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Evaluating Profit Earning Efficiency of Indian Banks: A DEA Approach

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Structured Abstract:

Purpose: Indian banking is now in a position of survival of the fittest. In order to survive, banks must be profitable. Present paper, therefore, aims at measuring and analyzing the profit earning relative technical efficiency of Indian banks.

Approach: Two basic models of Data Envelopment Analysis (DEA), a non-parametric performance assessment methodology are used to estimate the efficiency scores of a sample of 21 nationalized banks.

Findings: Results reveal that Indian banks still have the opportunity to increase their present profit level by on an average 37.4% using the present input resources. There exists high efficiency discrimination among Indian banks.

Research implications: The findings and suggestions will be helpful for the policy makers, bank managers, customers, researchers, academicians along with the general readers. Categorization of banks made in this study can help regulatory authorities in determining the future courses of action.

Research limitations: The future research could extend our works by considering data for a longer period, more banks in the sample and other DEA models.

Originality / Value: Unique input output combination selected for this study with reasonable validation by high degree of correlation and sample banks selected taking into account of more homogeneity condition can demand more robust and reliable results.

Keywords: Relative Technical Efficiency, Pure Technical Effiiciency Scale Efficiency, Data Envelopment Analysis.

Introduction

It is widely perceived that the competition among the banks in India has increased since the inception of financial sector reform in 1992. The competition level is increasing day by day. Banks are now in the race of becoming the best in the country by offering a host of products and services for better customer satisfaction. Indian banking is now in a position of survival of the fittest. In order to survive, banks must be profitable. Profitability is therefore an

important issue in this present customer oriented market economy. The importance of bank profitability can be appraised both at micro and macro level. In this background, the the present study intends to evaluate technical efficiency towards the profit earning capacity of Indian banks, that is, whether Indian banks are able to maximize their profits using the present resources available.

Most of the studies in India analyze the profitability of the banks mainly from the point of view of ratio analysis technique. They use either ROA (Return on Assets) or ROE (Return on Equity) ratio for this purpose. Naturally, they are unable to provide the answer of a number of research questions - Which banks are relatively more efficient in generating profit from their resources presently used? How banks can improve their profit earning technical efficiencies? Are Indian banks operating at appropriate scale of operation or under good managerial activities in order to maximize the profit earning level? Therefore, the present study will be able to throw further light on the existing banking literature in India by examining technical efficiency in profit earning of 21 Indian nationalized banks using the most popular technique - Data Envelopment Analysis (DEA).

Review of Literature

The measurement of financial institutions' efficiency using parametric and non-parametric frontier models has received considerable attention over the past two decades. Among the various approaches used, the use of Data Envelopment Analysis (DEA) approach has been frequent. There exists a great amount of literature on bank efficiency across the globe. But there has been little research effort in measuring and analyzing efficiency of banks particularly efficiency evaluation in profit earning in India using DEA approach. Several studies have analyzed the performance of the banking industry in developed and other countries. Berger and Humphrey (1997) reviewed the empirical studies of efficiency of banking industry in the world. Of the 130 studies of financial institutions efficiency, 116 were published between 1992 and 1997. They find that, overall depositor financial institutions/banks operate at an annual average technical efficiency level of around 77% (median 82%). The non-parametric technique has been extensively used to evaluate the efficiency of the US banking. Some notable studies on US banking efficiency are Rangan et al. (1988) concluded that pure technical inefficiency is the main source of total technical inefficiency. Miller et al. (1996) investigated technical efficiency of 201 large-sized banks from 1984 to 1990 and suggested that large and profitable banks have higher levels of

technical efficiency. Barr et al. (1999) found strong and consistent relationships between efficiency and the inputs and outputs, as well as independent measures of bank performance.

In Indian context, the literature of efficiency of the banking sector is mainly based on traditional measures. But, the studies analyzing the efficiency of Indian banks using frontier approach in India are far fewer. However, some recent studies that use non-parametric techniques mainly DEA are discussed below briefly.

One of the first published studies using non-parametric production frontier approach was Noulas and Ketkar (1996). Some other important studies are Bhattacharya et al. (1997), Saha and Ravishankar (2000), Sathya (2003), Mohan Ram and Ray (2003), Mohan, R. (2006), Das A (1997), Das et al. (2004), Debasish (2006), Kumar and Gulati (2008, 2009). There are many other studies since the 1990s in India, which have been confined to analyse the effect of deregulation on efficiency and productivity of banks.

