OPERATIONAL RISK MEASUREMENT FOR THE INDIAN BANKING SECTOR: ALTERNATIVE MEASURES

by

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INTRODUCTION

Banks, as major financial intermediaries, possess an inherent advantage in assessing the riskiness of potential borrowers. At the same time, the substantial credit, market and operational risks they face in their operations can have a significant impact on their earnings. Thus, risk management which is synonymous with bank management is the core activity for any bank. The ability of a bank to be successful/ survive under adverse economic conditions is related to the quality of its risk, its management processes, and to its capital adequacy. Capital adequacy not only helps prevent individual bank failures but also helps create a sound and safe banking system. While regulation exists in several industries, active prudential regulation through the imposition of minimum regulatory capital requirements (MRCR) is special to the financial sector.

The discussion on the optimal level of capital requirements or the minimum regulatory capital requirements has been continuing since the 1970s. Till then, the optimal level of capital that a bank should maintain was considered to be an internal decision of the bank as there was no explicit relationship expressed between the level of capital adequacy and the level of risk faced by a bank. Further, the safety and soundness of the banking system was promoted through a control on the level of competition through restrictions on entry and expansion of bank branches. A shift, however, in banking to a deregulated, competitive and internationally active and inter-dependent system saw regulators expressing a felt need for active prudential regulation in terms of development of uniform capital adequacy ratios for internationally active banks. Common minimum regulatory capital, apart from providing a safe and sound banking system, was also expected to ensure a level playing field among banks from different countries. The Basel I Accord of July 1988 was the first formal documentation of active prudential regulation and established an explicit link between the level of bank risk and its capital adequacy. The Accord prescribed a minimum level of regulatory capital for internationally active banks which required banks to hold a minimum regulatory capital of 8% or greater of the sum of risk-weighted bank assets (the Cooke Ratio). Further, it defined the concept of regulatory capital and its division into Tier I (core) and Tier II (supplementary) capital and also specified the risk weights for the different assets. The 1996 Amendment of the Basel I Accord addressed the issue of market risk and the regulatory capital requirement for market risk was incorporated in the capital adequacy framework through the introduction of a Tier III in supplementary capital.

It is pertinent to note here that the definition of regulatory capital is open to refinements as can be observed from the changes introduced in the minimum required capital requirement under Basel II which introduced an additional capital requirement for operational risk and made modifications to credit risk.

The Basel II Accord is based on three mutually reinforcing pillars – Pillar 1 Minimum Capital Requirements; Pillar 2 Supervisory Review, and Pillar 3 Market Discipline. The idea is that the enforcement of minimum capital requirements along with an effective and strong supervisory process and disclosure of risk and market discipline can ensure a sound financial system.

Pillar I Minimum Capital Requirements

The Basel II Accord introduced substantial changes under Pillar I to the regulatory capital requirements as regards credit risk and introduced an additional capital charge for operational risk. The total regulatory capital requirement is an addition of minimum capital requirement under credit risk, market risk, and operational risk. Banks under Basel II can choose from among any three of the following approaches for credit

risk – the Standardized Approach and between two sophisticated Internal Ratings-Based Approaches – Foundation and Advanced.

The Standardized Approach is the simplest and defines fixed risk weights for all credit exposures. The substantial difference from Basel I is that exposures to the same class of risk can be assigned different risk weights depending on the asset's external credit rating. Banks could alternatively adopt either of the more sophisticated Internal Ratings-Based Approaches where the risk weights assigned are a function of the probability of default of the borrower, loss given default, exposure at default and effective maturity. In the Foundation Internal Rating-Based Approach, the bank combines the internal estimates for probability of default with fixed parameters set by the regulator for the other three parameters, while in the Advanced Internal Ratings Based Approach all the four parameters of concern may be provided by the bank. Vital to the Internal Ratings Based Approach is a validation of the internal process by the supervisor/regulator.

The other substantial change introduced under Basel II was the introduction of a capital charge for operational risk. Banks can choose from any of three approaches – Basic Indicators Approach, the Standardized Approach and the Advanced Management Approach – whilst determining the capital charge for operational risk. Each of the three approaches is increasingly complex and sophisticated. (A detailed discussion on operational risk is in the next section)

The overall approach under Basel II, thus, has been to give banks the choice to adopt approaches with different levels of sophistication with the more advanced approaches resulting in a lower level of minimum regulatory capital requirement as compared to the simpler approaches. Since regulators were not willing to accept a reduction in average capital requirements, a trade-off between the approach adopted by a bank and the level of capital requirement was acceptable to regulators as banks that adopted the more sophisticated approaches would have the advantage of better risk measurement and management systems. Thus, under Basel II banks could have differing capital requirements dependent on the approach selected.

Pillar 2 Supervisory Review Process

The focus under this segment is on the role of processes in bank risk management. It draws attention to the role of the national regulator in bringing about improvements in banks' risk management techniques and procedures, provisioning policy, and their capital management processes. The Basel Committee on Banking Supervision has specified the following four key principles for supervisory review:

(i) Banks should have a process for assessing and maintaining overall capital adequacy with respect to their risk profile.
(ii) Supervisors should review banks' internal capital adequacy assessments and strategies, taking proper actions if they are unsatisfied with those processes.
(iii) Supervisors should expect banks to operate above Pillar 1 minimum regulatory capital requirements and should have the ability to require banks to hold additional capital; and
(iv) Supervisors should look for early intervention to prevent a bank from falling below the minimum regulatory capital requirement and take remedial action if the bank is under-capitalized.

Pillar 3 Market Discipline

This facet of the Accord focuses on strengthening market discipline. It concerns the pressure put on bank managements by financial markets to provide a sound banking system. The focus under this segment is on qualitative and quantitative disclosure requirements with an aim to increase the transparency of a bank's risk profile.

Section II of the paper contains the conceptual framework of the pricing and measurement of operational risk, wherein Section II.A focuses on the approaches proposed by the Basel II Accord, while Section II.B discusses the alternative approaches to operational risk capital measurement. Section III discusses the Basel II Accord and its relevance to India while the computational results of operational risk capital charge under different approaches and its impact on Tier I capital of banks and the sensitivity analysis of gross income of a bank to the gross income from its business lines is contained in Section IV. Section IV.A presents the results for the Basel II Approaches while Sections IV.B and IV.C contain the results of the Alternative Approaches and sensitivity analysis respectively. Section V concludes the paper.

II Operational Risk: Concept and Measurement

Management of credit and market risks has traditionally been at the centre of bank risk management. Operational risk must be distinguished from credit risk and market risk. For one thing, there is no equivalent to the concept of risk exposure. That is to say, Operational Risk does not correspond in a simple fashion to any financial indicator. Secondly, the distribution of Operational Risk is more fat-tailed than that of credit risk. In addition, Operational Risk is endogenous relative to credit and market risk. In other words, the scope for reduction of risk are greater in the case of Operational Risk. Operational Risk is founded on the premise that a bank,

independent of outside factors, will fail to meet one or more operational targets in a given year. Operational Risk and its management has garnered substantial attention since the mid-1990s as a consequence of banking crises resulting from human error, fraud and/or missing controls (e.g. Barings Bank, Daiwa Bank and Allied Irish) and due to the intent of the Basel Committee on Banking Supervision since 1999 to introduce a new regulatory capital charge for Operational Risk in addition to the minimum regulatory capital requirement for credit and market risk. Further, technology and increased product complexity has led to a greater focus on the management of Operational Risk rather than its mere measurement.

It is appropriate to begin with a compendium of definitions and approaches along with their limitations (Bonsón, Escobar and Flores, 2007). The Commonwealth Bank of Australia (1999) defines Operational Risk as all risks which would generate volatility in a bank's reserves, expenses and the value of its business. Others would confine the measure to unpredictability in its cost structures and exclude its revenue structure. The proposed checklist for the European Union is as follows (Oesterreichische Nationalbank, 2006): Interest income and non-interest income include interest receivable and similar income, income payable and similar changes, income from shares and other variable/fixed-yield securities, commissions and fees receivable, commissions and fees payable, net profit and net loss on financial operators and other operating income. The following data is not to be used in computing the indicator: Realized profits/losses from the sale of non-trading items, income from extraordinary or irregular items and income derived from insurance. Care is taken to ensure that the indicator is calculated before the deduction of provisions for operating expenses. The latter include fees paid for outsourcing services provided by third parties which are not a parent or a subsidiary of the bank or a subsidiary of a parent which is also the parent of the bank. If revaluation of trading book items is part of the profit-and-loss statement, revaluation must be included in the calculation of the indicator. A limitation of these concepts is that indicators of interest and non interest income only reflect the volume of business in each line but not the level of Operational Risk. The risk adequacy of the capital requirement calculated on the basis of these indicators is inadequate as bank-specific loss data is not used. Consequently, it is not possible to effect a control of Operational Risk tailored to their causes and targeted risk management. In addition, the potential diversification effects between business lines is not factored by aggregating the amounts of capital. According to the Basel Committee on Banking Supervision (BCBS), the financial impact of a loss event includes all out-of-pocket costs and excludes opportunity costs and foregone revenues.

The Basel Committee on Banking Supervision has defined operational risk as *"the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. This definition includes legal risk, but excludes strategic and reputational risk"* (Basel Committee, 2004). Operational risk, thus, is the risk arising from operational loss and operational losses in turn emerge from operational errors. In other words, operational risk is concerned with the risk to a bank's performance due to the management of the bank as opposed to the financing of the bank. Consequently, when operational risk is not addressed systematically it can result in inconsistent performance and earnings surprises for the stakeholders. Thus, operational risk exposures can have an impact on banks' revenues and net worth.

Operational risk, thus, generates operational losses and the losses generated are a cost to the bank. Hence, the pricing and the consequent measurement of the operational risk capital charge has to be adequate to cover for these losses. Therefore, to price operational risk appropriately, a bank would need a measure of expected loss which is based on its history of operational losses. This would require the development of an internal as well as external database on the sources and types of operational loss exposure in which every single operational loss event is recorded from which the mean and standard deviation of losses for the relevant time period can be computed. However, the creation of such a comprehensive database is fraught with several problems, namely, identifying the range of business activities across which operational loss events might be classified and allocation of a loss event to a particular area of activity. Besides, the database can only provide ex-post guidelines on the potential sources of operational risk events but not ex-ante signals. Further, at times, bank managements could write off small operational losses against revenue which raises issues regarding the credibility of the operational loss database. The problem of credible databases can be redressed through the creation of an independent external database which can be shared among banks. Another matter concerns the appropriate time frame over which data needs to be collected for a study of operational loss exposures. Apart from the issues related to data collection, there are statistical issues such as the nature of the underlying distribution of loss exposures. The distribution of loss exposures most likely would be non-normal and skewed as there would be a large number of small losses and infrequent and decreasing numbers of large operational loss events.

Correlations between different types of operational loss events could pose another statistical problem and one needs to investigate whether these correlations are stable. Among the problems here are the assumptions to be made about the correlation of operational loss events. The Basel II Accord assumes that all operational risk losses occur simultaneously. The simple summation of high percentile value at risks implies the simultaneous occurrence of a set of worst-case scenarios. The issue here is that it is hard to compute the degree of correlation between various risk types and/or banks because of the absence of historical data. Both *top down* and *bottom up* approaches, elaborated upon below, rely on historical data. The latter are based on loss events in individual processes whereas the former operate at the level of the bank moving down business lines. Top-down models are likely to superior at estimating capital requirements. According to the factor approach, an attempt is made to identify important determinants of Operational Risk (OR) either at the level of the banks or at the level of individual business lines. A formula like

$$OR = \alpha t \sum_{i=1}^{m} \beta_i F_i + \varepsilon$$

is used. The $F_i s$ are the risk factors. The approach covers risk indicators, CAPM-like models, and predictive models. In the risk indicators methodology, regression analysis is used to identify risk factors like the volume of operations, credit ratings, and employee turnover. CAPM-based models are used to connect the volatility of returns to OR variables. With predictive models, discriminant analysis is used to single out the elements that lead to OR losses.

Correlation, if any, between operational, market, and credit risk must be taken into consideration as it will have an impact on a bank's capital requirements. For instance, it can lower bank capital requirements. A failure to take into consideration such correlations might result in a bank being over-capitalised. The Accord specifies three distinct approaches to compute capital requirements for Operational Risk based on increasing risk sensitivity and allows banks to adopt different approaches to different operations. Banks, however, will not be allowed to revert to a simpler approach from a sophisticated approach (except under particular circumstances). The idea is to ensure that banks do not cherry pick among approaches to reduce their capital charges. Further, each approach has certain qualifying qualitative and quantitative standards (King, 2001; Saita, 2007; Tripe, 2000).

II.A Operational Risk Capital Charge: Basel II Approaches

The three approaches for computing operational risk capital charge are (i) the Basic Indicator Approach (BIA), (ii) the Standardized Approach (SA) and (iii) the Advanced Measurement Approach (AMA), each of which is detailed below. The identification and measurement of operational risk can be viewed as following either the top down or the bottom up mechanism depending on the method used to calculate the risk charge. In the top down approach, financial data is extracted from the balance sheet and Profit & Loss statement. This method may not result in the proper capturing of risks nor does it help in risk mitigation. This approach corresponds with the Basic Indicator and the Standardized Approaches of the Basel II Accord. The third approach of the Accord, the Advanced Measurement Approach, is consistent with the bottom up approach in which the regulatory capital requirement will be defined by the estimate generated by the internal operational risk measurement system. No eligibility priors are needed for using the Basic Indicators Approach because that approach is the "default position" designed for small local banks. According to the standardized approach, the business activities of a financial institution are divided into standardized business lines and assigned relevant indicators, net interest income and net non-interest income. In business line mapping, banks must enunciate principles and provide documentary evidence for mapping net income from their own current activities into the standardized framework. The principles include :

1. The mutually exclusive and exhaustive nature of the mapping from activities into business lines and 2. Costs generated in one business line and imputed to a different business line, may be reallocated to the business line to which they pertain. For instance, a formulation based on internal transfer costs between the two activities may be used.

Internationally active banks or those exposed to significant Operational Risk are expected to use more elaborate approaches than the Basic Indicators Approach. Lars Svensson notes the "Basel Paradox" here, that internationally active banks might not meet the eligibility criteria to use sophisticated approaches (Mussa, 2007)

(i) *The Basic Indicator Approach (BIA)*

The BIA is the simplest of the three approaches to calculating operational risk capital charges. This approach uses a single indicator, gross income, as a proxy for a bank's overall operational risk exposure. Minimum capital requirements under BIA is a percentage α (equal to fifteen percent) of the average of positive gross income (GI) over the preceding three

years. Years with negative gross income are excluded. Gross income is computed as net interest income plus net non-interest income, gross of any provisions and operation expenses,

$$K_{BIA} = \left[\Sigma GI_{1,\ldots n} * \alpha\right] / n$$

where

KBIA– capital charge under the Basic Indicators Approach

GI – annual gross income of a bank in a given year

n – the number of previous three years in which gross income (GI) is positive.

The advantage of this approach lies in its simplicity and ease of implementation. The BIA can be applied universally and allows for easy comparison across banks. However, while this approach is suitable for small banks, internationally active banks with substantial operational risk exposure would need to adopt a more sophisticated risk management and measurement approach within the overall framework.

(ii) *The Standardized Approach (SA)*

This approach is a refinement over the Basic Indicators Approach and can reflect better the differing risk profiles across banks as reflected by their broad business activities. Under the Standardized Approach, a bank's operational risk capital charge is sensitive to the risk arising from the various business lines.

Under this approach, a bank's activities are divided into a number of standardized business units and business lines. The SA can, hence, better reflect the differing risk profiles across banks as reflected by their broad business activities. However, similar to the BIA, the capital charge for the different business lines is standardized by the supervisor. The business lines proposed under the SA reflect an industry initiative to collect internal loss data in a consistent manner. A broad financial indicator has been specified for each business line and the indicator would reflect the size/volume of a bank's activity. The indicator can serve as a rough proxy for the amount of operational risk within each of these business lines. The operational risk capital charge within each of these business lines is calculated by multiplying a bank's broad financial indicator by a 'beta' factor. The beta provides a rough proxy for the relationship between the Operational Risk loss experience for the industry for a given business line and the financial indicator representing a given bank's activity in that particular business line. Table 1 below presents the eight businesses into which a banks' activities can be decomposed. Within each business line, gross income is the broad indicator which serves as a proxy for the scale of business operations and the operational risk exposure within each of these business lines. A detailed mapping of the activities under each business line is provided in Annexure I.

Table 1. Standardized Approach – Business Units and Business Lines

Business Units	*Business Lines*	*Beta Factors*
Investment Banking	Corporate Finance	18%
	Trading & Sales	18%
Banking	Commercial Banking	15%
	Retail Banking	12%
	Payment and Settlement	18%
Others	Retail Brokerage	12%
	Asset Management	12%
	Agency Services	15%

For instance, the operational risk capital charge for the business line of corporate finance under investment banking would be calculated as follows:

$$K_{\text{corporate finance}} = \beta_{\text{corporate finance}} * \text{Gross income}$$

where

$K_{\text{corporate finance}}$ – capital requirement under corporate finance business line

$\beta_{\text{corporate finance}}$ – Beta factor for the corporate finance business line.

It is relevant to observe that each business line has its assigned beta factor and a respective financial indicator. Gross income here refers to the gross income of a bank for that particular business line and does not refer to the gross income of the whole bank. Ideally, the beta factor for each business line should be calibrated as per its loss experience and the goal of the Basel Committee is to re-calibrate the SA when credible risk–sensitive data (loss experience information) is available. Such a mapping will enable each bank to map its structure into the regulatory framework. Since most banks are in the process of developing an internal loss database or may not choose to incur the investment required to develop an internal loss database for all business lines (especially for those business lines that present a less material operational risk), in the interim the SA could provide the required framework other than the BIA to calculate their regulatory capital charge. Alternatively, the SA can provide a basis on which a bank can move to more sophisticated approaches like the Advanced Management Approach that would help develop better risk management techniques within banks.

The Basel Committee on Banking Supervision has set qualifying criteria that a bank must satisfy before it can adopt

the Standardized Approach (items 660-663 of BCBS Report, June 2006). The total capital charge is computed as a three year average of the simple summation of the regulatory capital charges across each of the business lines in each year. For any given year, the negative capital charges (resulting from negative gross income) for a business line may offset positive capital charges in other business lines without limit. However, if the aggregate capital charge across all business lines is negative for a year, then the input for the numerator for that year would be zero. The total capital charge may be expressed as:

$$K = \alpha \sum_{i=1}^{3} \max \left[\sum_{j=1}^{8} \beta_j Y_j, 0 \max \right]$$

Banks may be allowed by national supervisors to adopt the Alternative Standardized Approach (ASA) in which retail banking and commercial banking operational risk exposures can be calculated by applying betas to a percentage '*m*' of outstanding loans rather than gross income. Capital charges for retail and commercial banking are calculated differently. Instead of using gross income as the indicator of exposure, the value of loans and advances is used. Gross income is substituted by a number that amounts to 0.035 times the value of loans and advances. Thus,

$$K = 0.035 \beta L$$

computed separately for retail and commercial banking. K is the capital charge against retail banking, the beta assigned to it is 0.12 and L is the total outstanding loans and advances (retail banking, non risk-weighted and gross of provisions) averaged over the previous year. A bank would be allowed at the discretion of the supervisor to adopt the ASA only when it is able to convince the supervisor that the ASA would provide a better basis for the calculation of regulatory capital. A bank would not be allowed to revert to the Standardised Approach from the ASA without obtaining the prior sanction of the supervisor (BCBS Report 2001, 2006; Saita, 2007).

An illustrative specification from the European Union Directive referred to is as follows:

Corporate finance	β1	
Trading and sales	β2	18%
Payments and settlement	β6	
Commercial Banking	β4	
Agency services	β7	15%
Retail brokerage	β3	
Retail banking	β5	12%
Asset management	β8	

The treatment of negative values here is not different: In each year, a negative capital requirement in one business line resulting from negative gross yield may be imputed to the whole. When, however, in a given year, the aggregate capital charge accruing to all business lines is negative, the element in the numerator for the year is zero.

A criticism that has been made in this context is that risk management in terms of risk control is not sufficient because the capital requirement is not determined by the actual Operational Risk but by the level of net interest income and net non interest income. The assumption is that, in general, higher income can only result from accepting higher Operational Risk. However, improved performance can also result from superior risk management techniques.

