are incidental parameters which are intended to capture group effects whose omission would result in biased estimates of β , a parameter vector common to all groups. The joint maximum likelihood estimator in the fixed effects probability models is inconsistent; the solution proposed by Chamberlin is to maximise a conditional likelihood function that conditions on sufficient statistics for the group-specific parameters. It is important to note that only observations that enter the conditional likelihood function are those for which the examined event (rating, in this context) takes place in one and only period per group. In the context of this exercise, this implies that the fixed-effects model can be estimated only for banks for which rating are available.

Karacadag and Taylor (2000) have observed that, in spite of their several disadvantages, internal ratings have important advantages over external ratings. Firstly, internal ratings potentially incorporate proprietary information on bank clients that is unavailable to the public at large and to rating agencies, if the borrower is not rated. The informational advantage of internal systems could help generate more accurate credit risk assessments

on the borrower. Accurate assessments, in turn, help to minimise the difference between regulatory and economic capital. In addition, the use of internal ratings places the responsibility of risk management squarely where it belongs: within each bank, a trend the New Capital Accord intends to accelerate.

The choice of explanatory variables is dictated by the CRAMEL (Capital Adequacy, Resources, Asset Quality, Management Evaluation, Earnings and Liquidity) approach. Therefore, the following variables have been used in understanding the determinants of ratings: non-performing assets, net interest income, fee income, bank deposits, off-balance sheet activity of the bank, profits, provisions and the hundred-per cent risk-weighted assets (all the variables are scaled by total assets). While GNPA can be taken to proxy asset quality, profits are a proxy for earnings. Bank deposits reflect a vulnerability of run on deposits and can be considered as a proxy for resources. While the off-balance sheet item indicates the degree of financial sophistication, the 100-per cent risk weighted assets reflects the riskiness of bank operations.

The independent variable used in the exercise is the rating (short-term/long-term) assigned to the bank by a domestic credit rating agency. Accordingly, depending on the rating assigned by the concerned agency, we assign a dummy variable defined as:

RATELO=1, if the rating reflects highest safety within the category; 0, otherwise.

As mentioned above, a similar exercise is carried out for banks which have received a short-term/medium-term rating from a domestic rating agency. This dummy variable is defined as:

RATESH=1, if the rating reflects highest safety within the category; 0, otherwise.⁴⁵⁴⁶

It needs to be mentioned here that we have only selected those banks whose ratings are available for all the quarters under consideration. This provides us with 12 banks that have been assigned long-term rating⁴⁷ and 18 banks that have been provided short/medium-term rating⁴⁸.

IV.3 Results and Discussion

The results of the panel data model for the long and short-term ratings case are presented in Table 4.3.

At the outset, it needs to be mentioned that it has not been the purpose of this exercise to assess the impact of the new Accord, especially since it is still in its early days. The treatment of ratings and how it is impacted upon by capital, among other variables, in this Chapter has been more based on 'back-of-the-envelope' calculations. However, what is intended is to raise some issues based on impending capital regulation which could point to future work which needs to be done in this direction. Secondly, the panel data set used in the methodology for determining long-term and short-term ratings is neither based on a uniform set of banks nor is the set of PSBs same in both cases. The results would therefore need to be interpreted with caution.

⁴⁵ The results with regard to foreign rating agencies are benchmarks, with the sovereign rating acting as the ceiling. As a result, there is a lack of dispersion of ratings across public sector banks. To that extent, the results need to be interpreted with caution.

⁴⁶ Long-term ratings are those assigned to debentures and bonds, while short-term ratings are those assigned to fixed deposits/commercial paper.

⁴⁷ These banks are Bank of Baroda, Bank of India, Dena Bank, Punjab National Bank, Central Bank of India, Corporation Bank, Punjab and Sind Bank (Nationalised Banks) and State Bank of India, State Bank of Hyderabad, State Bank of Patiala, State Bank of Saurashtra, State Bank of Travancore (SBI Group).

