Productive Scale Efficiency of Indian Banks

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ABSTRACT

The Indian banks have entered into a new millennium because new vistas have been opened up for this sector. This paper deals with the performance of Public Sector Banks and New Private Sector Banks in India for a period of thirteen years i.e. from 1996-97 to 2007-08. For this purpose the productive Scale efficiencies have been calculated. The scores have been calculated using the advanced non - parametric technique of DEA (Data Envelopment Analysis). The results reveal that New Private Banks are more efficient than the Public Sector Banks which is due to the reason of their access to the latest know-how. Inter-comparison of PSBs reveals that NBs group is performing better than the SBI&A group.

Key Words: *Constant Returns to Scale (CRS), Variable Returns to Scale (VRS), Scale Efficiency, and DEA (Data Envelopment Analysis).*

Introduction

India is the largest country in South Asia with a huge financial system characterized by many and varied financial institutions and instruments. Indian banking sector was well developed even prior to its political independence in 1947. The system expanded rapidly after nationalization of major commercial banks in late 1969 and 1980. Prior to liberalization the Indian banking system was working under a highly controlled and regulated environment. On the recommendations of Narasimham committee in 1991 a series of reforms were initiated. Probably the deregulation policies have the maximum positive impact on the banking sector. The global financial crisis of 2008 has proved that India banking sector is robust and resilient. In this cut throat era of cyber age the Indian Banking Industry is going through a period of intense change where the global trends are affecting the banking business.

Concept of Efficiency

The concept of efficiency denotes a producer's ability to produce an optimal set of outputs via the minimal use of inputs. Technical inefficiency results from a firm not operating with the "best-technology", i.e., it is using excessive resources to produce a given amount of output. The technical efficiency of the DMU is computed as the difference between its output to input ratio and the ratio achieved by the best DMU. Technical efficiency of a firm can be defined as the ability and the willingness of a firm to produce maximum output with a specified endowment of inputs, given the environmental conditions surrounding the firm. Technical efficiency is further decomposed into pure technical efficiency and scale efficiency. Pure technical efficiency is the proportion by which a firm could reduce its input usage by implementing the best technology portrayed by the variable returns to scale (VRS) frontier. However, a firm operating on the VRS frontier is scale inefficient because it is not operating on the socially and economically optimal constant returns to scale (CRS) frontier. Scale efficiency is defined as the ratio of Technical efficiency (CRS) / Technical efficiency (VRS). If the resultant ratio is less than 1, then the respective firm exhibits variable returns to scale. If the ratio is equal to 1, then the firm exhibits constant returns to scale.

Objectives of the Study

The main objective of the study is to analyse the scale efficiency of public sector and new private sector banks in the post liberalisation period.

Review of Literature

Casu and Molyneux (2003) used DEA to analyze the productive efficiency of European banking system during 1993 to 1997 following the process of EU legislative harmonization. The results revealed that the majority of the banks were found around the level of efficiency of 0.65. Listed banks were found to be more efficient than the non-listed banks. **Sathye (2005)** compared India's gradual privatization strategy with that of the other countries like Poland, Mexico and Mozambique during 1998-2002. The results revealed that partially privatized banks performed better than fully privatized public sector banks. **Singh and Kumar** (2005) analyzed the overall efficiency and its components in the banking sector in India with the help of production approach of DEA over the period of 1991-92 to 2002-03. Their analysis revealed that the average technical efficiency of public sector banks was better than that of private sector banks and foreign banks. The average allocative efficiency of foreign banks was highest and it was lowest in private sector banks. **Sinha (2008)** applied the ratio based approach of PCA along with technical efficiency of DEA on twenty eight commercial banks during 2002-03 to 2004-05. Only six banks were found efficient. Most of the observed commercial banks exhibited decreasing returns to scale during observation period. **Shanmugam and**

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Das (2004) in their article utilized the stochastic frontier production function model to measure technical efficiency of Indian Banks. The results indicated that the efficiency of raising interest margin was time invariant while the efficiencies of other outputs were time varying. **Tahir et al.** (2009) estimated technical and scale efficiency of commercial banks in Malaysia from the period 2000 to 2006. The results suggested that Pure technical inefficiency was the main reason for the domestic banks' inefficiency which indicated that these banks were producing below the production frontier. **Subbarao** (2011) stated that global financial crisis affected Indian economy because India is more integrated into the global system than we tend to acknowledge. According to him global imbalances need to be redressed for the sake of global stability and coordination. **Sufian and Noor** (2012) examined the internal and external factors which influenced the performance of banks during 2000-2008. Their study suggested that credit risk, network cycle, operating expenses, liquidity and size have statistically significant impact on the profitability of Indian banks. **Venkatesan and Govindarajan** (2012) examined performance of public and private banks during 1995 and 2006. Results of the empirical analysis show that for private sectors banks, a strong difference in liquidity status between two periods is found while for public sector banks a significant difference is found in the activity, solvency and profitability between pre and post acquisition period.