(iii) *Advanced Management Approach (AMA)*

This approach identifies potential risk areas for each line of business based on historical data and the frequency of their occurrence and size of loss. The AMA provides discretion to individual banks on the use of internal loss data while the method to calculate the required capital charge is uniform to all banks and established by the supervisor. Further, banks while adopting this approach will need to satisfy several quantitative and qualitative criteria (item 664-674, BCBS, June 2006) which would ensure the integrity of the measurement approach, data quality, and internal measurement processes. As the AMA is the most sophisticated in the spectrum of approaches available to measure operational risk capital, the Basel Committee believes that the adoption of this approach will incentivize banks to develop a credible internal loss database. The Committee recognizes that the industry is currently at a nascent stage in developing the database necessary for the implementation of the AMA and, consequently, some re-calibration would be required at a later date. Thus, under the AMA, the regulatory capital requirement will equal the risk measure generated by the bank's internal Operational Risk measurement system and its adoption is subject to regulator approval

Under the AMA the operational risk capital charge is to be determined through the following procedures:

(i) A bank's activities are categorized into a number of business lines and a broad set of operational loss types is defined and applied across business lines.

(ii) Within each business line/loss type combination, the supervisor specifies an exposure indicator (EI) which is a proxy for the size of each business line's operational risk exposure.

(iii) In addition to the EI, banks measure based on their internal loss data a parameter that would represent the

probability of loss event (PE) and a parameter that would represent the loss given that event (LGE), is calculated. The product of the EI*PE*LGE is used to calculate the expected loss (EL) for each business line.

(iv) The supervisor would supply a factor – the gamma term – for each business line which would translate the expected loss into a capital charge. The overall capital charge for a particular bank is the simple sum of all the resulting products for the different business lines.

(v) Finally, to facilitate supervisory validation, banks would provide the supervisor with the individual components of the expected loss calculation, namely the EI, PE and LGE, based on which the supervisor would calculate the expected loss (EL) and then adjust for the unexpected loss through the gamma term so as to achieve the desired level of safety and soundness.

The business lines under the AMA would be similar to those under the SA and the operational risk measure under the AMA must guarantee standards which are comparable with credit risk under the Internal Ratings Based Approach. Further, the regulatory capital requirement should be the sum of expected and unexpected losses unless the bank can show that the expected losses have been already captured and accounted for by its internal business processes. The risk from the different business lines are additive with no diversification benefit. However, the bank may be allowed to use internally-determined correlations after regulatory approval by the supervisor that the system of determining the correlations is satisfactory. Thus, crucial to the success of the Advanced Measurement Approach is accurate risk mapping which would help identify key risk indicators which, in turn, can provide anticipatory signals and enable better monitoring and control action through building of internal and external loss databases.

The Basel II Accord, further, includes guidelines for constructing internal loss databases or for avoiding double counting when operational losses are already included under regulatory capital for credit risk (e.g. collateral management failures). A bank would further monitor for changes in risk control and accordingly adjust operational risk estimates. Further, under the AMA a bank is permitted to consider risk-mitigation benefits which cannot be greater than 20% of the total AMA operational risk capital requirement. The possibility of loss data being hidden by operational management can be supplemented by having an appropriate organizational structure such as independent operational risk management, and internal loss databases can be compared with available external databases and scenario analysis to measure high severity losses. Scenario Analysis contributes "by suggesting what might happen, even if it (the loss event) never happened before" (Saita, 2007, p.125).

The strategy under AMA can, thus, be summarized as: (i) Map potential risks (ii) Measure risk (iii) Implement risk mitigation measures and (iv) Predict and forecast risks. Alternatively, operational risk estimates should be derived by a proper combination of (i) internal data (ii) relevant external data (iii) scenario analysis and (iv) business environment and internal control systems. (BCBS, 2004, 2006; Bhatia, 2002; Saita, 2007).

As banks move from the BIA to the AMA, their capital charges are lowered. The regulatory capital requirement will be calculated on the basis of the bank's own Operational Risk model. One of the objectives of the Basel II Accord is to align regulatory capital with the economic capital determined by the internal models of banks. Economic capital is the amount of capital that a bank must hold to protect itself, at chosen confidence intervals, from insolvency due to unexpected losses over a period of time. Under AMA, banks must quantify Operational Risk capital requirements for seven types of risk and eight business lines, giving a matrix with fifty-six elements. Ignoring correlation, these estimates are reduced to a summary statistic of the Operational Risk of the bank.

II.B Operational Risk Capital Charge: Alternative Approaches

Operational risk emanates not just from the activity of bank lending (which forms the core of credit risk) but from several other activities undertaken by a bank. Consequently, operational risk costs must be built into fees and commissions for activities such as deposit processing, cheque issuance and all other activities that can generate operational errors/losses. The alternative approaches to the pricing of operational risk in banks focus on the volatility of non-interest expense account by looking at two ratios: (i) Cost to Asset Ratio and (ii) Cost to Income Ratio. Further, the use of ratios insulates the operational risk capital charge from the growth observed in bank balance sheets. The operational risk capital charge under these approaches is linked to the volatility in the cost to asset ratio and the cost to income ratio. Tripe (2000) has suggested that the operational risk capital charge for a bank can be computed using a multiple of the standard deviation (say three standard deviations) of the cost to asset ratio relative to average total assets and to total income for the cost to income ratio. He writes '…this multiple having been selected for convenience rather than to reflect any particular theoretical rationale, it is not considered inconsistent with likely practical approaches' (p.11). The rationale for employing multiple standard deviations can be attributed to the non-normal, skewed, and fat tailed distribution of the loss exposures.

Hence, multiple standard deviations would cover a smaller proportion of the possible outcomes than that under a normal distribution. A fall-out of this would be that banks would possibly be under capitalized as compared to the actual risk exposure.

(i) *Cost to Asset Ratio*

The cost to asset ratio can be defined as the ratio of operating (non-interest) costs to average total assets. The operational risk capital charge is linked to volatility in the cost to income ratio. The ratio of cost to average assets of a bank reflects a bank's business mix. For instance, a bank with a focus on corporate lending or placements in the inter-bank market would have a lower cost to asset ratio as compared to a bank with a greater focus on retail lending. However, a problem with this ratio is the complications for cross-border comparisons (which is very relevant for internationally active banks). Banks in different countries can have different forms of constructing their balance sheets and this can have an impact on the cost to asset ratio more than the cost to income ratio. Further, it is important to note that if banks are undertaking substantial efforts to reduce costs, then the variations in the cost to asset ratio will be around a decreasing mean rather than around a stationary mean making comparisons difficult. Also, the cost to asset ratio does not capture the non-interest income which is a significant pointer to the operational risks in a bank. Further, banks at times may adjust operating losses (small losses) against revenues. Hence pricing operational risk by studying the volatility in the cost to income ratio would be an alternative to the cost to asset ratio.

(ii) *Cost to Income Ratio*

The cost to income ratio is also known as the Efficiency Ratio or Expense to Income Ratio. The ratio is used by bank managements and market analysts to assess bank performance. The components of the ratio are cost and income and, hence, the measure is indirectly related to bank profitability. A reduction in costs for a given level of income will reflect increased profits and vice versa. Increased profits, in turn, will result in improved return on equity and share prices of the bank which is of great interest to investors. Further, most bank costs have been reducing in response to margin squeezes, thus lowering both costs and income. Hence, volatility in a bank's cost to income ratio might be a better measure of volatility in a bank's cost performance.

The cost to income ratio is the ratio of non-interest (operating) costs excluding bad and doubtful debt to the net interest income plus non-interest income of the bank. Non-interest costs are perceived as those costs which are most amenable to management decisions and considered to be that part of a bank's costs which can be controlled. A focus on non-interest costs would ensure that fluctuations in the level of interest rates do not affect the volatility seen in this ratio. The use of the net interest income term in the denominator will reduce the volatility that could arise from fluctuations in the general level of interest rates.

The rationale for the exclusion of bad and doubtful debt can be attributed to the following: (i) Bad and doubtful debt largely reflects bad credit decisions made in the past rather than current performance. (ii) The cost to income ratio would be adversely affected by major write-offs, if any, undertaken at points of time in the future. (iii) Such assets can distort the ratio as well as reflect high levels of operating costs and low levels of income.

Since the cost to income ratio is affected by changes in both costs as well as incomes, the ratio needs to be interpreted with caution. An increase in the ratio on account of falling income needs to be studied so as to determine whether the fall in income is because of the bank's inability to generate income, thereby indicating inefficiency or is attributable to a change in competitive conditions which reduce margins across the board or a change in overall economic conditions which restrict opportunities to undertake profitable business from which a bank can earns fees.

The ratio is also sensitive to individual bank structure in terms of the strategy adopted for deposit mobilisation, spread of bank branch networks and business mix. Another factor that can have an impact on the cost to income ratio is banks holding excess capital or banks that are over capitalized. Banks holding excess capital are in a position to undertake greater wholesale lending or investment at low cost thus increasing their gross income with the same level of operating costs resulting in a lower cost to income ratio. Tripe (1998) has detailed, through several illustrations, the impact of differing bank structures on the cost to income ratio.

(iii) *Range*

Range between the maximum and minimum cost ratios can be looked at as an alternative to standard deviation for measuring the operational risk capital requirement. Such an estimate can be adopted when observations are sufficiently large and is based on a methodology like back simulation. However, an estimate based on range would be larger than that under standard deviation as the range extends on both sides of the mean (Tripe, 1998, 2000).

III The Basel II Accord and India

The Reserve Bank of India (RBI) has adopted a consultative approach as regards the implementation of Basel II. A Steering

Committee comprising of senior officials from fourteen banks (private, public, and foreign) has been constituted alongside a representation of the Indian Banks' Association. Keeping in view the RBI's goal to be consistent and harmonious with international standards, it has been decided that at a minimum, all banks in India will adopt the Standardized Approach for credit risk and the Basic Indicator Approach for operational risk with effect from March 31, 2007. After adequate skills are developed, both in banks and at supervisory levels, some banks may be allowed to migrate to the Internal Ratings Based Approach after obtaining the specific approval of the Reserve Bank of India. Further, the Reserve Bank of India will review the capital requirements produced by the Basic Indicator Approach for general credibility and, in the event that credibility is lacking, appropriate supervisory action under Pillar 2 will be considered. Banks will be encouraged to move along the spectrum of available approaches as they develop more sophisticated operational risk measurement systems and practices (Reserve Bank of India, 2005). While the RBI has mandated the BIA approach, banks are aware that they must progress toward the AMA approach. One problem that has been recognised is that 'low frequency, high impact' data, by definition, must be collated. Therefore, a data exchange by the Indian Banks' Association has been proposed along the lines of the Global Operational Loss Database (GOLD) set up by the British Bankers Association. In India, business continuity planning (BCP) is a part of Operational Risk (Reserve Bank of India, 2008A). The context is the increased leverage of technology. In that case, 'disaster recovery' is an important component of the BCP programme directed towards the recovery of technology. An effective BCP must factor in the possibility of disasters covering an entire region and the resulting attrition of staff. Thus, the BCP methodology includes the IT continuity template and formulating recovery time objectives (RTO) based on Business Impact Analysis. The model must be robust enough to contend with the most stressful situations. The recovery point objectives (RPO) for data loss in the case of each critical business will have to identified along with strategies to deal with them.

IV Pricing Operational Risk: Measurement for Indian Banks

This section presents the estimates of operational risk capital measurement for Indian banks and its consequent impact on Tier I capital under a broad spectrum of approaches, namely, the Basic Indicators Approach, the Standardized Approach, the Cost to Asset Ratio and the Cost to Income Ratio. The study estimates the operational risk capital charge at an individual bank level as well as bank group-wise depending on the availability of data. When the estimates have been presented at the individual bank level, it covers 30 banks including the 27 public sector banks (19 nationalized Banks and 8 banks of the State Bank group) and the 3 leading new private sector banks viz. ICICI Bank, HDFC Bank and UTI/ Axis Bank. The period of the study varies as per the Approach and the availability of data. The time period of the study spans 2005-2008 for three of the four approaches - the Basic Indicators Approach, the cost to asset ratio and the cost to income ratio, while it spans the period 2006-2007 for the Standardized Approach. The data has been sourced from various issues of the Reserve Bank of India's Basic Statistical Returns of Scheduled Commercial Banks in India and Statistical Tables Relating to Banks in India and Report on the Trend and Progress of Banking in India.

IV.A Basel II Approaches

(i) *The Basic Indicators Approach*

This approach is to be adopted by all banks in India from March 2007. This approach, as detailed above, would require banks to keep aside a percentage ? (equal to 15%) of positive gross annual income over the past three years excluding any year where gross income is negative as operational risk capital charge. Table 2 presents the additional capital charge requirement for operational risk under the Basel II Accord for the major bank groups.

Table 2. Operational Risk Capital Charge and Impact on Tier I Capital – Bank Group-wise (Basic Indicators Approach)

Year	*Gross Income (Rs. Crore)*	*Annual Capital Required*	*Capital Charge (Rs. Crore)*	*Networth (Rs. Crore)*	*Current Tier I (%)*	*Estimated Tier I (%)*
Public Sector Banks						
2002	48095	7214	-	57454	7.8	-
2003	58611	8792	-	65582	8.3	-
2004	71822	10773	-	79225	8.2	-
2005	75802	11370	8926	85946	7.4	6.6
2006	79276	11891	10312	115044	8.8	8.1

Table contd...

Table contd...

2007	85909	12886	11345	135626	8.3	7.6
2008	97039	14556	12049	174853	7.4	6.9
2009			13111			
Nationalised Banks						
2002	29888	4483	-	37395	7.1	-
2003	36952	5543	-	42450	7.9	-
2004	45343	6801	-	51475	8.1	-
2005	46298	6945	5609	61181	7.6	6.9
2006	46829	7024	6430	71012	9.0	8.2
2007	53945	8092	6924	84385	8.5	7.8
2008	60310	9047	7354	104325	7.5	7.0
2009			8054			
State Bank Group						
2002	18207	2731	-	20059	9.5	-
2003	21660	3249	-	23133	9.3	-
2004	26480	3972	-	27750	8.5	-
2005	28690	4304	3317	32764	7.9	7.1
2006	30787	4618	3842	37660	8.5	7.6
2007	30278	4542	4298	42942	7.7	6.9
2008	34437	5166	4488	61706	7.2	6.7
2009			4775			
Old Private Sector Banks						
2002	4451	668	-	5411	10.4	-
2003	4952	743	-	6295	10.6	-
2004	5569	835	-	7291	10.9	-
2005	4852	728	749	7926	9.0	8.1
2006	5346	802	769	9671	9.3	8.5
2007	5987	898	788	10737	11.2	10.3
2008	6838	1026	809	15315	14.1	13.4
2009			909			
New Private Sector Banks						
2002	4058	609	-	10514	7.5	-
2003	8205	1231	-	13404	8.2	-
2004	10163	1524	-	14846	7.0	-
2005	11507	1726	1121	18981	9.9	9.4
2006	16838	2526	1494	24314	8.8	8.3
2007	23035	3455	1925	33075	8.1	7.7
2008	32665	4899	2569	49332	10.3	9.8
2009			3627			

It is important to mention here that even while banks in India are to introduce the operational risk capital charge from March 2007, we have estimated this capital charge from 2005. Apart from giving a historical perspective to the impact of the operational risk capital charge, the exercise will also provide a useful continuation to an early study of ICRA in this area. ICRA in its estimates had suggested that in 2005 scheduled commercial banks would need Rs.120 billion as additional capital requirements for operational risk. Of this, a substantial amount would be needed by public sector banks comprising the nationalized banks and the State Bank group followed by the new private sector banks and the old private sector banks. While the pattern of capital requirements remains the same at the end of March 2007, the focus here is on the period

since March 2007 when Indian banks would start implementing the Operational Risk capital charge under BIA. Table 2 details the additional capital requirement on account of the Operational Risk capital charges for the Indian banking sector excluding foreign banks in India and estimates indicate that the requirements on account of operational risk capital charges would be of the order of Rs.14,058 crores at the end of March 2007 and Rs.15,427 crores in March 2008. The requirement is estimated to be Rs.17,647 crores for March 2009. Furthermore, the requirement at the end of March 2009 is about 1.63 times greater than the requirement at the end of March 2005 which was approximately Rs.10,796 crores. A substantial proportion – nearly 80.70% (at Rs.11,345 crores) – of the overall additional capital requirements on account of Operational Risk capital charge would form the requirement of the public sector banks at the end of March 2007. While the public sector banks have seen an increase in the absolute amount of capital requirements, the percentage as a proportion of the overall capital requirements for public sector banks has since declined and is estimated to be around 74.30% at Rs.13,111 crores in 2009 of the overall additional capital requirement on account of the Operational Risk capital charge. Compare this with the new private sector bank group whose additional capital requirements for Operational Risk, though substantially lower than the public sector banks, witnessed an increase both in percentage terms as well as in the absolute amount of capital required since March 2007. At end March 2007, the capital requirements of new private sector banks was estimated to be Rs.1925 crores, which was 13.69% of the overall requirement for the banking sector (excluding the foreign banks) and the percentage share is estimated to be around 20.55% (Rs.3627 crores) at the end of March 2009. The bank group of the old private sector banks has seen an increase in absolute amount of capital requirements from Rs.788 crores at the end of March 2007 to Rs.909 crores at the end of March 2009. The percentage share of this group however remains stable in the range of 5.15 – 5.61% over the period March 2007-09. The impact of this additional capital requirement has had the expected impact on lowering Tier I capital across all bank groups. On an average for 2007 and 2008, the impact of lowering the Tier I capital has been the highest for the old private sector banks at around 0.45% followed by the public sector banks at 0.6% and the lowest for the new private sector banks at 0.45%. The Operational Risk capital requirement for each of the individual 30 banks on an average for 2007-09 is encapsulated in Table 3 while a detailed analysis is in Annexure III. Table 3 highlights the fact that the Operational Risk capital charge for 23 of the 30 banks under consideration would, on an average for 2007-08, be below Rs.500 crores. Five banks would require an operational risk capital charge in the range of Rs.500–Rs.1000 crores, while the State Bank of India at Rs.2203 crores and ICICI Bank at Rs.1423 crores would need an additional capital requirement of above Rs.1000 crores. A graphical presentation of the comparative requirements of Operational Risk capital charges of each individual public sector bank vis-à-vis the overall requirement of the public sector banks and of each of the three leading private sector banks vis-à-vis the overall requirement for the new private sector banks for the period 2005-2009 is presented in Annexures VI and VII respectively.

Table 3. Operational Risk Capital Requirement of Banks: Average 2007-09 Basic Indicators Approach

(Rs. Crore)

Below 250	*250-500*	*500-1000*	*Above 1000*
BoM (184)	ALLA (315)	BoB (694)	ICICI (1423)
DENA (175)	ANDHRA (261)	BoI (643)	SBI (2203)
PSB (129)	CENTRAL (456)	CANARA (759)	
UNITED (213)	CORP (267)	PNB (925)	
VIJAYA (198)	INDIAN (330)	HDFC (594)	
SBBJ (198)	IOB (414)		
SBH (240)	ORIENTAL (327)		
SB-IND (117)	SYND (377)		
SBM (146)	UCO (300)		
SBP (209)	UNION (466)		
SBS (91)	AXIS (306)		
SBT (197)			

Figures in parentheses represent the Operational Risk capital charge.

Considering that a substantial burden of the additional capital requirement on account of Operational Risk capital charges lies on the public sector banks, it would be interesting to study and compare the impact of the Operational Risk capital charges on the regulatory Tier I capital. Tables 4, 4A and 4B summarize the impact on Tier I capital of the additional capital charges for Operational Risk for nationalized banks, the State Bank group and the three major new private sector banks respectively for 2005-08. As can be gleaned from Table 2, the introduction of the additional capital charges for Operational Risk has lowered the Tier I capital of banks. As of end March 2005, if the operational risk capital charge was assumed to be active, then all others remaining the same, the estimates from Table 4A indicate that nearly 9 of the 19 nationalized banks would have had a Tier I capital below 6% while two banks from the State Bank group – the State Bank of Indore and State Bank of Travancore (Table 4B) - would have a Tier I capital of less than 6%. The Reserve Bank of India on February 15, 2005, issued guidelines to all Scheduled Commercial Banks indicating the approach to be adopted for the implementation of the Basel II Accord in Indian banks. Subsequently, several nationalized and private banks boosted their Tier I capital through raising equity in 2005 and 2006 and the Tier I capital of the following banks showed substantial improvement, namely Allahabad Bank, Andhra Bank, Bank of Baroda, Dena Bank, Oriental Bank of Commerce, Punjab and Sind Bank, Punjab National Bank, Syndicate Bank and Union Bank of India.

