Efficiency of Indian Banking Industry in the Post-Reform Era

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Abstract

One of the major objectives of Indian banking sector reforms was to encourage operational self-sufficiency, flexibility and competition in the system and to increase the banking standards in India to the international best practices. The second phase of reforms began in 1997 with aim to reorganization measures, human capital development, technological up-gradation, structural development which helped them for achieving universal benchmarks in terms of prudential norms and pre-eminent practices. This paper seeks to determine the impact of various market and regulatory initiatives on efficiency improvements of Indian banks. Efficiency of firm is measured in terms of its relative performance that is, efficiency of a firm relative to the efficiencies of firms in a sample. Data Envelopment Analysis (DEA) has used to identify banks that are on the output frontier given the various inputs at their disposal. The present study is confined only to the Constant-Return-to-Scale (CRS) assumption of decision making units (DMUs). Variable returns to scale (VRS) assumption for estimating the efficiency was not attempted. It was found from the results that national banks, new private banks and foreign banks have showed high efficiency over a period time than remaining banks.

Keywords: Efficiency measurement, banking industry and DEA.

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I. Introduction

Indian banking industry, the backbone of the country's economy, has always played a key role in prevention the economic catastrophe from reaching terrible volume in the country. It has achieved enormous appreciation for its strength, particularly in the wake of the worldwide economic disasters, which pressed its worldwide counterparts to the edge of fall down. If we compare the business of top three banks in total assets and in terms of return on assets, the Indian banking system is among the healthier performers in the world.   This sector is tremendously competitive and recorded as growing in the right trend (Ram Mohan, 2008). Indian banking industry has increased its total assets more than five times between March 2000 and March 2010, i.e., US$250 billion to more than US$1.3 trillion. This industry recorded CAGR growth of 18 percent as compared to country's average GDP growth of 7.2 percent during the same period. The commercial banking assets to GDP ratio has increased to nearly 100 percent while the ratio of bank's business to GDP has recorded nearly twofold, from 68 percent to 135 percent. The overall development has been lucrative with enhancement in banking industry efficiency and productivity. It should be underlined here is financial turmoil which hit the western economies in 2008 and the distress effect widened to the majority of the other countries but Indian banking system survived with the distress and showed the stable performance. Indian banks have remained flexible even throughout the height of the sub-prime catastrophe and the subsequent financial turmoil.

The Indian banking industry is measured as a flourishing and the secure in the banking world. The country's economy growth rate by over 9 percent since last several years and that has made it regarded as the next economic power in the world. Our banking industry is a mixture of public, private and foreign ownerships. The major dominance of commercial banks can be easily found in Indian banking, although the co-operative and regional rural banks have little business segment.

The Indian banking sector has two kinds of scheduled banks i.e. scheduled commercial banks and scheduled co-operative banks. Under the first category of

scheduled banks, four types of entities have found based on their establishments and legal obligations. They are:

i)   Public banks (28)[3],
ii) Private Banks (25),
iii) Foreign Banks working in India (29) and
iv) Regional Rural Banks (91)

The second category of scheduled cooperative banks consists of:

i) Scheduled Urban Co-operative banks (55) and
ii) Scheduled State Co-operative Banks (16)

Under public & private sector, banks are more clearly defined according to nationalization and privatization. The banks under public banks are Nationalized Banks (20) and State Banks of India (with its associates, the number is come to 8). Under Private Bank category, banks are divided into two types i.e., Old private banks (17) and New-private banks (8).

II. Reforms and Banking system

In the post liberalization-era, Reserve Bank of India (RBI) has initiated quite a few measures to ensure safety and consistency of the banking system in the country and at the same point in time to support banks to play an effective role in accelerating the economic growth process. One of the major objectives of Indian banking sector reforms was to encourage operational self-sufficiency, flexibility and competition in the system and to increase the banking standards in India to the international best practices[4]. Although the Indian banks have contributed much in the Indian economy, certain weaknesses, i.e. turn down in efficiency and erosion in profitability had developed in the system, observance in view these conditions, the Committee on Financial System[5] (CFS) was lay down.