⁴⁸ These banks are Bank of Baroda, Bank of India, Canara Bank, Central Bank of India, Corporation Bank, Dena Bank, Oriental Bank of Commerce, Punjab National Bank, Punjab and Sind Bank, Indian Bank, Union Bank of India and Vijaya Bank (nationalised banks), State Bank of Bikaner and Jaipur, State Bank of India, State Bank of Hyderabad, State Bank

In both panels, high GNPA is clearly associated with higher probability of a low rating, confirming the fact that non-performing assets is a critical factor in determining a bank's rating. And importantly, higher the GNPA, the higher is the probability that a bank will receive a lower rating. The coefficient on the GNPA is negative in both the long-term and the short-term cases, and is statistically significant in both cases. Also, a rise in the 100-per

Table 4.3 : Determinants of Bank Ratings-1997:Q1 to 1999:Q4

Variables	Long-term	Short-term
	Dependent Variable:RATELO	Dependent Variable:RATESH
Constant	16.17 (2.38)*	7.64 (1.07)
Capital (t-1)	-0.05 (-0.36)	0.66 (2.60)*
NIIRWA	-1.31 (-1.85)**	-3.14 (-3.25)*
FIRWA	1.69 (1.05)	10.71 (3.78)*
BDRWA	-0.17 (-1.73)**	-0.14 (-1.16)
OBSRWA	0.02 (0.94)	-0.03 (-1.25)
PFRWA	-0.55 (-1.49)	0.79 (1.64)\$
PVRWA	-0.54 (-1.29)	1.74 (2.62)*
HRRWA	-0.07 (-1.21)	-0.06 (-0.92)
GNPA	-0.24 (-2.88)*	-0.34 (-3.50)*
R ²	0.35	0.62
No. of observations	144	228
Fraction of Correct Predictions	0.88	0.92
Log-likelihood	-42.63	-36.62

Figures in brackets indicate t-ratios.

*significant at 1 per cent

** significant at 5 per cent

\$ significant at 10 per cent

of Indore, State Bank of Mysore, State Bank of Patiala and State Bank of Travancore (SBI Group).

cent risk-weighted assets appears to worsen bank rating, although it is statistically insignificant in both cases. On the other hand, profitability plays an important role in determining short-term rating and is statistically significant, while the sign on the profit variable in the long-term ratings case appears to be counter-intuitive. The provisions variable has the expected sign, with a negative sign in the long-term and a positive sign in the short-term (and is statistically significant). Intuitively, higher the provisions in the short-run, the better is a bank equipped to deal with shocks in their balance sheets. In the long-run however, banks are expected to have fully provided for any contingency, so that, in an eventuality, higher provisions appear to lower the probability of a better rating. The bank deposit variable has the expected sign, being statistically significant in the long-run as opposed to the short-run. Economically, deposits suffer from a vulnerability to 'runs', so that deposits above a threshold often leads to a lower rating. Importantly, higher net interest income does not necessarily imply a higher rating, reflecting the perception that the bank is unable to diversify into non-fund based activities.

The primary focus of this exercise is to understand whether capital has a significant impact on rating. Our analysis reveals that, while the short-run impact of capital on ratings may be significant and higher capital increases the probability of a better rating, the reverse is the case in the long-run. However, while the short-run relationship is statistically significant, the long-term relationship is not. While the short-run relation conforms to intuition, the long-run result (although insignificant) appears contrary to established thinking. One might hazard a guess that, in the long-run, while capital might be playing an important role, the regulatory environment, the socio-political factors and the economic environment might be as much important as capital. Clearly, our results are only a pointer, and a much more detailed analysis is called for before one can predict with a reasonable degree of certainty what bank-specific and other economic factors play an important role in determining bank ratings.

Several caveats are in order at this juncture. The Reserve Bank, in clarifying its position on the Accord⁴⁹, has expressed skepticism of the role of the rating agencies in this process. While it has totally rejected their role in sovereign rating on the basis of their past track record, it has proposed that the banks and only the larger corporates approach the domestic rating agencies for this purpose in view of their low penetration. For the rest of the borrowers, banks will be expected to strengthen their internal ratings systems. The new Accord, however, sees the more sophisticated banks as being the ones who would be using their internal ratings based systems to assign risk weights. Therefore, in the near future, one might expect the BCBS to come out with a graded system of IRB approaches to fit different levels of sophistication in banks.

