 CHAPTER II
REVIEW OF LITERATURE

The review of literature for the current study is discussed under following heads:

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I. Conceptualization of Efficiency and Profitability in Banking System

Koopmans (1951) was the first to provide a formal definition of technical efficiency. According to him a producer is technically efficient if an increase in any output requires a reduction in atleast one other output or an increase in atleast one other input. Similarly a reduction in any input requires an increase in one other input or a reduction in atleast one output. Thus technically inefficient producer could produce the same outputs with less of atleast one input, or could use the same inputs to produce more of atleast one output. The outputs were to be satisfied in stipulated amounts while inputs were to be optimally determined in response to the prices and amounts exogenously fixed for each output. Special attention was then directed by Koopmans to "efficiency prices" which are the prices associated with efficient allocation of resources (inputs) to satisfy the pre-assigned demands for final goods. The combination of technical and allocative efficiencies was commonly referred to as X-efficiency and was regarded as a measure of the quality of management (Leibenstein, 1966). Technical efficiency measures the ability of a firm to obtain maximal output using a given set of inputs whereas allocative efficiency implies that a firm uses its inputs in the optimal proportions. Cost efficiency which refers to both technical and allocative efficiency provides a measure of how close a bank's actual cost was to what a best-practice firm's cost would be for producing an
identical output bundle under comparable conditions. Profit efficiency on the other hand measures the extent to which a firm’s profits fall below the profit of the best-practice firm. It was a wider concept than cost efficiency as it combines both costs and revenues in the measurement of efficiency. Kolari and Zardkoohi (1987) defined bank’s production process as having three-stages, each with a different output mix: in the first phase deposits are produced, in the second it produces loans and securities and in the third there is a vertically integrated process of production of deposits and loans.

Ferrier and Lovell (1990) compared two techniques for estimating production economies and efficiencies. One approach involved the econometric estimation of a cost frontier, second was a series of linear programs which calculated a production frontier. They used the stochastic cost frontier (translog cost frontier) and non stochastic production frontier (programming model) for 575 banks in 1984. The study compared the ability of these two approaches to shed light on the structure of production technology and the nature and extent of the cost inefficiency in US banking. These techniques yielded very similar results regarding cost economies and dissimilar results regarding cost efficiency which had ranged between 70–80 percent. Berger and Humphrey (1992) propose a conceptually more appealing model which allows both the input and output characteristics of deposits to be incorporated simultaneously by specifying deposits as both inputs and outputs of banks in the cost/profit functions. Specifically, banking functions associated with significant labour and capital expenditure to produce services was defined as outputs, including the value of various types of bank deposits.

Berger et al., (1993) provided an example of an early third generation model. They estimated the Fuss normalized quadratic profit function and used it to construct measures of allocative and technical inefficiencies. Using panel data over the period 1984–1989, total inefficiency averaged 70 percent of potential profits and ranges from 15 percent for large banks with assets greater than one billion dollars to 95 percent of potential profits for small banks with assets less than one hundred million dollars. Technical inefficiency dominates allocative inefficiency and output inefficiencies due to the production of less than feasible output and an inappropriate choice of output mix tend to dominate input technical and allocative inefficiencies. The study measured profit inefficiency as the ratio of lost potential variable profit to maximal potential variable profit. However the study does not explicitly state how zero or negative profits were treated. Davidson and MacKinnon (1993) propose a method (J-test) for choosing between two non-nested models. The test was based on the idea that if one model was the correct one, then the fitted values from the other model should not have explanatory power when estimating that model. Profitability was mainly based on the concept of profit. The profitability earned by an
organisation over the years is a barometer reflecting organisational performance. (Kolay 1993) A viable and profit making bank reflects operational efficiency and effective and efficient resource management. There was adoptability of well-planned systems and procedures and a successful organization (Sinha Kanhaiya 1993). Farrel’s (1957) work on ‘The Measurement of Productive Efficiency’ laid the basic framework for studying and measuring inefficiency with a frontier. Inefficiency had been defined as ‘the deviations of actual from optimum behaviour’ (Kaparakis et al., 1994).

The managerial risk preference hypothesis had been offered by Hughes et al., (1995) who link risk taking and operational efficiency of banks. They observe that traditional production functions and efficiency estimates were derived under the assumption of risk neutrality. However, since the penalties for being wrong in company are less severe than for being wrong in isolation, risk-averse managers might be willing to trade off reduced earnings for reduced risk, especially when a substantial portion of their wealth (or human capital) was tied to the performance of the firm. In doing so, they might incur additional costs in making higher quality loans and in monitoring loan performance which would tend to manifest itself in measured inefficiencies. The concept of efficiency relates to how well a bank employs its resources relative to existing production possibility frontier. Hence, the analysis of banking efficiency relies on intra-sector comparisons, involves both technological and relative pricing aspects and had partial indicator value for analyzing productivity performance. The concept of productivity refers to the performance of the sector as a whole and effectively combines changes in efficiency and technological advances in an average measure (Oster and Antioch, 1995). Calem and Rob (1996) developed a model of changes in bank’s asset choice and capital ratios and simulated the model using parameters estimated over the period 1984–93. They found that while severely under capitalized banks take more risks in response to higher capital requirements, banks with minimally adequate capital reduce their risk exposure, whereas well-capitalized banks increase their risk exposure to offset the increase in capital.

DeYoung and Nolle (1996) used estimation procedure and definition of profit inefficiency to analyse the relative performance of a panel of 62 foreign and 240 US owned bank subsidiaries from 1985 to 1990. The study used Fourier-flexible functional form and stochastic frontier approach to estimate profit efficiency and avoid negative and zero profit problems by truncating the residuals. The study defined profit efficiency as the ratio of actual to potential frontier profits. They also estimated nonstandard profits, by fixing output quantities instead of output prices, to allow for monopoly power. The study found that profit inefficiency was inversely related to size and that foreign owned banks were less efficient than US owned banks.
Satyanarayana (1996) presented a model for measuring the productivity of banking industry in India. He was of the opinion that efficiency measurement should be based on the ‘market share concept’. According to his model the market share should be taken in percentages instead of absolute terms so that comparison of one bank to the other bank can be done easily. Model was applied to compare the efficiency of various groups of banks from 1969 to 1994. The State Bank of India was maintaining the highest level of long-term average productivity i.e. 103.

Athanassopoulos (1997) developed an efficiency benchmarking method for linking service quality with profits and tested the method on a sample of retail bank branches. In the empirical results of his paper lies an important observation that incorporating multiple drivers of performance in the framework of efficiency benchmark studies yields superior insights than isolated efficiency analyses of different links of the service-profit chain. The study demonstrates that enhanced improvements in X-efficiency of branches were obtained if one account for potential improvements in service quality as well.

Berger and Mester (1997) consider the DFA as their ‘preferred frontier efficiency estimation technique’. The study revealed that merger banks survival increased technical efficiency due to economies of scale. Profit efficiency measures how close a bank is to attaining the maximum possible profit as a best-practice firm on the frontier for given levels of input and output prices (quantities) and other exogenous market variables. Previous literature offers two different specifications for the profit maximization objective, namely standard and alternative (non-standard) profit functions. The standard profit function assumes that output markets were perfectly competitive so that banks were price-takers in both output and input markets while alternative profit specification assumes that banks can have some power in determining output prices. Thus, the standard profit function is specified as a function of input and output prices, whereas alternative profit function is specified as a function of input prices and output quantities (Humphrey and Pulley, 1997; Berger and Mester, 1997). Ramamoorthy (1997) measured the productivity of Indian commercial banks for the period 1991–1996 using business per employee as the measure of productivity. He concluded that measuring productivity as the business per employee did not truly represent the business in all its facets both from quantitative and qualitative angles. Therefore, the researchers should keep trying to evaluate productivity on various other alternative criteria.

To Scott Frame et al., (1997) productivity is generally defined in terms of the efficiency improvement and technical change with which inputs were transformed into outputs in the production process (Coelli et al., 1998). Roger (1998) tested the statistical and economic significance of including a measure of off balance sheet (OBS) activities in production cost,
revenue and profit functions using distribution free frontier estimation method. The study reported evidence indicating that including net non-interest income increases both mean cost and mean profit efficiency scores, but does not increase mean revenue efficiency. However, there was no attempt to investigate whether the results were robust to alternative estimation methods or alternative measures of aggregate OBS activities. The study does not investigate the sensitivity of the derived efficiency measures to the relative composition of the OBS activities that generate the net non interest income measure. Rogers included fee income as a non-priced output to proxy off-balance sheet activity in his model for estimating non-standard profit efficiency. He found that models which omit non-traditional outputs, like off balance sheet activity, tend to understate bank profit efficiency.

Berger and Mester (2000) examined the possible sources of differences in measured efficiency of financial institutions, including differences in efficiency concepts, measurement methods, the number of banks considered, market and regulatory characteristics and others. They estimated the efficiency of almost 6000 US commercial banks that were in continuous existence over the period from 1990 to 1995. The study employed three distinct economic efficiency concepts: cost, standard profit and alternative profit efficiencies. The paper analysed the effects of measurement methods including use of the distribution-free approach versus the stochastic frontier approach, specification of the Fourier-flexible functional form versus the translog form and inclusion of problem loans and financial capital in a number of different ways. It was found that the mean efficiencies for standard and alternative profit functions were similar to each other; however the alternative profit function does not fit the data nearly as well as the standard profit functions. Different functional forms used (translog and Fourier) yield essentially the same average level and dispersion of measured efficiency and both rank the individual banks in almost the same order.

Hughes et al., (2000) estimated a model that shifts the focus of modeling production from the traditional assumptions of profit maximization and cost minimization to a more general assumption of managerial utility maximization that can incorporate risk incentives into the analysis of production and recover value-maximizing technologies. The study implemented the model using the almost ideal demand system. In addition, the study used the model to measure efficiency in a more general way that can incorporate a concern for the market value of firm's assets and equity and identify value-maximizing firms. This shift in focus bridges the gap between the risk incentives literature in banking that ignores the microeconomics of production and the production literature that ignores the relationship between production decisions and risk. Thus estimation of the model for a sample of U.S. commercial banks illustrated that results
obtained from their generalized model can differ significantly from those obtained from the standard profit maximization model, which ignores risk.

The efficiency of the banking sector can be decomposed into scale efficiency, scope efficiency, pure technical efficiency and allocative efficiency. The bank is said to have scale efficiency when it operates in the range of constant returns to scale and have scope efficiency when it operates in different diversified locations. Maximizing output from a given level of input is called technical efficiency and when a bank chooses the revenue maximizing mix of output, the allocative efficiency occurs (Chen, 2001). Rodrik (2002) grouped the shortcomings and required actions related to market driven reforms into five components: market stabilization, market regulation, market creation, market legitimization and market completion and concluded that a combination of directing resources of intermediaries in fulfilling a quasi-fiscal role for government, extra-commercial accountability structures and regulatory forbearance (arising out of an implicit overarching guarantee umbrella) had mitigated the essential corrective effect of market discipline in both lending and deposit decisions. To Falkena et al., (2004) efficiency in banking can be distinguished between allocative and technical efficiency. Allocative efficiency is the extent to which resources were being allocated to the use with the highest expected value. A firm is technically efficient if it produces a given set of outputs using the smallest possible amount of inputs. According to Falkena et al., “the notion of X-inefficiency suggests that comfortable incumbents may not produce in the most efficient method. If a few players dominate the market, they may be sheltered from competitive forces and may use rule of thumb rather than best practice methods”.

Khumbhakar (2006) examined the appropriateness of the nonstandard profit function (NSPF) proposed by Humphrey and Pulley (1997) as an alternative to the standard neoclassical profit function. Since the duality results do not hold for the NSPF, they argued that the NSPF approach cannot represent the underlying production technology in any meaningful way. The study suggested a specification of NSPF that does take this relationship into account and also proposed an alternative specification using the cost function approach and derived profit efficiency there from. Data from US commercial banks for the year 2000 were used to estimate three models, viz., the misspecified NSPF, the correctly specified NSPF and the cost function. The empirical results showed that the distributions of efficiency scores from these three models were not the same and also found that rank order of efficiency scores vary substantially among the competing models.

Grazyna Wozniewska (2008) computed efficiency analysis by means of both methods, i.e. classical index of balance sheet characteristics and DEA method. The analysis was carried
out in the biggest banks operating in Poland during the period 2000–2007. The empirical results showed that the efficiency measures give a similar although not identical picture of Polish commercial bank’s performance. These results (yielded by both methods) were complementary to each other and suggest that the non-parametric DEA method was really valuable and worth applying in bank practice. Kwaku et al., (2012) expanded the banking efficiency literature by developing a banking intermediation model that captures both profit-maximising and corporate social responsibilities (CSRs) of banks. Using dataset of 21 banks for the years 2006–2008, the relative efficiency of Ghanaian banks was evaluated using DEA. The study derived significant difference between the DEA model that includes CSR and without CSR, an indication that the inclusion of CSR may be important for bank efficiency assessment. As a further analysis, two stage OLS regression was used which confirms a positive relationship between CSR, profitability and efficiency indicators.

From the above literature it is apparent that there are been continuous evidence of upgrading and improvement in analysis of measurement of efficiency over the period of time. Starting with single definition of achieving optimal allocation of resources, the concept was widened to include x-efficiency, linking risk-taking with operational efficiency, efficiency based market share, manager’s utility maximizing model and incorporating of cost into profit maximizing model. Different functional forms were used to measure efficiency of banking system. Although no consensus emerge among the authors on the use of efficiency measures, the studies have highlighted the need for incorporating efficiency measure to bring optimum allocation of resources to achieve maximum results.

II. Theoretical Foundations of Bank Efficiency

Since the period of slavery and feudalism, the world has observed advanced technological and organizational progress, which caused increase in the efficiency of economic organizations. According to Wilkin (1997), acceptance of economic efficiency as a key criterion of economic valuation can be traced to representants of classical economics, mainly Adam Smith as well as representants of classic utilitarianism, including John Stuart Mill and Jeremy Bentham who promoted liberalism and individualism. Economic liberalism advocates laissez-faire capitalism, liberal principles of decision making and emphasizes the importance of firm efficiency. These ideas were accepted by neo-realist theories with special contribution of Ludwig von Misses and Friedrich A. von Hayek. Efficiency has often been identified with productivity. Adam Smith in his famous book “An Inquiry into the Nature and Causes of the Wealth of Nations” states that the division of labor will provide the greatest improvement in productivity and worker’s skill. Increase in the productivity of work, according to Smith, was owing to the
saving of the work time and to the invention of a great number of machines which facilitate and shorten labour and enable one man to do the work of many (Bremondet et al., 2005).

Marx drew a sharp distinction between the productivity of labour in terms of physical outputs produced, and the value or price of those outputs. He rejected the possibility of a concept of productivity that would be entirely neutral and unbiased by the interests of different social classes. According to Marxists, productivity growth without simultaneous wage rise increases the extraction of surplus value from the working class. Apart from above-mentioned theories, the focus on economic efficiency was also given by welfare economics, which attempts to maximize social welfare by examining the economic activities of the individuals. The first fundamental theorem of this theory was that competitive markets are efficient and lead to a unique and optimal allocation of resources (allocative efficiency). Pareto efficiency as a measure of social welfare was used by many scholars as their efficiency goal. According to this measure, a situation was optimal only if no individuals can be made better off without making someone else worse off. Contrary, situations are considered to have distributive efficiency when goods are distributed to those individuals who can gain the most utility from them. Reading of Samuelson and Nordhaus (1995) confirms that competition of the market mechanism assures efficiency and everyone’s welfare. They admit, however, that a perfect and absolutely efficient competitive mechanism has never existed and never will.

In the literature looking specifically at banks there is a wide range of definitions of efficiency. The term is approached from various angles. Efficiency is analyzed from the point of economic theory and organisation theory. According to Stepien (2004), it is possible to investigate efficiency at the level of bank or its organizational units and for particular bank’s activities. Pure economic concept of efficiency assumes that efficiency is the ratio of total output goods with respect to input resources. Efficiency is regarded to be higher with higher level of this ratio. Rose (1997) defines efficiency as an indicator showing the ability of bank managers and its staff to keep the rate of increase in revenues and income at the level that exceeds the rate of increase in operational costs. According to Jaworski (2006), efficient activities are those activities which not only lead to achieving intended goals but also assure economic benefits higher than inputs.

In the literature different techniques have been employed to estimate efficiency. Most economists generally accept the principle of rational behavior and analyse banks utilizing the neo-classical theory of the firm. Such approach makes possible to use traditional economic measures of efficiency (inputs, outputs, cost constraints, etc.). However, in reality banks operate under uncertainty and imperfect information. This suggests that banks should not be assessed
on the basis of traditional efficiency measures alone and that assessing their overall performance requires assessing both efficiency and risk factors. Banks strategy goal should be risk-adjusted profit maximization.