Table 4A. Impact of Operational Risk Capital Charge on Tier I Capital
Basic Indicators Approach – Nationalized Banks

Tier I Capital					
Year	*Below 5%*	*Between 5-6%*	*Between 6-7%*	*Between 7-9%*	*Above 9%*
2005	ORIENTAL PSB	ALLA CENTRAL DENA IOB SYND UCO UNION	BoI BoM CANARA VIJAYA	ANDHRA BoB INDIAN PNB	CORP UNITED
2006		DENA SYND UCO	BoI BoM CENTRAL UNION	ALLA CANARA IOB UNITED VIJAYA	ANDHRA BoB CORP INDIAN ORIENTAL PSB PNB
2007		BoI BoM CENTRAL DENA SYND UCO	CANARA UNITED VIJAYA	ALLA BoB IOB PSB PNB UNION	ANHDRA CORP INDIAN ORIENTAL
2008	BoM UCO	CENTRAL VIJAYA	CANARA DENA SYND UNION UNITED	ALLA ANDHRA BoB BoI IOB PSB PNB ORIENTAL	CORP INDIAN

In addition, as indicated by the spread of banks at the end of March 2007, when banks were to adopt the additional regulatory capital requirement for Operational Risk under the Basic Indicators Approach, regulatory Tier I capital adequacy would be below 6% for 6 of the 19 nationalized banks while nearly 10 of the 19 nationalized banks would have comfortable levels of Tier I capital (greater than 7%). A worrying scenario in the nationalized banks in 2008 is observed for the Bank of Maharashtra and UCO Bank whose Tier I capital would be below 5% and two other banks – Central Bank of India and Vijaya Bank – would have a Tier I capital in the range of 5-6%.

Annexure VIII contains a graphical presentation of the Operational Risk capital charge and the impact on Tier I capital at an individual bank level for nationalized banks

Table 4B. Impact of Operational Risk Capital Charge on Tier I Capital
Basic Indicators Approach - State Bank Group

Tier I Capital					
Year	*Below 5%*	*Between 5-6%*	*Between 6-7%*	*Between 7-9%*	*Above 9%*
2005		SB-IND SBT	SBH SBM	SBI SBBJ SBS	SBP
2006			SB-IND SBM SBT	SBI SBBJ SBH SBS	SBP
2007		SBM	SB-IND SBT	SBI SBBJ SBH SBP SBS	
2008		SBM	SBBJ SBH SB-IND SBP SBT	SBI SBS	

Table 4C. Impact of Operational Risk Capital Charge on Tier I Capital
Basic Indicators Approach – Axis Bank, HDFC Bank and ICICI Bank

Tier I Capital					
Year	*Below 5%*	*Between 5-6%*	*Between 6-7%*	*Between 7-9%*	*Above 9%*
2005				AXIS ICICI	HDFC
2006			AXIS	HDFC ICICI	
2007			AXIS	HDFC ICICI	
2008					AXIS HDFC ICICI

Table 4B presents a similar spread for the State Bank of India and its associate banks. The State Bank of India and some of its associate banks like the State Bank of Saurashtra, the State Bank of Bikaner and Jaipur, State Bank of Hyderabad and the State Bank of Patiala, have shown comfortable levels of capital adequacy under Tier I capital in 2007. At the end of March 2008, though, only two banks in the State Bank group viz. the State Bank of India and the State Bank of Saurashtra show comfortable levels of Tier I capital greater than 7% while 5 of the associate banks have Tier I levels in the range of 6%-7%. The State Bank of Mysore is the lone associate bank of the State Bank group to have a Tier I capital of less than 6% after the implementation of the Operational Risk capital charge in 2007.

Table 4C gives the similar spread for the 3 major new private sector banks considered in this paper. With the exception of Axis Bank in 2007, all banks have a Tier I capital greater than 9% after accounting for the capital requirement under Operational Risk.

(ii) *The Standardized Approach*

We attempt to provide an estimate for Operational Risk capital charge under the Standardized Approach (SA) (though it is not to be adopted and is the second in the spectrum of approaches suggested by the Basel II Accord). This approach is a refinement of the Basic Indicators Approach and under this approach a bank's business is divided into eight business lines and different percentages ? are applied to each business line's gross income so as to arrive the Operational Risk capital charge. Operational Risk under the SA is sensitive to the decomposition of income from different business lines.

Data constraints limit the computation of the Operational Risk capital charge under this approach to 2007 and 2008 for banks group-wise, namely, nationalized banks, the State Bank group and private sector (old and new) banks. Under the SA, a bank's business lines can be broadly classified into 3 major lines – Investment Banking, Banking and Others. Each of these 3 lines at Level 1 are, in turn, decomposed into the following (for details on Activity groups corresponding to each business line see Annexure II).

Investment Banking – (i) Corporate Finance (ii) Trading &Sales

Banking – (i) Retail Banking (ii) Commercial Banking (iii) Payment & Settlement and (iv) Agency Services

Others – (i) Asset Management (ii) Retail Brokerage and (iii) Insurance.

For most banks in India, a one-to-one correspondence with these business lines in terms of data availability is difficult. For instance, income from payment and settlement and agency services is included under Commission, Brokerage and Exchange, an item under Other Income in a bank's Profit & Loss account. Further, most banks undertake asset management and insurance as joint ventures and the income from this activity could be reflected to an extent under the item Income from Investments under Interest Earned in a bank's Profit and Loss account. Consequently, the estimation of Operational Risk capital charge has been restricted to Level 1 and the following heads of activity have been considered, viz. (i) corporate finance (ii) trading and sales under investment banking; (iii) Retail Banking and (iv) Commercial Banking under Banking. It is appropriate, here, to discuss the correspondence between the income from the different activity groups of a bank and available data. Data on income from corporate finance is the income a bank obtains from investments and other income, while income from trading and sales is the profit a bank makes from the sale of land, sale of investment assets and sale of foreign exchange, income from commission and brokerage and net repo income of the bank. Net repo income is the difference between interest earned on balances with the RBI and other inter-bank funds and the interest expended on borrowings from the RBI and other inter- bank funds. Some computations had to be undertaken to derive the income from retail and commercial banking and is obtained as under:

Income from Retail Banking = credit outstanding against each occupation for individuals * the weighted average of lending rate for each of the occupations

Credit outstanding under commercial banking = Total credit outstanding for each occupation – credit outstanding against individuals

Income from commercial banking = credit outstanding under commercial banking activity * by the weighted average of lending rate for each of the occupations

The Operational Risk capital charge is then obtained by applying the relevant Beta to the gross income from a particular business line. Table 5 presents the Operational Risk capital charge and its impact on Tier I capital at the level of the bank group viz. nationalized banks, the State Bank group and private sector (old and new) banks under the Standardized Approach).

Table 5. Operational Risk Capital Charge and Impact on Tier I Capital – Bank Group Wise (Standardized Approach)

Year	*Annual Capital Requirement (Rs.Crore)*	*Capital Charge (Rs. Crore)*	*Networth (Rs. Crore)*	*Current Tier I %*	*Estimated Tier I %*
Nationalised Banks					
2004	11273		51475	8.1	
2005	13144		61181	7.6	
2006	15292		71012	9.0	
2007	16261	13236	84385	8.5	7.2
2008	Na	14899	104325	7.5	6.4
State Bank Group					
2004	6524		27750	8.5	
2005	7302		32764	7.9	
2006	7857		37660	8.5	
2007	8241	7228	42942	7.7	6.4
2008	Na	7800	61706	7.2	6.3
Private Sector Banks					
2004	4332		22137	7.0	
2005	5280		26907	9.9	
2006	6880		33985	8.8	
2007	8473	5497	43812	8.1	7.1
2008	Na	6877	64647	10.3	9.2

The results of Table 5 indicate the additional capital requirement that has to be set aside by the different bank groups under the Standardized Approach would be higher than that estimated under the Basic Indicators Approach (Table 2). The pattern of capital requirements though remains similar to that under the Basic Indicators Approach, wherein the public sector banks would require a larger amount of additional capital requirements, with the nationalized banks required to set aside on an average nearly Rs.14,000 crores, the State Bank group on an average would need around Rs.7500 crores and the requirement for the private sector banks would be lower at around Rs.6000 on an average over 2007-08. Further, the estimated decline in the Tier I capital for all the bank groups studied is much greater than under the Basic Indicators Approach (Table2). Also, the extent of the impact is almost similar across the bank groups – the estimated Tier I capital after taking into consideration the Operational Risk capital charge is lower by 1% to 1.3% in 2007 and 2008.

IV.B Alternative Approaches

The alternative approaches, as discussed in Section II.B above, refer to the computation of the Operational Risk capital charges using the cost to asset and the cost to income ratios. Both these measures focus on the volatility of non-interest expenses. While the literature suggests the using of quarterly data, for comparison with the Basel II Approaches, the analysis has been done using annual data.

Tables 6A, 6B and 6C show the spread of banks across different ranges of Tier I capital, when the cost to asset ratio is used to compute the Operational Risk capital charge (Detailed results are in Annexure IV).

Table 6A underscores the severe impact of Tier I capital on the nationalized banks using the cost to asset ratio as a measure of the Operational Risk capital charge compared to that under the Basic Indicators Approach (see Table 4A). In 2005, the number of banks that had a Tier I capital below 6%, if we assumed the Operational Risk capital charge were applicable, remained the same at 9 banks as under the BIA the composition had reversed under the cost to asset ratio measure – 7 banks had Tier I capital below 5%, while 2 banks were in the 5%-6% range. Likewise, the performance for the later years also continued to reflect the severity.

Table 6A. Impact of Operational Risk Capital Charge on Tier I Capital
Cost to Asset Ratio - Nationalized Banks

	Tier I Capital				
Year	*Below 5%*	*Between 5-6%*	*Between 6-7%*	*Between 7-9%*	*Above 9%*
2005	ALLA CENTRAL DENA ORIENTAL PSB SYND UNION	BoM UCO	BoI CANARA INDIAN IOB	ANDHRA BoB PNB VIJAYA	CORP UNITED

Table contd...

Table contd...

2006	DENA PSB	BoI BoM CENTRAL SYND UNION	CANARA UCO	ALLA INDIAN IOB PNB UNITED	ANDHRA BOB CORP ORIENTAL VIJAYA
2007	CENTRAL DENA PSB SYND	BoI BoM UCO UNION VIJAYA	CANARA UNITED	ALLA ANDHRA BoB IOB ORIENTAL PNB	CORP INDIAN
2008	BoM CENTRAL VIJAYA	PSB SYND UCO UNION UNITED	ALLA CANARA DENA	ANDHRA BoB BoI CORP IOB ORIENTAL PNB	INDIAN

Some banks continued to be poor performers as regards Tier I capital (below 6%) using the cost to asset ratio viz Bank of Maharashtra, Central Bank of India, Dena Bank, Syndicate Bank, UCO Bank and Vijaya Bank. The surprise as indifferent performer under the cost to asset ratio has been Punjab and Sind Bank which has shown Tier I capital below 6%, while United Bank of India and Vijaya Bank showed a continuous decline in Tier I levels since 2005 to 2008. However, as compared to the State Bank group and the 3 leading new private banks, a substantial number of nationalized banks maintained a Tier I capital greater than 9% as can be seen from Tables 6B and 6C. Besides, the performance of some nationalized banks such as Andhra Bank, Allahabad Bank, Bank of Baroda, Corporation Bank, Oriental Bank of Commerce under the cost to asset approach for operational risk capital charge is similar to their performance under the Basic Indicators Approach.

The impact of the cost to asset ratio as a measure of determining Operational Risk capital charges on the regulatory Tier I capital for State Bank of India and its associates is in Table 6B and the impact has been extreme like that for the nationalized banks. There is no bank from the State Bank group that has a Tier I capital of above 9% while the State Bank of India, except for 2007, has had a relatively comfortable position on Tier I in the range of 7%-9%. The impact of the Operational Risk capital charge on Tier I capital for the associate banks in this group has been mixed. The associate banks that have scored badly on Tier I capital in this group (as compared to under BIA) have been the State Bank of Patiala whose Tier I capital has been declining since 2005 and the State Bank of Bikaner and Jaipur, while the State Bank of Mysore has worsened (as compared to the BIA) and its Tier I has consistently being below 5% under the cost to asset ratio measure.

The performance of the 3 major new private sector banks vis-à-vis Tier I capital is in Table 6C. The performance of HDFC Bank has been stable and its Tier I capital like under the BIA has been in the range of 7-9% while mixed performance is observed for Axis Bank and ICICI Bank.

Table 6B. Impact of Operational Risk Capital Charge on Tier I Capital Cost to Asset Ratio – State Bank Group

Tier I Capital					
Year	*Below 5%*	*Between 5-6%*	*Between 6-7%*	*Between 7-9%*	*Above 9%*
2005	SBM SBT SBH SBP SBS	SBBJ SBI-IND	SBI		

Table contd...

Table contd...

2006	SBM	SBBJ	SB-IND	SBI	
		SBT	SBP	SBH	
				SBS	
2007	SBBJ	SBP	SBI	SBH	
	SBM		SB-IND		
			SBS		
			SBT		
2008	SBBJ		SBH	SBI	
	SBM		SB-IND		
	SBP		SBS		
			SBT		

Table 6C. Impact of Operational Risk Capital Charge on Tier I Capital Cost to Asset Ratio – Axis Bank, HDFC Bank and ICICI Bank

Tier I Capital					
Year	*Below 5%*	*Between 5-6%*	*Between 6-7%*	*Between 7-9%*	*Above 9%*
2005			ICICI	AXIS	
				HDFC	
2006			AXIS	HDFC	
				ICICI	
2007		AXIS	ICICI	HDFC	
2008				AXIS	
				HDFC	ICICI

The second alternative approach adopted to estimate the operational risk capital charge is the cost to income ratio. Tables 7A, 7B and 7C highlight the impact on the Tier I capital of nationalised banks, the State Bank and its associate banks and the three leading private sector banks. (Detailed Results are in Annexure V).

Table 7A. Impact of Operational Risk Capital Charge on Tier I Capital Cost to Income Ratio – Nationalised Banks

Tier I Capital					
Year	*Below 5%*	*Between 5-6%*	*Between 6-7%*	*Between 7-9%*	*Above 9%*
2005	ALLA	BoI	ANDHRA	BoB	CORP
	CENTRAL	BoM	CANARA	PNB	UNITED
	DENA	IOB	INDIAN		
	ORIENTAL	UNION			
	PSB	VIJAYA			
	SYND				
	UCO				
2006	CENTRAL	BoI	CANARA	ALLA	ANHDRA
	DENA	SYND	PSB	INDIAN	BoB
	PSB		UNION	IOB	CORP
	UCO		VIJAYA	ORIENTAL	
				PNB	
				UNITED	
				VIJAYA	

Table contd...

Table contd...

2007	BoM CENTRAL DENA UCO	BoI SYND	CANARA PSB UNION VIJAYA	ALLA BoB IOB ORIENTAL PNB UNITED	ANDHRA CORP INDIAN
2008	BoM CENTRAL UCO	SYND UNITED VIJAYA	BoI CANARA DENA IOB PSB UNION	ALLA ANDHRA BoB CORP INDIAN PNB ORIENTAL	

The distribution of nationalised banks (Table 7A) for Tier I regulatory capital maintained is similar to that under the cost to asset ratio more so in the range below 5% and above 7% of Tier I capital, while some changes are observed for the middle range of 5-7% of Tier I. While Central Bank of India continues to score poorly under the cost to income measure, its Tier I capital is the lowest in the range of 1.30 to 3.57%. The other banks that have not fared well continue to be Dena Bank, Bank of Maharashtra, UCO Bank, Syndicate Bank.

Table 7B highlights the performance of the State Bank group where the performance is substantially varied from that under the cost to asset approach as well as the BIA. The State Bank of India's Tier I capital (between 6-7%) under the cost to income approach is lower as compared to the other approaches, while that of the State Bank of Bikaner and Jaipur matches its Tier I capital with that under the BIA markedly different from that under the cost to asset approach. The State Bank of Mysore also fares better as compared to the other two approaches.

Table 7B. Impact of Operational Risk Capital Charge on Tier I Capital
Cost to Income Ratio – State Bank Group

Tier I Capital					
Year	*Below 5%*	*Between 5-6%*	*Between 6-7%*	*Between 7-9%*	*Above 9%*
2005	SB-IND SBT	SBH	SBI SBM SBS	SBBJ SBP	
2006		SBT	SB-IND SBM	SBI SBBJ SBH SBS SBP	
2007	SBI		SBBJ SB-IND SBM SBP SBT	SBH SBS	
2008		SBI SBBJ SBM	SBH SB-IND SBP SBT		

Table 7C contains the results for the three major new private sector banks and it can be observed that under the cost to income approach as compared to the other two approaches – BIA and cost to assets, HDFC Bank shows a Tier I capital below 7% in 2006 and 2007. ICICI Bank continues to have a Tier I capital greater than 9%.

Table 7C. Impact of Operational Risk Capital Charge on Tier I Capital
Cost to Income Ratio (Axis Bank, HDFC Bank and ICICI Bank)

Tier I Capital					
Year	*Below 5%*	*Between 5-6%*	*Between 6-7%*	*Between 7-9%*	*Above 9%*
2005			ICICI	AXIS	
				HDFC	
				ICICI	
2006		AXIS	HDFC	ICICI	
2007		AXIS	HDFC	ICICI	
2008				AXIS	
				HDFC	ICICI

Thus, a comparison of the estimates of the impact of the additional operational risk capital charges on the Tier I capital of individual banks across the different approaches and bank groups indicates that some banks would continue to be comfortable and maintain high levels of Tier I capital (above 7%) after the imposition of the additional capital requirements especially for end March 2007 and 2008, namely, Andhra Bank, Bank of Baroda, Corporation Bank, Oriental Bank of Commerce, Punjab National Bank, State Bank of India (except under the cost to income approach). Canara Bank continued to maintain a Tier I capital between 6%-7% under all approaches, while the estimates for Bank of Maharashtra, Central Bank of India , UCO Bank and State Bank of Mysore show a Tier I capital below 6% under all the three approaches. Among the three new private sector banks considered, Axis Bank showed improved levels of Tier I capital under all the three approaches in 2008 as compared to 2007 and the Tier I capital of HDFC Bank is higher than 7% except for the cost to income approach where it was between 6-7%. Likewise ICICI Bank has been well capitalized and has had a Tier I capital greater than 7% except for 2007 under the cost to asset approach when its Tier I was between 6-7%. Annexure IX presents a graphical comparison at the individual bank level for the broad spectrum of 30 banks covering the nationalized banks, State Bank of India and its associate banks and three new private sector banks of the impact of the Operational Risk capital charge on the Tier I capital under the Basic Indicators Approach, the cost to asset ratio, and the cost to income ratio.

IV.C Sensitivity Analysis

This section estimates the sensitivity of a bank's gross income to gross income from a particular business line at Level 1 of the classification of business activity for a bank as specified under the Standardized Approach. In other words it is the amount of change in gross earnings given a unit change in the earnings from a single business line with all else held constant. Sensitivity analysis, thus, helps identify the business line/activity to which a bank's income is most sensitive.

Sensitivity analysis, thus, is the partial derivative of the earnings function with respect to a factor. It can be defined as:

$$\Delta E/\Delta X = \delta f/\delta x$$

where E – gross income of a bank X – income from a particular business line.

Sensitivity analysis has been performed using the standard elasticity approach by calculating the average elasticity of the change in a bank's gross income to a change in income from a particular business line. While panel data analysis is better suited to derive the sensitivity coefficients, the lack of a sufficient number of data points restricts the use of the panel data technique to ensure the reliability of our estimates. Besides, the sensitivity analysis could be estimated at the level of the bank group rather than at an individual bank level, as data on income from retail and commercial banking which was computed under the Standardized Approach, was available at the level of bank group. Table 8 presents the results of the sensitivity analysis for activities under Level 1 of the Standardized Approach (restricted in this study to just income from corporate finance, trading & sales, retail banking and commercial banking, since availability of data with a one to one correspondence for the 8 business lines specified under the SA is difficult) and within trading & sales income sensitivity to income from foreign exchange transactions and commission & brokerage.

