

Capital Requirements and Bank Behaviour: Theory and Evidence

Chapter I

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: Alfried (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 capital¹. A bank may exploit these differences by (a) selling assets that have appreciated in value to increase capital measured by regulatory 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 firmⁱⁱ.

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.

1.2 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 bankⁱⁱⁱ. 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-weight liquidation costs of failure or extreme assumptions about the distribution of asset returns.^{iv}

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.

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 calculations^v.

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 levels^{vi}.

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 decline^{vii}. 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 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.

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.

i 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.

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

iii. 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.

iv 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.

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