Rogowski (1998) points out that study on measuring bank efficiency have focused on two alternative approaches, namely analysis of technical efficiency and analysis of scale and scope efficiency. Capiga (2003) presents different possible views on bank efficiency, which include distinction between

- organizational efficiency which deals with organization goals, its resources, internal and external environment and business performance through time;
- financial efficiency which examines those items that are financial in nature (included in banks financial statements), for example, by use of financial ratios; and
- cost efficiency which determines how close bank’s costs lie to the efficient cost frontier for given inputs and their ratios (technology).

Basic concepts for measurement of technical efficiency of a firm in an industry by estimating production function of firms, which are fully efficient (i.e. frontier production function) was suggested by Farrell (1957). His definition of the efficient firm is “its success in producing as large as possible an output from a given set of inputs”. He defines technical efficiency as a firm’s success in producing maximum output from a given set of inputs, i.e., producing on the technical frontier. The production function can be estimated from sample data employing either a nonparametric (mathematical programming) or a parametric (econometric) approach. Technical efficiency is evaluated by the unit’s distance from the (best practice) production frontier. Rogowski (1998) marks that there are two measures of technical efficiency, which are primarily used in the literature: output-oriented and input-oriented technical efficiency. Input-oriented technical efficiency or X-efficiency refers to selecting the appropriate inputs, i.e. the optimal scale and mix of inputs, given the output bundle. One of the most common measures applied is cost X-efficiency. In output-oriented technical efficiency the focus is on increasing output without changing the inputs used. It is, among others, used for revenue analysis.

In recent years, various efficiency measures estimated could be broadly classified under two types of approaches – parametric and non-parametric approach.

**Parametric:**

There are three main parametric approaches in the estimation of best practice frontier as explained below:

i) **Stochastic frontier approach:** This method was first developed by Farrell (1957) and the stochastic production frontier was later developed by Afriat (1972) and Aigner et al., (1977).
More recent re-interpretations have come from Ferrier and Lovell (1990) and Fried et al., (1993). The frontiers are calculated relative to the function being estimated, which could be the production, cost or profit function. The aim was to discover the minimum or maximum function, given the level of output and input prices. In this approach, cost, profit or production functions of the most efficient producers were estimated and an institution’s deviation from the frontier comprises two components, a random error and an inefficiency term. The part of the error term which represents deviations from the frontier was assumed to be drawn from a two-sided distribution, while the inefficiency was assumed to be drawn from a one-sided distribution, because inefficiency increases cost. The stochastic frontier approach can be estimated using cross-sectional data.

ii) **Distribution free approach**: The distribution free approach (DFA) was developed by Berger et al., (1993). Under this approach, efficiency differences are assumed to be stable over time, but no specific distributional assumptions are required (Goddard, Molyneux and Wilson, 2001). The estimate of inefficiency for each firm was the difference between its average residual and the average residual of the firm on the frontier, with some truncation performed to account for the failure of the random component to average out to zero. Estimation through distribution free approach model requires panel data set.

iii) **Thick frontier approach**: The thick frontier technique (TFA) developed by Berger and Humphrey (1991) proposes a much simpler separation which assumes deviations from predicted costs within the lowest average-cost quartile of banks in a size class representing random error. Deviations in predicted costs between the highest and lowest quartile represent productive inefficiencies (Goddard, Molyneux and Wilson, 2001). This approach imposes no distributional assumptions on either the inefficiencies or the random error. The TFA itself does not provide exact point estimates of efficiency for individual firms, but does provide an estimate of the overall level of efficiency.

**Non-parametric:**

The main non-parametric approaches are data envelopment analysis (DEA) and free disposal hull (FDH). DEA employs mathematical programming to construct a best practice frontier from the observed data and to measure efficiency relative to the constructed frontier. The DEA does not require output or output prices for identifying the best practice production frontier. It was first developed by Charnes et al., (1978). The best practice frontier was identified as piece-wise linear combination that connects the set of best practice observations, given the specifications of inputs and outputs. The outcome was to produce a convex production frontier for output oriented DEA and concave production frontier for input oriented DEA (Berger and
Humphrey, 1997). As a consequence, DEA efficiency score for a decision making unit (DMU) was not defined by an absolute standard but was defined relative to other forms. DEA generates a within sample efficiency score between 0 and 1, with 1 being the most efficient. Later, Banker, Charnes, and Cooper (1984) extended CCR model to allow variable return to scale. Recently Ray, Chen, and Mukherjee (RCM) (2008) introduced a cost-minimization DEA model for a multi-plant firm that faces a different input prices vector \((w_j)\) at different plant locations \((j = 1, 2, \ldots, N)\).

Under FDH approach, the assumption of convexity was dropped and it was expected to allow for a better approximation of observed data and generate larger efficiency estimates than DEA. However, a significant advantage of DEA was that it does not superimpose a particular functional form on the data in determining the most efficient decision making units and so captures the interplay between inputs and outputs of different dimensions. On the other hand, DEA’s major shortcoming was that it assumes data to be free of measurement error and could, therefore, give inaccurate results if the integrity of data was not assured (Avkiran, 1998).

**Analytical view**

Several techniques have been proposed in the literature to measure efficiency using frontier approaches. Non-parametric techniques such as DEA use linear programming techniques to compute efficiency scores. They do not require any assumptions regarding the functional form of the frontier, allowing the frontier to tightly envelop the data. However, their main weakness was that they do not allow for any error in the data. The entire distance to the frontier was considered as inefficiency, resulting in the inclusion of exogenous events in the inefficiency term. Inefficiency may then be overestimated. Furthermore, DEA has the major drawback of increasing the number of efficient observations by default when there was a small number of an observation relative to the number of inputs and outputs. Parametric approaches such as the stochastic frontier approach use econometric tools to estimate the efficiency frontier. Their main weakness was that they impose more structure on the shape of the frontier by specifying a functional form for the cost function. However their major advantage was that they allow for random error, which improves the estimation of efficiency scores. But this allowance creates a new problem: the separation of random error from inefficiency. Parametric approaches then differ in the method adopted to separate random error from inefficiency. The stochastic frontier approach uses a composed error model in which inefficiency was assumed to follow an asymmetric distribution (e.g. half-normal, truncated normal, gamma) while random error was assumed to follow a symmetric distribution (usually normal). The rationale was that inefficiency cannot diminish costs and thus must have an asymmetric distribution, whereas random error can add or subtract cost and then have a symmetric distribution. Following
Jondrow et al., (1982) efficiency was then computed by the conditional mean of the inefficiency term, given the residual which was an estimate of the composite error. Therefore, the computation of efficiency for the stochastic frontier approach requires arbitrary assumptions regarding the distributions of the inefficiency term and random error.

Other parametric techniques have been developed, notably to allow a separation of random error from the inefficiency term without imposing assumptions on the distributions of random error and the inefficiency term. However their specifications do not allow their use in various works. The distribution-free approach requires panel data, which are not available for a sufficient period. The thick frontier approach only provides average efficiency scores for the whole tested sample which may not be suitable when comparison was made between the efficiency of domestic-owned and foreign owned banks. Finally parametric approaches allow easier control of the influence of variables on the structure of the cost frontier than non-parametric techniques. Indeed the inclusion of some environmental variables or the risk differences was easily done by adding terms in the estimated cost frontier (Mester, 1996).

To sum up, four approaches have come to dominate the literature on banking output: the production approach, the intermediation approach, the operating (income-based) approach and more recently, the modern approach. There are five frontier techniques to measure the relative efficiency of banks. They are Stochastic Frontier Analysis (SFA), Distribution Free Approach (DFA), Thick Frontier Approach (TFA), Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH). The first three frontier techniques are parametric approach which requires explicit specification of production frontier like Cobb-Douglas and translog, etc. The remaining two techniques are non-parametric approach which does not require a specification of production frontier and was based on mathematical programming techniques. Amongst above mentioned techniques, the most popular and widely used technique in banking efficiency analyses is Data Envelopment Analysis (DEA). Few studies have attempted to compare different estimation techniques which found that choice made concerning efficiency measurement usually make very little difference which suggest that efficiency estimates are robust to different methodologies (Bauer et al., 1998).

III. Empirical Reviews

1. Technical and Scale Efficiency

1.1 Indian Experience

Singh (1992) carried out a comprehensive study to analyze the trends in the productivity of the Indian banking industry. The State Bank of India and its subsidiaries along with other
nationalized banks were considered for analysis. He performed cross sectional and inter-temporal analysis on the basis of 17 indicators. The results showed that all the banks under study showed improvement in their productivity except the UCO bank, which showed decline in productivity. One of the first published studies using non-parametric production frontier approach was Noulas and Ketkar (1996) who used intermediation approach and determined the technical and scale efficiency of public sector banks for 1993. They found average technical inefficiency of 3.75 percent, of which two thirds was due to scale inefficiency. The study identified that pure technical efficiency was 1.5 percent and scale inefficiency was 2.25 percent and none of the banks were operating under decreasing returns to scale.

Athma and Srinivas (1997) conducted a study to analyze the productivity in commercial banks in India group wise (public sector banks, private sector banks and foreign banks) for the period 1982 to 1995. All the three bank groups made efforts to improve their productivity in 1994–95 and succeeded in earning profits by recovering the operative costs fully. The study concluded that the efficient operations prompt recoveries, proper appraisal of credit risks and avoidance of risky investments are the key to profitability in banking. Das (1997) studied technical, allocative and scale efficiency of different public sector banks for the period 1990–96 using DEA under intermediation approach. The efficiencies were calculated for each year for all the banks. The study found decline in overall efficiency over time - decline in technical efficiency with slight improvement in allocative efficiency. Thus, change in inefficiency was due to technical inefficiency rather allocative inefficiency. The State Bank was found to be more efficient than other public sector banks. Das (2000) analyzed the technical and allocative efficiency of 27 public sector banks using cross-sectional data for the year 1997–98. It was found that public sector banks had the scope of producing 1.23 times as much output from the same inputs. Further, the inefficiency that appeared in public sector banks was more a result of both technical and allocative inefficiency. The study found a negative relationship between non-performing assets and efficiency and size and efficiency.

Pal et al., (2000) examined the productivity of 68 major Indian commercial banks for the year 1999. Output oriented DEA model was employed to find the relative efficiency of Indian banks. The results showed that 16 banks were CCR (constant return to scale) efficient (efficiency =1). The average efficiency figure for the banks came out as 0.9. About 45 banks had efficiency rating greater than 0.9 and out of these 50 percent were private banks. They concluded that the privately owned banks performed better than the foreign owned banks. Saha and Ravishankar (2000) estimated productivity of 25 public sector Indian commercial banks for the period 1992 to 1994 and examined the efficiency of the public sector banks in two phases.
using intermediate approach. The results obtained showed that the performances of the public sector banks (with the exception of the few) had improved over the study period. Syed (2001) applied DEA technique to analyse banking sector efficiency in the post reform era of 1993–98 using intermediation approach. The sample consisted of 37 banks out of which 18 were domestic owned while 19 were foreign owned and tested for factor productivity growth using Malmquist productivity index. The overall average inefficiency for the sample of banks over six-year period turned out to be approximately 20 percent. The poor performance of banking sector was due to poor performance of real sector, rather than vice versa.

Janki (2002) analyzed the effect of technology on the productivity of employees using DEA for the period 1986–91. The study found that public sector banks had the highest efficiency followed by foreign banks. The private banks were found to be the least efficient. They also found a temporal improvement in the performance of foreign banks. Nath et al., (2002) studied efficiency of 68 commercial banks operating in India for the period 1998–99 using DEA method. The result showed that the private commercial banks have the higher efficiency figure and least variation whereas the foreign owned banks exhibits the least average efficiency figure and maximum variation. The public sector commercial banks come in-between. Kumbhakar and Sarkar (2003) analysed the relationship between deregulation and total factor productivity (TFP) growth in the Indian banking industry using a generalized shadow cost function approach. TFP growth was decomposed into technological changes, scale and miscellaneous component. A disaggregated panel data analysis using the population of public and private banks over 1985–96 which cover both pre and post-deregulation period indicated that with a significant decline in regulatory and deregulation, the private sector banks have improved their performances mainly due to the freedom to expand output while public sector banks have not responded to the deregulation measures. Misra (2003) examined whether allocative efficiency of the Indian banking system had improved after the introduction of financial sector reforms in the early 1990s. Allocative efficiency had been studied for 23 states of India for two periods 1981–1992 and 1993–2001, broadly corresponding to the pre and post-reforms periods. The analysis carried under panel co-integration framework revealed that overall allocative efficiency of the banking system had almost doubled in the post-reform period. Result suggested that while allocative efficiency of bank's funds deployed in the services sector had improved that in the agriculture and industry had deteriorated in the post-reform period for majority of the states. Estimates of elasticity of output with respect to credit improved from 0.30 during the period 1981–1991 to 0.35 during 1992–2001 indicating as improvement in the allocative efficiency of the banking system at the all India level.
Naidu and Nair (2003) examined whether the technical efficiency of scheduled commercial banks in India had improved after the implementation of Narasimham Committee recommendations using stochastic production frontier approach. The period of the study was 1988–89 to 1990–91 and 1991–92 to 1998–99. The result showed that the technical efficiency levels of public sector banks had recorded a decline in the post-liberalization period whereas the technical efficiency levels of both domestic private and foreign banks improved slightly. The differences in the technical efficiency levels among bank groups had declined in the post-liberalization period indicating enhanced competition among bank groups. Ram Mohan and Ray (2003) have studied productivity and efficiency of public and private sector banks in India, using DEA, for the period 1992–2000. They studied 27 public sector, 21 old private sector and 14 foreign banks. They employed three measures: Tornquist total factor productivity growth, Malmquist efficiency index and revenue maximization efficiency. They assumed CRS technology and used intermediation approach. Only foreign banks showed an improvement in technical efficiency while both public and private firms showed a decline. Also the average level of technical efficiency was significantly higher for foreign banks (0.331 percent) compared to the PSBs (-0.075 percent). They found public sector banks to be more efficient and productive compared to their private sector competitors.

Sathye (2003) examined the measured variation in the performance and therefore the productive efficiency of Indian commercial banks for the year 1997–98 compiled by the Indian Banks’ Association (IBA, 1999). The efficiency had been calculated using variable returns to scale (VRS) input oriented model of the DEA methodology. To measure efficiency as directly as possible, two input and two output variables, namely, interest expenses, non-interest expenses (inputs) and net interest income and non-interest income (outputs) have been used (referred to as Model A). A second DEA analysis was run with deposits and staff numbers as inputs and net loans and non-interest income as outputs (referred to as Model B). In the Model B, where a less direct approach was taken to measure efficiency, deposits replace interest expense, staff numbers replace non-interest expenses and net loans become proxy for net interest income. The two models have been used to show how efficiency scores differ when inputs and outputs are changed. The study found that the mean efficiency score of Indian banks (0.83 percent) compares well with the world mean efficiency score and the efficiency of private sector commercial banks as a group was, paradoxically lower than that of public sector banks and foreign banks in India. The study showed that as per Model A, the public sector banks (0.83) have a higher mean efficiency score as compared to the private sector and foreign commercial
banks in India. As per Model B, they have lower mean efficiency score (0.62) than the foreign banks but still higher than private sector commercial banks.

De (2004) used an econometric approach to determine the technical efficiency of the Indian banks and examined the relationship between ownership and efficiency and impact of reforms on efficiency. Panel data for the years 1985–1996 were used and a stochastic frontier production function was fitted to the data. The overall finding was that banking industry was technically inefficient. The average inefficiency levels varied from 55 percent and 20 percent for the two output measures used in the study. Technical efficiency had increased in the post-liberalization for only 14 banks out of 18 banks and for more than two-third of the banks in the sample technical efficiency was constant over the period. Ram and Ray (2004) attempted a comparison between public sector banks and their private sector counterparts based on measures of productivity that use quantities of outputs and inputs. They employed two measures of productivity: Malmquist total factor productivity growth and have attempted comparisons over the period 1992–2000, comparing PSBs with both domestic private and foreign banks. Out of a total of four comparisons made, there were no differences in three cases, PSBs do better in two and foreign banks in one. To put it differently, public sector banks were seen to be at a disadvantage in only one out of six comparisons. It was difficult, therefore, to sustain the proposition that efficiency and productivity have been lower in public sector banks relative to their peers in the private sector.

Shanmugam and Das (2004) analysed the efficiency of 94 banks belonging to four different ownership groups in India during 1992–1999 using stochastic frontier production model. The banking industry had shown a progress in terms of efficiency of raising non-interest income, investments and credits. The efficiency improvement was considerable in the case of investments in all banks particularly in private banks. Thus, the result matches with the economic growth objective of the reform measure. It was found that the State Bank group (48.7–51.4 percent) and foreign banks (38.7–41.3 percent) were more efficient than their counterparts. However, they found that there were still larger gaps between the actual and potential performances of banks. Chakrabarti and Chawla (2005) applied DEA to evaluate the relative efficiency of Indian banks during the period 1990–2002. They utilized two models to specify input-output vectors and labeled these models as “quantity” and “value” approaches. The results of the study suggested that on the “value” bases, the foreign banks as a group have been considerably more efficient than all other bank groups followed by the Indian private banks. However, from the “quantity” perspective (volume of deposits and credit), private banks seem to be doing the best while the foreign banks were the worst performers. Further, public
sector banks have, in comparison, lagged behind their private counterparts in terms of performance.