Thus, it is expected that banks in India would eventually use a mixture of external ratings and internal ratings. This brings in the issue of the 'time horizon' over which the rating assigned to a borrower would be considered to be valid since a change in the rating would lead to a change in the risk weight. The existing capital regulation excludes this dimension to the extent that risk weights remain unchanged for loans to corporates irrespective of the change in their financial condition over time. Once risk weights are driven by ratings, then this aspect becomes important both from the point of view of assigning capital by the bank and monitoring by the supervisor. In this context, the Basle Committee paper points out that the ratings assigned by external agencies which are claimed to be 'through the cycle' may be hence more stable over time than the 'point in time' ratings derived from IRB approach, which could change more frequently over the business cycle and hence introduce a greater degree of volatility in the regulatory capital requirements. In either case, it can be expected that variability would be introduced into the capital regulation framework by the

⁴⁹ Comments of the Reserve Bank on *A New Capital Adequacy Framework*, RBI, 2000.

use of ratings for assigning risk weights and it will for the supervisors and banks to decide whether this should be pro or anti cyclical.

Yet another type of rating can be expected to play a significant role in capital regulation and that is the supervisory rating. The second pillar of the new Accord expects supervisors to specify bank-specific capital add-ons based on the risk profile of individual banks thus effectively raising the Basle minima for riskier banks. Although supervisors would use different methods to diagnose the risk profile of their banks, it can be expected that some would use the component or composite ratings of supervisory rating models (such as CAMELS) which can provide useful indicators of risk profile. The BCBS is expected to come out with more detailed guidelines on the second pillar for the use of supervisors. Whatever be the manner of determining risk profile, what is evident is that several banks in the Indian context could be expected to have higher than system capital charge required of them, which again would raise the capital requirements for the system as a whole.

IV.4 Concluding Observations

With the Accord still in its early days and expected to be revised based on the comments received by the BCBS from the respondents to the June 1999 consultative paper, it is too early to gauge the full impact of the final Accord on our banks. Some simple conclusions however suggest themselves. Claims on banks would overall attract higher risk weights irrespective of whether they continue to remain unrated or obtain ratings, internal or external since the present ceiling of 20 per cent would now become a floor. With most corporates being unrated, there would be no major change in the overall risk weights on good quality assets, and there would even be lower risk weights for premium borrowers. However, net NPAs would attract the 150 per cent risk weight from the 100 per cent at present and hence require more capital to support them. And, if the second pillar is implemented, then an add-on can be expected for some banks, though some of this could be met by the existing system-wise add-on of 1 per cent prescribed from the year

2000-01. However, if the Reserve Bank's position of keeping the ceiling on risk weights at 100 per cent for corporates and 50 per cent on banks is accepted, then the strain on the system may be minimized. Yet, overall the conclusion is inescapable that the new Accord would require net additional capital for the system.

CHAPTER V

REGULATING MARKET RISKS IN BANKS: A COMPARISON OF ALTERNATE REGULATORY REGIMES

Introduction

The introduction of the Basle Accord marks an important watershed in establishing capital standards among banks across the globe. Prior to 1992, uniform minimum capital standards were applied to all banks, regardless of any differences in the levels of their investment risk. The task of limiting banks' portfolio risks and ensuring capital adequacy, was left to regulatory monitoring and supervision, and to some degree, to market pressures.

The Basle Accord represented the first step in linking bank capital standards to credit risk exposures, and to that extent, a movement away from a subjective judgement of capital requirements and towards a more objective rule-based approach. However, the growing disenchantment with the Capital Adequacy Ratios (CAR), have led regulators to search for feasible alternate possibilities to regulate market risk in banks. Three alternative approaches have been discussed in the literature.

The first of the approach to the market risk capital standards is the Building Blocs Approach (BBA). The BBA consists of a single model to be applied to all banks. This approach is characterized by a 'building bloc' framework, a framework it shares with the 1988 Basle Accord credit risk capital standards. Two regulatory frameworks, those of the Capital Adequacy Directive (CAD) of the European Union and of the Basle Standardised Measures (BSM), incorporate this approach. Under this approach, capital charges are determined for each of the four major market risk categories

(interest rate, exchange rate, equity and commodities) and are then aggregated. Different procedures are used for each category to determine the category's respective capital charge. It is a set of rules that assigns risk charges to specific instruments and crudely accounts for selected portfolio effects on banks' risk exposures. Interest rate and exchange rate risks dominate the market risks for most banks trading departments. Under the building bloc approach, debt securities incur a specific and a market risk capital charge. The specific risk-charge is intended to cover changes in the market value of securities owing to changes in credit quality. It is a weighted average of gross debt security positions where the weights vary between zero and eight, according to the quality measures of the security (issuer, maturity, rating). These specific risk capital charges for interest rate products would substitute for the credit risk capital requirement these positions currently require under the Basle Capital Accord. The market risk charge covers changes in the value of the debt positions that owe to changes in the general level of (risk free) interest rates. Equity positions are subject to both a specific risk and a market risk capital charge. Equity capital charges are determined on a notional market basis and are then aggregated across markets at current exchange rates with no offsets permitted for hedging or diversification among markets. Finally, commodity capital charges are essentially 15 per cent of the net position in each commodity (Kupiec and O'Brien, 1997). Some additional capital charges are also assessed for basis risk and interest rate risk.