Hypothesis of the Study

Keeping in mind the survey of literature and objectives of the study, the following hypothesis have been formulated to carry out the study.

H1. New private sector banks are more efficient than Public sector banks.

H2. The performance of State Bank of India & its associates' group is better than the performance of nationalized banks among public sector banks.

Research Methodology

Period of Study

The study covers the post liberalisation period of thirteen years i.e. 1995-1996 to 2007-2008.

Scope of Study

For the study purpose banks have been segregated into four groups: namely nationalised banks (NBs), State Bank of India & its associates (SBI&A), public sector banks (PSBs) and new private sector banks (NPSBs).

Sample size

Twenty seven public sector banks (nineteen nationalised banks and eight banks from State Bank of India and its associates) and five new private sector banks in India have been selected for the study purpose.

Data Collection

The study is primarily based on secondary data which has been collected from Data base on Indian Banks published by Indian Banks' Association, Data base from Trend and Progress of Banking in India published by RBI, Performance Highlights of public sector banks published by IBA, Statistical Tables relating to banks in India published by RBI, Performance Highlights of private sector banks published by IBA, Bank Profiles for various years published by Bank Sourcë.

Data Analysis

Data Envelopment Analysis (DEA) is a non-parametric mathematical linear programming technique to assess the relative efficiency and productivity of economic units with minimal prior assumption on input output relation. This methodology is used for determining the relatively efficient production frontier, based on empirical data on chosen inputs and outputs of a number of entities, called Decision Making Units (DMU). In banking, a bank constitutes a DMU. One of the earliest studies on DEA was conducted by Farrell (1957) who attempted to measure the efficiency of production in the single input and output case. Charnes et al. (1978) proposed a model that generalizes Farrell's single-input, single-output measure of a decision-making unit (DMU) to a multiple-input, multiple-output setting. This methodology was later further extended by Banker et al. (1984). The DMUs that lie-on the frontier are the best practice banks and retain a value of one; those enveloped by the extremal surface are scaled against a convex combination of the DMUs on the frontier facet closest to it and have values somewhere between 0 and 1.

Measurement of input and output variables

In the present study production approach has been adopted for analysis by considering eight variables four inputs variables (Deposits, Advances, Investments and Spread) and four outputs variables (Interest Expenditure, Operating Expenditure, Employees and Branches). Output oriented model has been selected for DEA analysis. Output oriented model stresses on maximising the outputs without making any change into the input level whereas input oriented model stresses on minimising inputs keeping the same output level.

Scale Efficiency: Table 1 deals with scale efficiency which is defined as the ratio of technical efficiency (CRS) to technical efficiency (VRS) for nationalised banks, State Bank of India & its associates, public sector banks and new private sector banks during the study period of 1995-96 to 2007-08. The average scale efficiency score for the banking industry over the sample period is 94.4% which indicates that banks are not operating on the appropriate scale. It is further revealed that approximately 5.6% average scale inefficiency provides a room to operate at most productive scale size (MPSS). The highest average scale efficiency during the study period is enjoyed by NPSBs (96.3%) followed by NBs group (94.3%),

PSBs (94%) and in last by SBI&A group (93.3%). SBI&A group is having more serious scale inefficiencies since its average scale efficiency score is least. The analysis further reveals that out of thirty two banks only two banks are on efficient frontier. Both these banks are from NPSBs category namely HDFC Bank Ltd. and IndusInd Bank Ltd. These banks are working on the optimal scale during the whole study period while ICICI Bank Ltd. is also near to the efficient frontier with average scale efficiency score of 99.6%. The lowest average score is of Centurion Bank of Punjab Ltd. (83.5%). In SBI&A group no single bank on an average has been on efficient surface but State Bank of Patiala's performance (98.6%) is best among the group. The average scale inefficiency of State Bank

of Patiala is 1.4% which is due to failure in operating at CRS. State Bank of Patiala has lagged behind State bank of India in mean scale efficiency score. After State Bank of Patiala next place is captured by State Bank of Travancore (96.3%) and State Bank of Hyderabad (96.2%) while State Bank of India has registered least average scale efficiency (85.8%). In NBs group, not even a single bank is on best practice frontier in average scale efficiency. The average scale efficiency is highest in Corporation Bank (98.7%) followed by Oriental Bank of Commerce (98.1%) while it is least in Punjab National Bank (90%). Year-wise analysis reveals that except for NPSBs in the years 1997-98 and 2006-07, no other bank group has been on extremal frontier during the study period.