Das and Ghosh (2005) analysed the efficiency and examined the interrelationships among credit risk, capital and productivity change in the Indian context, using the data on state-owned banks (SOBs) for the period 1995–96 to 2000–01, where credit risk was measured by the ratio of net non-performing loans to net advances. The results showed that higher productivity leads to a decrease in credit risk and also there was a positive relation between productivity and bank capitalization. This finding supported the fact that poor performers were more prone to risk taking than better performing banking organizations. Das and Ray (2005) empirically estimated and analysed various efficiency scores of Indian banks during 1997–2003 using DEA. It was observed that Indian banks are still not much differentiated in terms of input or output-oriented technical efficiency and cost efficiency. However, they differ sharply in respect of revenue and profit efficiencies. Apparently, revenue rather than cost played a dominant role in determining profit efficiency of Indian banks. Bank size, ownership, and being listed on the stock exchange were some of the factors that have a positive impact on average profit efficiency and to some extent, revenue efficiency scores.

Ataullah and Le (2006) using the Indian banking industry as a case study proposed and tested hypotheses regarding the possibility of a relationship between three elements of the Economic Reforms (ERs) – namely, fiscal reforms, financial reforms and private investment liberalisation and bank efficiency in developing countries. Bank efficiency was measured using DEA. The relationship between the measured efficiency and various bank specific characteristics and environmental factors associated with the economic reforms was examined using the OLS and GMM estimations. The results showed an improvement in the efficiency of banks, especially that of foreign banks, after the economic reforms. The study found a positive relationship between the level of competition and bank efficiency. However, a negative relationship between the presence of foreign banks and bank efficiency was found, which was attributed to a short-run increase in costs due to the introduction of new banking technology by foreign banks. Furthermore, the study found that fiscal deficits negatively influence bank efficiency. However, the results also suggested that the gap between the efficiency of public sector banks and private sector banks declined during the post-economic reforms era. Chatterjee and Sinha (2006) estimated input oriented technical and scale efficiency of the Indian commercial banks using the DEA under variable returns to scale and free disposal hull approaches respectively. The periods of study were 1996–97, 1998–99, 2000–01 and 2002–03.
As per the study the observed public sector banks exhibited lower mean technical efficiency as compared to the observed private sector banks irrespective of the output indicator chosen.

Das et al., (2006) empirically investigated the performance of Indian commercial banking during the post reform period 1992–2002 using DEA. Three different approaches namely; intermediation approach, value-added approach and operating approach have been employed to differentiate how efficiency scores vary with changes in inputs and outputs. The analysis links the variation in calculated efficiencies to a set of variables, i.e., bank size, ownership, capital adequacy ratio, non-performing loans and management quality. A multivariate analysis based on the logit model suggest that medium-sized public sector banks performed well and were more likely to operate at higher levels of technical efficiency. A close relationship was observed between efficiency and soundness as determined by bank’s capital adequacy ratio. The empirical results also showed that technically more efficient banks were having less non performing loans. Raojibhai (2006) attempted to bridge the gap between identification of efficiency indicating factors separately for all the three sectors. Hence 23 variables were grouped under three factors namely, efficiency factors related to per branch, efficiency factors related to operations and efficiency factors influencing ultimate profits. Out of the scheduled commercial banks, five banks from each sector were selected as representative banks on the basis of size of deposits for the year 2006. The ‘per branch’ sub-factors influence significantly the overall efficiency of public sector banks. Efficiency factors related to per branch do not play significant role in influencing the efficiency of foreign sector banks.

Uppal and Kaur (2007) analysed the efficiency of all the bank groups in the post banking sector reforms era (1999–2000 to 2004–05). The sample for the study comprises of five different ownership groups and the ratio method was used to calculate the efficiency of different bank groups. The paper concluded that the efficiency of all the bank groups had increased in the second post banking sector reforms period but these banking sector reforms were more beneficial for new private sector banks and foreign banks. Omprakash et al., (2008) compared the performance of the Indian banking sector in two stages: through the construct of productive efficiency using DEA and finding the determinants of productive efficiency through TOBIT model for the period 1999–2003. The study showed that SBI and its group have the highest efficiency: Indian Bank had shown most and consistent increase in efficiency over the five years (0.6924 to 0.8444) followed by private banks and the other nationalized banks. The results were consistent over the period, but efficiency differences diminish over period of time. The most important parameter for the output efficiency was the operating profit per total asset (OPTA) followed by the capital adequacy ratio (CAR). Operating profit to total assets had a positive and significant
effect on efficiency. The capital adequacy ratio was found to have a significant positive impact on productive efficiency.

Paroma Sanyal and Rashmi Shankar (2008) analyzed the effect of ownership and competition on bank productivity while controlling for size and structure of the bank. They used a feasible GLS model controlling for bank specific characteristics and time fixed effects and computed four different market shares based on total income of the bank, total assets owned, loans and loans plus deposits. They estimated the measures based on the Herfindahl index. The study found that Indian private banks dominate the public and foreign banks, both in terms of productivity levels and productivity growth and that competition affects banks differently depending on ownership. Sunil and Rachita (2008) analyzed technical, pure technical and scale efficiencies in Indian public sector (1992–2005) using logistic regression analysis, slacks and targets setting analysis and Input-oriented efficiency scores. The results of logistic regression analysis provided that the factors like market share, profitability, and asset quality do not have any significant impact on the overall technical efficiency of Indian public sector banking industry.

Tianshu et al., (2008) using a balanced panel data set covering the period of 1992–2004, employing DEA based Malmquist total factor productivity (TFP) index, examined the impact of regulatory reform on the performance of Indian commercial banks and whether it affected the risk-taking behaviour of market participants. The empirical results indicated that, after an initial adjustment phase, the Indian banking industry experienced sustained productivity growth, which was driven mainly by technological progress. Bank's ownership structure does not seem to matter as much as increased competition in TFP growth. Foreign banks appear to have acted as technological innovators when competition increased, which added to the competitive pressure in the banking market. Finally, results also indicated an increase in risk-taking behaviour along with the whole deregulation process. Dash and Charles (2009) investigated the technical efficiency of Indian banks using DEA model segmented in terms of ownership during the period 2003–08 for a sample of 41 major banks operating in India. The results of the study showed that foreign banks were slightly more efficient than public and private banks, and that there was not much of difference in the efficiency of public and private banks.

Pal et al., (2009) conducted study on productivity growth of the Indian banking sector using panel data for 63 commercial banks from 1996–2005 using DEA and decompose the Malmquist index of total factor productivity growth into technical change, change in technical efficiency and change in scale efficiency. The study revealed that overall productivity growth was the result of technical progress accompanied by stagnating and negative growth rate in the
other components of total factor productivity. Kumar and Gulati (2010) examined whether the effect of ownership on the efficiency of Indian domestic banks was significant. The efficiency scores for public and private sector banks were computed using DEA for financial years 2005–06 and 2006–07. The study found that the new private sector banks dominate the formation of efficient frontier of Indian domestic banking industry, the overall technical inefficiency stems primarily from managerial inefficiency (as reflected by pure technical inefficiency) rather than scale inefficiency and though the efficiency differences between the public and private sector banks have been noted, these differences were statistically insignificant in most of the instances. On the whole, the study concluded that ownership does not matter in the Indian domestic banking industry.

Seema Sharma and Sanjeev Gupta (2010) attempted to analyse the productivity and efficiency growth pattern of Indian banking industry during the post-liberalisation era by using Malmquist data envelopment analysis (DEA) for the period 1996–2006. Results indicated that during the study period, the industry experienced regress in technological progress along with stagnation in technical efficiency. Some progress was reported in scale economies but the dominating technological regress resulted in productivity decline. From the group-wise analysis, nationalized banks came out to be the leader in case of scale economies whereas private sector emerged as the best performer in technical efficiency. None of the groups could experience positive productivity growth over the study period. Suman Tandon (2010) attempted to analyze the total factor productivity changes of Indian public sector banks during the post-reforms period from 1991–2007. A non parametric Malmquist productivity index was applied to calculate productivity. Total factor productivity change (TFPCH) in performance of nationalized banks (except SBI and its associates) averaged at 2.2 percent during 1992–93 to 2006–07. The decomposition of TFPCH showed that the mean technical progress increased by 1.9 percent whereas mean technical efficiency had shown a marginal increase of 0.3 percent during the period. Whereas TFPCH in productivity of SBI and its associates was 2.1 percent, the change in technology was 3.8 percent and no change was observed in PECH. The change in scale efficiency had shown declining trend of 0.7 percent.

Amit Kumar and Kumara (2011) determine the impact of various market and regulatory initiatives on efficiency improvements of Indian banks. DEA was used to identify banks that are on the output frontier given the various inputs at their disposal under intermediation approach. The banks that estimated mean technical efficiency under DEA-CRS model to be 95.6 percent in 2005 moved up to 97.9 percent in 2010. In terms of technical efficiency, most of the sample units showed more than 90 percent efficiency. The national, new private and foreign banks have
showed high efficiency over the time period than remaining banks. Namita and Monika (2011) evaluated the technical efficiency (TE) of public sector banks (PSBs) operating in India during the post-reforms period from 1992–1993 to 2009–2010, using DEA. The results exhibited the positive impact and greater propel of reforms on 20 banks and seven showed an inverse trend. Namita and Monika (2011) evaluated the efficiency of foreign banking sector as a group and individual foreign banks operating in India over the period 2005–2010, using the intermediation approach. The efficiency score by foreign banks grew from 0.790 (2006) to 0.862 (2010). Seventeen foreign banks which showed increasing efficiency trend while remaining 10 banks exhibited inverse results.

Neetu and Sunil (2011) using the cross-section data for the financial year 2008–09, investigated the efficiency of public sector banks in India. DEA was used to compute the efficiency scores for individual PSBs with modified version of intermediation approach as opposed to the production approach. The empirical findings revealed that public sector banks had high level of efficiency which was reflected by the mean efficiency score of 0.890. The banks with lesser priority sector advances and more income from non-traditional activities were found to be more efficient. Rachita Gulati (2011) measured the extent of technical, pure technical and scale efficiencies of Indian domestic banking industry using DEA. The results showed that only 9 of the 51 domestic banks operating in the financial year 2006–07 were found to be efficient, with the TE scores range from 0.505 to 1 and an average of 0.792. The managerial inefficiency was the main source of overall technical inefficiency in Indian domestic banking industry. The efficiency differences between public and private sector banks were not statistically significant. Rajan et al., (2011) examined technical efficiency and productivity performance of Indian scheduled commercial banks for the period 1979–2008. The investigations was based on panel data which comprises of four cross sections viz., Nationalized Banks other than SBI and Associates (NB), State Bank and its Associates (SBI), Indian private banks (PB) and foreign banks (FB). Significant changes in the policy environment have clearly enabled banks to expand their operations efficiently under the new liberalized atmosphere.

Rao (2011) attempted to bridge the gap between identification of efficiency indicating factors separately for public sector banks. Hence, 23 variables were grouped under five factors namely, efficiency factors related to employees, efficiency factors related to per branch, efficiency factors related to operations, efficiency factors influencing liquidity and efficiency factors influencing ultimate profits as dependent variables. And the independent variables were deposits, assets and advances. The data was collected for a period of five years (2001–2005). It
was found that per branch and operations related efficiency factors were influencing the overall efficiency of public sector banks. Uppal (2011) analysed the efficiency of all the bank groups in the post-banking sector reforms era. Time period of the study was related to second post-banking sector reforms (1999–2000 to 2005–06). The study concluded that among the Indian banks, efficiency of new private sector banks was quite high, but foreign banks have even edge over new private sector banks and that profitability of public sector banks were dependent more on interest income where as new private sector banks and foreign banks are able to step-up their non-interest income higher in comparison to public sector banks.

Gupta and Monika (2012) assigned ranks to different bank groups on the basis of their overall performance scores. The study had analyzed overall performance of banking sector divided into nine groups on 12 selected variables relating to efficiency, productivity and profitability for five different periods (1991–92, 1995–96, 1999–2000, 2003–2004, 2007–2008) to take the effect of different reform measures taken by RBI. Overall performance index revealed that new private sector banks occupied the top position in 1995–96 and 1999–2000 and after that, foreign banks maintained their top position (2003–04, 2007–08). Public sector banks and old private banks had improved their performance from 1991 and inter-bank group differences were reduced from 56.37 in 1995–96 to 19.49 in 2007–08 showing the impact of various reform measures taken by government to enhance competition. Thus, the policy changes on entry of foreign banks in India had significant impact on their presence in the structure of Indian banking industry. Arora and Arora (2012) examined productivity growth in public sector banks (PSBs) in India in post-liberalisation period from 1991–1992 to 2008–2009. Total factor productivity (TFP) in Indian public sector banks was computed using Hicks-Moorsteen index numbers as given by O'Donnell (2010). Results show that Indian PSBs have experienced positive productivity growth since liberalisation. Also, there exists significant difference in the productivity growth experienced by SBIG (State Bank of India group) and NBs (nationalised banks) with the latter having experienced higher TFP growth. The difference had been traced to greater technological progress experienced in NBs rather than to the effect of higher efficiency gains.

Manas Kumar Baidya and Debabrata Mitra (2012) evaluated the technical efficiency of 26 Indian public sector banks from the cross-section data for the financial year 2009–2010 and ranked the efficiency of the banks using two popular DEA models: CCR and Andersen and Petersen’s super-efficiency model. The results reveal that average technical efficiency of entire sample was 86.5 percent and only seven banks (23 percent) were found to be fully efficient. The study found that, the banks which were using more labour for providing their services were
relatively more inefficient. State Bank of India was observed to be the most efficient bank followed by Indian Bank, Corporation Bank as per super-efficiency scores whereas most inefficient bank was United Bank of India. Arora and Arora (2013) examined year-to-year TFP changes experienced by Indian banks (public and private) in the post-liberalisation era (1991–1992 to 2007–2008) using H-M (Hicks-Moorsteen) index numbers. The main finding of the study was that productivity (TFP) in Indian banks had remained stagnant since 1991 to 1992 with no significant differences observed in the three sub-periods studied and type of ownership had a significant effect on scale efficiency in Indian banks.

Jolly Puri and Yadav (2013) measured the OTE (overall technical efficiency), PTE (pure technical efficiency) and SE (scale efficiency) of public sector and private sector banks for the year 2009 to 2010 using DEA. The findings showed that, public sector banks outperformed private sector banks in all categories of efficiencies. The contribution of scale inefficiency in overall technical inefficiency had been observed to be smaller than the contribution of pure technical inefficiency. The highest and lowest levels of average overall technical inefficiency have been seen for old private sector banks (48.8 percent) and SBI and its Associates (2.2 percent), respectively and the results by sensitivity analysis are quite robust to discriminate between efficient and inefficient banks.

To sum up the majority of studies that have examined efficiency of banking sector in India can be divided on the basis of econometric methodologies into two, namely parametric and non-parametric. Most researchers used DEA (data envelopment analysis) a non-parametric approach to estimate the total productivity and efficiency of banks. Most of the early studies found significant improvement in the efficiency scores of Indian commercial banks in the post-reform period. However conflicting claims were advanced with regard to the performance of bank groups with few studies claiming foreign banks out performing Indian banks on efficiency score (Rajan et al., 2011; Uppal et al., 2011 and Kapil, 2007) while few others claimed domestic banks to be better performer than foreign banks (Rao, 2011 and Paroma Sanyal and Rashmi Shankar, 2008). On the whole, the study concluded that ownership does not matter in the Indian domestic banking industry.

1.2 Experience in Other Countries

Berg et al., (1992) examined the changes in productivity in banking industry for the period covering 1980–1989 by taking a sample of 346 banks in Norway. They concluded that the productivity declined on an average before deregulation and productivity had shown increasing trend after deregulation. Berg et al., (1993) used DEA to study the efficiency in Scandinavian banking markets and found the average Swedish bank (79 percent) to be more
efficient than the average Norwegian bank (57 percent), which in turn, was more efficient than the average Finnish bank. Berger et al., (1993) compared the efficiency of banks in Norway, Sweden, and Finland, all of which permit universal banking. These data, however, mostly cover U.S. banks and make no explicit distinction between universal and non-universal banks, found that larger banks were more efficient. However, since there were large disparities between banks of similar size, the study indicated that the way individual banks were run was much more important than their form of organization or size, as such. Benston et al., (1994) found that the data on economies of scale and scope and X-efficiency indicate some advantage for universal banks over specialized banks. However, considering that specialized banks were able to survive in direct competition with universal banks, the author concedes that the efficiency advantages of neither form of banking appear to be overwhelming.