Table 8. Sensitivity Analysis for 2005-2007: Bank Group-wise

Bank Group	*Corporate Finance*	*Trading & Sales*	*Retail Banking*	*Commercial Banking*	*Foreign Exchange*	*Comm. & Brokerage*
Nationalised	2.3912	0.2884	-0.6337	0.6390	0.2446	0.3137
State Bank	0.2562	-0.1642	0.1834	0.0229	0.7039	0.4092
Private	0.1795	0.6910	0.6789	-4.4634	0.5526	0.4993

The results of the sensitivity analysis present a mixed scenario for the three bank groups considered – nationalized banks, State Bank group and private sector banks (old and new). All the three bank groups show the existence of a positive relationship between the gross income of a bank and the income from corporate finance. Nationalized banks show a very high degree of elasticity with reference to corporate income. A percentage change in corporate income increases gross income by almost 2.3%, while for the State Bank group and the private banks (old and new) this coefficient is comparatively smaller and a percentage increase in income from corporate finance brings about a 0.25% and 0.18% increase in gross income respectively. The sensitivity of gross income to income from trading and sales is the highest for the private bank group indicating that a 1% increase in income from trading and sales would have an impact of increasing gross income by about 0.69%, while for the nationalized banks it was comparatively lower at 0.28%. The State Bank and its associate banks surprisingly have a negative coefficient but this could be explained by the fall in the income from trading & sales since 2005 for the State Bank group from a high of Rs.12858 crores in 2004 to Rs.10392 crores in 2005 and a further decline to Rs.9911 crores in 2007. This fall in income from trading and sales can be attributed to a fall in the profit from the sale of investments and a decline in net repo income. The estimate for net repo income would also include income from the inter-bank funds market. The sensitivity of income from retail banking is the highest for the private bank group at 0.68% followed by the State Bank group where a 1% increase in income from retail banking brings about only about less than a quarter percent increase in gross income. The high negative coefficient for the nationalized banks for retail banking income seems unexpected and may perhaps be attributed to the high proportion of credit outstanding to agriculture, large credit outstanding of less than Rs.2 lakhs and other social objectives such as priority sector lending where recovery is slow. These factors may also explain the substantial difference in the sensitivity coefficients observed between the State Bank group and the private sector banks. The sensitivity of the gross income to income from commercial banking is the highest for the nationalized banks at 0.64, whereas the sensitivity is much lower for the State Bank group at 0.02, while the private banks are described by a negative coefficient on sensitivity to income from commercial banking. The private sector banks have seen a decline in income from commercial banking since 2005 and income from commercial banking in 2007 was almost half at Rs.5935 crores as compared to 2006. Within trading and sales, we have further looked at sensitivity of gross income to two major sources of income for a bank, namely foreign exchange transactions and commissions and brokerage. All the three bank groups studied showed a positive sensitivity to income from both these business activities. The sensitivity for both these business activities for the private sector banks was in the range of 0.49 to 0.55 implying thereby that a one percent increase in income from these activities would reflect in about half a percent increase in gross income of the banks. The State Bank of India and its associate banks showed a high sensitivity of nearly 0.70 for foreign exchange transactions and 0.40 on commission and brokerage, while the nationalized banks had the lowest sensitivity coefficients. The gross income for all the bank groups is sensitive to income from foreign exchange transactions, but this sensitivity at 0.77% is the highest for the private banks followed by the State Bank group and the nationalized banks. A similar pattern is observed on the sensitivity of gross income to income from commission and brokerage.

V. Conclusion

Operational Risk, thus, generates potential losses and this potential loss can be viewed as a cost to the bank. While Operational Risk exists and needs to be priced appropriately, there is a view among practitioners and analysts (Webb, 1999) that the focus should be on the elimination of Operational Risk rather than a focus on its measurement. However, in practice, the costs involved in the elimination of Operational Risk could be substantially higher than the probability of a loss event actually occurring. Also, it may not be feasible to foresee all the potential future loss events. Most of the banks in India are operating at capital adequacy ratios higher that the prescribed Basel II requirements. Still, overall capital requirements are expected to go up on account of Operational Risk (Reserve Bank of India, 2008B). The paper focuses on

the measurement of the Operational Risk capital charges that banks in India have to incorporate from 31st March 2007 and the impact of this additional capital requirements on the regulatory Tier I capital of banks. The paper estimates Operational Risk capital charges and its Tier I impact at the level of the bank group and for individual banks according to the availability of data. At the level of individual banks, the paper covers 30 banks – 19 nationalized banks, 8 banks of the State Bank group and 3 leading new private sector banks – Axis Bank, HDFC Bank and ICICI Bank over the period since 2005. We compute Operational Risk capital charges using two of the Basel II Approaches, namely, the Basic Indicators Approach (at the bank group as well as individual bank level) and the Standardized Approach (at the level of bank groups) and alternate approaches using the cost to income and cost to asset ratios. The additional capital requirements on account of the Operational Risk capital charges for the Indian banking sector excluding foreign banks in India would be to the tune of about Rs.14,058 crores at the end of March 2007 and Rs.15,427 crores in March 2008. This requirement is estimated to be Rs.17,647 crores for March 2009 under the Basic Indicators Approach. Of this requirement, approximately 80% would be needed by the public sector banks. The empirical estimates reveal the introduction of the Operational Risk capital charges that will have the expected impact of lowering the Tier I capital, but this decline would be marginal under the Basic Indicators Approach. Also, in 2007 and 2008 nearly 10 of the 19 nationalized banks will have a Tier I capital above 7%. The State Bank group, though, would show a fewer number of associate banks with a Tier I capital higher than 7% in 2008 as compared to 2007. While the State Bank of India would continue to be in the range of 7%-9% of Tier I capital in both 2007 and 2008, the only associate bank in the same range would be the State Bank of Saurashtra. All the three private sector banks would have a Tier I capital higher than 7% after the introduction of the additional capital requirement for Operational Risk. Compared to the Basic Indicators Approach, under the Standardized Approach, the nationalized banks would be required to set aside, on an average, nearly Rs.14,000 crores and the State Bank group, on an average, would need around Rs.7500 crores and the requirement for the private sector banks would be lower at around Rs. 6000, on an average, over 2007-08. Further, Tier I capital would be lower for all bank groups under the Standardized Approach as compared to the Basic Indicators Approach. The alternate approaches which use the cost to income and cost to assets ratio for determining the Operational Risk capital charges show a markedly different picture for Tier I capital. Under the BIA, there were no banks in the Tier I range below 5% in 2007 and in 2008 only two nationalized banks i.e. Bank of Maharashtra and UCO Bank were in this category - whereas there are at least 3 nationalized banks and 2-3 associate banks of the State Bank group with a Tier I capital lower than 5% under the alternate approaches.

A comparison of the estimates of the impact of the additional Operational Risk capital charges on the Tier I capital of individual banks across the different approaches indicates that some banks would continue to be good performers and maintain a high level of Tier I capital (above 7%) viz. Andhra Bank, Bank of Baroda, Corporation Bank, Oriental Bank of Commerce, Punjab National Bank, State Bank of India (except under the cost to income approach). Canara Bank would maintain a Tier I capital between 6%-7% under all approaches while the estimates for Bank of Maharashtra, Central Bank of India, UCO Bank and State Bank of Mysore show a Tier I capital below 6% under all the three approaches. Among the three new private sector banks considered, Axis Bank showed improved levels of Tier I capital under all the three approaches in 2008 as compared to 2007, while HDFC Bank and ICICI Bank continue to be well-capitalized. The low Tier I levels of some of the nationalized banks (not taking into account the Operational Risk capital charge) has resulted in the government agreeing to infuse capital in UCO Bank, Central Bank of India and Vijaya Bank to the tune of Rs.38 billion through investment in shares in February and for United Bank of India to the tune of Rs.800 crores in two tranches until March 2010. Apart from the measurement of Operational Risk capital charges and their impact on Tier I, the paper has computed some preliminary estimates of the sensitivity of gross income of a bank to the income from different business lines. Sensitivity analysis will, thus, help identify the potential sources of Operational Risk for a bank.

Finally, the best approach to the appropriate pricing of Operational Risk would be the Advanced Management Approach which requires a bank to review its history of operational loss events and create a database wherein every loss event, the frequency of its occurrence, and the size of the loss is recorded. Such an approach could result in developing key risk indicators that could signal the occurrence of a loss event and banks would have the discretion to use their own internal loss data and be encouraged to develop sophisticated risk measurement and risk management techniques.

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ANNEXURE I

LIST OF ABBREVIATIONS

Abbreviation	Bank Name
ALLA	Allahabad Bank
ANDHRA	Andhra Bank
BoB	Bank of Baroda
BoI	Bank of India
BoM	Bank of Maharashtra
CANARA	Canara Bank
CENTRAL	Central Bank of India
CORP	Corporation Bank
DENA	Dena Bank
INDIAN	Indian Bank
IOB	Indian Overseas Bank
ORIENTAL	Oriental Bank of Commerce
PSB	Punjab and Sind Bank
PNB	Punjab National Bank
SYND	Syndicate Bank
UCO	UCO Bank
UNION	Union Bank
UNITED	United Bank of India
VIJAYA	Vijaya Bank
SBI	State Bank of India
SBBJ	State Bank of Bikaner and Jaipur
SBH	State Bank of Hyderabad
SB-IND	State Bank of Indore
SBM	State Bank of Mysore
SBP	State Bank of Patiala
SBS	State Bank of Saurashtra
SBT	State Bank of Travancore

ANNEXURE II

Mapping of Business Lines under Standardized Approach

Business Unit	*Level 1*	*Level 2*	*Activity Groups*
Investment Banking	Corporate Finance	Corporate Finance	Mergers & Acquisitions, Underwriting,
		Municipal/Government Finance	Privatisations, Securitisation, Research, Debt
		Merchant Banking	(Government, High Yield), Equity,
		Advisory Services	Syndications, IPO, Secondary Private Placements
	Trading & Sales	Sales	Fixed Income, Equity, Foreign Exchanges,
		Market Making	Commodities, Credit, Funding, Own Position
		Proprietary Positions	Securities, Lending and Repos, Brokerage, Debt,
		Treasury	Prime Brokerage
	Retail Banking	Retail Banking	Retail Lending and Deposits, Banking Services, Trust and Estates
		Private Banking	Private Lending and Deposits, Banking Services, Trust and Estates, Investment Advice
		Card Services	Merchant/Commercial/Corporate Cards, Private Labels and Retail
Banking	Commercial Banking	Commercial Banking	Project Finance, Real Estate, Export Finance, Trade Finance, Factoring, Leasing, Lends, Guarantees, Bills of Exchange
	Payment & Settlement	External Clients	Payments & Collections, Funds Transfer, Clearing & Settlement
	Agency Services	Custody	Escrow, Depository Receipts, Securities Lending (Customers) Corporate Actions
		Corporate Agency	Issuer and Paying Agents
		Corporate Trust	
	Asset Management	Discretionary Fund Management	Pooled, Segregated, Retail, Institutional, Closed, Open, Private Equity
		Non-Discretionary Fund Management	Pooled, Segregated, Retail, Institutional, Closed, Open
Others	Retail Brokerage	Retail Brokerage	Execution and Full Service
	Insurance	Life Insurance and Benefit Plans	
		Property and Casualty Insurance	
		Health Insurance	
		Reinsurance	
		Brokerage & Advisory	

Source: Consultative Document on Operational Risk, BCBS, 2001

ANNEXURE III

Basic Indicators Approach

Bank-wise Operational Risk Capital Charge and Impact on Tier I Capital –
(Nationalized Banks, State Bank Group & Axis Bank, HDFC Bank & ICICI Bank)

Year	*Gross Income (Rs. Crore)*	*Annual Capital Required (Rs. Crore)*	*Capital Charge (Rs. Crore)*	*Networth (Rs. Crore)*	*Current Tier I (%)*	*Estimated Tier I Capital (%)*
Allahabad Bank						
2002	1116	167		1002	6.22	
2003	1433	215		1190	6.35	
2004	1836	275		1552	6.26	
2005	2004	301	219	2328	6.46	5.85
2006	2059	309	264	3639	9.53	8.84
2007	2127	319	295	4477	8.10	7.57
2008	2637	396	310	5221	7.75	7.29
2009			341			
Andhra Bank						
2002	880	132		884	8.80	
2003	1357	204		1116	8.19	
2004	1588	238		1453	8.17	
2005	1822	273	191	1837	8.03	7.19
2006	1561	234	238	2894	12.20	11.20
2007	1864	280	249	3156	9.98	9.19
2008	2001	300	262	3249	8.54	7.85
2009			271			
Bank of Baroda						
2002	2873	431		3827	7.56	
2003	3366	505		4387	8.10	
2004	4291	644		5131	8.47	
2005	4284	643	527	5628	8.21	7.44
2006	4301	645	597	7845	10.98	10.14
2007	4959	744	644	8650	8.74	8.09
2008	5962	894	677	11044	7.63	7.16
2009			761			
Bank of India						
2002	2943	441		2845	6.37	
2003	3678	552		3541	7.56	
2004	3994	599		4010	7.47	
2005	3393	509	531	4465	7.05	6.21
2006	3816	572	553	4984	6.75	6.00
2007	5003	750	560	5895	6.54	5.92
2008	6346	952	611	10589	7.70	7.26
2009			758			

Table contd...

Table contd...

Bank of Maharashtra						
2002	895	134		698	6.56	
2003	1037	156		981	5.88	
2004	1236	185		1436	7.03	
2005	1267	190	158	1543	7.10	6.37
2006	1023	153	177	1573	7.47	6.63
2007	1359	204	176	1742	6.03	5.42
2008	1509	226	182	1782	5.13	4.60
2009			195			
Canara Bank						
2002	3250	488		3472	8.07	
2003	3745	562		4149	7.85	
2004	4755	713		5252	7.81	
2005	4694	704	588	6109	7.29	6.59
2006	4898	735	660	7132	7.81	7.09
2007	5478	822	717	10354	7.17	6.67
2008	5751	863	754	10500	7.01	6.51
2009			806			
Central Bank of India						
2002	2135	320		1997	5.20	
2003	2451	368		2424	5.66	
2004	3086	463		2974	6.23	
2005	3294	494	384	3265	6.08	5.37
2006	2911	437	442	3442	7.19	6.27
2007	2950	443	465	3790	6.32	5.55
2008	3014	452	458	5943	5.42	5.00
2009			444			
Corporation Bank						
2002	1008	151		2046	16.80	
2003	1325	199		2370	17.30	
2004	1481	222		2768	16.52	
2005	1695	254	191	3054	13.55	12.70
2006	1700	255	225	3374	12.41	11.58
2007	1944	292	244	3765	11.30	10.57
2008	2144	322	267	4228	9.64	9.03
2009			289			
Dena Bank						
2002	795	119		977	4.36	
2003	1005	151		999	5.31	
2004	1209	181		1055	5.19	
2005	997	150	150	1104	6.63	5.73
2006	1162	174	161	1339	5.96	5.25
2007	1248	187	168	1497	6.06	5.38
2008	1337	201	170	1801	6.75	6.11
2009			187			

Indian Bank						
2002	1033	155		4185	0.85	
2003	1345	202		5130	7.51	
2004	1864	280		5538	7.66	
2005	1873	281	212	5936	7.60	7.33
2006	1974	296	254	2492	10.29	9.24
2007	2605	391	286	3841	12.28	11.37
2008	3060	459	323	5211	11.41	10.70
2009			382			
Indian Overseas Bank						
2002	1501	225		1133	6.17	
2003	1742	261		1460	5.83	
2004	2340	351		2081	6.74	
2005	2654	398	279	2575	7.10	6.33
2006	2608	391	337	3178	8.54	7.63
2007	2948	442	380	3991	8.20	7.42
2008	3487	523	411	4857	7.86	7.20
2009			452			
Oriental Bank of Commerce						
2002	1446	217		1621	8.89	
2003	1746	262		2110	10.72	
2004	2178	327		2677	9.87	
2005	2029	304	269	3327	5.42	4.98
2006	2158	324	298	5171	10.37	9.77
2007	2294	344	318	5601	10.05	9.48
2008	2299	345	324	5776	9.34	8.82
2009			338			
Punjab & Sind Bank						
2002	545	82		502	6.37	
2003	693	104		489	6.11	
2004	749	112		467	6.38	
2005	829	124	99	440	5.26	4.07
2006	751	113	114	1222	10.05	9.12
2007	995	149	116	1406	9.58	8.79
2008	1103	165	129	2093	8.04	7.55
2009			142			
Punjab National Bank						
2002	3273	491		3381	6.34	
2003	4374	656		4033	7.11	
2004	5492	824		5012	7.01	
2005	5683	852	657	8161	8.87	8.16
2006	5941	891	777	9376	10.06	9.23
2007	6556	983	856	10435	8.93	8.20
2008	7532	1130	909	12318	8.52	7.89
2009			1001			

Table contd...

Table contd...

Syndicate Bank						
2002	1383	207		1683	8.47	
2003	1705	256		1614	7.69	
2004	2205	331		1905	6.75	
2005	2284	343	265	2199	6.10	5.37
2006	2442	366	310	2834	7.40	6.59
2007	2768	415	347	3623	6.24	5.64
2008	2962	444	375	4291	6.62	6.04
2009			409			
UCO Bank						
2002	1313	197		2762	4.89	
2003	1491	224		1214	5.19	
2004	1819	273		1783	6.08	
2005	1925	289	231	2069	5.75	5.11
2006	1940	291	262	2462	6.09	5.44
2007	2138	321	284	2662	5.78	5.16
2008	2260	339	300	2926	5.05	4.53
2009			317			
Union Bank of India						
2002	1836	275		2107	6.16	
2003	2323	348		2607	6.86	
2004	2567	385		3087	6.47	
2005	2831	425	336	3614	6.07	5.51
2006	2869	430	386	4558	7.32	6.70
2007	3477	522	413	5190	7.79	7.17
2008	4173	626	459	7348	7.45	6.98
2009			526			
United Bank of India						
2002	996	149		1964	8.84	
2003	1147	172		1962	12.63	
2004	1286	193		1960	15.04	
2005	1393	209	171	1957	14.15	12.91
2006	1457	219	191	1828	10.01	8.96
2007	1498	225	207	2415	7.72	7.06
2008	1370	206	217	2661	6.74	6.19
2009			216			
Vijaya Bank						
2002	674	101		781	8.86	
2003	990	149		962	7.42	
2004	1364	205		1336	8.37	
2005	1338	201	151	1590	7.59	6.87
2006	1257	189	185	1670	9.26	8.24
2007	1347	202	198	1897	7.07	6.33
2008	1362	204	197	2460	5.73	5.27
2009			198			

State Bank of India						
2002	13255	1988		15224	9.22	
2003	15718	2358		17203	8.81	
2004	18798	2820		20231	8.34	
2005	8515	1277	2389	24072	8.04	7.24
2006	8994	1349	2152	27644	9.36	8.63
2007	21823	3273	1815	31298	8.01	7.55
2008	25716	3857	1967	49032	8.48	8.14
2009			2827			
State Bank of Bikaner & Jaipur						
2002	791	119		752	9.22	
2003	891	134		903	8.81	
2004	1208	181		1149	8.34	
2005	1352	203	145	1298	8.04	7.14
2006	1241	186	173	1406	9.36	8.21
2007	1432	215	190	1654	8.01	7.09
2008	1411	212	201	1713	6.95	6.13
2009			204			
State Bank of Hyderabad						
2002	1014	152		998	9.86	
2003	1209	181		1251	9.84	
2004	1548	232		1574	8.42	
2005	1384	208	189	1765	7.58	6.77
2006	1553	233	207	2114	8.95	8.07
2007	1811	272	224	2541	8.25	7.52
2008	1790	269	237	2694	7.24	6.60
2009			258	1317	7.01	5.64
State Bank of Indore						
2002	567	85		413	8.15	
2003	669	100		584	9.40	
2004	814	122		791	8.31	
2005	680	102	103	904	6.67	5.91
2006	787	118	108	1018	7.55	6.75
2007	800	120	114	1177	6.74	6.09
2008	883	132	113	1317	7.01	6.41
2009			124			
State Bank of Mysore						
2002	548	82		352	6.70	
2003	680	102		431	7.23	
2004	794	119		582	7.18	
2005	931	140	101	756	7.12	6.17
2006	948	142	120	935	7.44	6.48
2007	1034	155	134	1141	6.62	5.84
2008	1184	178	146	1378	6.54	5.85
2009			158			

Table contd...

Table contd...