Table 1

	Scale Efficiency													
Bk\Yr	1995 -96	1996 -97	1997 -98	1998 -99	1999 -2000	2000 -01	2001 -02	2002 -03	2003 -04	2004 -05	2005 -06	2006 -07	2007 -08	Mean
ALLB	0.998	0.919	0.917	0.999	0.830	0.917	0.944	0.976	0.989	0.954	0.981	0.997	1	0.955
AB	0.996	0.931	0.933	0.999	0.805	0.884	0.955	0.964	0.994	0.998	0.996	1	0.986	0.957
BOB	0.861	0.852	0.948	0.977	0.776	0.826	0.838	0.909	0.910	0.918	0.924	1	1	0.903
BOI	0.940	0.886	1	1	0.817	0.986	0.854	1	0.988	0.978	0.886	1	1	0.949
BOM	1	0.923	0.949	1	0.766	0.932	0.967	0.975	1	0.971	0.995	0.980	0.970	0.956
CAB	0.981	0.913	0.938	0.957	0.769	0.861	0.832	0.904	0.938	0.954	0.989	1	0.894	0.918
CBI	0.994	0.915	0.884	0.936	0.704	0.845	0.861	0.901	0.889	0.921	0.940	0.986	1	0.906
COB	1	1	1	0.988	0.893	1	0.970	0.975	0.999	1	1	1	1	0.987
DB	1	0.828	0.972	0.964	0.803	0.921	0.982	0.985	0.990	0.985	0.972	0.976	0.980	0.951
IB	0.785	0.871	0.942	0.975	0.754	0.873	0.964	0.956	0.965	0.972	0.997	0.995	1	0.927
IOB	0.904	0.874	0.954	0.989	0.807	0.890	0.899	0.932	0.959	0.914	1	1	0.988	0.932
OBC	1	1	1	1	0.955	0.797	1	1	1	1	1	1	1	0.981
PSB	0.998	0.913	0.934	0.999	0.864	0.985	0.948	0.970	0.942	0.962	0.939	0.91	0.952	0.947
PNB	0.939	0.843	0.867	1	0.736	0.833	0.826	0.940	0.900	0.847	0.974	1	1	0.900
SB	1	0.962	0.941	0.999	0.844	0.888	0.921	0.990	1	0.946	0.985	0.972	0.985	0.956
UCOB	0.983	0.928	0.877	0.957	0.707	0.894	0.944	0.957	0.977	0.95	0.963	0.98	0.999	0.932
UBI	0.993	0.865	0.925	0.947	0.779	0.852	0.866	0.905	0.921	1	1	1	1	0.927
UTBI	1	0.982	1	0.997	0.675	0.884	0.966	0.980	1	0.999	0.983	1	1	0.959
VB	0.997	0.950	0.942	0.999	0.800	0.976	0.997	0.986	0.979	0.993	0.991	1	1	0.970
NBs	0.967	0.913	0.943	0.983	0.794	0.897	0.923	0.958	0.965	0.961	0.974	0.989	0.987	0.943
SBI	0.931	0.781	0.920	0.936	0.716	0.784	0.780	0.852	0.794	0.874	0.838	1	0.954	0.858
SBBJ	0.989	0.825	0.949	0.993	0.847	0.988	0.977	0.957	0.943	0.963	0.94	0.96	0.934	0.943
SBH	0.974	0.807	0.992	1	0.841	0.930	0.997	1	1	0.982	0.994	1	0.992	0.962
SBIN	1	0.878	1	1	0.923	0.887	0.786	0.885	0.864	0.963	0.916	0.956	0.931	0.922
SBM	1	0.832	0.962	0.993	0.956	0.939	0.858	0.886	0.89	0.935	0.908	0.956	0.874	0.922
SBOP	1	0.898	0.992	1	0.927	1	1	1	1	1	1	1	1	0.986
SBS	1	0.847	0.997	0.973	0.972	0.847	0.780	0.852	0.897	0.982	0.959	0.88	0.828	0.909
SBT	0.974	0.863	0.984	0.972	0.838	0.977	0.977	0.990	0.984	1	0.987	1	0.976	0.963
SBI&A	0.984	0.841	0.975	0.983	0.878	0.919	0.894	0.928	0.922	0.962	0.943	0.969	0.936	0.933
PSBs	0.972	0.892	0.953	0.983	0.819	0.904	0.914	0.949	0.952	0.962	0.965	0.983	0.972	0.940
ICICI	0.987	0.99	1	1	0.965	1	1	1	1	1	1	1	1	0.996
HDFC	1	1	1	1	1	1	1	1	1	1	1	1	1	1.000
IDSB	1	1	1	1	1	1	1	1	1	1	1	1	1	1.000
UTI	0.966	1	1	1	1	1	0.848	1	1	1	1	1	1	0.986
CBL	1	1	1	0.938	0.844	0.811	0.593	0.617	0.592	0.783	0.888	1	0.789	0.835
NPSBs	0.991	0.998	1	0.988	0.962	0.962	0.888	0.923	0.918	0.957	0.978	1	0.958	0.963
Mean	0.975	0.909	0.96	0.984	0.841	0.913	0.91	0.945	0.947	0.961	0.967	0.986	0.970	0.944

Source: Calculated.