Berger and Humphrey (1997) reported that very little of the interbank differences in efficiency scores was correlated with potential correlates such as size, market concentration and organizational form. In many instances, variables that appear to have some explanatory power were not under the direct control of managers. Griffel-Tatje and Lovell (1997) analyzed the various causes of productivity change in Spanish banking industry for the period 1986–1993 by using Malmquist productivity Index. They concluded that commercial banks had lower rate of productivity growth than saving banks but these banks have higher rate of potential productivity growth. Paster et al., (1997), using a non-parametric approach together with the Malmquist index, analysed the differences in the productivity and efficiency between different European and US banking system. The study found that, under the assumption of a constant returns to scale production technology, France had the highest efficiency score of (0.95) and the UK had the lowest efficiency score (0.56). Mendes and Rebello (1999) studied the Portuguese banking sector relating to productivity efficiency, technological change and productivity and illustrated that deregulation in specific case did not lead to an increase in cost efficiency but rather to technological regress.

Wheelock and Wilson (1999) examining the technical progress, inefficiency and productivity changes in US banking for the period 1984–1993, found that US commercial banks became more technical inefficient between 1984 and 1993. They used DEA (Shephard output distance function) for 14108 banks in 1984 and 11387 banks in 1993. The findings indicated that during 1984–93 banks of all sizes experienced decline in technical efficiency. Yet, there was technological progress over the period for banks in all size categories. Battese et al., (2000) analyzed the impact of the deregulation on productive efficiency in Swedish banking industry in mid–1980s using stochastic frontier approach with a specification of translog cost function to
estimate the labour use. The study identified that there were significant technical inefficiency effects for labour use in banks and the overall inefficiency was estimated to be around 12 percent.

Ashton (2001) analysed 11 retail banks using the econometric approach to test for economies of scale, scope, cost complementarities and cost efficiency. The study utilized both the intermediation and production approach and found that substantial economies of scale were present in UK banking, that efficiency levels were narrowly dispersed around 98 percent and that the smallest banks in the sample exhibit the highest levels of efficiency. This was compared with the production approach where efficiency levels range from 71 percent to 100 percent with a mean of 82 percent. Pinho (2001) used accounting data to provide estimates of productive efficiency in Portuguese banking, a model of the production process of the banking firm consistent for the years 1986–1992. In the first one, banks use capital and labour to originate deposits, which was described by a transformation function. The second consists of the fund matching of assets and liabilities, which was described by the balance-sheet equation. By using this framework profit functions were obtained in which deposits have a positive user price and therefore they were classified as an output. This framework differs from existing literature on the explicit inclusion of the balance sheet constraint on the cost minimization problem. Results showed clear evidence for the existence of economies of scale for the smaller banks and economies of scope between deposits and loans were found for all but the largest banks. The effect of market share on efficiency was convex, declining from zero to a minimum of 7 percent and then grows back to zero close to the 14 percent level and was positive from there on. Its impact nevertheless, was very small reaching a value close to 0.7 percent at the minimum. The determinant of individual inefficiency scores which was about 17 percent was size, type of ownership and age. A positive trend on efficiency was also found.

Devaney and Weber (2002) used non parametric linear programming methods to calculate the directional distance function and profit function for a random sample of U.S banks from 1994–1999. The study found that the difference between maximum profit and actual profit was due to technical and allocative inefficiencies. Technical inefficiency averaged 0.03 in 1994 rose to 0.07 in 1997 and then declined to 0.02 in 1999. The estimates imply that the gain in small business lending from reducing technical inefficiency was minor compared to the gain possible from eliminating allocative inefficiency. Allocative inefficiency ranged from a low of 0.51 in 1998 to a high of 0.71 in 1995. Technical inefficiency declined as bank asset increased. As a percentage of assets, small business lending was larger for the most efficient banks.
Fuckuyama and Weber (2002) used panel data on Japanese banks over the period of 1992–1996 to measure productivity growth. The study concluded that Japanese banks experienced productivity declines over the period of analysis and that each bank could have used somewhere between 78–93 percent of actual inputs if they had chosen the most efficient, revenue maximizing combination of outputs. The cross-country analysis of commercial bank efficiency in transition countries were undertaken by Grigorian and Manole (2002). The sample covered countries from the CEECs and CIS from 1995 to 1998. The study employed DEA approach in the first stage to generate estimates of efficiency measures and in the second stage seek to explain the determinants of efficiency variation. Efficiency estimates revealed that the existence of clusters with CIS countries being the worst performers. Isik and Hassan (2002) employed DEA to investigate efficiency in the Turkish banking sector and found that foreign banks operating in Turkey seem to be significantly more efficient than their domestic peers. Jemric and Vujcic (2002) reported improvement and equalisation in efficiency measures in the Croatian banking sector over 1995–2000 using DEA approach. Foreign banks were found to be more efficient than state and private-owned banks. Furthermore new banks perform better than old banks. Poor performance of both the state-owned and old banks was due to the non-performing loans inherited from the previous system.

Lozano-Vivas et al., (2002) investigated the operating efficiency differences of a sample of commercial banks across 10 European countries. They also considered stochastic frontier approach (SFA) in order to check the consistency of the efficiency results obtained in their primal analysis. The average change in their efficiency scores was around 12 percent. Belgium ranked in fourth place and Germany, France, Portugal and UK ranked equally in fifth place in terms of their average environmental conditions, show a similar average improvement in their efficiency scores, around 36 percent. Denmark and Spain which were ranked at the bottom, obtain an increase of around 60 percent in their average efficiency score. The comparison between the two models shows that country-specific environmental conditions exercise a strong influence over the behavior of each country’s banking industry.

Yildirim (2002) analyzed the efficiency performance of Turkey commercial banks during deregulated period by adopting DEA for the years 1988–1999. The analysis revealed that the banks faced decreasing returns to scale and pure technical efficiency and scale inefficiency were positively related to size. Besides, the analysis observed that state-owned banks performed better than the private and foreign banks. Canhoto and Dermine (2003) tried to estimate the magnitude of efficiency gains in Portugal over the years 1990–1995, a period of significant financial deregulation following EU (European Union) membership. The DEA
approach used in the study showed an improvement in efficiency for the overall sample over time, with the new banks dominating the old ones in terms of efficiency. Casu and Molyneux (2003) investigated whether there had been an improvement in and convergence of productive efficiency across European banking markets since the creation of the single internal market programme (SMP) from 1993 to 1997. Using efficiency measures derived from DEA estimation, the determinants of European bank efficiency were evaluated using the Tobit regression model approach. Overall, the results suggest that since the EU’s SMP there had been a small improvement in bank efficiency levels, although there was little evidence to suggest that these have converged. The majority of DMUs comprising the sample seem to cluster around efficiency levels of 0.65. The results show that the efficiency gap among countries grew wider over the period.

The study conducted by Diego (2003) using panel estimation technique to assess the mechanisms through which policy changes have influenced the growth performance of 15 European Union economies also supports the above postulations. He came to the conclusion with the aid of two channels. First was the increase in the level of financial intermediation measured by the rise in the private credit to GDP. The second channel was the improvement in the quality and efficiency of the financial intermediation process proxied by the fall in the growth rate of the ratio of non-performing loans to total loans. The result revealed that the harmonisation process had impacted growth through the increase in the level and efficiency of financial intermediation. The liberalisation of capital controls had primarily affected growth through improvements in the degree of efficiency in financial intermediation. Drakos (2003) employed net interest margins as an indicator of efficiency showed that the transition process had been effective in increasing efficiency in the banking systems of 11 transition economies from the CEECs and Commonwealth of Independent States (CIS) over 1993 and 1999. Furthermore, he reported that ownership matters with state owned banks setting the lowest margins followed by foreign banks. Isik and Hassan (2003) employing a nonparametric approach in the first stage, estimated five different efficiency scores, namely cost (CE), allocative (AE), technical (TE), pure technical (PTE) and scale efficiencies (SE), between 1988 and 1996. In the second stage, using generalized least square (GLS) and Tobit multiple regressions, explained the differences in measured efficiency across various forms of banks operating in Turkey. They found that public and foreign banks outperform private banks in terms of cost and technical efficiency whereas, public banks dominate both in terms of allocative efficiency; larger size was strongly negatively associated with scale efficiency, suggesting that recent growth policies of medium and large banks in Turkey were inconsistent with cost
minimization and banks with a more educated work force were more cost efficient. Asset growth was negatively associated with cost efficiency.

Robert M. Webb (2003) utilized DEA window analysis in order to investigate the relative efficiency levels of large UK retail banks during the period of transition 1982–1995. He found that for the entire sample, the mean inefficiency levels were low in comparison to past studies, that the overall long run average efficiency trend was falling and that all banks in the study showed reduced levels of efficiency over the entire study period. The study also found that scale inefficiencies dominate pure technical inefficiencies. Ataullah et al., (2004) compared the technical efficiency of commercial banks in India and Pakistan by employing DEA for the period 1988–1998. The study identified that after 1995–1996 the overall technical efficiency of the banking in both countries improved. In India, efficiency increased due to improvement in both pure technical efficiency and scale efficiency while in Pakistan it was due to an improvement in scale efficiency. The analysis revealed that a gap in efficiency was due to high non-performing loans and financial reforms closed the efficiency gap between large and small banks. Weill (2004) examined the consistency of efficiency frontier method on European banking samples between 1992 and 1998. He observed a lack of robustness among these approaches. The mean efficiency ranged between 80–90 percent.

Yang et al., (2004) derived theoretical framework to predict possible rankings in technical efficiencies of public, mixed and private banks by using a Translog distance function for 43 Taiwanese banks during 1997–1999. The relationship between technical efficiency and government shareholding was also examined. Empirical results showed that a public bank in Taiwan can improve its technical efficiency by mixed ownership at a diminishing rate. Moreover, banks in Taiwan on average performed worse after the 1997 Asian financial crisis. Bonnaccorsi et al., (2005) examined the efficiency of the Pakistani banking sector in isolation. Over the period of modernisation, they observed an increase in efficiency as a result of the new competitive environment resulting from the first round of deregulation. The study also found that new private banks sometimes outperformed foreign banks in terms of efficiency. Hauner (2005) examined the sources of efficiency difference among large German and Austrian commercial banks for the period 1995–99 for a sample of 97 banks. Cost-efficiency, scale efficiency and productivity change were estimated by DEA and cost-efficiency was regressed on explanatory variables. By DEA cost efficiency averages 63 percent and scale efficiency averages 96 percent. No evidence was found for average productivity responding to deregulation over the period studied. Second, cost-efficiency was regressed on a number of variables, yielding three major results; state-owned banks were found to be more cost-efficient (likely owing to cheaper
funds) and cooperative banks to be about as cost-efficient as private banks. Increasing economies of scale but decreasing economies of scope provide rationale for M&A’s among banks with similar product portfolios. Interbank and capital market funding was found to be more cost-efficient than deposits when the cost of retail networks was controlled.

Jaffry et al., (2005) examined the effect of significant modernisation and deregulation upon technical efficiency within the Asian sub-continent over the time period 1993–2002. A three pronged approach had been used for efficiency measurement within the Indian sub-continent, namely, Malmquist index, variable return to scale output oriented DEA and panel Tobit analysis of the resultant DEA scores. Findings revealed that with efficiency change values greater than one, banks in all three countries have been becoming more efficient. However this was offset by the technical change value of less than one, leading the study to conclude that the inward contracting of the total factor productivity frontier could be the result of macroeconomic conditions. The greatest trends in terms of efficiency gains over the course of the sample can be seen in India and Bangladesh—both of which experience dramatic and continued improvements in efficiency throughout the entire deregulatory period. Okeahalam (2006) used Bayesian stochastic frontier analysis to assess the production efficiency of 61 bank branches in the nine provinces of the Republic of South Africa. Result revealed that every branch was operating at increasing returns to scale and that the level of production efficiency of bank branches was lower than it could be. It was found that at current levels of output, on an average, bank branches can reduce their costs by about 17 percent if they improve the level of efficiency. In addition, Fadzlan and Razali (2008) investigated the performance of the Malaysian Islamic banking sector during the period 2001–2005. In the first stage, the productivity estimates of individual banks were evaluated using the nonparametric Malmquist productivity index. A multivariate analysis was employed in the second stage to determine factors that influence the productivity of the domestic Islamic Banking Scheme (IBS) banks, the foreign IBS banks and the full-fledged Islamic banks. The empirical findings suggested that during the period of study, the Malaysian Islamic banking sector exhibited progress in productivity, attributed to an increase in efficiency rather than to technological change. The empirical findings suggested that profitability and bank size have positive relationships with Malaysian Islamic bank’s productivity, while capitalisation and market share exhibit negative relationships with it.

Grazyna (2008) in his article presented the results of efficiency analysis computed by both methods, i.e. using the traditional financial indicators and the non-parametric DEA method. The analysis was carried out on commercial banks operating in Poland covering the years 2000–2007. The ROA, ROE and ROS ratios were used to evaluate the efficiency of bank’s
performance. The results achieved by both methods showed an increase of the efficiency of bank's performance in recent years. Bruce (2009) examined the consideration of off-balance sheet (OBS) activities on banking efficiency and productivity performances within the UAE banking sector. The study observed that despite overall growing profits and increasing total factor productivity (TFP) change in the United Arab Emirates banking sector, there was evidences of over-banking and inefficiency by the sector as a whole and several banks in particular. The inclusion of OBS activities increases efficiency scores and estimated productivity levels for most banks, reinforcing the prevailing view that the exclusion of non-traditional activities leads to a misspecification of bank's output. Fadzlan (2009) employing the Malmquist productivity index (MPI) method, attempted to examine the impact of OBS items on Chinese bank's TFP. The results suggested that state-owned commercial banks, joint stock commercial banks and city commercial banks have exhibited lower TFP change (TFPCH) levels with the inclusion of OBS items. The study found that state-owned and city commercial banks have exhibited lower TFPCH due to technological change (TECHCH), while joint stock commercial banks have exhibited lower TFPCH due to technical efficiency change (EFFCH).

Fadzlan (2010) attempted to empirically analyze the Malaysian banking sector's productivity during the period 1995–2004. The empirical findings suggested that the Malaysian banking sector had exhibited productivity regress during the period under study mainly due to technological regress rather than efficiency decline. The results suggested that the domestic bank's productivity were almost stagnant while the foreign banks have exhibited productivity decline. The relationship between different bank size and productivity indicates that the majority of Malaysian banks which experienced productivity growth were the medium and large bank groups while the majority of banks that experienced productivity regress belonged to the small bank groups. Fadzlan (2010) applying the non-parametric MPI method, attempted to investigate the sources of productivity changes of China's state-owned and joint-stock commercial banks (JSCBs) during the period 2000–2005. The empirical findings suggested that the China's banking sector had exhibited productivity progress attributed to the increase in efficiency. The second stage multivariate regression results suggest that profitability, income diversification, capitalisation and loan intensity leads to a higher level of total factor productivity, technological change and efficiency, while risk was negatively related to the bank's technological change levels. Fadzlan (2010) examined the sources of total factor productivity in the Thailand banking sector during 1999–2008. The study employed the output-oriented MPI to isolate efforts to catch up to the frontier (efficiency change (EFFCH)) from shifts in the frontier (technological change (TECHCH)). The study explored main sources of EFFCH: either improvements in management
practices (pure technical efficiency change) or optimal size (scale efficiency change). The
findings indicated that the majority of the medium banks (MED_BNKS) and large banks have
exhibited productivity growth, while the majority of the small banks have experienced
productivity regress. Zohra Jabeen (2010) measured efficiency of 14 selected banks in the
financial sector of Pakistan. The study used the parametric OLS technique and selected the
variables from the CAMEL rating system and applied DEA approach to the sample and
assessed their relative efficiency in terms of inputs and outputs of the intermediation approach.
The study deduced from the results of the OLS method that the CAMEL ratios do attempt to
gauge the efficiency ratios of the sample under considerations. Within the five independent
factors, the CAR and earnings have significant predictability.

Fadzlan (2011) employed the MPI method to analyse the impact of risks on China bank's
total factor productivity. The results indicate that the China banking sector had exhibited a lower
total factor productivity change (TFPCH) with the inclusion of risk factor. The joint stock
commercial banks and city commercial banks have exhibited lower TFPCH owing to
technological change (TECHCH), while the state owned commercial banks have exhibited lower
TFPCH owing to technical efficiency change (EFFCH). Gurcharan Singh and Sukhmani (2011)
studied productivity and profitability for a period of nine years (1999–2000). It was found that
profitability in all selected DCCBs of Punjab had shown a negative trend whereas the
productivity improved significantly over the period of study. The deposits per employee (10.76
percent) and per branch (9.24 percent), loans per employee (12.05 percent), per branch (10.51
percent), business per employee (11.52 percent) and per branch (9.98 percent) registered
significant increases in average profitability of DCCBs in Punjab. Net profit in relation to own
funds showed a significant decline at the rate of 8.83 percent while the decline in net profit in
relation to business was found to be insignificant. Fred et al., (2011) developed a multivariate
discriminant model to differentiate between low efficiency and high efficiency community banks
(US) (less than $1 billion in total assets) based upon the efficiency ratio, a commonly used
financial performance measure that relates non-interest expenses to total operating income.
The discriminant model was tested using data for 2006–2008. This includes periods of high
performance as well as deteriorating industry conditions associated with the current financial
crisis. The mean ROA for low efficiency banks ranges between −.29 to .33 percent while the
ROA for high efficiency banks ranges from 1.0 to 1.73 percent. An important factor affecting
profitability was the ratio of salaries and benefits to average assets (SalAA). Low efficiency
banks have an average SalAA ratio as high as 2.36 percent in 2007 which was substantially
higher than the 1.29 percent for high efficiency banks in 2006. For asset quality low efficiency
banks have a value of about 65 percent while high efficiency banks were even lower at 23 percent. The study found that model’s classification accuracy ranges from approximately 88 percent to 96 percent for both original and cross-validation datasets.