State Bank of Patiala						
2002	921	138		1142	9.97	
2003	1135	170		1412	10.39	
2004	1452	218		1731	9.87	
2005	1332	200	175	2045	11.05	10.10
2006	1344	202	196	2235	9.96	9.09
2007	1447	217	206	2488	8.36	7.67
2008	1486	223	206	2459	6.74	6.17
2009			214			
State Bank of Saurashtra						
2002	453	68		568	12.11	
2003	534	80		625	11.66	
2004	710	107		767	10.99	
2005	641	96	85	794	8.68	7.75
2006	584	88	94	977	9.02	8.15
2007	575	86	97	1043	8.17	7.41
2008	571	86	90	1145	8.06	7.43
2009			87			
State Bank of Travancore						
2002	655	98		618	7.79	
2003	822	123		731	6.80	
2004	1153	173		925	6.23	
2005	1305	196	132	1130	6.17	5.45
2006	1307	196	164	1332	7.24	6.35
2007	1356	203	188	1599	7.55	6.66
2008	1446	217	198	1718	6.94	6.14
2009			205			
Axis Bank						
2002	616	92		694	6.42	
2003	733	110		1040	6.44	
2004	1106	166		1138	6.44	
2005	1147	172	123	2422	8.87	8.42
2006	1808	271	149	2886	7.26	6.88
2007	2577	387	203	3403	6.42	6.04
2008	4381	657	277	8769	10.17	9.85
2009			438			
HDFC Bank						
2002	962	144		2132	10.81	
2003	1304	196		2608	9.49	
2004	1818	273		2694	8.03	
2005	2428	364	204	4520	9.60	9.17
2006	3669	550	278	5299	8.55	8.10
2007	5226	784	396	6433	8.57	8.04
2008	7511	1127	566	11497	10.30	9.79
2009			820			

ICICI Bank						
2002	1168	175		6618	7.47	
2003	4583	687		7289	7.05	
2004	4944	742		8360	6.09	
2005	6255	938	535	12900	7.59	7.28
2006	8890	1334	789	22556	9.20	8.88
2007	12565	1885	1004	24663	7.42	7.12
2008	16115	2417	1386	46821	11.32	10.99
2009			1879			

Note: Net worth of a bank is computed as per the Reserve Bank of India's definition which is as follows: *Net worth would comprise of Paid-up capital plus Free Reserves including Share Premium but excluding Revaluation Reserves, plus Investment Fluctuation Reserve and credit balance in Profit & Loss account, less debit balance in Profit and Loss account, Accumulated Losses and Intangible Assets. No general or specific provisions should be included in computation of net worth. Infusion of capital through equity shares, either through domestic issues or overseas floats after the published balance sheet date, may also be taken into account for determining the ceiling on exposure to capital market.*

(i) Gross Income = Net Interest Income + Non-Interest Income
(ii) Impact on Tier I capital = capital charge/networth
(iii) Estimated Tier I = (1-impact on Tier I capital)* current Tier I

These definitions are adopted in all relevant calculations.

ANNEXURE IV

Cost-Asset Ratio

Bank-Wise Operational Risk Capital Charge and Impact on Tier I Capital –
(Nationalized Banks, State Bank Group & Axis Bank, HDFC Bank & ICICI Bank)

Year	*Cost-Asset Ratio (%)*	*Average PSB (%)*	*Three standard deviations (%)*	*Total Assets (Rs. Crore)*	*Capital Charge (Rs. Crore)*	*Networth (Rs. Crore)*	*Current Tier I (%)*	*Estimated Tier I Capital (%)*
Allahabad Bank								
2005	2.37	2.09	2.53	45145	1142	2328	6.46	3.29
2006	1.87	2.05	1.36	55292	754	3639	9.53	7.56
2007	1.52	1.77	0.88	67664	598	4477	8.10	7.02
2008	1.4	1.54	0.72	82940	595	5221	7.75	6.87
Andhra Bank								
2005	2.53	2.09	1.13	3273	37	1837	8.03	7.87
2006	2.11	2.05	1.06	4067	43	2894	12.20	12.02
2007	1.96	1.77	1.02	47541	487	3156	9.98	8.44
2008	1.67	1.54	0.50	56592	286	3249	8.54	7.79
Bank of Baroda								
2005	2.09	2.09	0.27	94664	256	5628	8.21	7.84
2006	2.1	2.05	0.22	113393	248	7845	10.98	10.63
2007	1.78	1.77	0.11	143146	155	8650	8.74	8.58
2008	1.63	1.54	0.22	179600	394	11044	7.63	7.36
Bank of India								
2005	2.03	2.09	0.39	94978	373	4465	7.05	6.46
2006	1.88	2.05	0.50	112274	559	4984	6.75	5.99
2007	1.84	1.77	0.41	141637	581	5895	6.54	5.90
2008	1.48	1.54	0.41	178830	734	10589	7.70	7.17
Bank of Maharashtra								
2005	2.19	2.09	1.09	32885	358	1543	7.10	5.45
2006	2.11	2.05	1.03	31215	321	1573	7.47	5.95
2007	1.91	1.77	0.39	39009	151	1742	6.03	5.51
2008	1.74	1.54	0.53	48151	257	1782	5.13	4.39
Canara Bank								
2005	1.91	2.09	0.78	110305	865	6109	7.29	6.26
2006	1.77	2.05	0.95	132822	1263	7132	7.81	6.43
2007	1.55	1.77	0.85	165961	1405	10354	7.17	6.20
2008	1.55	1.54	0.76	180529	1364	10500	7.01	6.10
Central Bank of India								
2005	2.46	2.09	1.30	68596	892	3265	6.08	4.42
2006	2.3	2.05	1.09	74681	811	3442	7.19	5.50
2007	1.81	1.77	0.95	93008	885	3790	6.32	4.84
2008	1.41	1.54	0.60	123956	748	5943	5.42	4.74

Corporation Bank								
2005	1.97	2.09	1.13	33924	383	3054	13.55	11.85
2006	1.84	2.05	0.72	40507	293	3374	12.41	11.33
2007	1.52	1.77	0.74	52721	389	3765	11.30	10.13
2008	1.34	1.54	0.81	66598	541	4228	9.64	8.41
Dena Bank								
2005	2.56	2.09	1.17	24029	282	1104	6.63	4.93
2006	2.11	2.05	1.01	26545	268	1339	5.96	4.77
2007	1.94	1.77	1.07	31451	336	1497	6.06	4.70
2008	1.68	1.54	0.48	38642	187	1801	6.75	6.05
Indian Bank								
2005	2.08	2.09	1.09	43861	479	5936	7.60	6.99
2006	2.27	2.05	1.16	47635	552	2492	10.29	8.01
2007	2.22	1.77	1.06	56149	597	3841	12.28	10.37
2008	1.99	1.54	1.43	70508	1007	5211	11.41	9.20
Indian Overseas Bank								
2005	2.28	2.09	0.44	50815	225	2575	7.10	6.48
2006	2.13	2.05	0.46	59358	274	3178	8.54	7.80
2007	1.69	1.77	0.47	82257	386	3991	8.20	7.41
2008	1.46	1.54	0.29	101860	300	4857	7.86	7.38
Oriental Bank of Commerce								
2005	1.47	2.09	1.32	54069	711	3327	5.42	4.26
2006	1.64	2.05	0.87	58937	513	5171	10.37	9.34
2007	1.35	1.77	0.89	73936	659	5601	10.05	8.87
2008	1.19	1.54	0.74	90705	673	5776	9.34	8.25
Punjab & Sind Bank								
2005	3.63	2.09	5.15	15718	810	440	5.26	-4.42
2006	2.54	2.05	5.10	19043	971	1222	10.05	2.06
2007	2.38	1.77	3.66	21963	805	1406	9.58	4.10
2008	1.81	1.54	1.76	30949	543	2093	8.04	5.95
Punjab National Bank								
2005	2.6	2.09	1.15	126241	1447	8161	8.87	7.30
2006	2.08	2.05	1.11	145267	1610	9376	10.06	8.33
2007	2.05	1.77	1.24	162423	2007	10435	8.93	7.21
2008	1.77	1.54	0.77	199020	1535	12318	8.52	7.46
Syndicate Bank								
2005	2.43	2.09	2.14	52109	1114	2199	6.10	3.01
2006	2.35	2.05	1.15	61077	704	2834	7.40	5.56
2007	1.55	1.77	1.07	89277	954	3623	6.24	4.60
2008	1.4	1.54	0.84	107132	903	4291	6.62	5.23
UCO Bank								
2005	1.99	2.09	0.59	1085	6	2069	5.75	5.73
2006	1.9	2.05	0.46	1177	5	2462	6.09	6.08
2007	1.59	1.77	0.54	1193	6	2662	5.78	5.77
2008	1.45	1.54	0.53	1306	7	2926	5.05	5.04

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Union Bank								
2005	1.74	2.09	1.19	72413	859	3614	6.07	4.63
2006	1.57	2.05	1.46	89126	1304	4558	7.32	5.23
2007	1.44	1.77	1.44	102678	1480	5190	7.79	5.57
2008	1.28	1.54	1.35	124073	1679	7348	7.45	5.75
United Bank of India								
2005	2.42	2.09	1.16	29098	336	1957	14.15	11.72
2006	2.45	2.05	1.38	33248	458	1828	10.01	7.50
2007	1.84	1.77	1.11	42310	470	2415	7.72	6.22
2008	1.66	1.54	0.90	54311	488	2661	6.74	5.50
Vijaya Bank								
2005	1.84	2.09	1.55	2934	45	1590	7.59	7.37
2006	1.98	2.05	0.63	3153	20	1670	9.26	9.15
2007	1.54	1.77	0.74	42357	312	1897	7.07	5.91
2008	1.25	1.54	0.80	56184	449	2460	5.73	4.68
State Bank of India								
2005	2.19	2.09	0.39	459883	1778	24072	8.04	7.45
2006	2.37	2.05	0.72	494029	3569	27644	9.36	8.15
2007	2.09	1.77	0.98	566565	5570	31298	8.01	6.58
2008	1.75	1.54	1.06	721526	7636	49032	8.48	7.16
State Bank of Bikaner & Jaipur								
2005	2.66	2.09	1.58	23430	370	1298	8.04	5.75
2006	2.76	2.05	2.12	27514	583	1406	9.36	5.48
2007	2.18	1.77	2.12	34507	731	1654	8.01	4.47
2008	1.82	1.54	1.84	41154	756	1713	6.95	3.88
State Bank of Hyderabad								
2005	1.92	2.09	1.53	34922	534	1765	7.58	5.29
2006	2.01	2.05	1.06	40630	432	2114	8.95	7.12
2007	1.65	1.77	0.45	49052	220	2541	8.25	7.53
2008	1.3	1.54	0.58	61620	355	2694	7.24	6.29
State Bank of Indore								
2005	1.94	2.09	0.37	16898	62	904	6.67	6.21
2006	1.92	2.05	0.43	20711	90	1018	7.55	6.88
2007	1.67	1.77	0.47	24527	116	1177	6.74	6.08
2008	1.47	1.54	0.38	29275	111	1317	7.01	6.42
State Bank of Mysore								
2005	2.89	2.09	2.40	16553	397	756	7.12	3.38
2006	2.63	2.05	2.33	19337	451	935	7.44	3.85
2007	2.09	1.77	2.20	26843	591	1141	6.62	3.19
2008	1.87	1.54	1.57	33070	519	1378	6.54	4.08
State Bank of Patiala								
2005	1.52	2.09	1.86	31503	586	2045	11.05	7.88
2006	1.48	2.05	2.06	41233	849	2235	9.96	6.18
2007	1.39	1.77	1.89	47461	897	2488	8.36	5.35
2008	1.2	1.54	1.62	59060	958	2459	6.74	4.11

State Bank of Saurashtra								
2005	1.69	2.09	0.98	15053	148	794	8.68	7.06
2006	1.87	2.05	1.03	16530	171	977	9.02	7.45
2007	1.73	1.77	0.93	18847	176	1043	8.17	6.79
2008	1.84	1.54	0.75	21358	160	1145	8.06	6.94
State Bank of Travancore								
2005	1.74	2.09	1.23	28875	354	1130	6.17	4.24
2006	1.98	2.05	1.03	31862	329	1332	7.24	5.45
2007	1.7	1.77	0.77	37993	293	1599	7.55	6.17
2008	1.56	1.54	0.21	44111	95	1718	6.94	6.56
			NEW PRIVATE SECTOR BANKS					
Axis Bank								
2005	1.54	2.18	1.59	37744	377	2422	8.87	7.49
2006	1.64	2.41	1.94	49731	497	2886	7.26	6.01
2007	1.66	2.33	2.09	73257	733	3403	6.42	5.04
2008	1.97	1.97	1.77	109578	1096	8769	10.17	8.90
HDFC Bank								
2005	2.11	2.18	0.81	51429	417	4520	9.60	8.71
2006	2.3	2.41	0.75	73506	553	5299	8.55	7.66
2007	2.65	2.33	0.73	91236	669	6433	8.57	7.68
2008	2.81	1.97	1.92	133177	2558	11497	10.30	8.01
ICICI Bank								
2005	1.97	2.18	0.74	167659	1233	12900	7.59	6.86
2006	1.99	2.41	1.07	251389	2701	22556	9.20	8.10
2007	1.94	2.33	1.29	344658	4463	24663	7.42	6.08
2008	2.04	1.97	1.22	399795	4897	46821	11.32	10.14

ANNEXURE V

Cost-Income Ratio

Bank-Wise Operational Risk Capital Charge and Impact on Tier I Capital –
(Nationalized Banks, State Bank Group & Axis Bank, HDFC Bank & ICICI Bank)

Year	*Cost-income Ratio (%)*	*Average PSB (%)*	*Three standard deviations (decimal)*	Gross Income *(Rs. Crore)*	*Capital Charge (Rs. Crore)*	*Networth (Rs. Crore)*	*Current Tier I (%)*	*Estimated Tier I Capital (%)*
Allahabad Bank								
2005	53.39	48.46	0.37	2004	735	2328	6.46	4.42
2006	50.30	51.94	0.19	2059	382	3639	9.53	8.53
2007	48.30	51.08	0.13	2127	266	4477	8.10	7.62
2008	43.90	48.32	0.12	2637	306	5221	7.75	7.30
Andhra Bank								
2005	45.50	48.46	0.14	1822	259	1837	8.03	6.90
2006	54.96	51.94	0.12	1561	187	2894	12.20	11.41
2007	50.05	51.08	0.09	1864	172	3156	9.98	9.44
2008	47.18	48.32	0.07	2001	144	3249	8.54	8.16
Bank of Baroda								
2005	46.27	48.46	0.08	4284	347	5628	8.21	7.70
2006	55.45	51.94	0.11	4301	473	7845	10.98	10.32
2007	51.30	51.08	0.09	4959	436	8650	8.74	8.30
2008	49.21	48.32	0.08	5962	459	11044	7.63	7.31
Bank of India								
2005	56.94	48.46	0.20	3393	689	4465	7.05	5.96
2006	55.42	51.94	0.20	3816	750	4984	6.75	5.73
2007	52.13	51.08	0.20	5003	980	5895	6.54	5.45
2008	41.68	48.32	0.16	6346	1019	10589	7.70	6.96
Bank of Maharashtra								
2005	56.83	48.46	0.18	1267	226	1543	7.10	6.06
2006	64.42	51.94	0.32	1023	326	1573	7.47	5.92
2007	54.89	51.08	0.33	1359	447	1742	6.03	4.48
2008	55.40	48.32	0.31	1509	475	1782	5.13	3.76
Canara Bank								
2005	44.93	48.46	0.14	4694	677	6109	7.29	6.48
2006	47.92	51.94	0.16	4898	782	7132	7.81	6.95
2007	46.82	51.08	0.15	5478	794	10354	7.17	6.62
2008	48.53	48.32	0.12	5751	715	10500	7.01	6.53
Central Bank of India								
2005	14.57	48.46	0.78	3294	2569	3265	6.08	1.30
2006	22.32	51.94	0.96	2911	2799	3442	7.19	1.34
2007	57.08	51.08	0.96	2950	2842	3790	6.32	1.58
2008	57.93	48.32	0.67	3014	2028	5943	5.42	3.57

Corporation Bank								
2005	39.35	48.46	0.37	1695	630	3054	13.55	10.75
2006	43.94	51.94	0.29	1700	495	3374	12.41	10.59
2007	41.36	51.08	0.33	1944	641	3765	11.30	9.38
2008	41.60	48.32	0.30	2144	649	4228	9.64	8.16
Dena Bank								
2005	61.79	48.46	0.30	997	296	1104	6.63	4.85
2006	48.28	51.94	0.30	1162	354	1339	5.96	4.38
2007	49.04	51.08	0.30	1248	370	1497	6.06	4.56
2008	48.62	48.32	0.09	1337	119	1801	6.75	6.30
Indian Bank								
2005	48.80	48.46	0.29	1873	546	5936	7.60	6.90
2006	54.71	51.94	0.26	1974	507	2492	10.29	8.20
2007	47.87	51.08	0.09	2605	235	3841	12.28	11.53
2008	45.75	48.32	0.11	3060	322	5211	11.41	10.71
Indian Overseas Bank								
2005	43.65	48.46	0.16	2654	415	2575	7.10	5.95
2006	48.39	51.94	0.13	2608	345	3178	8.54	7.61
2007	47.08	51.08	0.15	2948	449	3991	8.20	7.28
2008	42.59	48.32	0.17	3487	580	4857	7.86	6.92
Oriental Bank of Commerce								
2005	39.23	48.46	0.51	2029	1032	3327	5.42	3.74
2006	44.76	51.94	0.41	2158	893	5171	10.37	8.58
2007	43.50	51.08	0.30	2294	678	5601	10.05	8.83
2008	46.98	48.32	0.22	2299	513	5776	9.34	8.51
Punjab & Sind Bank								
2005	68.88	48.46	0.89	829	735	440	5.26	-3.53
2006	64.31	51.94	0.90	751	674	1222	10.05	4.51
2007	52.56	51.08	0.51	995	505	1406	9.58	6.14
2008	50.86	48.32	0.27	1103	298	2093	8.04	6.90
Punjab National Bank								
2005	57.68	48.46	0.20	5683	1165	8161	8.87	7.60
2006	50.88	51.94	0.20	5941	1197	9376	10.06	8.78
2007	50.73	51.08	0.20	6556	1292	10435	8.93	7.82
2008	46.81	48.32	0.04	7532	299	12318	8.52	8.31
Syndicate Bank								
2005	55.34	48.46	0.37	2284	854	2199	6.10	3.73
2006	58.76	51.94	0.25	2442	620	2834	7.40	5.78
2007	50.07	51.08	0.21	2768	572	3623	6.24	5.25
2008	50.47	48.32	0.15	2962	454	4291	6.62	5.92
UCO Bank								
2005	56.36	48.46	0.26	1925	504	2069	5.75	4.35
2006	60.67	51.94	0.26	1940	497	2462	6.09	4.86
2007	55.80	51.08	0.27	2138	576	2662	5.78	4.53
2008	57.79	48.32	0.29	2260	658	2926	5.05	3.91

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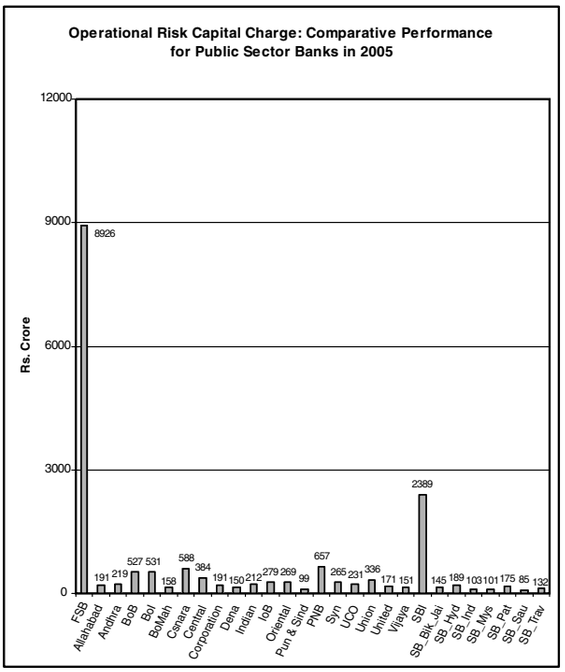
Union Bank								
2005	44.40	48.46	0.15	2831	435	3614	6.07	5.34
2006	48.87	51.94	0.12	2869	357	4558	7.32	6.75
2007	42.45	51.08	0.21	3477	739	5190	7.79	6.68
2008	38.17	48.32	0.29	4173	1210	7348	7.45	6.22
United Bank of India								
2005	50.54	48.46	0.17	1393	232	1957	14.15	12.47
2006	55.87	51.94	0.18	1457	260	1828	10.01	8.59
2007	51.94	51.08	0.10	1498	144	2415	7.72	7.26
2008	65.91	48.32	0.38	1370	525	2661	6.74	5.41
Vijaya Bank								
2005	40.21	48.46	0.30	1338	396	1590	7.59	5.70
2006	49.64	51.94	0.26	1257	325	1670	9.26	7.46
2007	48.33	51.08	0.19	1347	257	1897	7.07	6.11
2008	51.47	48.32	0.10	1362	138	2460	5.73	5.41
State Bank of India								
2005	26.72	48.46	0.47	8515	4000	24072	8.04	6.70
2006	28.34	51.94	0.69	8994	6169	27644	9.36	7.27
2007	54.18	51.08	0.68	21823	14923	31298	8.01	4.19
2008	49.03	48.32	0.51	25716	12992	49032	8.48	6.23
State Bank of Bikaner & Jaipur								
2005	46.01	48.46	0.07	1352	93	1298	8.04	7.46
2006	61.24	51.94	0.21	1241	257	1406	9.36	7.65
2007	52.58	51.08	0.21	1432	296	1654	8.01	6.58
2008	53.15	48.32	0.22	1411	317	1713	6.95	5.66
State Bank of Hyderabad								
2005	48.48	48.46	0.34	1384	465	1765	7.58	5.58
2006	52.54	51.94	0.23	1553	351	2114	8.95	7.47
2007	44.62	51.08	0.14	1811	249	2541	8.25	7.44
2008	44.64	48.32	0.16	1790	283	2694	7.24	6.48
State Bank of Indore								
2005	48.24	48.46	0.34	680	230	904	6.67	4.97
2006	50.44	51.94	0.23	787	178	1018	7.55	6.23
2007	51.25	51.08	0.03	800	26	1177	6.74	6.59
2008	48.81	48.32	0.03	883	30	1317	7.01	6.85
State Bank of Mysore								
2005	51.45	48.46	0.07	931	67	756	7.12	6.49
2006	53.69	51.94	0.08	948	75	935	7.44	6.84
2007	54.35	51.08	0.10	1034	105	1141	6.62	6.01
2008	52.11	48.32	0.11	1184	133	1378	6.54	5.91
State Bank of Patiala								
2005	35.96	48.46	0.50	1332	671	2045	11.05	7.43
2006	45.54	51.94	0.42	1344	571	2235	9.96	7.42
2007	45.54	51.08	0.32	1447	463	2488	8.36	6.80
2008	47.58	48.32	0.18	1486	268	2459	6.74	6.01