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[3] The number in brackets are No. of the Banks exists in that type.
[4] Dr. Y.V. Reddy (2002), "Monetary and Financial Sector Reforms in India: A Practitioner's Perspective", The Indian Economy Conference, Program on Comparative Economic Development (PCED) at Cornell University, USA.
[5] Narsimham Committee-I

Reserve Bank of India has implemented banking sector reforms in two phases. The first reform focused on introduction of several prudential norms, major changes in the policy framework, and formation of competitive atmosphere. The second phase of reforms began in 1997 with aim to reorganization measures, human capital development, technological up-gradation, structural development which helped them for achieving universal benchmarks in terms of prudential norms and pre-eminent practices. The Financial sector reforms were undertaken in 1992 based on the recommendations of the CFS. Later, The Narsimham Committee has provided the proposal for reforming the financial sector. The committee also argued that 'economic reforms in the real sector of economy will, however, fail to realize their full potential without a parallel reform of the financial sector. It focused on several issues like, releasing of more funds to banks, deregulation in interest rates, capital adequacy, income recognition, disclosures and transparency norms etc. However, financial sector reforms focused on improving the competitive efficiency of the banking system. The financial reform process has commenced since 1991 which was made the banking sector healthy, sound, well- capitalized and become competitive.

This paper seeks to determine the impact of various market and regulatory initiatives on efficiency improvements of Indian banks. The reform process has shifted the focus of public sector dominated banking system from social banking to a more efficient and profit oriented industry. While the reform process has resulted in the private sector replacing the government as the source of resources for public sector banks (PSBs), the infusion of private equity capital has led to shareholders challenges to bureaucratic decision making. PSBs also face increasing competition not only from private and foreign banks but also from growing non-banking financial intermediaries like mutual funds and other capital market entities. The competitive pressures to improve efficiency in the banking sector has resulted in a switch from traditional paper based banking to electronic banking, use information technology and shift of emphasis from brick and mortar banking to use of ATMs.

III. Brief review of literature

A few DEA-based studies of efficiency in the Indian banking system have appeared in recent years. They have used a variety of specifications for inputs and outputs as evident from Table 1. Inputs vary from purely financial such as interest and non-interest expenses to purely physical like number of branches and employees. Outputs are either income related interest or non-interest income or product/service related – loans, investments and non-interest income. Deposits appear as inputs or outputs depending upon whether the authors work with the intermediation or production interpretation of banking business. The efficiency scores were found to be relatively sensitive to the specification in terms of inputs and outputs.