The second approach is the Internal Models Approach (IMA), whereby capital charges would be based on market risk estimates from banks' internal risk measurement models. The bank would use its proprietary risk measurement model to estimate its trading risk exposure which, when multiplied by a certain scaling factor as a measure of regulator's conservatism, would become the basis for the regulatory capital charge for market risk. Regulators would also impose a number of standardizing restrictions on banks' internal models, in order to ensure rough comparability

across banks that use this approach. The IMA approach has been adopted recently by the Basle Committee as an alternative measure to the BSM.

The third and latest proposal is the Pre-commitment Approach (PA), based on work done by Kupiec and O'Brien (1997). Under this approach, each bank pre-commits to a maximum loss exposure over a designated horizon. The maximum loss commitment becomes the bank's market risk capital charge. If the bank incurs trading losses in excess of its capital commitment, it is subject to penalties, which may include fines, a capital surcharge in future periods, or other regulatory disciplinary measures.

Pertinent from the point of view of the Indian scenario are the Internal Models Approach and to a lesser extent, the Pre-commitment Approach, which are taken up for discussion. What follows is a brief description of the two approaches followed by an examination of the likelihood of the use of these models in the Indian context (Appendix A4).

V.2 Internal Models Approach

In the past, banks have usually measured the risks in individual parts of their trading books separately. Nowadays however, they are increasingly moving towards a whole trading book approach, using a Value-at-Risk (VaR) model, which is a statistical approach to the evaluation of market risks. The aim of the VaR model is to calculate consistently the loss, with a specified probability, over a specified holding period of time, which a bank might experience on its portfolio from an adverse market movement. For example, with a confidence interval of 97.5 per cent, corresponding to about two standard deviations from the mean, any change in portfolio value over one day resulting from an adverse market movement will not exceed a specified amount, given the relationships between assets holding over the observation period. VaR should therefore encompass changes in all major market risk components.

The VaR model retains the basic CAR philosophy of a 'hard link' between risk exposure and capital requirements, set exogenously by the regulator. However, there is an important difference. In the traditional CAR approach, the risk-weights are also set by the regulator, whereas, in the VaR approach, the risk weights are based on the banks internal model. This amendment is addressed to overcome two weaknesses of the CAR approach— one, that it ignores diversification benefits accruing from holding assets of varying risk in the same portfolio and two, that it fails to efficiently exploit internal information specific to the bank. However, the VaR model comes with its own price tag. The regulator has to ensure that the bank's internal model does not misrepresent its risk exposure and hence, a checking mechanism has to be in place.

Although the internal models approach represents an important advance over standardised risk measure, it still has important disadvantages that might impair its efficiency and effectiveness. The advantages of the internal models approach will be realized only if (a) the bank's internal risk measurement model is capable of providing an accurate measure of a bank's risk exposure over a holding period of concern to the regulators, and (b) that the regulatory authority can verify that each bank's model is indeed providing such an accurate measure of the bank's risk exposure. In practice, it might well turn out that neither of these two conditions are completely satisfied.

Importantly, these models are not designed to measure the longer-horizon exposure that is the intended basis of regulatory capital requirements. Simply stated, longer horizon risk exposure depends not simply on a bank's initial risk exposure, but also on its risk management strategy and the risk control systems that a bank has in place. Risks need to be measured and managed on a daily basis. However, the longer the horizon, the less important will be the initial risk exposure and the more important will be management's risk objectives and the bank's risk management

system. The internal models proposal sets the capital requirement at some multiple of the model risk-risk estimate for an initial portfolio composition. This risk measure places undue emphasis on the initial portfolio at the expense of ignoring the importance of the bank's risk management objectives and the efficacy of its risk control systems.