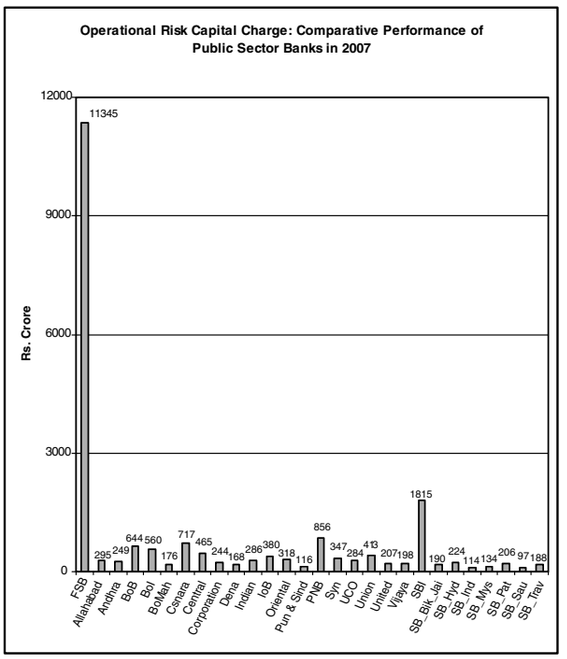
State Bank of Saurashtra								
2005	39.63	48.46	0.27	641	175	794	8.68	6.77
2006	52.74	51.94	0.27	584	156	977	9.02	7.58
2007	56.70	51.08	0.22	575	128	1043	8.17	7.17
2008	69.00	48.32	0.45	571	260	1145	8.06	6.23
State Bank of Travancore								
2005	38.54	48.46	0.26	1305	342	1130	6.17	4.30
2006	48.36	51.94	0.26	1307	336	1332	7.24	5.41
2007	47.57	51.08	0.24	1356	320	1599	7.55	6.04
2008	47.51	48.32	0.11	1446	156	1718	6.94	6.31
			NEW PRIVATE SECTOR BANKS					
Axis Bank								
2005	50.65	48.46	0.21	1147	241	2422	8.87	7.99
2006	45.02	51.94	0.30	1808	544	2886	7.26	5.89
2007	47.15	51.08	0.25	2577	634	3403	6.42	5.22
2008	49.19	48.32	0.24	4381	1073	8769	10.17	8.93
HDFC Bank								
2005	44.69	48.46	0.19	2428	455	4520	9.60	8.63
2006	46.09	51.94	0.27	3669	988	5299	8.55	6.96
2007	46.33	51.08	0.29	5226	1515	6433	8.57	6.55
2008	49.87	48.32	0.23	7511	1740	11497	10.30	8.74
ICICI Bank								
2005	52.74	48.46	0.10	6255	623	12900	7.59	7.22
2006	56.25	51.94	0.10	8890	881	22556	9.20	8.84
2007	53.25	51.08	0.03	12565	409	24663	7.42	7.30
2008	50.60	48.32	0.04	16115	571	46821	11.32	11.18

ANNEXURE VI

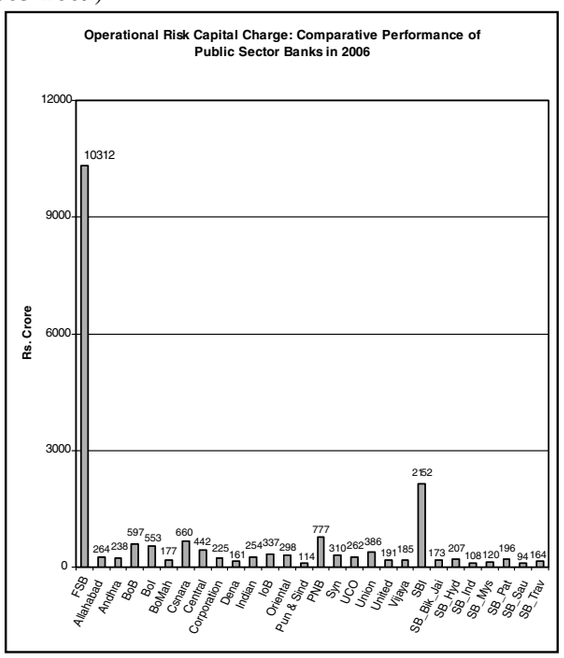
Graphical presentation of the Operational Risk Capital Charge under the Basic Indicators Approach for Public Sector Banks (2005-2009)



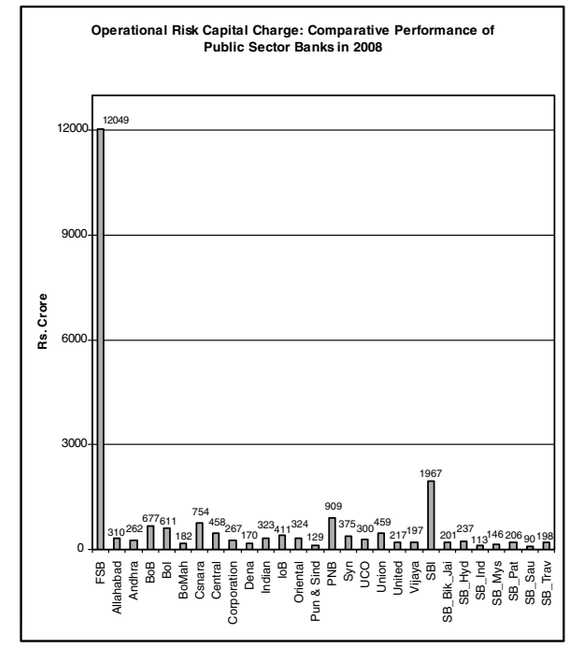
Graphical presentation of the Operational Risk Capital Charge under the **Basic Indicators Approach** for Public Sector Banks (2005-2009)



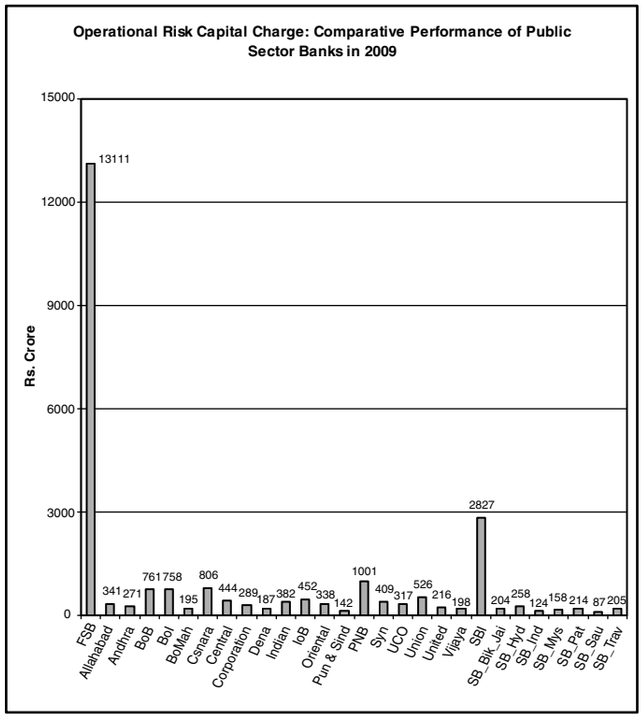
Graphical presentation of the Operational Risk Capital Charge under the **Basic Indicators Approach** for Public Sector Banks (2005-2009)



Graphical presentation of the Operational Risk Capital Charge under the **Basic Indicators Approach** for Public Sector Banks (2005-2009)

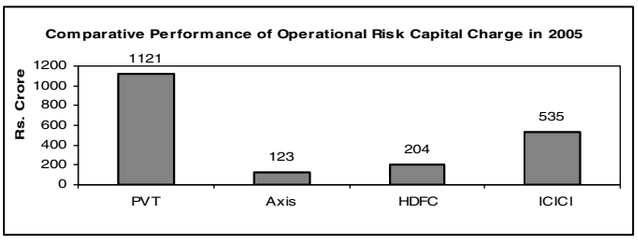


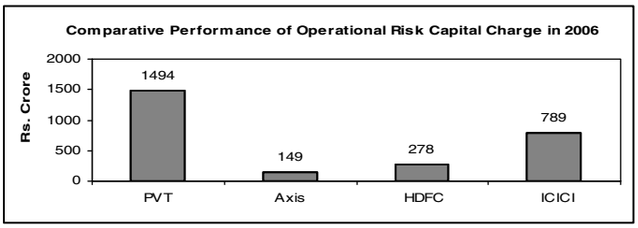
Graphical presentation of the Operational Risk Capital Charge under the Basic Indicators Approach for Public Sector Banks (2005-2009)

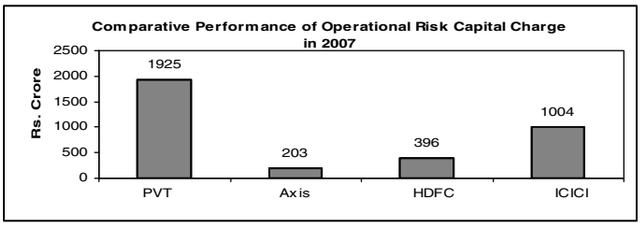


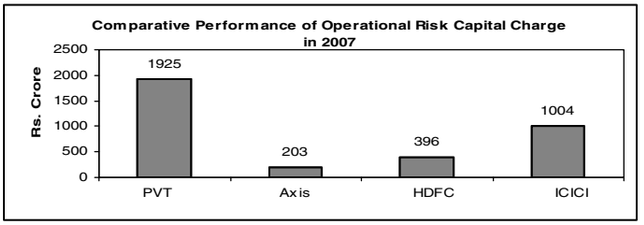
ANNEXURE VII

Graphical presentation of the operational Risk Capital Charge under the **Basic Indicators Approach** for New Private Sector Banks (2005-2009)

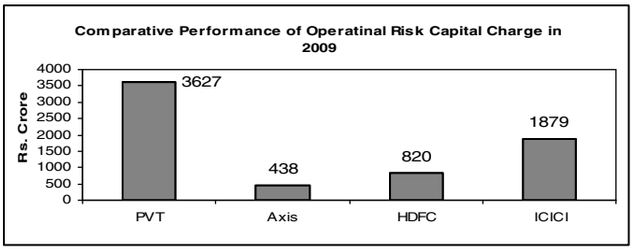






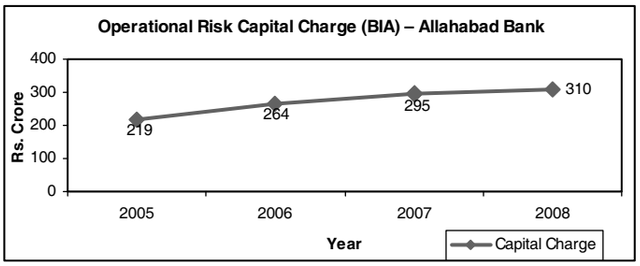


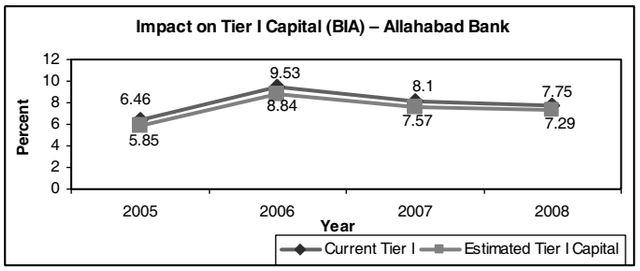
Graphical presentation of the operational Risk Capital Charge under the **Basic Indicators Approach** for New Private Sector Banks (2005-2009)

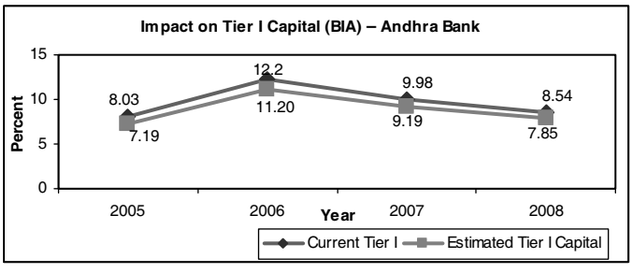


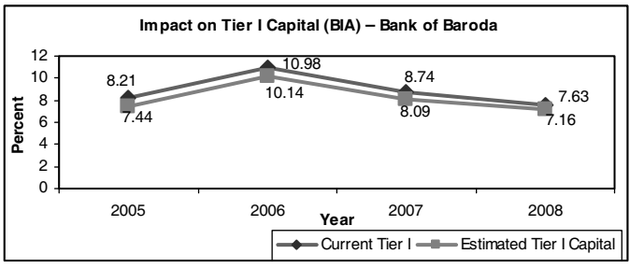
ANNEXURE VIII

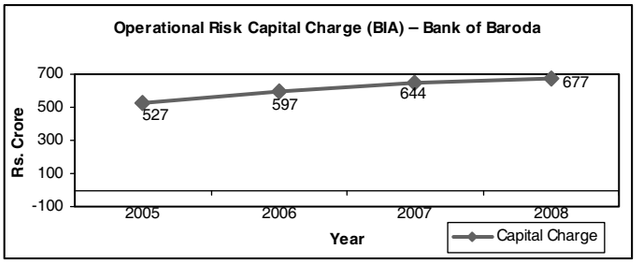
Graphical presentation of the operational risk capital charge that individual nationalized banks have to keep aside on account of operational risk and its impact on their Tier I capital for 2005 to 2009 under the Basic Indicators Approach

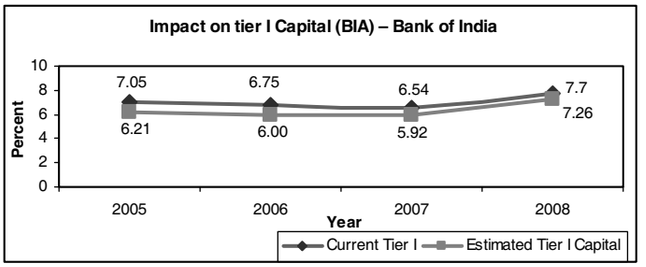


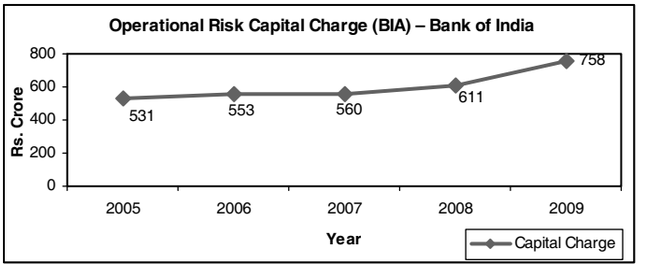


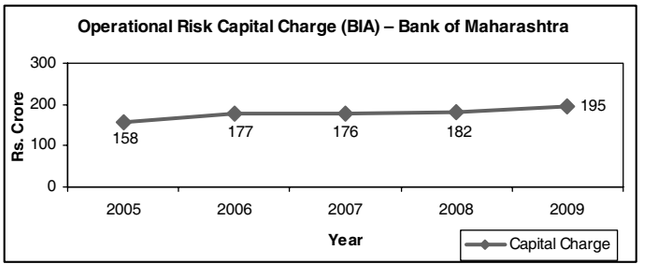


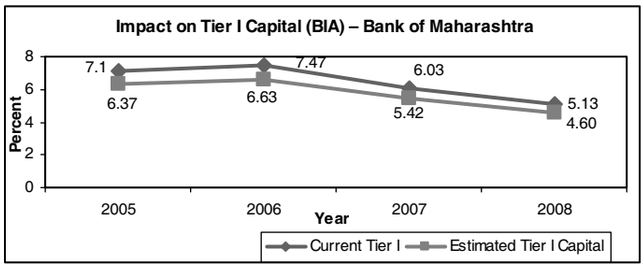


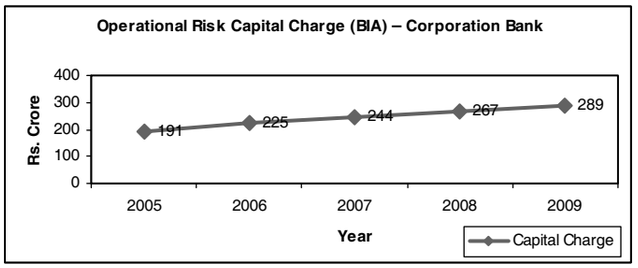


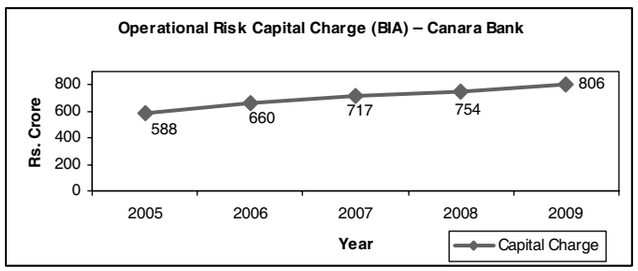


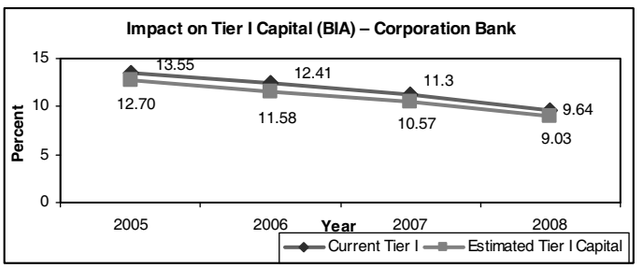


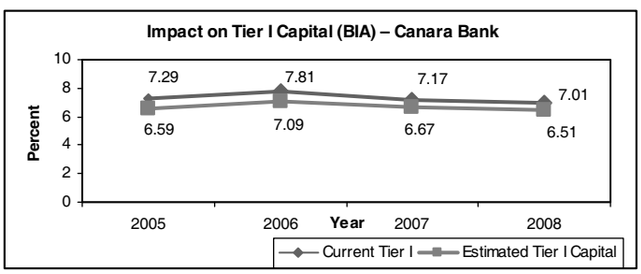


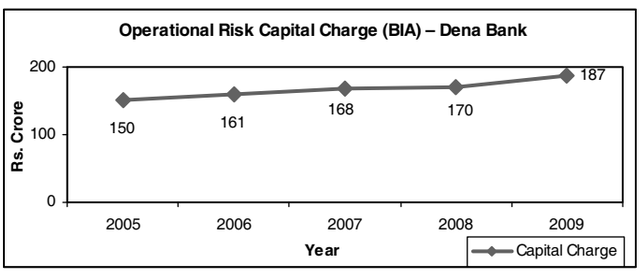

Impact on Tier I Capital (BIA) – Bank of Maharashtra
Percent
Year
2005
2006
2007
2008
7.1
7.47
6.03
5.13
6.37
6.63
5.42
4.60
Current Tier I
Estimated Tier I Capital

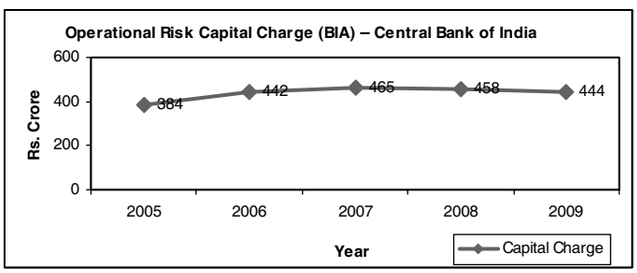

Operational Risk Capital Charge (BIA) – Corporation Bank
Rs. Crore
Year
2005
2006
2007
2008
2009
191
225
244
267
289
Capital Charge