Fadzlan (2012) employed the MPI method to examine the sources of total factor productivity change of the Philippines banking sector during the period of 1998 to 2008. The results indicate that both the domestic and foreign banks have exhibited productivity regress due to technological regress rather than efficiency decline and found that the more diversified Philippines banks tend to be less productive in their intermediation function. On the other hand, the relatively more productive Philippines banks were also the ones which were relatively more profitable. The results seem to suggest that the different structures of bank ownership have no significant impact on bank productivity. Daehoon et al., (2013) investigated the efficiency and productivity of banks in Vietnam during 2000–2006 and also the impact of the regulatory environment on profit performance. The specific regulations of concern are minimum capital-adequacy constraint and deposit-taking constraint. The study found that imposing the capital-adequacy constraint does not affect the technical efficiency of domestic banks in most cases and even for the few cases where it had effect the largest difference was only 0.008. This implies that in most cases the directional vector faces a facet of the technical frontier other than the one that was formed by the capital-adequacy constraint. Fadzlan (2013) provided empirical evidence on the impact of economic freedom on bank efficiency. By employing DEA method, he computed the efficiency of the Indonesian banking sector during the post-Asian financial crisis period of 1999–2008. The results indicated positive relationship between business and monetary freedoms and bank efficiency, while the relationship between technical efficiency and financial freedom seems to be negative. Wang et al., (2014) utilized the network DEA approach to disaggregate, evaluate and test the efficiencies of 16 major Chinese commercial banks during the third round of the Chinese banking reform period (2003–2011) with the variable returns to scale setting and the consideration of undesirable/bad output. The main findings of the study were: (i) the two-stage DEA model was more effective than the conventional black box DEA model in identifying the inefficiency of banking system and the inefficiency of the Chinese banking system primarily results from the inefficiency of its deposit producing sub-process, (ii) the overall efficiency of the Chinese banking system improved over the study period because of the reform, (iii) the state-owned commercial banks (SOBs) appear to be more overall efficient than the joint-stock commercial banks (JSBs) only in the pre-reform period and the efficiency difference between the SOBs and the JSBs was reduced over the post-reform period and (iv) the disposal of non-performing loans (NPLs) from the Chinese banking system in general
explains its efficiency improvement and the joint-equity reform of the SOBs specifically increases their efficiencies.

To sum up though domestic and foreign studies follow different technology and banking practices, the relative common inferences of the study was the positive impact of deregulatory policies on the efficiency and productivity of banks while the ownership effect on the efficiency of banks was inconclusive. Most of the studies have used DEA analyses for measuring the efficiency of the banking system. Most of the studies found improvements in efficiency throughout the entire deregulatory period and that country–specific environmental conditions exercise a strong influence over the behavior of banking industry in different countries.

2. Cost and Profitability Efficiency

2.1 Indian Experience

Pradeep (1999) presented findings from a cross-section analysis of banking data in India for the fiscal year 1994–95. Using a multi-output translog cost function and the intermediation approach; the paper presented three different measures of economies of scale and scope in banking. The analysis showed that virtually all banks in India are operating below minimum-cost scale, including the public-sector banks. However, gains in cost efficiency were generally feasible only if scale expansion occurs without further increase in branch networking. The findings also suggest that any effective distancing of the government from the ownership, management and operations of Indian banking would lead to considerable activity in mergers and acquisitions in this sector. Kumbhakar and Sarkar (2004) used stochastic cost frontier analysis to examine the efficiency of the Indian banking system using panel data for the period 1986–2000. Using dummy variables, they examined the contribution of reforms and role of ownership to the change in efficiency. The results indicated that the Indian banks on an average do exhibit the presence of cost inefficiency in their operations. However there was the tendency for inefficiency to decline overtime but the rate of decline slowed down after the reforms. The deregulation resulted in increase in inefficiency and there was no significant difference in impact of deregulation on private sector and public sector banks. Das et al., (2005) analysed various efficiency scores of Indian banks during 1997–2003 using DEA. Instead of taking a single measure of efficiency, they used multiple measures, i.e. two measures of technical efficiency, cost efficiency, revenue efficiency and profit efficiency under intermediation approach. Their results showed that there was not much difference in the technical efficiency of various banks. However for the remaining two measures of efficiency relating to cost and profit banks appear to be more differentiated, this was particularly true with respect to profit efficiency. Also, there had been a noticeable improvement in the profit profile of banks over the years, particularly after
1999–2000. Profit efficiency seems to have a positive relation with bank size (atleast by 30–40 percent), which showed that bigger banks were more efficient.

Sensurma (2005) examined the cost and profit efficiency of the Indian commercial banks during 1986–2003 using stochastic frontier method. The study used DEA to estimate the cost and profit efficiency. Cost efficiency improved during the sample period while profit efficiency underwent a decline. In an emerging economy undergoing a process of deregulation in term of bank groups, domestic banks appear to be more efficient than foreign banks. Chatterjee et al., (2006) compared the performance of commercial banks in the reform period with regards to lending (in a cost minimization framework) making use of DEA a non parametric method for 30 commercial banks for the period 1996–97, 1998–99, 2000–2001 and 2002–2003. The results showed that the mean cost efficiency of the observed commercial banks had declined in 2002–2003 significantly, that is, the banks have diverged from the best practice cost frontier. Further the observed private sector banks exhibited higher mean cost efficiency than the observed public sector banks both in respect of cost efficiency and allocative efficiency. They attributed the outcome to lending aversion behaviour by the public sector banks in the current legal and regulatory environment. Mahesh (2006) attempted to examine the efficiency level of Indian banks for the period 1985–2004, an unbalanced panel of 94 banks for 20 years. Banks were divided into four groups of 12: State Bank of India and associates (SB and A), nationalised banks (NB), private banks (PB) and foreign banks (FB). The technique of stochastic frontier analysis was used to estimate bank specific cost, profit and advance efficiencies. The results showed that deregulation had significant impact on all three types of efficiency measures. Public sector banks (89 percent) rank first in two of the three efficiency measures showing that, as opposed to the general perception, these banks do not lag behind their private counter parts. One of the reasons for PBS being less profit efficient compared to PB was that, PSB spends around 15 percent of their total income on salaries, whereas PB spends around 8 percent of their income on salaries. Thus, the income generated per employee was higher in the case of PB compared to PBS. FB was the least efficient in all three efficiency measures. Ramathilagam and Preethi (2007) attempted to evaluate cost efficiency of Indian commercial banks in the post reform period using the framework of a translog cost frontier function and a distribution free approach to derive the bank specific level of efficiency for the period 1992–2001. The result obtained by them showed the mean level of cost efficiency to be 53 percent showing that the banks could have reduced their costs by 47 percent to produce the same output bundle than that they have been producing in 2001. In the post reform period the banks have improved their cost efficiency by 10 percent. The study stressed on banks to undertake the cost audit to find
out ways and means by which they could improve their utilization of resources. The study rejected the popular notion that the banks were over staffed.

Pardeep and Gian (2010) examined the cost efficiency of Indian commercial banks by using non-parametric DEA technique and examined the impact of mergers on the cost efficiency of banks that in the post-liberalization period. The findings revealed that over the entire study period average cost efficiency of public sector banks was 73.4 percent and for private sector banks it was 76.3 percent. The findings suggested that to some extent merger programmes have been successful in Indian banking sector. Santosh (2010) analyzed the performance of the Indian banking sector after the initiation of financial liberalization and also measured the cost efficiency of the Indian banking sector during the post-reform period. The study found, after deregulation, the concentration had declined which resulted in increasing competition. The share of private and foreign banks in banking asset, deposit and credit had gone up. The profitability of all bank groups had gone up, but the foreign banks were more profitable. The efficiency scores of the public sector banks (PSB) varied from 0.974 to 0.969. There was a marginal decline in the cost efficiency of the PSB in the post reform period. A comparison among various bank groups in the post-reform period showed, the domestic private banks were becoming more efficient in comparison to the PSB and FB. However, the study found the PSB to be more cost efficient than the private and foreign banks. Ray (2011) evaluated the overall cost efficiency of a network of branches of a single largest public sector bank in India within the city of Calcutta using the data for the year 2002. DEA results showed that while in many cases, consolidating multiple branches would be more cost efficient, there are numerous instances, where increasing the number of branches would be optimal. In general, the actual number of branches of the bank exceeds the optimal number in most districts. Eliminating cost inefficiency could result in 27 percent reduction in total costs. Another 8 percent saving could come from restructuring of the network primarily through consolidation of branches within the districts. Santosh et al., (2011) analyzed the cost efficiency of the Indian banking sector by applying the stochastic frontier approach. The study found the public sector banks to be most efficient banks followed by the domestic private sector and foreign banks. The mean efficiency score of the Indian banking sector as a whole was about 0.9. The public sector banks (0.911) and the private banks (0.907) have the mean efficiency which was higher than the all banks mean efficiency (0.898). The foreign banks (0.866) were found to be least efficient among the bank groups.

A number of studies have been carried out nationally, mainly focused on the cost efficiency of banks and the drivers of the differences. Using translog cost frontier function it was found that there was the tendency for inefficiency to decline overtime but the rate of decline
slowed down after the reforms. However looking only at cost efficiency does not give a complete picture, so there has been an increasing move by researchers to investigate both cost and profit efficiency. Many studies found that domestic banks appeared to be more efficient than foreign banks and the overall findings reveals that the inefficient public sector banks were not only catching up but also moving ahead than the efficient ones.

2.2 Experience in Other Countries

Berger (1995) used derived frontier cost efficiency measures from a nationwide sample of banks to test jointly four hypotheses relating bank profits and seller’s concentration for the period 1980–1989. Berger constructed sellers’ concentration and market share measures for each bank by averaging over all local markets where they compete. Separating the institutions according to state banking restrictions (unit banking, limited branching, or statewide branching), Berger found the estimated coefficient on the derived x-efficiency measure to be positive and statistically significant, which was consistent with ESH (efficient structure hypothesis) or RMPH (relative market power hypotheses). In fact, only the sample of banks from limited branching states consistently had a positive coefficient on market share – in accordance with the RMPH.

Hunter et al., (1995) compared the empirical results obtained from estimating a bank cost function based on the assumption that inputs into the bank production function are completely variable and hence employed at their long run equilibrium levels with the results obtained from a specification that takes into account the quasi fixed nature of core deposits and bank physical capital. The distribution free approach (DFA) was used to analyse 317 banks for the period 1983–1990. The results indicated that the Ray Scale economy estimates appeared to be different for the banks up to $10 billion in asset and for largest banks, with assets in excess of $10 billion. As for banks efficiency measures and ranking produced by different cost specifications, while the efficiency measures were similar across the sample subgroups, the mean efficiency indices produced by the various specifications were generally found to be statistically different and the correlations of the rankings of the individual bank and the new efficiency measures were found to be weak. Akhavein et al., (1996) referred three main explanations for the increasing of bank’s profits after mega mergers. The first was improving cost efficiency approach, the second was improving profit efficiency approach and the third was market power approach. They found that structural changes in banking market – in 1980s due to mega mergers – lead to increasing profits depending on improving profit efficiency approach. Allen and Rai (1996) employed both the stochastic frontier and distribution free approaches to estimate a standard translog functional form for 15 developed countries over the period 1988–1992. The study report that the cost inefficiency measures range from 15 percent for large
banks in universal banking countries to 27.5 percent for large banks in functionally separated banking countries. On an average, functionally separated banks were found to be operating less cost efficiently than their universal. The study also found that, greater efficiency was associated with higher profitability, lower total cost, smaller bank size and higher level of loans.

Clark (1996) evaluated scale economies and competitive viability in terms of the more general concept of economic cost. The thick frontier approach was used to estimate the cost frontier of 440 banks located in U.S for the period 1986–91. The results indicated that the economic cost inefficiency was smaller (3 percent) and largely invariant with the size. Production cost inefficiency was found to be considerably larger (9 percent) and increased with the size. Scott and David (1997) derived measures of bank x-efficiency using a panel of cost data from rural Georgia banks in the 1990’s. Tests suggested that the sample banks that are shielded from competition by severe intrastate branching restrictions have market power (in the sense of the RMPH). The analysis also tested rigorously the adverse effects of legal and possible market barriers to entry. The market power they created leads to supernormal profits (net income). The study rejected the notion, that these profits are a result of superior x-efficiency (XEFF). Kraft and Tirtiroglu (1998) estimated levels of cost efficiency and scale efficiency in the Croatian banking sector in 1994 and 1995. The study employed the stochastic frontier approach on a sample of 43 banks. The results suggested that newer banks were less cost-efficient and scale-efficient than either older privatized banks or older state banks. Taci and Zampieri (1998) used the distribution free approach to investigate the cost efficiency of Czech banks. Efficiency was analyzed in conjunction with size and ownership structure (private or public). The conclusion was that private banks have a higher mean efficiency score, supporting rapid privatization. Lozana-Vivas (1998) observed the effectiveness of deregulation and cost efficiency of the Spanish banking industry by applying thick frontier and DEA methods. The study identified that deregulation was associated with a decrease in relative cost efficiency for commercial banks and inefficiency was composed of technical rather than allocative.

Bikker (1999) applied the stochastic cost frontier approach to the European banking industry in order to measure the effect of increased competition on bank efficiency. He found that, on an average, Spanish, French and Italian banks appear to be less efficient than those in Germany, the Netherlands and the UK, while banks in Luxembourg, Belgium and Switzerland were the most efficient. Iftekhar and Katherin (2000) analyzed the experiences and development of Hungarian banking sector during the traditional process from a centralized economy to market-oriented system. The ROA increased from a negative ratio of 0.24 in 1993 to a high of 0.56 in 1996 and then declined substantially by 1997 to 0.26. A similar trend was
also observed in the other performance proxy ratio – ROE in respect of foreign bank's share increased from 51.4 percent in 1993 to 74.3 percent in 1997. Banks with atleast 75 percent foreign involvement were the most efficient group, with cost-inefficiency score of 20.06 and profit inefficiency score of 23.14. Opiela (2000) employed the stochastic frontier approach to estimate cost and profit efficiency for a sample of 56 Polish banks. The study tentatively concluded that there were two tendencies. First, there were more 100 percent efficient banks among foreign-owned banks than among Polish-owned banks, suggesting higher efficiency for foreign-owned banks. Second there were fewer 100 percent efficient banks among small banks than among large banks, suggesting the existence of economies of scale in the Polish banking sector. Berger and De Young (2001) assessed the effect of geographic expansion on bank efficiency using cost and profit efficiencies estimated for over 7000 US banks from 1993–98 using Frontier flexible functional form. The results revealed the mean cost efficiency to be 76.4 percent for the small banks and 78 percent for banks in the main sample. Mean profit efficiency was 66.8 percent and 66.3 percent respectively for the small banks and main sample. Maudos and Pastor (2001) analysed the cost and profit efficiency of banks for a sample of 14 countries of the European Union, Japan and USA (1984–1994) using stochastic approach under translog method. The results obtained showed that since 1990s increasing competition had led to gains in profit efficiency in USA and Europe but not so in the Japanese banking system. The Japanese banking sector was more volatile with a steep fall in profit efficiency after 1988 reaching a minimum value of 71.01 in 1995. Europe showed much more stable behaviour in profit efficiency around an average value of 0.45. The results also showed that the inequalities of profitability between countries would be considerably reduced if inefficiency were eliminated.

Weill (2001) used the stochastic frontier approach to measure the evolution of cost efficiency between 1994 and 1997 for 22 Polish banks and 12 Czech banks. The study was more specifically analysed the outcome of the enterprise and bank restructuring program on bank performance in Poland. The result was mixed evidence in favor of the Polish model of banking reform. The improvement in cost efficiency was greater for Polish banks than for Czech banks. On the other hand the polish banks which benefited from the program showed less improvement in cost efficiency than the other polish banks. Christopoulos et al., (2002) estimated cost efficiency of the Greek banking system over the period 1993–1998, a period where the country joined EMU (European Monetary Union) and hence underwent a period of liberalisation and deregulation. The empirical results of the study showed that larger banks were less efficient than smaller ones. A heteroscedastic stochastic frontier approach suggested that there was an incentive to conduct merger activity, which will obtain cost and efficiency gains, as
a great majority of banks involved in mergers and acquisitions exhibited increasing returns to scale. Clark and Siems (2002) investigated the impact of off-balance-sheet (OBS) activities on the measurement of X-efficiency in the banking industry. Both the distribution free and the stochastic econometric frontier estimation methods were used to derive bank specific measures of cost and profit X-efficiency, with and without the inclusion of aggregate measures of OBS activities. The potential relationship between X-efficiency scores, bank size, and the composition of OBS activities was also examined. The results indicate that economic cost and production cost X-efficiency estimates increase with the inclusion of the OBS measure. Profit X-efficiency estimates was largely unaffected. Further, the composition of bank’s OBS activities appears to help explain inter-bank differences in cost and profit X-efficiency estimates, whereas bank size and the mix between on- and off-balance-sheet banking activities were largely uncorrelated with the X-efficiency estimates.