V.3 The Pre-commitment Approach

An alternative to model-based regulation, another approach which has gained currency in recent times has been the Pre-commitment Approach (PA). Unlike the VaR, which retains the basic CAR philosophy of a 'hard link' between risk exposure and capital requirements, the PA emphasizes the use of a 'soft link', i.e., a link arising endogenously rather than being externally imposed.

Under this approach, each bank pre-commits an amount of capital to cover what is believed to be its maximum trading loss exposure over a given regulatory horizon, which can be one quarter or even a shorter period. The capital becomes the focus of regulation. A bank would be in breach of this pre-commitment if cumulative losses from the beginning of the capital period exceeded its capital commitment on any close of business. The appeal of the PA lies in the fact that it does not require the regulator to estimate the level of trading book risk of any specific bank or to assess its internal model. Banks which have good risk management systems, conservative portfolios, or more risk averse preferences, could pre-commit to lower maximum loss levels and hold less capital because of their confidence that they will not breach their pre-committed maximum trading loss.

In this situation, breaches would be penalised in two ways. Firstly, there would be explicit regulatory penalties. Second, the commitment could be publicly disclosed, providing a double incentive for the bank-to contain losses within its committed capital and to not greatly over-commit capital. The latter may send signal of an effective risk measurement system, as well

as of possible excessive risk exposure in the upcoming period. It also encourages the regulatory authorities to act promptly over breaches, imposing the necessary penalties and determining management shortcomings. Disclosure therefore both complements and strengthens the incentives created by the penalties.

V.4 Pros and Cons of Market Risk Models

Regulators traditionally have utilized simple, generic models to measure bank capital adequacy. This is no longer possible: the increased presence of market risk in banks, and the opaqueness of such risk in a portfolio have rendered such an approach less than satisfactory. Three main alternative approaches have emerged in the literature to replace it. Out of them, VaR and PA have the potential for greater applicability in the Indian scenario. Each approach needs to be judged on the basis of the trade-off between the prevention of the costs of bank failure and the costs of implementation of such regulations.

The VaR concept can potentially be applied to both credit and market risk, thus allowing for the possibility that, in time, banks may be able to have a single firm-wide measure of these risks across all business areas, and so measure return on (credit and market) risk consistently across the whole firm. The concept, however, has no substitute for the wider risk management process of analyzing stress scenarios and keeping tabs on operational and legal risks. For example, neither the VaR nor the other approach offers a direct solution to the problem of operating risk-the existence of sloppy internal controls-which has been responsible for many of the recent problems involving derivatives (Stephanou, 1996).

The internal model approach based on VaR is an improvement to the BBA, since it is aligned to bank industry best practice. However, the attempt by regulators to create consistent estimates of VaR across different institutions' models, as well as their conservative parameters, have reduced

the approach's appeal. In addition, at least in the near future, its application will be limited to a relatively small number of institutions that have both material trading activities and sophisticated, comprehensive VaR models.

Presently in India, the banks are free to set gap limits with RBI's approval, but are required to adopt Value at Risk (VaR) approach to measure the risk associated with forward exposures. Thus, the open position limits together with the gap limits form the risk management approach to forex operations.

In contrast to the aforesaid model which supports model-based regulation, the pre-commitment approach by-passes the micro-management of banks; models, focusing instead on outputs. If appropriate incentive-compatible penalties can be devised, the incentives for gaming by banks, present in different ways and extent in both the BBA and the IMA are significantly reduced. It is necessary though for the PA to be further examined and refined, given the severe doubts that still exist over the implications of its adoption in practice⁵⁰.

V.5 Concluding Observations

The views of the regulators and the industry on the appropriate method of setting bank capital standards for market risks have evolved away from the use of regulatory standard model approaches and towards the use of banks' internal risk estimates. This evolution represents a promising development as internal-model based approaches have clear advantages, both in terms of the efficacy as well as effectiveness of risk-based capital

⁵⁰ A Pilot Project of the Pre-commitment Approach was organised by the New York Clearing House Association and ten participating institutions (Considine, 1998). The exercise demonstrated that (a) the PA is a viable alternative to the internal models approach for establishing the capital adequacy of a trading business for regulatory purposes, (b) while there were differences in each institution's perception of determining an appropriate amount of capital (free of any regulatory pre-conceptions), the institutions believed that such differences arose from differences among the institutions in the nature of their trading books, the varying risk appetites and risk management techniques, differing ratios of proprietary trading revenues to customer flow revenues among firms and different views as to the relationship between economic and regulatory capital.

standards. While the internal models approach focuses solely on risk measurement of a static portfolio and ignores the fundamentally important determinants of bank's trading risk-its-risk-taking strategy and its risk management ability, the pre-commitment approach, on the other hand, is yet to gain international recognition.