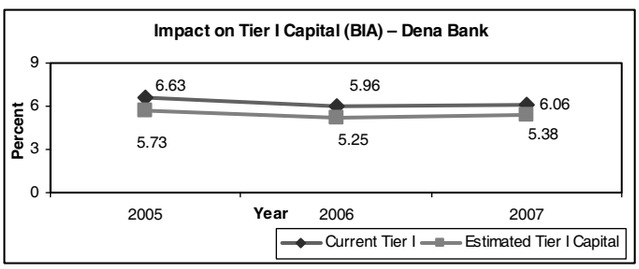

Operational Risk Capital Charge (BIA) – Canara Bank
Rs. Crore
Year
2005
2006
2007
2008
2009
588
660
717
754
806
Capital Charge

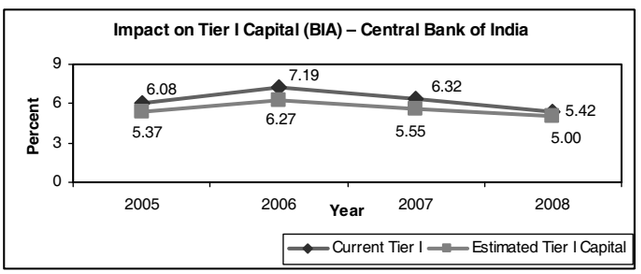

Impact on Tier I Capital (BIA) – Corporation Bank
Percent
Year
2005
2006
2007
2008
13.55
12.41
11.3
9.64
12.70
11.58
10.57
9.03
Current Tier I
Estimated Tier I Capital

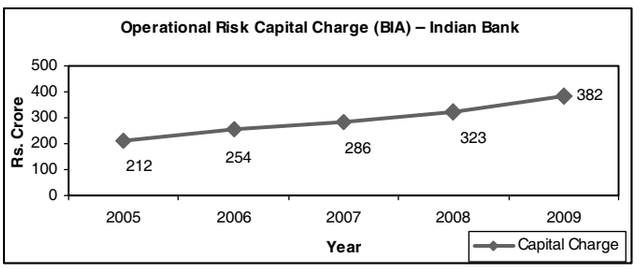

Impact on Tier I Capital (BIA) – Canara Bank
Percent
Year
2005
2006
2007
2008
7.29
7.81
7.17
7.01
6.59
7.09
6.67
6.51
Current Tier I
Estimated Tier I Capital

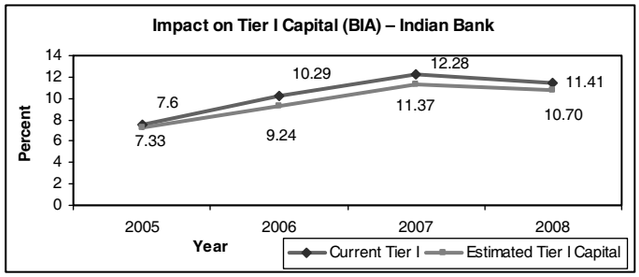

Operational Risk Capital Charge (BIA) – Dena Bank
Rs. Crore
Year
2005
2006
2007
2008
2009
150
161
168
170
187
Capital Charge

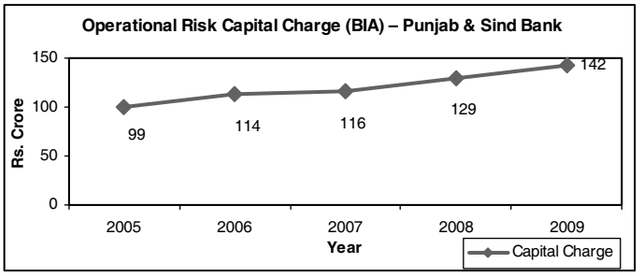

Operational Risk Capital Charge (BIA) – Central Bank of India
Rs. Crore
Year
2005
2006
2007
2008
2009
384
442
465
458
444
Capital Charge

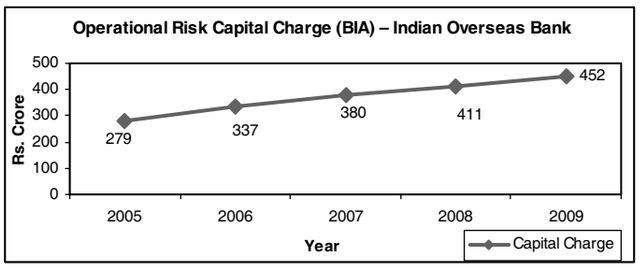

Impact on Tier I Capital (BIA) – Dena Bank
Percent
Year
2005
2006
2007
6.63
5.96
6.06
5.73
5.25
5.38
Current Tier I
Estimated Tier I Capital

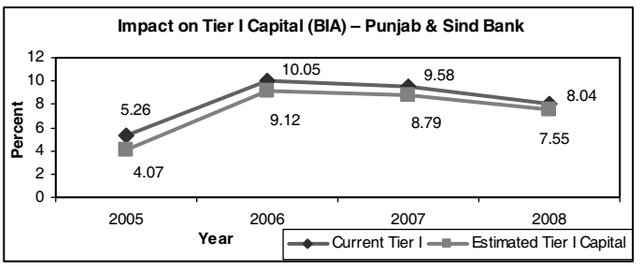

Impact on Tier I Capital (BIA) – Central Bank of India
Percent
Year
2005
2006
2007
2008
6.08
7.19
6.32
5.42
5.37
6.27
5.55
5.00
Current Tier I
Estimated Tier I Capital

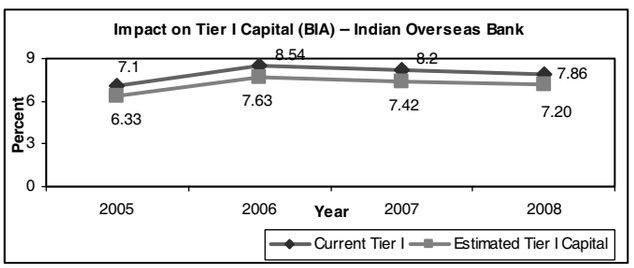

Operational Risk Capital Charge (BIA) – Indian Bank
Rs. Crore
Year
2005
2006
2007
2008
2009
212
254
286
323
382
Capital Charge

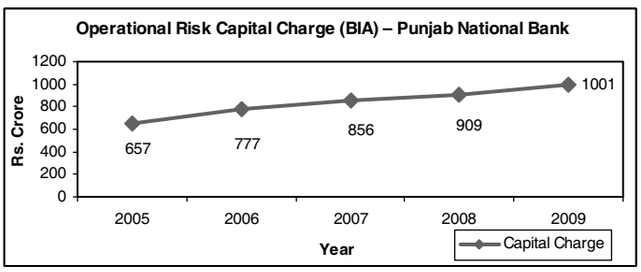

Impact on Tier I Capital (BIA) – Indian Bank
Percent
Year
2005
2006
2007
2008
7.6
10.29
12.28
11.41
7.33
9.24
11.37
10.70
Current Tier I
Estimated Tier I Capital

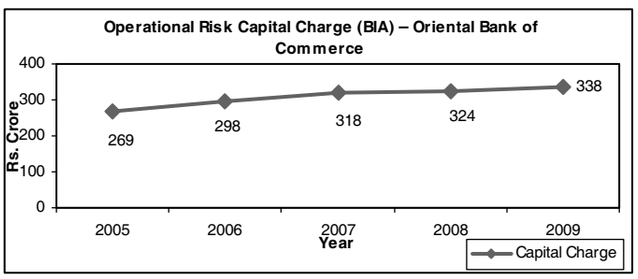

Operational Risk Capital Charge (BIA) – Punjab & Sind Bank
Rs. Crore
Year
2005
2006
2007
2008
2009
99
114
116
129
142
Capital Charge

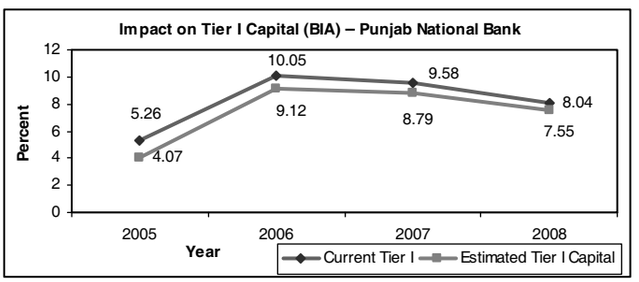

Operational Risk Capital Charge (BIA) – Indian Overseas Bank
Rs. Crore
Year
2005
2006
2007
2008
2009
279
337
380
411
452
Capital Charge

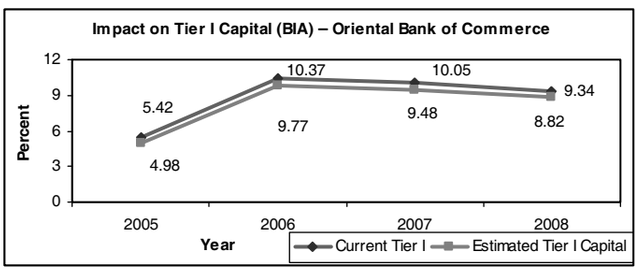

Impact on Tier I Capital (BIA) – Punjab & Sind Bank
Percent
Year
2005
2006
2007
2008
5.26
10.05
9.58
8.04
4.07
9.12
8.79
7.55
Current Tier I
Estimated Tier I Capital

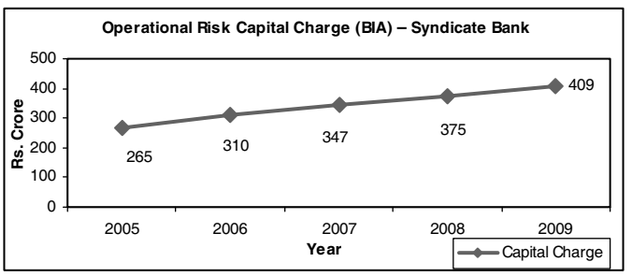

Impact on Tier I Capital (BIA) – Indian Overseas Bank
Percent
Year
2005
2006
2007
2008
7.1
8.54
8.2
7.86
6.33
7.63
7.42
7.20
Current Tier I
Estimated Tier I Capital

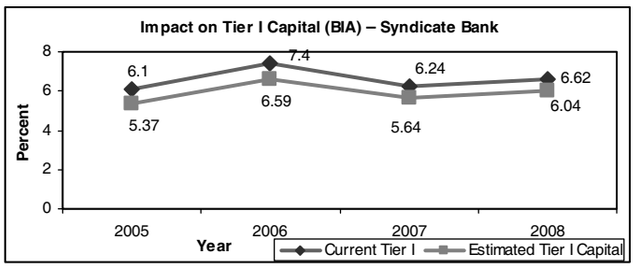

Operational Risk Capital Charge (BIA) – Punjab National Bank
Rs. Crore
Year
2005
2006
2007
2008
2009
657
777
856
909
1001
Capital Charge

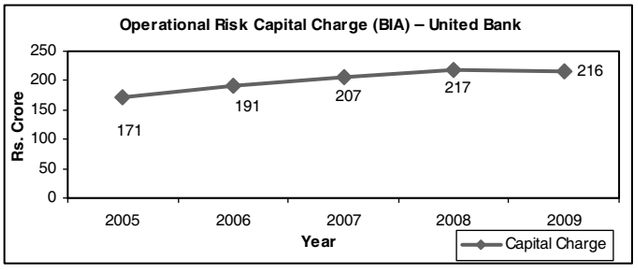

Operational Risk Capital Charge (BIA) – Oriental Bank of Commerce
Rs. Crore
Year
2005
2006
2007
2008
2009
269
298
318
324
338
Capital Charge

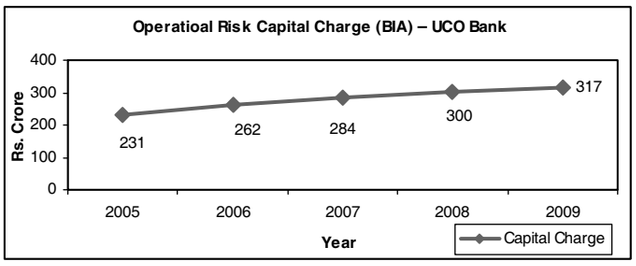

Impact on Tier I Capital (BIA) – Punjab National Bank
Percent
Year
2005
2006
2007
2008
5.26
10.05
9.58
8.04
4.07
9.12
8.79
7.55
Current Tier I
Estimated Tier I Capital

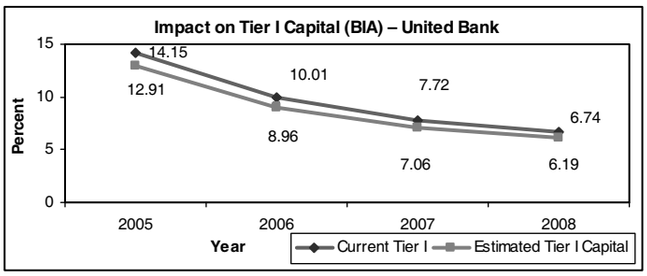

Impact on Tier I Capital (BIA) – Oriental Bank of Commerce
Percent
Year
2005
2006
2007
2008
5.42
10.37
10.05
9.34
4.98
9.77
9.48
8.82
Current Tier I
Estimated Tier I Capital

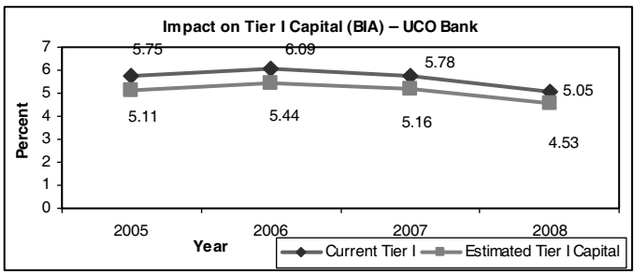

Operational Risk Capital Charge (BIA) – Syndicate Bank
Rs. Crore
Year
2005
2006
2007
2008
2009
265
310
347
375
409
Capital Charge

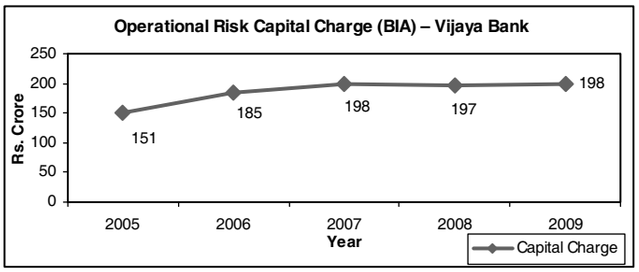

Impact on Tier I Capital (BIA) – Syndicate Bank
Percent
Year
2005
2006
2007
2008
6.1
7.4
6.24
6.62
5.37
6.59
5.64
6.04
Current Tier I
Estimated Tier I Capital

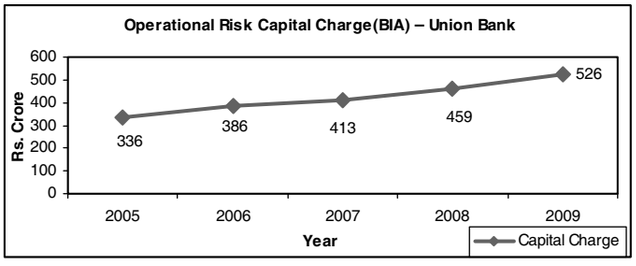

Operational Risk Capital Charge (BIA) – United Bank
Rs. Crore
Year
2005
2006
2007
2008
2009
171
191
207
217
216
Capital Charge

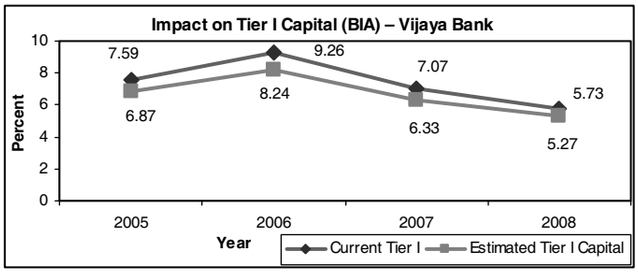

Operatioal Risk Capital Charge (BIA) – UCO Bank
Rs. Crore
Year
2005
2006
2007
2008
2009
231
262
284
300
317
Capital Charge

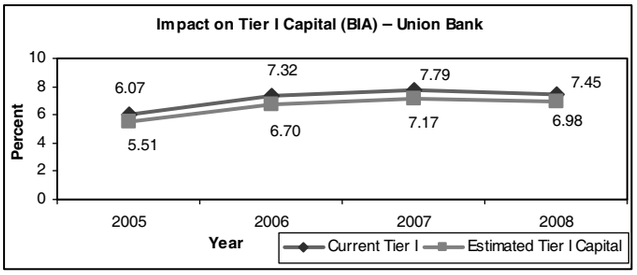

Impact on Tier I Capital (BIA) – United Bank
Percent
Year
2005
2006
2007
2008
14.15
10.01
7.72
6.74
12.91
8.96
7.06
6.19
Current Tier I
Estimated Tier I Capital


Impact on Tier I Capital (BIA) – UCO Bank
Percent
Year
2005
2006
2007
2008
5.75
6.09
5.78
5.05
5.11
5.44
5.16
4.53
Current Tier I
Estimated Tier I Capital


Operational Risk Capital Charge (BIA) – Vijaya Bank
Rs. Crore
Year
2005
2006
2007
2008
2009
151
185
198
197
198
Capital Charge

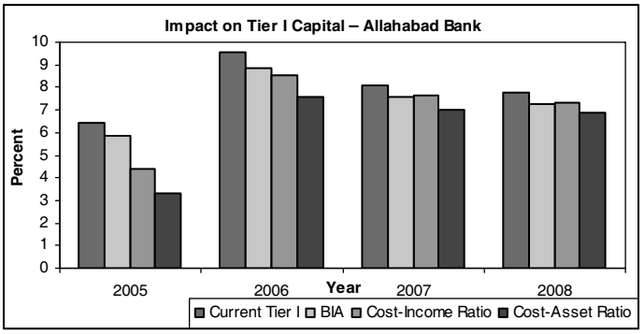

Operational Risk Capital Charge(BIA) – Union Bank
Rs. Crore
Year
2005
2006
2007
2008
2009
336
386
413
459
526
Capital Charge

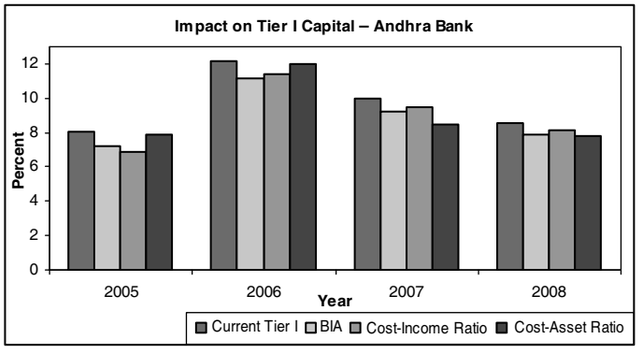

Impact on Tier I Capital (BIA) – Vijaya Bank
Percent
Year
2005
2006
2007
2008
7.59
9.26
7.07
5.73
6.87
8.24
6.33
5.27
Current Tier I
Estimated Tier I Capital

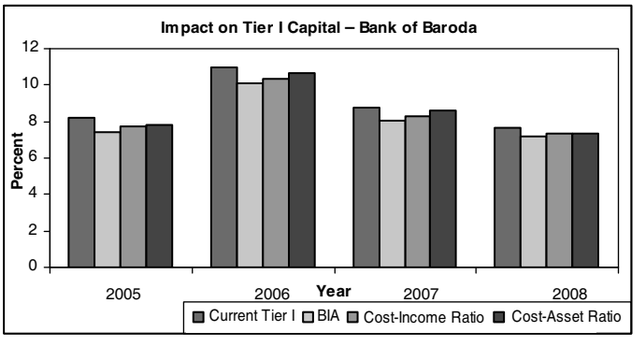

Impact on Tier I Capital (BIA) – Union Bank
Percent
Year
2005
2006
2007
2008
6.07
7.32
7.79
7.45
5.51
6.70
7.17
6.98
Current Tier I
Estimated Tier I Capital