Guevara and Maudos (2002) analysed the inequalities of cost and profit efficiency existing in the banking sectors of the European Union covering the period from 1993 to 1997. The decomposition of the Theil index showed that on the cost side the greatest differences within groups occur when the total sample was divided into institutional groups. In this case the inequalities between groups represent 3.89 percent of the total. This percentage was slightly lower than that obtained when the total sample was divided into countries (6.10 percent) and into productive specialization groups (commercial banks, saving banks, co-operative banks and other banks) or clusters (5.63 percent), the country effect and the type of productive specialization being more important in explaining the differences between groups. In profit efficiency, there are great differences between countries, but none between specialization clusters. In the case of institutional groups, the differences between groups (3.097 percent) were very similar to those obtained in cost efficiency. However, when the study divides the total sample into countries, the differences between countries were substantial, the inter-group component accounting for 18.22 percent of the total. The type of productive specialization was more important than the type of institution in explaining the differences between groups.

Isik and Hassan (2002) measured the cost and profit efficiency of the Turkish commercial banks during 1988–96 using stochastic frontier approach to examine the effect of bank size, corporate control and governance, as well as ownership on the cost and alternative profit efficiency of Turkish banks. The study found that the oligopolistic nature of the Turkish banking industries had contributed to less than optimal competition in the loan markets and deposit markets. The degree of linkage between cost and profit efficiency was significantly low. This suggest that high profit efficiency doesn’t require greater cost efficiency in Turkish banks
and the cost inefficiency banks can continue to survive in this imperfect markets where profit opportunities were abundant for all types of banks. Maudos et al., (2002) analysed the importance of productive specialization in explaining cost efficiency differences between banking companies during the period 1985–1996, using DEA analysis. The study showed that if CE measurements were corrected for the effect of different specialization, by the estimation of separate frontiers for four different groups of competitors, the efficiency of companies improves. The behaviour of costs would thus be compatible with that of other competition indicators, reflecting the effects of a more competitive situation in the Spanish banking sector at present than at the start of the period considered. In the order of the clusters (CL), the foreign banks (CL4=0.7778) were the group with the highest efficiency level (lowest average costs) in relation to the common frontier, followed by the small banks (CL2=0.7215), the universal banks (CL1=0.6411) and savings banks (CL3=0.6022). Vennet (2002) analyzed cost and profit efficiency of European financial conglomerates and universal banks during 1995–96. The study found that conglomerates were more revenue efficient than their specialized competitors and that the degree of both cost and profit efficiency was higher in universal banks than in non-universal banks. In order to find, whether a generalized shift to universal banking would be of benefit to the European Union economies the study used standard translog and Fourier flexible specification for stochastic cost and profit frontier on 2375 banks. The empirical result of the study showed the mean cost efficiency to be 70 percent and the mean profit efficiency to be 70 percent. Using stochastic frontier approach, Weill (2002) calculated cost efficiency of Polish and Czech banks for 1994 and 1997 in order to evaluate the impact of the restructuring programme implemented in Poland. Performance in both banking sectors improved between the two years, with Polish banks recording relatively higher efficiency gains. However, comparison of Polish banks that took part in the restructuring programme with those that did not reveal that improvement of cost efficiency in the latter group was slightly higher.

Devi Bedari (2003) analyzed cost and profit efficiency of some banks in Botswana, Namibia and South Africa for the period 1996–2001 using the parametric–stochastic frontier approach and non parametric DEA. The result showed that in terms of profit efficiency, both accounting ratios and stochastic profit frontier show that Botswana banks had higher profit than South African banks. In terms of cost efficiency, the South African banks were more cost inefficient. However, Namibian banks were more cost efficient than others according to SCF, although accounting ratio indicates in favour of Botswana. Hasan and Marton (2003) evaluated cost and profit efficiencies in Hungarian banking from 1993 to 1998, a period during which development of a mostly private-owned banking sector was completed and foreign multinational
bank’s share of the sector recorded a major increase. Using parametric approach, average cost inefficiency and profit inefficiency were found to be 28.76 and 34.50 respectively. In addition, significant decreases in both measures over the period took place. The foreign ownership involvement was found to be significantly less inefficient than domestic banks. Also higher the share of the foreign involvement, the more efficient the bank was.

Maudos and Pastor (2003) analysed the efficiency in costs and profits of the Spanish banking sector (SBS) in the period 1985–1996 using DEA. The results showed the existence of profit efficiency levels well below those corresponding to cost efficiency, alternative profit efficiency being below standard profit efficiency. Weill (2003) employed stochastic frontier approach to estimate cost efficiencies in the Czech Republic and Polish banking sectors in 1997 in order to provide information on comparative managerial performance. In the second step, the efficiency scores were then put into a Tobit regression model in order to analyze the explanatory variables of the efficiency gap between both types of banks. The study found that foreign banks were more efficient than domestic banks. In addition, the impact of foreign ownership on performance was robust to the impacts of size and structure of activities as well as risk preferences. Furthermore, the regression of cost efficiency scores on control variables for size and the structure of activities as well as the variable for the nature of ownership showed a positive and significant influence of foreign ownership.

Casu and Girardone (2004) extended the literature by evaluating the cost and profit efficiency and productivity change of Italian financial conglomerates during the 1990s using both parametric and nonparametric approaches. According to the results, Italian banking conglomerates seem to have managed to reduce overall cost inefficiency from 29.5 percent in 1996 to 22.2 percent in 1999 (translog specification) and from 34.8 percent in 1996 to 28.3 percent 1999. The results seem to indicate that Italian banking groups have benefited from a consistent improvement in profit efficiency, while they have not experienced a clear increase in cost efficiency. Casu and Girardone (2004) examined cost and profit efficiency of large banking firms by defining a common European frontier over the period immediately following the completion of the single market programme in 1992. The results showed that there was little evidence to suggest that cost efficiency levels of large EU banks have converged over the 1990s. Indeed, the finding suggested that on an average not only had profitability increased consistently across the five main EU banking markets under study, but also the profit efficiency gap seems to have decreased (8.3 per cent) after 1993. In contrast, results derived from the estimation of an alternative profit function seem to suggest that the efficiency gap among countries decreased substantially over the years under study (2 percent). This indicates a shift in
the productive structure of European banks towards becoming more aggressive, profit oriented and shareholder value maximiser firms.

Carvallo and Kasman (2005) estimated a stochastic common cost frontier using IBCA information for a panel of 481 banks from 16 Latin American countries. The results suggest the largest economies were the most inefficient and that very small and very large banks were significantly more inefficient than large banks. Hussain (2005) examined the cost, profit and X-efficiency of 43 Islam banks in the world (21 countries). The result showed that on an average, the Islam banking industry was relatively less effective compared to other conventional counterparts in other parts of the world. All the five efficiency measures were highly correlated with ROA and ROE, (0.702 and 0.688) suggesting that these efficiency measures can be used concurrently with conventional accounting ratios in determining Islam bank performances.

Kasman (2005) examined cost efficiency and scale economies of banks operating in Poland and the Czech Republic for the period 1995–2000, using a common cost frontier with country–specific environmental variables. The study found that banks in Poland were on average more efficient than the banks in the Czech Republic. Further, the study suggested that foreign banks operating in the Czech banking sector have significantly higher efficiency levels than those of domestic banks. Pang et al., (2005) adopted a stochastic cost frontier method to investigate the influence of off-balance sheet (OBS) activities on the cost efficiency of Taiwan’s banks. The study estimated and compared cost inefficiency with or without OBS outputs for 46 Taiwanese commercial banks during the period 1998 to 2001. The empirical study concluded that, omitting OBS outputs in estimating the cost frontier function of banks results in an underestimation of bank efficiency by approximately 5 percent. Further, large banks were associated with higher cost efficiency and have an increased ability to develop OBS activities. Finally, the study observed evidence of economies of scale (−0.4301) in both models with or without OBS specification in Taiwan’s bank industry. Economies of scope between loans and OBS outputs were also observed.

Pastor and Serrano (2005) analysed the efficiency and the credit risk of the banks of the most important countries of the Euro area (1993–97), using a one-stage parametric stochastic procedure. They used DFA with and without adjustment of risk. The result by size of firm revealed that it was the biggest firms that enjoy advantages in terms of cost efficiency. Also, in all the countries profit efficiency was lower than cost efficiency. By sizes, it was the small banks and the big ones that experience the steepest falls in risk management efficiency (RME 22 percent) levels. Kasman and Yildirim (2006) analysed cost and profit efficiencies in commercial banking in eight Central and Eastern European countries (1995–2002) that became new
members to the European Union. Common stochastic cost and profit frontiers with country-specific variables were employed in order to take into account macro-economic and financial sector conditions that vary over time and across countries. The impact of foreign ownership on performance was also examined. The results indicated a wide range of cost and profit inefficiency scores across countries and across different size groups. All banking systems in the sample display significant levels of cost and profit inefficiency and there does not seem to be any continuous improvement in performance over time. There was also some evidence that foreign banks perform, on average, better than domestic banks.

Pastor and Serrano (2006) analysed the effects of specialisation on the cost efficiency of a set of banking systems of the European Union for the period 1992–1998 using DEA. Unlike in the established literature in which specialisation differences were not considered, in this paper cost inefficiencies were decomposed into two different components: the first was related to the inefficiency associated with the composition of specialisations’ in each banking system and the second was related to specific inefficiencies of banks within their specialisation. The results showed the existence of high cost inefficiencies. However, the intra–specialisation inefficiencies indicated that the inefficiencies of the European banking systems were much smaller when the effect of productive composition (specialisation) was discounted. Yildirim and Philippatos (2006) examined the cost and profit efficiency of banking sectors in twelve transition economies of Central and Eastern Europe (CEE) during the period 1993–2000, using the stochastic frontier approach (SFA) and the distribution–free approach (DFA). The managerial inefficiencies in CEE banking markets were found to be significant, with average cost efficiency level for 12 countries being 72 percent and 77 percent by the DFA and the SFA, respectively. The alternative profit efficiency levels were found to be significantly lower relative to cost efficiency. According to the SFA, approximately one–third of bank’s profits were lost to inefficiency and almost one–half according to the DFA. The results of the second–stage regression analysis suggested that higher efficiency levels were associated with large and well–capitalized banks. The degree of competition had a positive influence on cost efficiency and a negative on profit efficiency, while market concentration was negatively linked to efficiency. Finally, foreign banks were found to be more cost efficient but less profit efficient relative to domestically owned private banks and state–owned banks.

Mthuli Ncube (2009) investigated the cost and profit efficiency of South African banks, over the period 2000–2005 by using a stochastic frontier model. The results of the study showed that South African banks have significantly improved their cost efficiencies (92 percent) between 2000 (85 percent) and 2005 (98 percent). However, efficiency gains on profitability,
over the same time period (55 percent), were not significant. A weak positive correlation was found to exist between the cost and profit efficiencies (0.045), with the most cost efficient banks also being most profit efficient. With regard to bank size, cost efficiency declined with increasing bank size. Izah Mohd Tahir et al., (2010) investigated the efficiency levels of commercial banks in Malaysia between 2000 and 2006 using SFA: cost and profit frontier approach. The study suggested that foreign banks were more cost and profit efficient than domestic banks and that the managerial inefficiencies for the Malaysian commercial banks were found to be significant. The domestic banks were found to be more cost efficient relative to their foreign counterparts. However, foreign banks were more profit efficient than domestic banks. Ahmad M. Abu-Alkheil (2013) employed DEA to examine the relative efficiency of Islamic and conventional banks in the UK and Switzerland during 2008–2009. Results suggest that the Islamic banks in Europe experience lower cost efficiency, higher allocative inefficiency and poor, but relatively better technical efficiency compared to conventional banks. The inefficiency of the banks was mostly due to their sub-optimal size of operations. A comparison of the bank's performance, before and after the crisis does not show statistically significant differences. Wanke et al., (2014) measured the efficiency in Brazilian banking using two-stage process. In the first stage called cost efficiency, number of branches and employees were used to attain a certain level of administrative and personnel expenses per year. The second stage called productive efficiency which includes two important variables, namely, net outputs: equity and permanent assets. The network-DEA centralized efficiency model was adopted to optimize both stages simultaneously. Results indicate that Brazilian banks were heterogeneous, with some focusing on cost efficiency and others on productive efficiency.

To conclude the most of the studies used the stochastic frontier analysis (SFA): cost and profit frontier approach to examine the cost efficiency of banks located in various countries. Most of these studies found that foreign banks were more cost and profit efficient than domestic banks (Pang et al., 2005; Kasman and Yildirim, 2006; Tahir et al., 2010) while others argued that foreign banks were found to be more cost efficient but less profit efficient relative to domestically owned private banks and state-owned banks (Pastor and Serrano, 2005; Casu and Girardone, 2004). Under both domestic and international cost and profit efficiency studies majorly analysed through parametric approach it was found that adjustment for risk was important in the case of profit efficiency but not in the case of cost efficiency. Foreign banks were found to be more cost efficient but less profit efficient relative to domestically owned private banks and state-owned banks. There was also some evidence that foreign banks perform, on average, better than domestic banks.
3. Profitability and determinant of profitability

3.1 Indian experience

Shah (1979 and 1982) in his papers discussed bank profitability and productivity. He expressed concern about increased expenses and overheads, slow growth in productivity and efficiency, wasteful work of banks and that higher profitability can result from increased spread and that innovation have a limited role. He also emphasized reduction of costs, creation of a team spirit and improvement in the management for improving bank profitability and productivity. Kallu and Thomas (1996) attempted to find out the influence of SLR (statutory liquidity ratio) on advances disbursed to various sectors as well as on the income and profit of the three sample banks to understand the impact of year–wise changes in SLR on changes in individual variables. The co-efficient of determination which explain the impact of SLR on the profit of Andhra bank, Vijaya Bank and Canara Bank gave the result that the influence of SLR was more on the profit of Andhra Bank and Canara bank which explain above 93 percent variance in the profit of these two banks while, for Vijaya Bank the SLR could explain a variance of 52 percent only, showing a comparatively less influence on its profit.

Bhattacharya et al., (1997) examined the efficiency of Indian banks using a two-step procedure namely DEA technique to determine the technical efficiency and then applying stochastic frontier approach to explain variation in calculated efficiency using intermediation approach on five–year data of 70 banks for the period 1986–1991. They found that the public sector banks were more efficient than foreign banks, which in turn were marginally more efficient than private sector banks. They also found that 78 percent of banks operated with decreasing returns to scale while 16 percent showed increasing returns to scale. For the second stage regression analysis, they used a set of variable to account for time, ownership and regulatory policy. They concluded that public sector bank efficiency declined over time (after 1987) whereas that of foreign banks improved over time. The performance of private banks remained almost unchanged. Thomas (1996) reviewed the performance effectiveness of Syndicate Bank and other nationalised banks in India using an economic-managerial-efficiency-evaluation model (EMEE Model). The study concluded that the performance of the nationalised banks especially banks like Syndicate Bank leaves scope for improvement.

Sarkar et al., (1998) compared performance across the three categories of banks, public, private and foreign in India, using two measures of profitability, return on assets and operating profit ratio and four efficiency measures, net interest margin, operating profit to staff expense, operating cost ratio and staff expense ratio. The authors attempted these comparisons after controlling for a variety of non-ownership factors that might impact on performance: asset
size, the proportion of investment in government securities, the proportion of directed credit, the proportion of rural and semi-urban branches, and the proportion of non interest income to total income. The results showed that private enterprises may not be unambiguously superior to public enterprises in a developing economy. Swamy (2001) studied the comparative performance of different bank groups since 1995–96 to 1999–2000 to identify factors that led to changes in the position of individual banks in terms of their share in the overall banking industry. The study concluded that in many respects nationalized public sectors banks were much better than private banks, even they were better than foreign banks.

Wahab (2001) analyzed the performance of the commercial banks under reforms and also highlighted the major issues that need to be considered for further improvement. He concluded that reforms have produced favorable effects on performance of commercial banks in general but still there were some distortions like low priority sector advances, low profitability etc, which needed to be reformed again. ICRA (2003) analysed the fast-changing environment, of Indian banks against those of select international banks on three dimensions—structural factors, operational factors and efficiency factors. The study found that the profitability of Indian banks in recent years compared well with that of the global benchmark banks primarily because of the higher share of profit on the sale of investments, higher leverage and higher net interest margins. However, many of these drivers of higher profits of Indian banks may not be sustainable. To ensure long-term profitability, the study suggested that Indian banks should diversify their loans across several customer segments, introduce robust risk scoring techniques to ensure better quality of loans, reduce their operating expenses by upgrading banking technology and improve the management of market risk. Singh (2003) analyzed profitability management of banks under the deregulated environment with financial parameters of the major four bank groups i.e. public sector banks, old private sector banks, new private sector banks and foreign banks and found that profitability had declined in the deregulated environment.