However, the general conclusions that emerge from the above review of literature on banking efficiency in Indian context are: First, there is an increasing trend of efficiency level across all the bank groups over post reform period of time. There is still room for improvement in resource utilization by the Indian banks with the range of 5% to 30%. Second, efficiency variation among the banks is explained by exploring the various factors. Indian banking literature does not suggest a consistent relationship between size and efficiency, ownership and efficiency.

Most of the studies which use non-parametric DEA technique for Indian banks report their results at highly aggregated basis. They do not concentrate on the area of how an individual bank can improve its efficiency. This study differs from other studies in at least three ways: (i) the time period (2015-16) taken in the analysis (ii) the input-output variables specification in the DEA model and (iii) Categorization of banks and their rankings.

Objective of the Study

Indian banking is now in a position of survival of the fittest. In order to survive, banks must be profitable. Present paper, therefore, aims to measure and evalute the profit earning relative technical efficiency of select 21 Indian nationalized banks using the most popular and relevant methodology - Data Envelopment Analysis (DEA).

Limitation of the Study

Present study measures efficiency of only 21 indian banks considering the annual data of a year. Study also follows only basic DEA models based on one set of inputs and output combination. The future research could extend our works by considering data for a longer period, more banks in the sample and other DEA models. Their analysis may go further by technological progress using DEA-based Malmquist productivity index and looking into determinants of efficiency by considering bank-specific and economic factors. In this regard we advise to use Tobit regression model for this analysis. We also advise to utilise factor analysis for selecting appropriate inputs and outputs combination in this direction.

Research Methodology

As already pointed out, the study has followed the technique-data envelopment analysis (DEA) to estimate the technical efficiency of Indian banks. DEA is a non-parametric performance assessment methodology originally designed by Charnes, Cooper and Rhodes (1978) to measure the relative efficiencies of organizational units or decision making units (DMUs) under evaluation from the identical input output data set. This technique aims to measure how efficiently a DMU uses the resources available to generate a set of outputs. The DEA approach applies linear programming techniques to constructs an efficient production frontier based on best practices over the data set. Each DMU's efficiency is then measured relative to this frontier.

Several different mathematical programming DEA models have been proposed in the literature. Essentially, these models seek to establish which of n DMUs determine the envelopment surface or best practice frontier or efficient frontier. The geometry of this surface is prescribed by the specific DEA model employed (Kumar and Gulati, 2009). There are two types of efficiencies- input oriented and output oriented. Input oriented efficiency aims at reducing input amounts as much as possible while keeping at least the present output levels and output oriented technical efficiency maximizes the output level while using at least the present input levels. In the present study, we have utilized two input oriented basic DEA model-CCR (named after its developers Charnes, Cooper and Rhodes, 1978) and BCC (named after Bankers, Charnes and Cooper, 1984).

Mathematical Formulation: CCR Model

Assuming that there are n DMUs to be evaluated [DMUj (j = 1, 2… n)]. Each DMU consumes 'm' different inputs of identical nature for all DMUs [x_{ij} (i = 1,2, …..,m)] to produces 's' different outputs of identical nature for all DMUS [y_{rj} (r = 1,2, …….,s)].

$$\underset{(\theta_k, \lambda, s_i^-, s_r^+)}{\text{Min}}\ \theta_k - \varepsilon \left(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+ \right)$$

Subject to

$$\sum_{j=1}^{n} x_{ij} \lambda_j + s_i^- = \theta_k x_{ik} \quad i = 1,2,\ldots..,m.$$

$$\sum_{j=1}^{n} y_{rj} \lambda_j - s_r^+ = y_{rk} \quad r = 1,2,\ldots..,s$$

$$\lambda_j \geq 0 \quad j = 1, 2,\ldots.., n$$

$$s_i^-,\ s_r^+ \geq 0 \text{ for all i and r}$$

where,

x_{ij} = Amount of input of i utilized by the jth DMU

y_{rj} = Amount of output of r produced by the jth DMU

x_{ik} = Amount of input of i utilized by DMU_k

y_{rk} = Amount of output of r produced by DMU_k

θ_k= efficiency score of DMU 'k' being evaluated

λs represent the dual variables which identify benchmarks for inefficient units.

Slack variables - s_i^- (input slacks), s_r^+ (output slacks)

Here $\varepsilon > 0$ is non-Archimedean element defined to be smaller than any real number and to be accommodated without having to specify the value of ε.

The above model is an input-oriented model and assumes constant returns to scale of operation to measure overall technical efficiency (OTE). Optimal value θ_k reflects the OTE score of DMU 'K'. It needs to solve 'n' times to get efficiency score for each DMU under evaluation. If $\theta_k = 1$ and $s_i^- = s_r^+ = 0$, then DMU_K is CCR efficient otherwise CCR inefficient.