SUMMARY AND CONCLUSIONS

Several broad conclusions can be inferred from the above study. These are listed as under:

1. Given the wide heterogeneity across public sector banks in terms of their product sophistication and customer orientation as well as their adjustment response, the regulatory framework should be designed so as to encourage individual banks to maintain higher CRAR than the stipulated minimum so as to reflect their differential risk profiles.

2. The second aspect of the Study has been to test the hypothesis of how CRAR is impacted upon by a range of conditioning variables and whether there has been any discernible shift from towards relatively less risky assets, during our period of study. Such an econometric exercise has two advantages, viz., it allows a distinction between long-run and short-run capital ratios and secondly, it allows for testing the impact of various regime shifts. Our analysis reveals that (a) capital remains a useful regulatory tool in the hands of policy makers for influencing bank behaviour, and (b) there is no conclusive evidence to support a shift from high-risk towards low-risk asset category by banks.

3. In view of the composite rating for banks introduced by the Reserve Bank in June 2000 and the need to evolve a system wherein regulators might need to take corrective action depending on the bank's risk profile, the study examines the impact of putting in place a Prompt Corrective Action (PCA) based on capital for the PSBs. Based on data availability, the framework is studied only for the year 1998. Our analysis reveals that PCA might prove to be an effective framework for arresting bank deterioration and prevent systemic failure of banks.

4. Fourthly, in view of the growing internationalization and universalisation of banking operations, the risks emanating from idiosyncratic failures might have far more serious repercussions throughout the system as a whole than ever before. In view of the above, the Basle Committee on Banking Supervision (BCBS) has proposed the New Capital Adequacy Accord which not only endeavours banks to hold higher levels of capital, but also envisages a greater role for the market (or, for that matter, the credit rating agencies). Although the role of internationally acclaimed rating agencies has been put under a cloud ever since the South-East Asian crisis, the fact nonetheless remains that rating agencies would need to play a far more important role in the future, once the New Accord is put in place. In view of the above, Chapter 5 examines, within the framework of the extant model, the *possible* impact of capital adequacy on credit rating. Our analysis reveals that capital ratios of banks are a crucial determinant of bank ratings, especially in the short-term.

5. Finally, to the extent that the role of the market is expected to be far more important under the new Accord and an increased emphasis is going to be placed on market risks, newer models of measurement of market risks viz., Value at Risk (VaR) and the Pre-Commitment Approach (PA) have gained currency in recent years. International experience with their applicability is also a testimony to the growing popularity of these models. In view of the above, the final Chapter sums up the Indian experience and provides a view point as to the plausibility of the usage of these models in the foreseeable future, especially by Indian banks.

To synopate, banking regulation and supervision are extremely complex areas where the regulator has to tread a careful middle path between the *ex-cathedra* overzeal for intervention and a complacent belief in the ability of the banking system to self-rectify all its own deficiencies. In a recent contribution, Caprio and Honohan (1999) remind us in a similar vein “banking regulation must be seen as an evolutionary struggle and regulatory innovation will remain a constant challenge”.

**APPENDIX A1 :
BACKGROUND OF THE BASLE ACCORD OF 1988**

Year	Event Description
January 1986	US bank regulators proposed new guidelines for establishing risk-based capital reserves.
March 1986	G-10 banking supervisors planned to implement stricter measures requiring off-balance sheet liabilities to have capital backing.
January 1987	US and UK bank regulators proposed a joint risk-based capital regulation.
April 1987	The Basle Committee formally took the US-UK agreement under consideration and addressed the possibility of expanding it to include all G-10 countries plus Luxembourg and Switzerland.
June 1987	The 'Brussels formula' was conceived that defined banks capital similar to the method used in the US-UK agreement. For the first time, German authorities indicated they could, in principle, support the new plan.
September 1987	The US, UK and Japanese regulators met for the first time. It was decided to use the two-tier capital definition, that loan-loss reserves would be included in tier-II capital and that Japanese banks would count 45 per cent of their hidden reserves as tier-II capital.
November 1987	Long-standing German and unexpected French objections threaten to delay the international bank-capital agreement. German officials contended that the definition of capital was too broad while French authorities avered that the definition of capital was too narrow.
April 1988	The EC unveiled a plan to require banks in the EC to maintain a common minimum capital-to-risk-adjusted assets ratio.
July 1988	Central bankers agreed to a new minimum capital standards for international banks.