Mohan and Ray (2004) compared the performance of public, private and foreign banks using physical quantities of inputs and outputs and comparing the revenue maximization efficiency of banks during 1992–2001. The findings showed that public sector banks performed significantly better than private sector banks but not differently from foreign banks and that there was convergence in performance between public and private sector banks in respect of technical efficiency but not in respect of allocative efficiency, in the post-reform era. Sharma Deepak (2005) examined the overall productivity and profitability of public sector banks and private sector banks for the year 1999 to 2003. The average of productivity per branch in all
private sector banks was Rs.129.15 crores which was more than four times compared with public sector banks. The average of public sector banks was very poor with Rs. 1.70 crores per employee while the average of private sector banks was excellent with Rs. 8.02 crores per employee. The overall profitability of Indian banking sector had been significantly different in all selected banks during the study period. Kumar (2007 and 2008) conducted a study based on cross-sectional data for 27 PSBs operating in India during the financial year 2004/05 to explore the relationship between technical efficiency and profitability. The technique of DEA had been utilized to compute the TE-score for each bank in the year 2005. The mean level of TE for the industry had found to be 88.5 percent. This implies that public sector banks can produce 1.13 times as much output from the same inputs if they operate at the efficiency frontier. In 20 inefficient banks, the technical inefficiency ranges from 2.6 percent to 36.8 percent. Also the banks belonging to SBI group outperform the banks belonging to the ‘Nationalized Banks Groups’ in terms of operating efficiencies.

Kusum and Ketkar (2008) investigated the long run impact of reforms and liberalization on individual bank’s efficiency and profitability by using DEA and bank–specific data from 1997 to 2004. DEA results showed that the relative efficiency of banks by ownership does not critically depend upon whether deposits were treated as an input (intermediation approach) or output (production approach). In general it was found foreign banks to be the most efficient followed by new private banks. While the efficiency scores of all banks have increased over the reform period, the nationalized banks have registered the strongest gains. This reflects the infusion of new capital and the increase in competition that these banks have experienced in recent years. The regression analysis undertaken to explain efficiency differences among banks showed that the mandates on priority sector lending have hurt the efficiency of state-owned and nationalized banks but bank branch expansion mandates have not hurt their efficiency. Finally the new MSI variable developed to measure the income environment facing each bank was found to be quite relevant in explaining lower efficiency scores of state-owned and nationalized banks. The study found that efficiency scores and net interest spreads impact it positively while NPAs and priority sector lending have the opposite impact on bank’s profitability. Finally the statistically insignificant impact of the H-H index indicated that the State Bank of India had not been successful in leveraging its relatively large market share to raise either its efficiency or its profitability.

Meenakshi (2008) attempted to understand the determinants of the share of gross NPA in total advances using panel data set for 94 banks over the years 1997–2005. It was observed that profit efficiency of the public sector banks have improved over the period (1997–2005) while
efficiency of the private and foreign banks were more or less stagnant. The study employed
fixed effect model or a random effect model using generalized least square (GLS) method.
Efficiency was estimated using the stochastic frontier analysis. Results showed that while rural
branches do not contribute to inefficiency, NPA levels do contribute to profit efficiency. Bodla
and Richa (2009) presented the earning quality ratios of the banks as worked out on lines of
CAMEL model for the period 1991–92 to 2005–06 which was divided into three sub-groups:
1992–95, 1996–00 and 2001–06. It was found from the study that foreign banks (FBs) have
edge over their domestic counterparts in terms of operating profits to average working funds
ratio, spread to total assets ratio and non-interest income to total income ratio. PSBs (public
sector banks) enjoy the same in terms of net profits to average assets ratio and interest income
to total income ratio. On the whole, the banks operating in India have shown appreciable
improvement in their fee based income.

Uppal (2009) examined that structure of Indian banking in terms of share of individual
banks in total assets of all scheduled commercial banks and further examined the factors
responsible for the changes during the period from 2002–03 to 2007–08. The paper concluded
that the PSB have dominant position in their share in total assets of all scheduled commercial
banks. Among 88 banks, 21 banks have recorded increase in interest spread and have
improved their share in assets of all scheduled commercial banks. From among the new private
sector banks four banks have recorded increase in their spread and total assets while two
banks witnessed decline in spread but all 7 new private sector banks improved their share in
total assets of all scheduled commercial banks. Profitability have recorded deterioration in all
the bank groups during the study period.

Kumar and Sanjeev (2011) examined the impact of economic liberalization on the
performance of Indian banks in CAMEL framework. The study found that the public sector
banks have exhibited an excellent growth in terms of profitability, productivity, assets quality,
technology upgradation and even prudential norms like CRR, structure of interest rates
including deregulation of interest rates, priority sector lending etc. Misra (2011) used PRH
(Panzar-Rosse H-statistic) statistic and assessed the degree of competition of the Indian
banking sector after the penetration of private and foreign banks in India. The study used a
dynamic panel data involving 75 domestic and foreign banks and found that the Indian banking
sector was monopolistically competitive having a few bigger size banks, both in public sector
and private sector, influencing the market conditions and pricing system. Financial sector
liberalization had improved the efficiency, productivity and stability of the Indian banking sector.
With two sub-periods panel data analysis, the study found that there had been improvement in
the degree of competition since 1997. The PRH Statistic which was positive and less than one indicated that the Indian banking system was monopolistically competitive. Nandy (2011) examined significant influence of selected variables on profitability of banks in India, using secondary data for a period of 3 years from 2004–05 to 2006–07. The result showed that interest expenses was the only good predictor for net profit of all different bank groups taken together during the years 2004–05 to 2006–07 with the given data set. Rajesh and Reddy (2011) assessed the profitability performance of selected public sector banks through spread ratios, spread related ratios, burden ratios, burden related ratios and profitability ratios. The study revealed that the profit earning capacity of a bank can be understood in terms of four influential factors interest earned, other income, interest expended and operating expenses. Uppal (2011) reviewed the banking sector reforms policy on the basis of certain parameters like productivity, profitability and NPAs management. The paper concluded that foreign banks and new private sector banks were much better in performance as compared to nationalized banks in the post-banking reform period. Uppal and Juneja (2011) analyzed the performance of all bank groups with reference of 17 parameters from 2007–11. It was found that old private banks were much profitable and efficient than any other bank group. The performance of foreign banks was worst during the study period on all the parameters which shows that this bank group was yet not able to make its place in Indian banking industry and Indian banking industry was still dominated by old private sector banks.

Dhanapal and Ganesan (2012) examined factors influencing the profitability and efficiency and measured the operational efficiency of public sector banks in India for the period 2006–07 to 2010–11 using DEA techniques. The study found that there was a significant relationship between operating profit and NPA, total income, total expenses and spread. Out of 21 banks, 18 banks were influenced by spread and 16 banks by total expenses. There was a significant relationship between profitability and six independent variables. NPA to total assets and ROA were the key factors as they have highest positive coefficient. Similarly, NPA to net advances was a key factor as it had highest negative co-efficient. The stepwise regression reveals that cost to income was the dominant factor for tuning the profitability. DEA had identified 6 banks out of the 12 small size banks and 6 banks out of the 9 large size banks as efficient banks. Prabhakar et al., (2012) determined the relative efficiency of 80 banks from groups of public, foreign and Indian private banks that operate in India by comparing the efficiencies and identifying the factors that contribute most to the inefficiency of the banks. Using financial ratios of banks as inputs and outputs the study found that increase in ratio of net NPA to net advances and decrease in return on investments adjusted to cost of funds have been the
primary contributors for decreases in efficiency index across sectors. The study noted that the decrease in cost of deposits and increase in return on investments/advances adjusted to cost of funds have been the primary contributors for increase in efficiency index across sectors. Overall, the foreign sector banks were the best performing banks in terms of relative efficiency, followed by private sector banks and the public sector banks.

Purohit, Jeevraj (2012) evaluated the impact of reform measures on the efficiency, profitability and overall performance of bank groups in the public and private sector banks for the period 1993–2010. He found that the Indian banks have positively responded to the reform policies and procedures of the government. The reforms process had increased the competition and operational autonomy in public sector as well as private sector banks. Sriharsha Reddy (2012) evaluated the relative performance of banks in India during 1999–2009 using CAMEL approach. It was found that public sector banks (out of 26 banks 9 banks have improved their ranks) have significantly improved indicating positive impact of the reforms in liberalizing interest rates, rationalizing directed credit and investments and increasing competition.

To sum up profitability analysis done at the aggregate and individual bank level highlighted the need for favouring non-interest income sources, better utilization of resources, reduced NPAs and intermediate cost. Further the profit earning capacity of a bank can be understood in terms of four influential factors interest earned, other income, interest expended and operating expenses. There was a significant relationship between operating profit and NPA, total income, total expenses and spread. The decrease in cost of deposits and increase in return on investments/advances adjusted to cost of funds have been the primary contributors for increase in efficiency index across sectors.

3.2 Experience in Other Countries

Vivas (1997) analysed the effects of deregulation on the profit efficiency of Spanish savings banks during 1986–1991 using thick frontier approach. The results suggested that the profit efficiency of Spanish savings banks, which averaged 28 percent, fell by 40 percent between 1986 and 1991 and also there was no significant shift in the profit frontier itself (in other words, there was no technological change). DeYoung and Hasan (1998) estimated non-standard profit efficiency of de novo banks using a Fourier-flexible functional form. They found that new banks were significantly less profit efficient (36 percent) than established banks (46 percent). While the profit efficiency of new banks increased rapidly in the second and third year of operation it does not reach that of established banks until the ninth year. A substantial number of de novo banks earn negative profits during the first few years of operation and more than 1200 observations have their profit efficiency measure truncated at zero.
Tai-Hsin Huang (2000) used multiproduct translog normalized shadow profit function to examine X-efficiency and related issues with respect to Taiwan’s banking industry with panel data from 22 domestic banks, spanning the period 1981–1995. Translog evidence indicated that larger banks were more technically efficient than smaller ones. The overall estimated mean inefficiencies constitute 66.40 percent, 76.28 percent and 71.74 percent of the potential variable profits of public, private and all banks respectively. Claessens et al., (2001) examining the foreign bank operations in 80 countries, concluded that foreign banks experience lower (higher) net-interest margins, overhead expenses and profitability than domestic banks in developed (developing) countries. They also concluded that foreign banks presence associates with a lower profitability and a higher provisioning for bad loans by domestic banks. Khumbhakar et al., (2001) used short run profit function to investigate the effects of deregulation on the performance of Spanish savings banks over the period 1986–1995. The study concluded that mean output losses due to technical inefficiency increased post deregulation suggesting that struggle to keep pace with the changing banking environment. The study also found that branch expansion was an effective competitive strategy. Jahangir et al., (2003) examined productivity and profitability of the banking sector in Bangladesh during the period 1992–1998. Result revealed that foreign commercial banks were more profitable and productive than private, nationalized commercial banks and other specialized banks. The reason behind the comparatively less satisfactory performance of nationalized banks was due to the absence of profit making objectives, mismanagement, government intervention, directives to loan program of government, red tapism, employment of inefficient employees, manual accounting procedures, etc.

Majnoni et al., (2003) examining the dynamics of foreign bank ownership reported that foreign banks achieve higher profitability levels, measured by Return on Assets and this performance was dependent on the duration of their presence in the country and the nature of the initial investment, with green-field foreign banks outperforming other foreign banks. Moreover, foreign ownership was associated with lower lending spreads with green-field banks setting the lowest spreads. Demirguc et al., (2004) examined the impact of bank regulation, market structure and national institutions on bank net interest margins and overhead costs using data for over 1400 banks across 72 countries, for the periods 1995–1999. While concentration was positively associated with net interest margins, this relationship breaks down when controlling for regulatory impediments to competition and inflation. Fa¨re et al., (2004) focused on two measures namely profit efficiency in banking using newly developed technique and determined the effect of risk-based capital requirements on the profit performance of US banks.
for random sample of 938 banks during 1990–1994 using non-parametric linear programming technique. A leverage ratio constraint and risk-weighted capital ratio constraint were explicitly included in the model, which allowed identification of the effect on profits of these constraints. The results indicated that allocative inefficiency was a larger source of profit loss than technical inefficiency and that the risk-based capital standards have a significant effect on bank allocative efficiency.

Reboredo (2004) examined the relationship between efficiency and solvency in banking with respect to a risk–return frontier for a sample of Spanish commercial banks for the period 1995–1999. Using intermediate cost for each bank, the ratio return on equity was computed for each year in the sample in order to calculate the expected profit as the time average of this ratio and the profit risk as the standard deviation of this ratio. The empirical finding supported that greater efficiency with respect to a risk–return frontier leads to a greater solvency level but solvency was not related to efficiency. The empirical evidence revealed that solvency in some inefficient banks may be as high as solvency in some efficient banks and that an increase in banking competition generates both more efficiency and solvency. Fitzpatrick and Mcquinn (2005) analyzed profit efficiency of credit institutions using stochastic frontier approach and inefficiency model were estimated simultaneously for 55 banks during the period 1996–2002. The study employed translog and maximum likelihood method. The result indicated that both the hypothesized “bad management” and “bad luck” factor appear to have some influence on the inefficiency levels. These included various indicators of market structure such as branch density, concentration and the presence of non-domestic banks.

Jeon and Miller (2005) examined the performance and identified factors of profitability for domestic and foreign banks, in Korea before and after the Asian financial crisis. Two sets of regressions for the foreign, nationwide and regional banks were estimated. In each set, the first regression considers three different types of individual bank explanatory variables: portfolio distribution variables, risk variable and scale variable. The second regression broadened the analysis to include the macro-economic variables the unemployment rate, the rate of growth of real gross domestic product (GDP), the rate of depreciation of the won, the fiscal budget surplus as a fraction of nominal GDP, and the rate of inflation in the consumer price index. Overall, the domestic Korean banks suffered more severely from the Asian financial crisis than foreign banks. Since foreign banks, unlike domestic Korean banks, were not subject to credit allocation directives from the Korean government to selected, favored industries, foreign banks achieved higher efficiency and better asset and liability management. Jonathan and Nguyen (2005) have studied the relationship between commercial bank performance and bank ownership in South
East Asia (Indonesia, Korea, Malaysia the Philippines, and Thailand) between 1990 and 2003, where performance was measured using three concepts- alternative profit efficiency, technical change and productivity. The study found positive relation between the performance of commercial bank and deregulation. In terms of state versus private ownership; state-owned banks were found to under-perform vis-à-vis their private counterparts.

Abbasoğlu et al., (2007) analyzed the changes in concentration and competition in the Turkish banking sector and focused on efficiencies of all commercial banks and the existence of the relationship between efficiency and profitability by applying Panzar and Rosse’s approach for the period 2001 to 2005. Regression results show that larger banks generally turned out to be more efficient than the smaller ones and the least efficient banks were the foreign banks. Further foreign banks reached higher profitability levels in the Turkish banking sector without having high efficiency scores. The relationship between the efficiency and profitability was not confirmed by the panel regression estimates. Only one coefficient which was the dummy for foreign banks turned out to be significant in explaining return on assets as the measure of profitability. Kader and Asarpota (2007) evaluated the performance of the UAE Islamic banks. Balance sheets and income statements of 3 Islamic banks and 5 conventional banks during 2000–2004 were used. The results of the study showed that in comparison with UAE conventional banks, Islamic banks of UAE were relatively more profitable, less liquid, less risky, and more efficient. Muhammad (2008) evaluated the performance of first Islamic bank in Pakistan, i.e. Meezan Bank Limited in comparison with that of a group of 5 Pakistani conventional banks in profitability, liquidity, risk, and efficiency for the period of 2003–2007. The study found that MBL was less profitable, more solvent (less risky) and also less efficient compared to the average of 5 conventional banks. However, there was no significant difference in liquidity between the two groups of banks which may be due to the facts that conventional banks in Pakistan have longer history and experience in doing banking business and hold dominating position in financial sector with large share in the overall financial assets of Pakistan as compared to Islamic banks. Nader Alber (2009) evaluated the effects of the structural changes on the performance of Egyptian banking sector as a whole, during the period 1996–2006. The results showed that the higher the market concentration, the higher the liquidity, activity and capital adequacy, while it doesn’t affect profitability. Robustness check showed that market concentration as measured by “HHI” affects liquidity and activity, using assets, deposits and loans as measures of size.