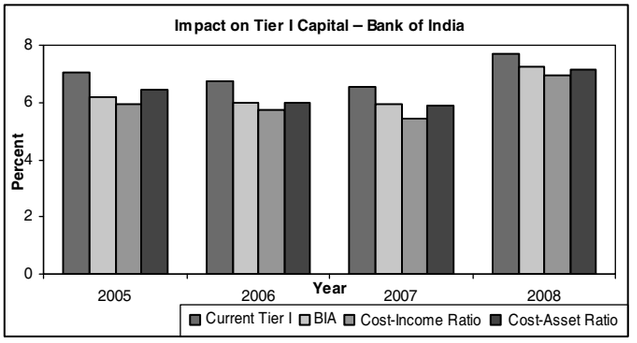
ANNEXURE IX

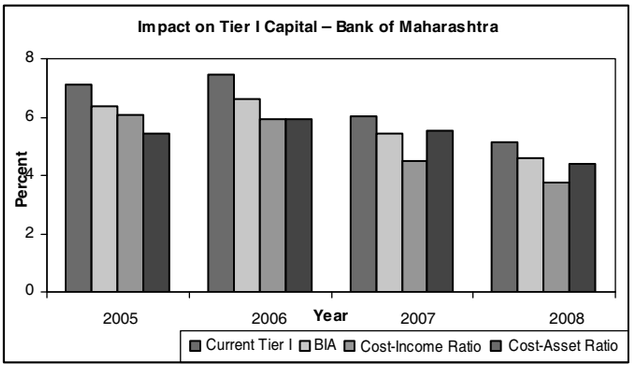
A graphical comparison of the impact of Operational Risk Capital Charge on Tier I Capital on Public Sector Banks and Major New Private Sector Banks (Bank –Wise) under the Basic Indicators Approach and the alternative measures of Operational Risk

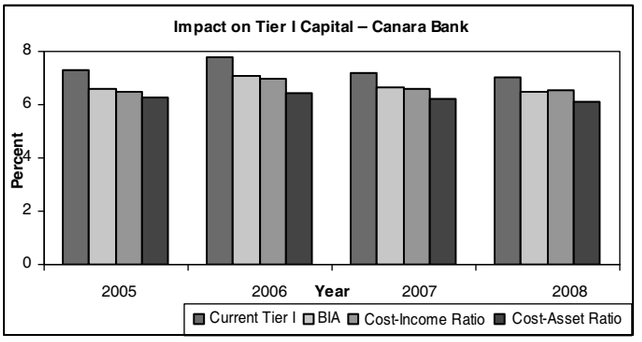


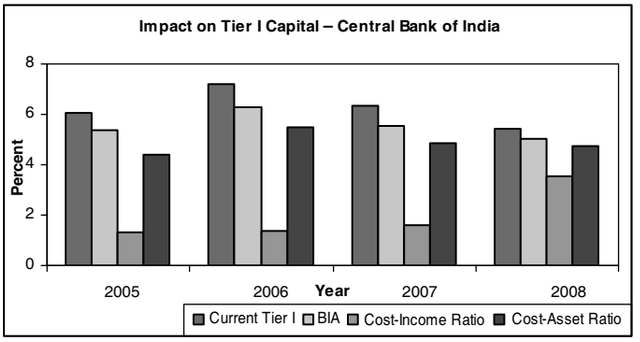


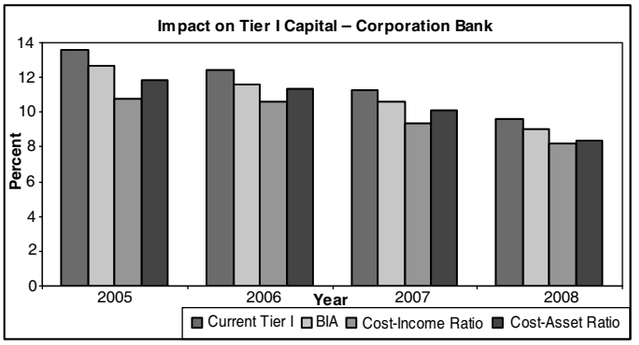


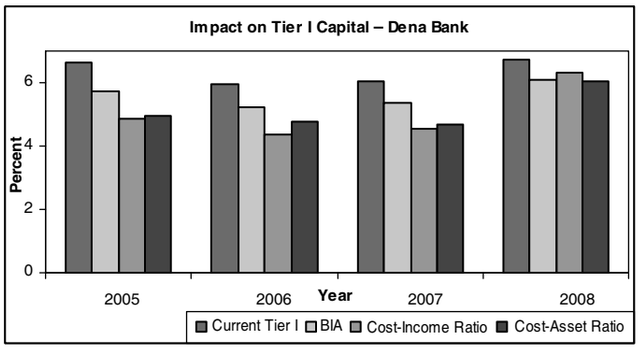


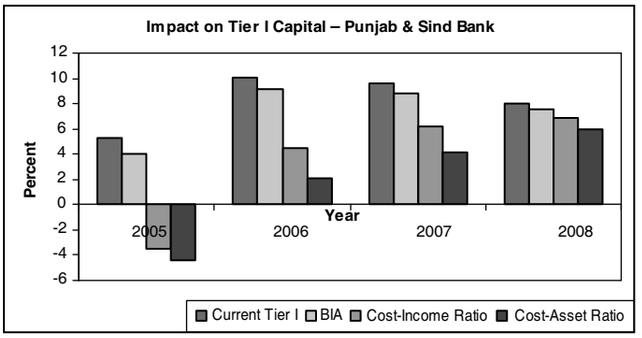


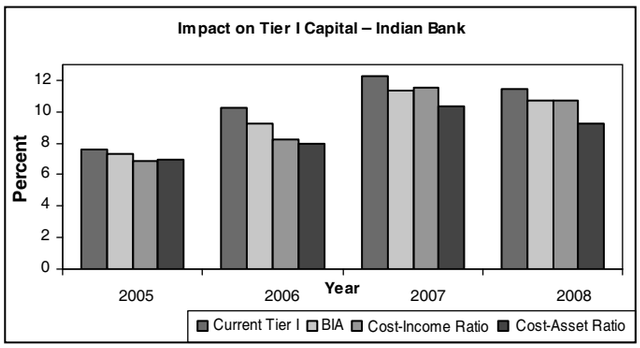


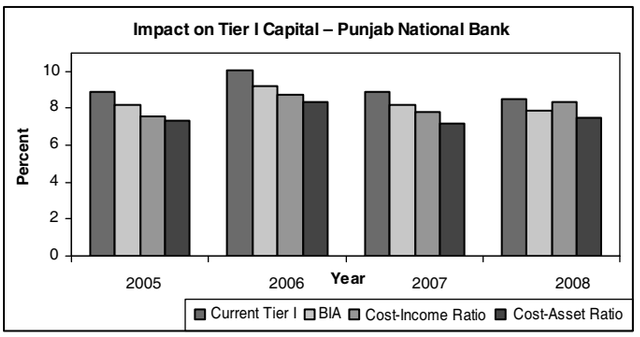


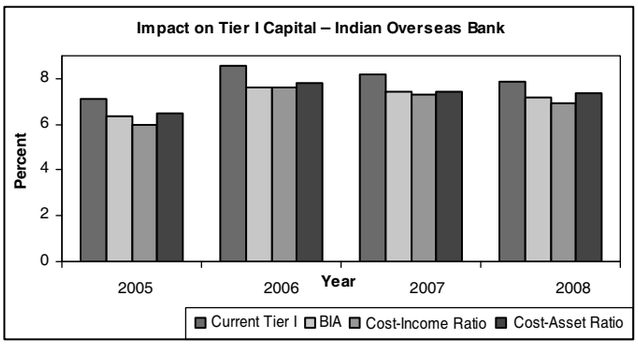


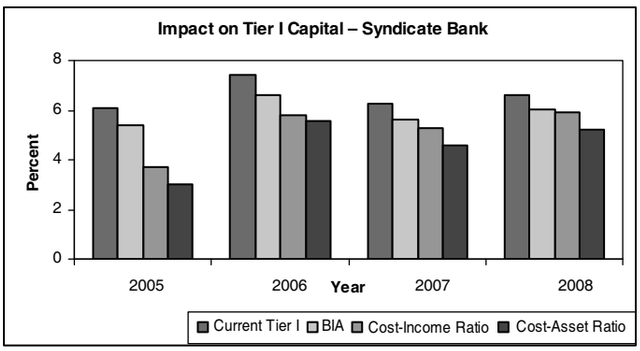

Impact on Tier I Capital – Dena Bank
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

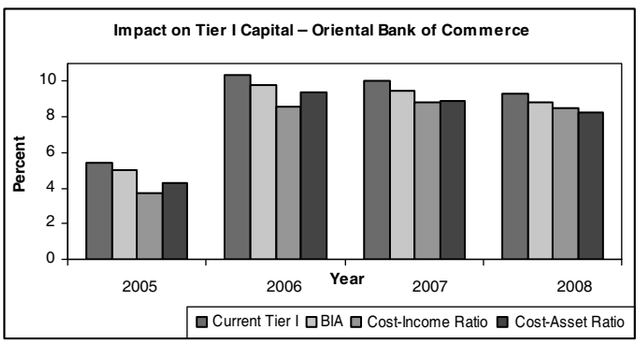

Impact on Tier I Capital – Punjab & Sind Bank
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

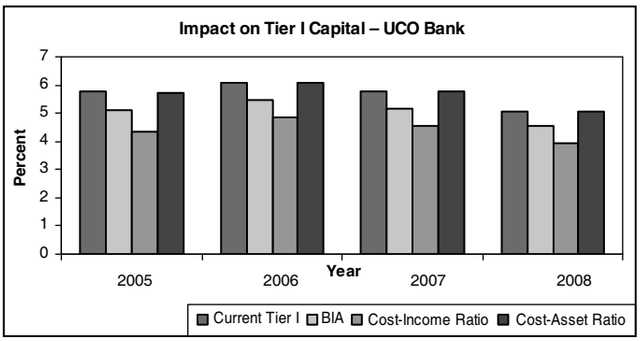

Impact on Tier I Capital – Indian Bank
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

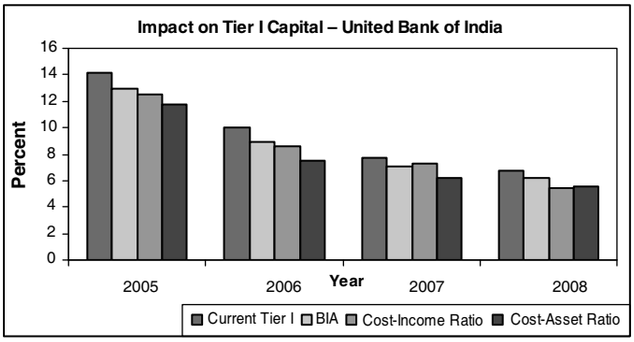

Impact on Tier I Capital – Punjab National Bank
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

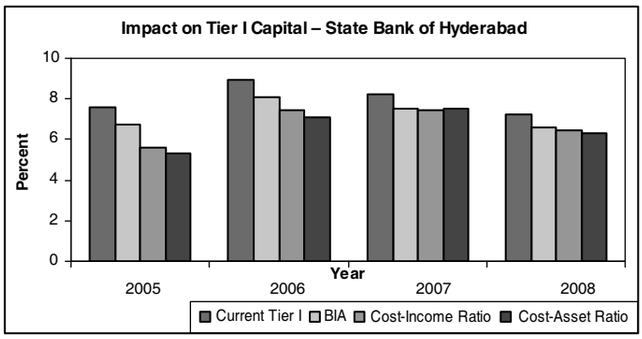

Impact on Tier I Capital – Indian Overseas Bank
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

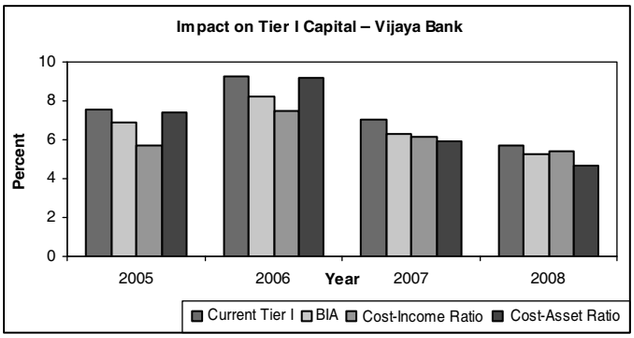

Impact on Tier I Capital – Syndicate Bank
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

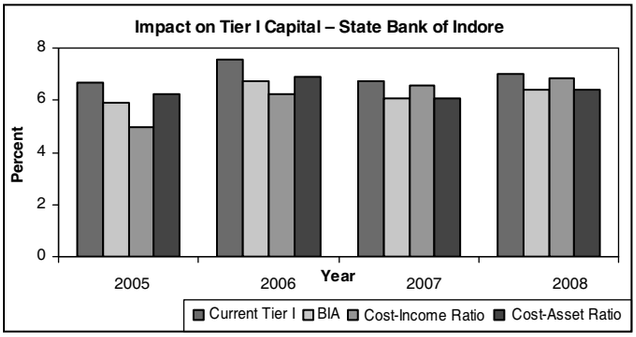

Impact on Tier I Capital – Oriental Bank of Commerce
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

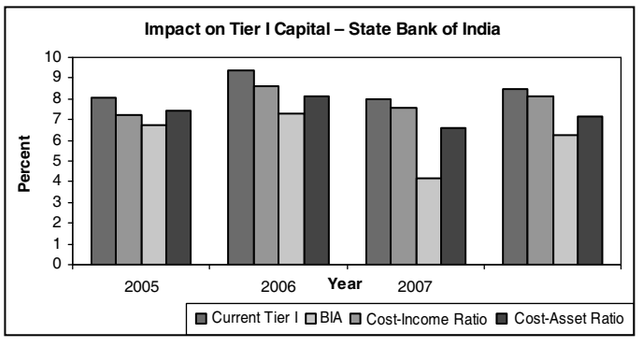

Impact on Tier I Capital – UCO Bank
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

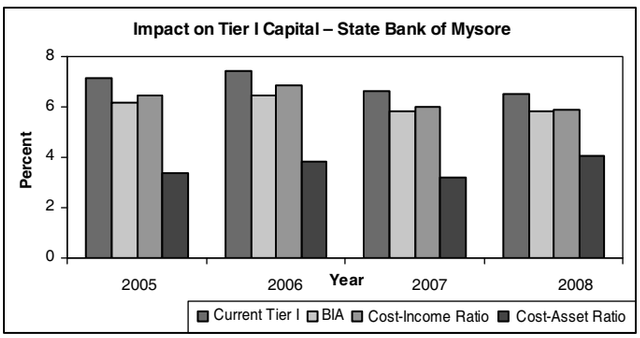

Impact on Tier I Capital – United Bank of India
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

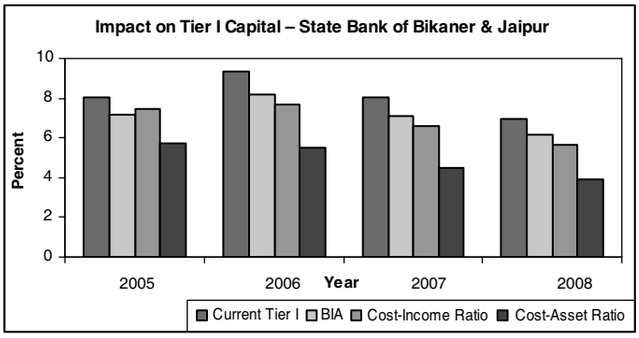

Impact on Tier I Capital – State Bank of Hyderabad
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

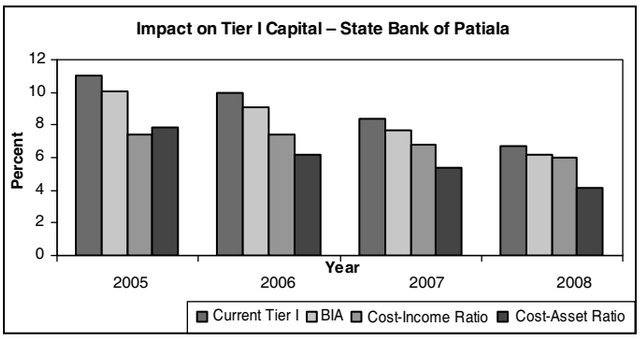

Impact on Tier I Capital – Vijaya Bank
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

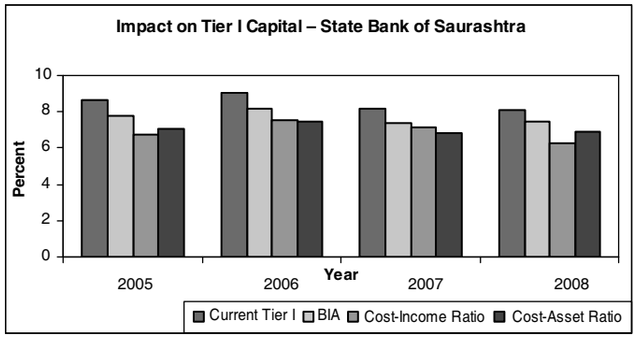

Impact on Tier I Capital – State Bank of Indore
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

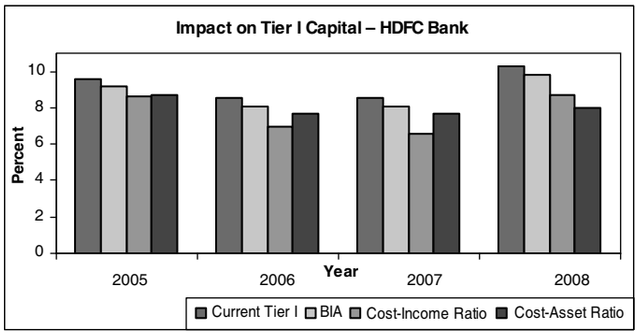

Impact on Tier I Capital – State Bank of India
Percent
Year
2005
2006
2007
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

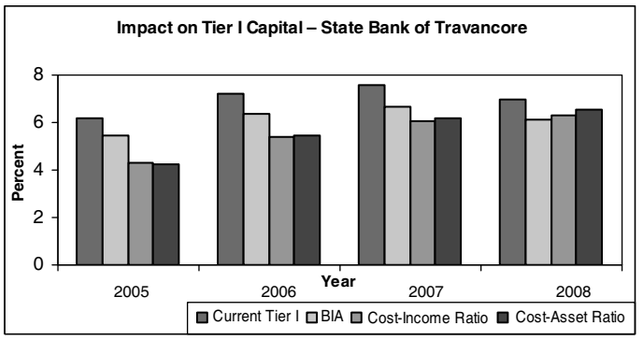

Impact on Tier I Capital – State Bank of Mysore
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

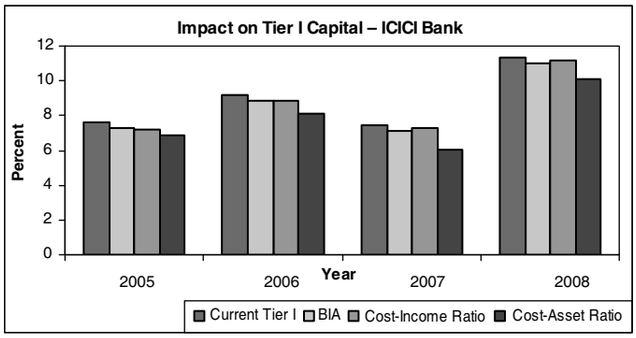

Impact on Tier I Capital – State Bank of Bikaner & Jaipur
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio

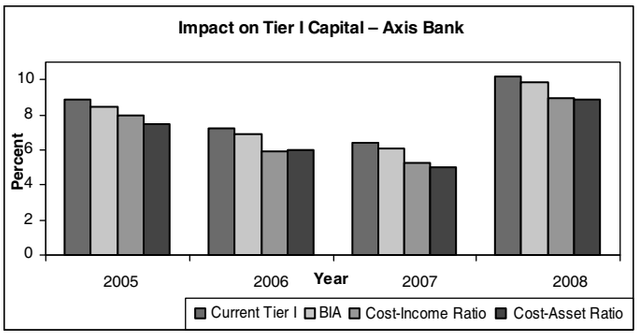

Impact on Tier I Capital – State Bank of Patiala
Percent
Year
2005
2006
2007
2008
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio


Impact on Tier I Capital – State Bank of Saurashtra
Percent
10
8
6
4
2
0
2005
2006
2007
2008
Year
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio


Impact on Tier I Capital – HDFC Bank
Percent
10
8
6
4
2
0
2005
2006
2007
2008
Year
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio


Impact on Tier I Capital – State Bank of Travancore
Percent
8
6
4
2
0
2005
2006
2007
2008
Year
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio


Impact on Tier I Capital – ICICI Bank
Percent
12
10
8
6
4
2
0
2005
2006
2007
2008
Year
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio


Impact on Tier I Capital – Axis Bank
Percent
10
8
6
4
2
0
2005
2006
2007
2008
Year
Current Tier I
BIA
Cost-Income Ratio
Cost-Asset Ratio