Table 1. Recent studies on efficiency of Banking system in India

Sl.	Year	Authors	Methodology	Brief Recommendations	Scope	Assessment Parameters/ Drivers
1.	2008	Sunil KUMAR & Rachita GULATI	1.Logistic Regression Analysis 2.Slacks and Targets Setting Analysis 3. input-oriented efficiency scores	The results of logistic regression analysis provides 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.	Technical, Pure Technical, and Scale Efficiencies in Indian Public Sector (1992-2005)	**Outputs:** i) net-interest income, and ii) non-interest income, while input vector contains three **Inputs:** i) physical capital, ii) labour, and iii) loanable funds.
2.	2008	Anthony Musonda	1.translog stochastic frontier cost function 2. conditional mean (CM) inefficiency model 3. stochastic frontier approach 4.data envelopment analysis (DEA)	the efficiency gap between domestic banks and foreign banks remains wide. Banks continue to exhibit poor risk assessment techniques as exemplified by higher loan loss provisions	DETERMINANTS OF COST EFFICIENCY IN THE ZAMBIAN BANKING SECTOR(1998– 2006)	1.Labour Cost 2.Funding Cost 3.Capital Cost
3.	2003	Biswa Swarup Misra	The credit output dynamics has been studied for three broad sectors of each State viz, agriculture, industry and services	improvement in the overall allocative efficiency in the post reform period for the majority of the States	Allocative Efficiency of the Indian Banking System in the Post-Reform Period: A State Level Analysis(1981-1992) and (1993- 2001)	
4.	2010	Subhash C. Ray , Abhiman Das	Nonparametric DEA methodology. Nonparametric kernel density estimation	Relatively high cost efficiency levels for Indian banks during the post-reform period 1997–2003. There is no definite evidence that privatization enhances efficiency, at least in the case of Indian banks	Distribution of cost and profit efficiency: Evidence from Indian banking (1997–2003).	**Inputs:** 1.Funds, 2.Labour, 3.Capital, 4.Quasi-fixed inputs **Outputs:** 5.Investments, 6.Earning advances, Other income
5.	2009	Panayiotis P. Athanasoglou, Evangelia A. Georgiou, Christos C. Staikouras	Assesses the evolution of output and productivity in the Greek banking industry for the period 1990– 2006. (a) the production approach; (b) the intermediation approach; and (c) the user-cost approach.	Assesses the evolution of output and productivity in the Greek banking industry for the period 1990– 2006. Capital and total factor productivity have also improved remarkably mainly since 1999, due to the structural changes that took place within the industry, capital (mainly IT) investments and improvement in the quality of human capital.	Assessing output and productivity growth in the banking industry 1990– 2006.	1. Three categories: financial intermediation, payment services and "other" services. 2. the effect of labor quality on productivity measurement of Greek banks,5 as well as the contribution of inputs' and TFP growth to output growth.
6.	2001	Leigh Drake, Maximilian	Non-parametric frontier approach, data	Powerful size-efficiency relationships are established with respect to both technical and scale	Efficiency in Japanese banking:	1.Total loans and bills discounted, 2.Liquidasset s and other investments

		J.B. Hall	envelopment analysis, to analyse the technical and scale efficiency in Japanese banking using a recent cross-section sample	efficiency.	An empirical analysis (1997)	in securities, 3.Other income; 1 General and administrative expenses, 2.Fixed assets (premises and equipment), 3 Retail and wholesale deposits.
7.	2010	Santosh Kumar Das	Stochastic Frontier Approach (cost frontier) and RBI data for 60 Indian commercial banks and on the basis of empirical investigation (panel estimation), the	1.after financial liberalization there has been no significant change in the cost efficiency of the public sector banks 2. the domestic private banks are becoming more efficient in comparison to the public sector and the foreign banks	Financial Liberalization and Banking Sector Efficiency: The Indian Experience (1980-2007)	**Input:** 1.interest cost, 2.labor cost and 3.capital cost **Output:** 1.total loans, 2.investment in securities and 3.other investments
8.	2009	Abhiman Das & Saibal Ghosh	1.Non-parametric DEA methodology 2.Univariate analysis and determinants of inefficiency	indicate high levels of efficiency in costs and lower levels in profits, reflecting the importance of inefficiencies on the revenue side of banking activity, The proximate determinants of profit efficiency appear to suggest that big state-owned banks performed reasonably well and are more likely to operate at higher levels of profit efficiency. A close relationship is observed between efficiency and soundness as determined by bank's capital adequacy ratio.	Financial Deregulation and Profit Efficiency: A Non-parametric Analysis of Indian Banks (1992-2004)	**Input:** 1.deposits, 2.number of employees, 3.fixed assets and 4.equity **Output:** three measures- 1.investments, 2.loans and 3. advances and other non-interest fee based incomes.
9.	2006	Abhiman Das & Saibal Ghosh	1. Nonparametric Data Envelopment Analysis (DEA). 2.Three different approaches viz., intermediation approach, value-added approach and operating approach have been employed to differentiate how efficiency scores vary with changes in inputs and outputs	1. Results suggest a large asymmetry between banks regarding their technical efficiency over the years. 2. Technical efficiency estimates were found to be higher under value-added approach than under the intermediation approach. Under the latter approach, Indian banks were marked with relatively low level of technical efficiency and there was a persistent but apparently declining trend in technical efficiency	Financial deregulation and efficiency: An empirical analysis of Indian banks during the post reform period (1992-2002)	**Variables:** 1.bank size, 2.ownership, 3.capital 4.adequacy ratio, 5.non-performing loans and 6.management quality