Catarina et al., (2010) examined whether domestic banks perform better than their foreign-owned counterparts by examining the banking system across eight Southeast Asian
countries for the period 1994–2005. According to the result, bank's performance worsened in the post-Asian crisis period. The higher non-performing loan to total assets ratio was a sign of higher risk and was negatively associated with bank profits. The results also suggested that multinational banks possessing global advantage were more cost efficient than domestic banks in developed countries while the reverse seems to occur in developing countries. This home-field advantage pattern appeared to be stable over time while that for global advantage had changed with no such advantage being reported after the recovery from the financial crisis. Achsania Ruziqa (2012) examined the impact of credit and liquidity risk on bank's financial performance. The study especially focused on Indonesian conventional bank with total asset above 10 trillion Rupiah during 2007–2011. The results showed that credit risk had negative significant effect on ROA and ROE, while liquidity ratio was found having positive significant effect. The effect of bank capital was positively significant on ROA, ROE and NIM (net interest margin). The bank size was only found to have negative significant while credit risk and liquidity ratio was found to have insignificant impact on NIM.

Eljelly (2013) explored the determinants of profitability of Islamic banks in Sudan, one of the few countries that have total Islamic economic and banking systems. The paper found that only the internal factors of these banks have a significant impact on bank's profitability as measured by return on assets (ROA), return on equity (ROE) and net financing margin (MARG). More specifically cost, liquidity and size of the bank were found to have positive and significant effects on profitability. However, external macroeconomic factors were classified as redundant and have no significant effects on profitability. Yasser et al., (2013) tested the performance of Indonesian banks in the most-stable period, 2005–2007, after having the worst crisis in the Indonesian bank's history, the Asian Financial Crisis 1997–1998. By using ROA, ROE and net interest income to total asset (NIITA) as the proxies for bank performance and non performing loan (NPL) as the proxy for bank efficiency, the study investigated 25 Indonesian banks for three consecutive years and applied multivariate regression analysis to test the proposed hypotheses. The results revealed the bank characteristics play important roles to determine the bank's performance measurement; however these variables have less influence on the bank efficiency measurement. Guillén et al., (2014) developed a model to estimate the determinants of Latin American bank's profitability and tried to understand the reasons why banks were reluctant to decrease their interest rate spreads even when change in competitiveness in the financial system was improving. By using DEA analysis to better exploit the information of several variables at the same time for 200 banks located in Argentina, Bolivia, Brazil, Costa Rica, Ecuador, El Salvador, Mexico, Nicaragua, Paraguay, Peru, Uruguay and Venezuela, they
found that bank’s profits grew consistently above the normal levels of profits adjusted by risk. The results showed that Latin America banks have been profiting from oligopolistic position in detriment to their clients in particular and whole economy in general.

Findings of the above studies highlights the significance of profitability for the sustainability of banking sector and that though banking functions are more or less uniform, cost differs between institutions across countries not only because of technological improvement but also due to competence, risk factor, size and deposit. However the studies are not exhaustive and lack system wide analysis and the decision making orientation was altogether missing.

IV. Related Studies

Sergio (1996) studying non-performing loans in Italy found an increase in the riskiness of loan assets was rooted in a bank’s lending policy adducing to relatively unselective and inadequate assessment of sectoral prospects. Business cycle could be a primary reason for banks non-performing loans. But the increase in bad debts as a consequence of recession alone was not empirically demonstrated. Berger and Young (1997) employed Granger-causality techniques to test four hypotheses regarding the relationships among loan quality, cost efficiency and bank capital. The results suggested that the inter-temporal relationships between loan quality and cost efficiency run in both directions. Further the study provide support for the bad luck hypothesis–increases in nonperforming loans tend to be followed by decreases in measured cost efficiency suggesting that high levels of problem loans cause banks to increase spending on monitoring, working out, and/or selling off these loans. For the industry as a whole, the data favor the bad management hypothesis over the skimping hypothesis. However for a subset of banks that were consistently efficient across time, the data favor the skimping hypothesis and also supported the moral hazard hypothesis and further suggested that, on an average, thinly capitalized banks take increased portfolio risk, which results in higher levels of problem loans in the future.

Peristiani (1997) made an attempt to ascertain whether mergers enhanced the efficiency of surviving banks. The study was conducted in US with 4900 individual transactions utilizing the translog flexible functional form and DFA to estimate the cost structure of banks and derive measures of efficiency. The results indicate that during 1980s mergers were not beneficial to banks in terms of x-efficiency. The analysis showed that acquiring banks achieved only moderate improvements in scale efficiency. This may be due to the fact that the smaller target banks were on an average are less scale efficient than their acquirers. The analysis showed that some merger survivors were able to enhance performance after the merger. Claessens et al., (2001) investigated performance differences between domestic and foreign banks in 80
countries both developed and developing, from late–1990’s to mid 2000’s and found that foreign bank entry was generally followed by a reduction in both profitability and the overhead expenses of domestic banks suggesting that foreign participation improved the efficiency of domestic banks. Shanling Li et al., (2001) investigated the financial performance of Chinese banks using financial ratio analysis. They used the data on 15 banks, 4 states owned and 11 joint equity banks during 1996–97. The analysis showed that the low productivity of state owned commercial banks resulted from the higher ratio for non-interest expenses and lower interest margin than joint equity banks. The lower profit margin in state owned banks brought down their ROA and ROE even with the offsetting effects of more efficient utilization of the assets and higher financial leverage. Chinese banks generated lower returns with higher financial risks than their western counter parts. Cuesta and Oreia (2002) analysed mergers and technical efficiency in Spanish savings banks by using a stochastic output distance function to accommodate multiple output technology during the period 1985–1998. The study concludes that merged firms will be more efficient than non-merged firms. Das (2002) examined the interrelationship among risk, capital and productivity change of the 27 public sector banks in India from 1995–96 through 2000–2001. The simultaneous equations system was fitted by pooled time-series, cross-section procedure separately used for each size class. The study concluded that higher productivity led to a decrease in credit risk, it had a positive influence on bank capitalization. It supported the fact that productivity, capital and risk taking tend to be determined jointly and these were counterbalancing each other.

Fries et al., (2002) examined the performance of banks in 16 transition countries during 1994–1999. The findings indicated that bank’s performance depend significantly on the reform environment together with the competitive conditions that they experience. Banks operating in environments where substantial progress had been undertaken in banking and enterprise reforms were found to be making sufficient margins on loans and offering competitive margins on deposits while still recording negative returns on equity. Ownership structures do not seem to affect margins except for foreign banks, which have slightly lower margins. Bhattacharya and Das (2003) examined the nature and the extent of changes in the structure of banking in India during the 1990s and the impact of these changes on prices and output of banking services during the same period. The study found strong evidence of change in the market structure in banking in India and that the major part of the change occurred during the early 1990s. Despite a spate of mergers during the late 1990s market concentration was not significantly affected and argued that the favourable market structure in India could be one important factor that led to a reduction in the ‘prices’ of banking services after the administered interest regime was lifted.
Fuentes and Maquieira (2003) analysed the effect of legal reforms and institutional changes on credit market development and the low level of unpaid debt in the Chilean banking sector using time series data (1960–1997). They concluded that both information sharing and deep financial market liberalisation were positively related to the credit market development.

Jimenez and Saurina (2003) used logit model for analysing the determinants of the probability of default (PD) of bank loans in terms of variables such as collateral, type of lender and bank-borrower relationship while controlling for the other explanatory variables such as size of loan, size of borrower, maturity structure of loans and currency composition of loans. Their empirical results suggested that collateralised loans had a higher PD, loans granted by savings banks were riskier and a close bank-borrower relationship had a positive effect on the willingness to take more risk. At the same time, size of bank loan had a negative effect on default while maturity term of loans, i.e., short-term loans of less than one-year maturity had a significant positive effect on default. Rajan and Dhal (2003) empirically examined how bank’s NPAs were influenced by three major sets of economic and financial factors, i.e., terms of credit, bank size induced risk preference and macroeconomic shocks. The results showed that when the bank size was measured in terms of assets, the bank size had negative impact on NPAs, while the measure of bank size, in terms of capital, gives opposite result. Further, measure of credit orientation had significant negative influence on NPAs, implying that borrowers attach considerable importance to relatively more credit (customer) oriented banks. The exposure to priority sector had positive impact on the NPA level. Dongili and Zago (2005) estimated the technical efficiency of Italian banks by taking into account problem loans and using directional distance functions. The results showed that once problem loans were taken into account, the economic efficiency of banks increase significantly suggesting that a significant aspect of banking production, credit quality needs to be considered when evaluating bank’s performances.

Using data on Indian manufacturing sector for 1993–94, Ghosh (2005) examined the association between corporate leverage and bank’s non-performing loan. The results showed that the capital adequacy of banks have a significant and negative effect on asset quality. The findings also indicated that the lagged leverage was an important determinant of bad loans of banks. Using financial data collected from the public listing companies in China’s stock market, Lu et al., (2005) empirically examined the relationship between bank’s lending behaviour and non-performing loans. Results showed that state-owned enterprises (SOEs) got more loans than other firms, other things being equal and SOEs with high default risks were able to borrow more than the low-risk SOEs and non-SOEs. This suggests that Chinese banks had a systemic
lending bias in favour of SOEs, particularly those with high default risks, during the period under investigation. Madhavankutty (2007) analysed banking industry for best practices. He concluded the banking system in India had attained enough maturity and was ready to address prudential management practices as comprehensively as possible. Banks have to lay down sound risk management strategies and internal capital adequacy assessment committees to ensure that they do not diverge from the prudential requirements. Nur et al., (2007) discussed the efficacy of bank regulations and supervisory practices during the deregulation, pre-crisis and crisis periods in the Turkish banking sector. The crises in the last two decades underlined the importance of prudential and independent supervision, especially in emerging markets with inadequate legal, judicial and financial infrastructure. The 2000–2001 crises in Turkey showed that ineffective regulation, weak supervision and political interference aggravated the cost of the banking crisis.

Ved Pal and Malik (2007) examined the difference in financial characteristics of 24 public, 24 private and 23 foreign sector banks based on factors such as profitability, liquidity, risk and efficiency for the period of 2000–2005. Multinomial regression analysis revealed that foreign banks proved to be high performer in generating business with a given level of resources and they were better equipped with managerial practices and in terms of skills and technology. Foreign banks were more consistent with market system as reflected in terms of net interest margin. The public banks emerged as the next best performer giving a higher return on equity in comparison to foreign and private banks. The private sector banks emerged as a better user of resources when compared to public sector banks. Anca et al., (2008) estimated the effects of banking competition in the Czech Republic between 1994 and 2005. Competition was measured by the Lerner index on the loan market, using data on loan prices. The study found no improvement in banking competition during the transition period. The study investigated the relationship and causality between competition and efficiency by employing Granger-causality-type analysis, which supported negative causality running from competition to efficiency. Therefore, results rejected the intuitive ‘quiet life’ hypothesis and indicate a negative relationship between competition and efficiency in banking.

Mamoun (2008) examined the mediation effect of service quality implementation on the relationship between service quality and bank performance. The findings indicated that service quality dimensions (functional and technical) have a positive and significant effect on bank performance. The findings indicated that marketing capabilities and corporate image exerted the strongest mediation effect on the relationships between functional quality and financial-based measures. Organisational factors and marketing capabilities exerted the strongest mediation effect on the relationships between functional quality and customer-based measures.
Organisational factors and corporate image have fully mediated the relationship between functional quality and improving bank’s image. Tsai-lien Yeh (2008) examined whether mergers promote efficiency in the banking industry. DEA study revealed that technical efficiency and productivity in Taiwanese banks increased more during the ex-post period (2003–2004) of the Merger Act than during the ex-ante periods (1999–2000). The empirical results of the study indicated that banks surviving mergers exhibited increased technical efficiency due to economies of scale. Further, productivity analysis documented a positive association between size of banks and productivity growth. Kanika (2010) analysed of NPAs of the public sector banks for the period 2002–03 to 2008–09. The study observed increase in gross as well as net NPAs in absolute terms and improved asset quality of banks. The statistical tests found insignificant association between gross NPAs and gross advances and net NPAs and net advances.

Mahipal (2011) examined the concept of NPAs, its magnitude and impact on the indices of profit, non-performing asset, spread burden, credit-deposits ratio, fixed deposits ratio, operating expenses, provisions and contingences and various other indices for all 27 public sector banks for the period of 1994–95 to 2005–06. The simple linear regression function was used to analyse the impact of NPA on profitability of the public banks. One fourth credit of total advances was in the form of doubtful asset in the initial year of the nineties and had an adverse impact on profitability of public banks at aggregate or sectoral level indicating high degree of riskiness in credit portfolio and raising question mark on the credit appraisal. The profitability of all public sector banks (50 percent) was affected to very large extent when NPAs work with other banking strategic variables and also affect productivity and efficiency. Pacha (2011) examined the state of affair of the NPAs of the public sector and private sector banks in India with special reference to weaker sections from 2004–2010. The asset quality of public sector banks and private sector banks improved consistently in the past few years as reflected in the decline in the ratio of NPAs as percentage of advances to weaker sections from 18.9 percent to 3 percent in case of public sector banks and from 12.15 percent to 0.5 percent for private sector banks. The study observed that the public sector banks have achieved a greater penetration compared to the private sector banks vis-à-vis the weaker sections. Syed Ibrahim (2011) evaluating the operational performance of the scheduled commercial banks in India since 2000, found banks significantly improved their operational performance in 2009. Credits deployed and investments made by these banks have shown significant improvement. Improvement in investment deposit ratio and share of percentage of priority sector advances in total credit can further help in improving operational efficiency as well as the profitability of Indian scheduled
commercial banks. Vivek et al., (2011) compared the technical efficiency of Indian banks operating abroad and foreign banks operating in India and investigated the effect of openness of the country, ownership pattern of the banks on their technical efficiency for the period 2006–2007 to 2008–09 using RBI database. The results revealed that Indian banks operating abroad were more efficient than the foreign banks operating in India and banks operating in developed countries were found to be more efficient than the banks operating in developing countries. The effect of openness of the country as well as ownership pattern of the Indian banks operating outside India had no significant effect on their technical efficiency.

Eliza Sharma and Mukta Mani (2012) measured the impact of macroeconomic and financial market indicators on the performance of the Indian banks for the year 2006–07 to 2010–11. It was found from the study that interest income of the bank get affected by the economic and financial cycles. Deposits and advances get affected by the macroeconomic indicators, showing a greater degree of cause and effect relationship between variables. Further, banks’ variables were less affected by the financial market indicators showing a lesser degree of cause and effect relationship between variables. Kavitha (2012) examined the management of asset-liability in banking sector for the period 2001 to 2010. Result showed that in terms of capital adequacy SBI group (12.45 percent) and private bank groups (12.42 percent) were performing better than the nationalized banks group. Liquidity position of the bank groups revealed that the nationalized banks group (8.43 percent) stood first followed by private banks group and SBI group. The borrowings of private banks group (63.42 percent) have the least variability in terms of dispersion.

Chien et al., (2014) filled the gap in the literature by applying the GMM techniques on dynamic panels using bank-level data for Asian countries to investigate the impact of foreign ownership on financial stability, as well as whether the relation between foreign ownership and stability changes under different conditions of bank reforms in the host country. Specifically, the study reached five conclusions. First, the existence of the home field advantage hypothesis was supported; nevertheless, when considering the effects of bank reforms, the global advantage hypothesis holds. Second, an inverse U-shaped relation between foreign ownership and stability was supported. Third, a higher degree of credit control liberalization mitigates the negative effect of foreign ownership on stability. Fourth, liberalization of interest rate control and banking supervision do enhance stability. Fifth and finally, the study confirm a significantly negative relation between an explicit deposit and stability. Fang et al., (2014) explored the causal effects of institutional reforms on bank risk in transition economies. Using difference-in-difference approach showed that bank’s financial stability increases substantially after these countries
reform their legal institutions, liberalize banking and restructure corporate governance. The effects of legal and governance reforms on bank risk may critically depend on the progress of banking reforms. A further examination of alternative risk measures reveals that the increases in financial stability among banks mainly come from the reduction of asset risk. Banks tend to have lower ROA volatility and fewer nonperforming loans after reforming the institutional environment. Finally, dividing the sample into foreign and domestic banks it was found that the enhancement of financial stability was more pronounced for domestic banks.

**CONCLUSION**

To sum up most of studies looking at the efficiency of Indian commercial banks used DEA analysis (Chakrabarti and Chawla, 2005; Day and Ray, 2005; Chatterjee and Sinha, 2006; Dash and Charles, 2009; Manas Kumar Baidya, Debabrata Mitra, 2012), while few others used stochastic frontier analysis (Sensurma, 2005; Das, 2010; Das and Drine, 2011). While few studies concentrated on the efficiency of commercial banking system, others looked at the relationship between ownership and efficiency. Most of these studies were related to single period or limited parameters and the time span was also smaller. Further most of the studies focused only on single aspect of performance viz., efficiency / productivity / profitability and not on the combination of all aspects viz., productivity, profitability, operational, financial management and asset quality, which were focused by the post liberalization committee’s recommendations. The choice of few parameters does not bring out every aspects of information about the performance of banks, since bank that is poor in certain dimension may appear to be performing well when some other factors are considered. In contrast the present study focuses on five parameters namely productivity, profitability, operational, liquidity and asset quality to evaluate the efficiency of banks, covering a period from 1981 to 2012.