Source: Hall (1993) and Wagster (1996).

**APPENDIX A2 :
COMPONENTS OF TIER 1 AND TIER 2 CAPITAL**

Tier I	
Paid-up Capital	
Disclosed Free Reserves	
Capital Reserves representing surplus arising out of sale proceeds of assets	
Reserves (excluding Revaluation Reserves)	
<i>Less</i>	
Losses, including accumulated losses	
Equity Investment in Subsidiaries	
Intangible Assets	
Tier II	
Undisclosed Reserves	
Revaluation Reserves (at a discount of 55 per cent)	
Hybrid Debt Capital Instruments	
General Provision/General Loan-loss Reserves (subject to a ceiling of 1.25 per cent RWA #)	
Sub-ordinated Debt*	

RWA: Risk-weighted assets

* Sub-ordinated Debt: Original maturity not less than 5 years

Remaining Maturity (in Years)	Rate of Discount-(per cent)
Less than 1	100
1-2	80
2-3	60
3-4	40
4-5	20

APPENDIX A3 :
SALIENT RECOMMENDATIONS OF THE
NARASIMHAM COMMITTEE-I AND NARASIMHAM COMMITTEE-II
ON CAPITAL ADEQUACY NORMS

Narasimham Committee - I

1. The ratio of capital funds in relation to a bank's deposits or its assets is a well-recognised and universally accepted measure of the strength and stability of the institution.
2. For the purpose of calculating capital adequacy, risk weights have to be assigned to different categories of assets. The specific circumstances obtaining in India have to be taken due note of in assigning such weights.
3. For the purpose of calculation of capital, BIS has classified capital into two categories, namely Tier I capital consisting of share capital and disclosed reserves and Tier II capital consisting of undisclosed and latent reserves, hybrid capital and subordinated debt. It has also been indicated that Tier II capital should not exceed Tier I capital.
4. The BIS norm for capital adequacy is 8 per cent of the risk-weighted assets. The Committee recommends that all banks in India reach this figure in a phased manner. For those banks which operate on an international scale, the norm should be achieved as early as possible and in any event within three years, i.e., March 1994. As far as other banks are concerned, they should achieve a capital adequacy norm of 4 per cent by March 1993 (of which Tier I should not be less than 2 per cent) and the 8 per cent norm in full within the next three years, i.e., by March 31, 1996.
5. Before arriving at the capital adequacy ratio for each bank, it is necessary that the assets of the banks be evaluated on the basis of their realisable values. The Committee proposes that the banks and financial institutions' adopt uniform accounting practices particularly in regard to income recognition and provisioning against doubtful debts.

Narasimham Committee - II

1. Pending the emergence of markets in India where market risks cannot be covered, it would be desirable to take into account market risks in addition to the credit risks.
2. In the next three years, the entire portfolio of Government securities should be marked to market and this schedule of adjustment should be announced at the earliest. It would be appropriate that there should be a 5 per cent weight for market risk for Government and approved securities.

3. In order to ensure that banks do not suddenly face difficulties in meeting the capital adequacy requirement, the new prescription on risk weight for Government guaranteed advances should be made prospective from the time the new prescription is put in place.

4. There is an additional capital requirement of 5 per cent of the foreign exchange position limit. Such risks should be integrated into the calculation of risk-weighted assets. The Committee recommends that the foreign exchange open position limits should carry a 100 per cent risk weight.

5. The Committee believes that it would be appropriate to go beyond the earlier norms and set new and higher norms for capital adequacy. The Committee accordingly recommends that the minimum capital to risk weighted assets ratio be increased to 10 per cent from its present level of 8 per cent. Accordingly, the Committee recommends that an intermediate minimum target of 9 per cent be achieved by the year 2000 and the ratio of 10 per cent by 2002.