IV. Specification of model

Data Envelopment Analysis (DEA) was used to identify banks that are on the output frontier given the various inputs at their disposal. Efficiency of each institution is then derived relative to the best-practice bank on the frontier that uses a comparable mix of inputs. Efficiency of firm is measured in terms of its relative performance that is, efficiency of a firm relative to the efficiencies of firms in a sample. A formal econometric approach for estimating relative efficiency is with reference to the "best practice frontier". Best practice frontier, a term originally coined by Farrell (1957) denotes maximum output that can be obtained with a given set of input quantities for a given set of firms in a sample. He also proposed that the efficiency of a firm consists of two components: technical efficiency, which reflects the ability of a firm to obtain maximum output from a given set of inputs, and allocative efficiency, which reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices and the production technology. These two measures are then combined to provide a measure of total economic efficiency. The output and input perspective will coincide when measuring technical efficiency under Constant-Return-to-Scale (CRS). The allocative and economic efficiency measures however are completely different in nature and are not likely to coincide for other reasons than by chance.

Data Envelopment Analysis (DEA) involves the use of linear programming methods to construct a non-parametric piecewise surface (or frontier) over the data, so as to be able to calculate efficiencies relative to this surface. More detailed reviews of the DEA methodology were also presented by Seiford and Thrall (1990), Lovell (1993), Ali and Seiford (1993), Lovell (1994), Charnes et al (1995) and Seiford (1996).

Consider 'n' firms producing 'm' different outputs using 'h' different inputs. Thus, Y is an m*n matrix of outputs and X is an h*n matrix of inputs. Both matrices contain data for all 'n' firms. The technical efficiency (TE) measure under the assumption of constant returns to scale (CRS) can be formulated as follows:

$$\text{Min } \theta, \lambda \quad \theta$$

Subject to $\quad -y_i + Y\lambda \geq 0,$

$\quad\quad\quad \theta x_i - X\lambda \geq 0,$

$\quad\quad\quad \lambda \geq 0$

$\quad\quad\quad \theta \, \varepsilon \, (0,1]$

and solved for each firm in the sample. θ_i is firm i's index of technical efficiency relative to the other firms in the sample. y_i and x_i represents the output and input of firm 'i' respectively. $Y\lambda$ and $X\lambda$ are the efficient projections on the frontier. A measure of $\theta_i = 1$ indicates that the firm is completely technically efficient. Thus, $1 - \theta_i$ measures how much firm i's inputs can be proportionally reduced without any loss in output.

However, the assumption of CRS is correct only as long as firms are operating at an optimal scale (Coelli et al, 2002). Various constraints on inputs like financing and the goals of the farmer may cause the firm to operate at a non-optimal scale. Using the CRS-DEA model when firms are not operating at their optimal scale will cause the TE-measures to be influenced by scale efficiencies and thus the measure of technical efficiency will be incorrect. By adding a convexity constraint to the model above variable returns to scale (VRS) is instead assumed:

$$\text{Min } \theta, \lambda \quad \theta$$

Subject to $\quad -y_i + Y\lambda \geq 0,$

$\quad\quad\quad \theta x_i - X\lambda \geq 0,$

$\quad\quad\quad N1'\lambda = 1$

$\quad\quad\quad \lambda \geq 0$

$\quad\quad\quad \theta \, \varepsilon \, (0,1]$

The new constraint is N1'λ =1 where N1 is a n*1 vector of ones. This constraint makes the comparison of firms of similar size possible, by forming a convex hull of intersecting planes, so that the data is enveloped more tightly. The technical efficiency measures under VRS (Pure TE) will always be at least as great as under the CRS-assumption.