Returns to Scale: The results are confirmed in Table 2 which reports the details on the scale of operations of different ownerships. This table deals with the percentage share of returns to scale among the four bank groups namely Nationalized banks, State Bank of India & its associates, Public sector banks and New private sector banks. Among NPSBs average percentage share for constant returns to scale is 78.46% which is highest among all the bank groups. NPSBs are followed by NBs group (21.46%), PSBs (21.37%) and SBI & A group (21.15%) respectively in CRS. In NPSBs the average percentage share for increasing returns is 16.92% while for decreasing returns it is 4.62%. The public sector banks have the average share of 20.80% and 57.83% respectively for increasing and decreasing returns while the nationalised banks display on an average 13.36% share for increasing and 65.18% share for decreasing returns to scale respectively. In the last SBI & A group gives its share to the tune of 38.46% and 40.38% as average percentage share for increasing returns to scale for the former and average percentage share for decreasing returns to scale for the latter..

Table 2

	Nationalised Banks			SBI&A Group			Public Sector Banks			New Private Sec Banks		
Returns to Scale (Percentage Share)												
Year	irs	crs	drs	irs	crs	drs	irs	crs	drs	irs	crs	drs
1995-96	15.79	31.58	52.63	0.00	50.00	50.00	11.11	37.04	51.85	40.00	60.00	0.00
1996-97	0.00	10.53	89.47	0.00	0.00	100.00	0.00	7.41	92.59	0.00	80.00	20.00
1997-98	0.00	21.05	78.95	0.00	12.50	87.50	0.00	18.52	81.48	0.00	100.00	0.00
1998-99	21.05	21.05	57.89	37.50	37.50	25.00	25.93	25.93	48.15	20.00	80.00	0.00
1999-00	0.00	0.00	100.00	12.50	0.00	87.50	3.70	0.00	96.30	20.00	60.00	20.00
2000-01	0.00	5.26	94.74	37.50	12.50	50.00	11.11	7.41	81.48	20.00	80.00	0.00
2001-02	5.26	5.26	89.47	62.50	12.50	25.00	22.22	7.41	70.37	20.00	60.00	20.00
2002-03	10.53	10.53	78.95	50.00	25.00	25.00	22.22	14.81	62.96	20.00	80.00	0.00
2003-04	21.05	21.05	57.89	62.50	25.00	12.50	33.33	22.22	44.44	20.00	80.00	0.00
2004-05	26.32	15.79	57.89	50.00	25.00	25.00	33.33	18.52	48.15	20.00	80.00	0.00
2005-06	31.58	21.05	47.37	62.50	12.50	25.00	40.74	18.52	40.74	20.00	80.00	0.00
2006-07	15.79	57.89	26.32	50.00	50.00	0.00	25.93	55.56	18.52	0.00	100.00	0.00
2007-08	26.32	57.89	15.79	75.00	12.50	12.50	40.74	44.44	14.81	20.00	80.00	0.00
mean	13.36	21.46	65.18	38.46	21.15	40.38	20.80	21.37	57.83	16.92	78.46	4.62

Source: Calculated. irs represents increasing returns to scale, crs represents constant returns to scale, drs represents decreasing returns to scale.

Conclusion

Liberalization has changed the banking scenario in India by making the entire system more convenient and swift. The empirical results of DEA reveal that HDFC Bank Ltd. and IndusInd Bank Ltd. are on the efficient frontier while ICICI Bank Ltd. is nearest to the efficient frontier. Centurion Bank of Punjab Ltd. is suffering from the serious scale inefficiency. The reason for the existence of HDFC Bank Ltd. and IndusInd Bank Ltd. on the efficient frontier is that during the entire study period both these banks have worked on the proper scale and maintained their efficiency. State Bank of India is suffering from the serious scale inefficiencies because it has never worked on efficient frontier under constant returns to scale. State Bank of Patiala has lagged behind State Bank of India by being on efficient frontier during the maximum of the study period. Group-wise analysis indicates that new private sector banks are more efficient than the public sector banks.

So, in the light of above the first hypothesis is accepted. Inter-comparison of PSBs reveals that NBs group is performing better than the SBI & A group. NBs group has lagged behind SBI & A group because the former group has registered higher efficiency score under scale efficiency. The results are not in confirmation of the second hypothesis so, the second hypothesis is rejected.

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