**APPENDIX A4 :
VALUE-AT-RISK AND PRE-COMMITMENT APPROACHES
TO MEASUREMENT OF MARKET RISK**

I. Value at Risk Approach to Market Risk

The bank's capital charge at date t is based on the larger of the bank's current 10-day-ahead risk estimate or the average of its risk estimates over the prior 60 business days, subject to a multiplication factor. Let VAR_{t-1} represent a bank's risk exposure estimate for date (t-1), and CMR_t represent the banks market risk capital requirement for date t. The bank's regulatory market risk capital requirement is,

$$CMR_t = Max\left[\frac{SM_t}{60} \sum_{i=1}^{60} VaR_{t-i}, VaR_{t-1}\right] + SR_{t-1}, \quad (A1)$$

where SM_t is the supervisory determined multiplication factor and SR_t is the additional capital charge for the specific risk of trading book positions. The proposed minimum value for the multiplication factor, SM_t is 3. The multiplier can be increased if the supervisor is not satisfied with the accuracy of a bank's risk exposure estimate. For verifying risk estimates, a "back-testing" methodology is proposed which would be based on the frequency of realized daily losses exceeding the models' predicted daily losses at the 1 per cent critical values. The specific risk capital charge applies to traded debt and equity positions. It is intended to account for idiosyncratic risks, as risk measurement generally measure risks generated by market-wide factors. The specific risk charge is equal to one-half of the specific risk capital charge as calculated under the standardised approach.

II. Pre-Commitment Approach to Market Risk

Assume that the bank's overall financial position is such that the bank could pay any penalty that it might incur for a capital violation. The penalty is assumed to be a direct Rupee charge proportional to the excess of the loss over the pre-committed capital. Let K_T denote the capital committed to cover trading losses. The *ex-post* charge for a capital commitment breach is

$$\Psi(\Delta V) = -y \text{Min}\{\Delta V + K_T, 0\} \quad (A2)$$

where ΔV represents the change in the value of the trading portfolio realized at the end of the period. Thus, the bank incurs a penalty if

$$\Delta V < -K_T \quad (\text{A3})$$

In determining the appropriate incentives, the cost of regulatory capital to the bank plays an important role in determining the appropriate regulatory choice of a penalty rate, ψ . Among other things, this cost will depend on the bank's leverage and will vary with the leverage ratio. For purposes of this illustration, the bank's cost of regulatory capital is assumed to be strictly proportional at the rate R to the level of capital. Let, $f(\Delta V)$ be the probability density for ΔV , $F(\Delta V)$ be the associated distribution function and r the required discount rate on a payoff described by $\Psi(\Delta V)$. The full cost of the capital commitment, inclusive of potential penalty, is

$$R K_T - \frac{\mathcal{Y}}{1+r} \int_{-\infty}^{-K_T} (\Delta V + K_T) d(\Delta V) \quad (\text{A4})$$

The first term of expression (A4) is the current cost of committing K_T of capital to trading risk. The second term is the current value of the monetary policy for a pre-commitment violation.

Assuming that the bank minimizes (A4), the capital commitment K_T that satisfies an interior optimum first-order condition is given by the expression:

$$R = \frac{\mathcal{Y}}{1+r} F(-K_T^*) \quad (\text{A5})$$

Expression (A5) suggests how the regulator might set an appropriate penalty rate. Solving (A5) for Ψ leads to the penalty rate

$$\mathcal{Y}^* = \frac{R(1+r)}{F^*} \quad (\text{A6})$$

where F^* represents the regulator's objective in terms of the probability of trading losses exceeding committed capital. Replacing Ψ in expression (A5) with the optimal penalty rate in expression (A6) shows that a cost-minimising bank will choose a capital commitment K_T^* , such that,

$$F(K_T^*) = F^* \quad (\text{A7})$$

Expression (A6) indicates that the penalty rate is inversely related to the regulator's acceptable probability of losses exceeding capital. Lowering the desired probability of

observing a breach of capital lowers the likelihood of a penalty and thereby, lowers the expected penalty cost. To counter this effect, a higher penalty rate is needed. Expression (A6) also indicates that the appropriate penalty rate depends on the cost to the bank of meeting the regulatory capital commitment, R (with r being of second order importance). In general, it is difficult to know this cost as it will depend on the value of the leverage to the bank. A single penalty rate that reflects the highest cost of regulatory capital will be a conservative approach in that it will lead to over-commitment by most banks. Thus, some flexibility in the penalty rate based on the likely cost of regulatory capital would be desirable.⁵¹

⁵¹ In case where R is zero, the bank would want to commit equity even if $F(-K_T) < F^*$.

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