Many studies have decomposed the TE scores obtained from a CRS DEA into two components, one due to scale inefficiency and one due to "pure" technical efficiency. If there is a difference in the two TE scores for a particular DMU, then this indicates that the DMU has scale inefficiency and that the scale inefficiency can be calculated from the differences between the TE_{VRS} score and the TE_{CRS} score (Coelli, 2006).

$$TE_{CRS} = TE_{VRS} \; x \; SE$$

However, the present study is confined only to the CRS assumption of DMUs. We did not use the VRS assumption for estimating the efficiency. Each observation included two outputs i.e., loans/advances (Y_1) per unit per annum and non-interest income (Y_2) per unit per annum. In the input category, three variables were included. They were no.of branches (X_1), total operating expenses per annum (X_2) and deposits (X3). The DEA model was estimated using DEAP 2.0 algorithm (Coelli, 1996).

While inputs and outputs are easily identified in most businesses, that is hardly the case in banking. At the heart is the question of whether deposits are input or output. A typical financial intermediation role for banks involves the use of deposits together with physical inputs of land, labor and capital to make loans and earn interest income. Banks also recognize the importance of generating non-interest income as an anti-dote to the variability in interest income. This approach suggests that we should treat the number of bank branches, total operating expenses and deposits as inputs and loans (advances) and non-interest income as outputs. In this formulation, deposits are not coveted as an independent output; instead they are treated only as a conduit to generating loans. In most banking systems, bank investments (in addition to loans) are also considered as a legitimate output. But such investments in India are mostly in government securities which are often thought of as reflections of "lazy" banking. According to this line of thinking, higher investments simply imply that banks are not pushing loans adequately.

In view of this, we do not use investments as banks' output. For the present study data from 2005 to 2010 was used for the analysis. These results are based on data from the Performance of Indian Banks by the Association of Indian Banks and the Banking Statistics and Annual Reports of the Reserve Bank of India (RBI).

V. Results and Discussions

The technical efficiencies of sample banking units under CRS models of DEA approach is presented in table 2. All banks estimated mean technical under DEA-CRS model were 95.6 per cent in 2005 and move up to 97.9 per cent in 2010. In terms of technical efficiency, most of the sample units showed more than 90 per cent efficiency.

Table 2 Efficiency of different banking units

Type	2005-06	2006-07	2007-08	2008-09	2009-10
State-owned banks	0.904	1.000	1.000	1.000	1.000
National Banks	1.000	1.000	1.000	1.000	1.000
Total – public sector banks	0.966	1.000	1.000	1.000	1.000
Old-private banks	0.934	0.936	0.924	0.878	0.889
New-private banks	1.000	1.000	1.000	1.000	1.000
Total private banks	0.982	0.986	0.984	0.972	0.972
Foreign banks	1.000	1.000	1.000	1.000	1.000
All-banks	0.956	0.986	0.996	0.994	0.979

It is concluded from the table that the national banks, new private banks and foreign banks have showed high efficiency over a period time than remaining banks. They are all performed equally in relative terms. The units under state-owned banks, total-public sector banks and old private banks have improved their efficiency in the recent times when compared to 2005 status. The scheduled commercial banks together improved their efficiency continuously up to 2007-08 and after there was a slight decline in the last two subsequent years.

In general, the efficiency scores were improved among all the scheduled commercial bank types when compared with earlier research studies. Further scrutiny of these results is needed by bank-wise to get better understanding of them. Similarly, identification of factors for enhancing the efficiency could also be analyzed. The variables influencing the bank efficiency negatively could also be identified. This comprehensive assessment will bring better clarity about the efficiency in Indian banking system.

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