Mathematical Formulation: BCC Model

BCC model differs slightly yet remarkable from CCR model with an additional constraint

n

$$\sum_{j=1} \lambda_j = 1$$

in the above CCR envelopment model. This constraint is called convexity constraint in mathematics literature. It imposes of assessing the efficiency under variable returns to scale.

Selection of Input and Output Variables, Sample Banks and Data Source

The most challenging task to the researchers for estimating efficiency of banks through DEA methodology is to select appropriate and relevant inputs and outputs. The choice of inputs and outputs largely affects the derived efficiency level. There is no consensus on what constitutes inputs and outputs of banks. The choice of input and output variables is mainly guided by operational pattern, objectives of the decision making units (DMU) and the availability of data. Present study has inetended to choose the input and output variables in such a way in order to measure profit earning efficiency of Indian banks.

Most of the studies use ROA to measure bank profitability as ROA is not distorted by a high equity multiplier. But they ignore financial leverage i.e. fund management efficiency to increase the return of the owners. Besides, ROA may be biased due to income from off-balance sheet activities as it is not reflected in the balance sheet. Higher ROA does not necessarily mean higher return to owners. On the other side, ROE considers financial leverage but disregards risk associated with financial leverage. With this existing literature, the present study includes the components of both ROA and ROE in the input and output set in order to capture both operational as well as the fund management ability for profit creation. We select 3 inputs: (i) Number of Employees , ii) Net Worth (Capital + Researve Surplaus) and iii) Earning Assets (Advance + Investment)) and one output: Operating Profit for evaluating relative technical efficiencies of the select banks. Yeh, Quey-Jen (1996) states that it is important to take into account the homogeneity condition during the choice of DMUs to make the DEA result more realistic. Giving more emphasis on the criteria of homogeneity condition, the present study selects only the Indian nationalized banks listed in Table:1. Input and output variables are computed for the year 2015-16. All the data are annual and secondary in nature available on the official website of Reserve Bank of India (http://rbi.org.in).

Empirical Findings and Analysis

In this section, we examine the content of efficiency scores obtained by utilizing DEA models – CCR and BCC. DEA scores are derived by using DEA software 'DEA-Solver Learning Version 3' designed by Cooper, W.W. et al., 2007.

Present study has selected three inputs (m = 3) and one output (s = 1) with a sample size of 21 (n = 21). Therefore, the sample size in this study exceeds the desirable size as per the rule of thumb (21>12) i.e. n (number of DMUs) equal to or greater than max {m × s, 3 x (m + s)} (Cooper, W.W. et al., 2007). Thus, selected number of input and output variables allows accepted number of degree of freedom i.e. efficiency discriminatory powers. It is also found that there is a high correlation between selected input and output variables. So, with this appropriate number of inputs and outputs, sample banks selected taking into account of more homogeneity condition and reasonable validation by high degree of correlation between input and output variables, the present study can demand more robust and reliable results. So, the efficiency results of this study correctly explore the profit generating capacity of the Indian banks under DEA methodology.

Overall Technical Efficiency (OTE) or CCR efficiency under constant return to scale (CRS) assumption represents the efficiency which measures inefficiency due to wrong mix of input output configuration i.e., operational inefficiency as well as scale inefficiency. OTE reveals that only 2 banksAndhra Bank and IDBI Bank Ltd (bolded in the CCR score column in Table:1 ANB and IDB) out of 21 are found to be fully technical and scale efficient bank towards the profit earning based on the select input and output variables. The average CCR score is 72.8 % which means 19 inefficient banks could have increased their preset profit level by on an average 37.4% using the same level of input resources. Alternatively Indian banks still have the opportunity to reduce 27.2% of preset input consumption in order to earn the same level of profit. The results also indicate that there is still asymmetry between Indian nationalized banks as regards their OTE as evidenced from the high range of efficiency score between 17.5% and 100% and SD 21.3%. Only two banks namely ANB and IDB are frequently referred for evaluation of 19 and 7 inefficient banks respectively under CCR model . So, ANB and IDB are the two most efficient and stable nationalized r banks so far as profit generating technical efficiency is concerned as because of the higher frequency in the reference set indicates higher stability in maintaining fully efficiency. It is to be pointed out that ANB is more stable in maintaining fully efficiency than that of IDB.

Pure technical efficiency (PTE) or BCC efficiency provides efficiency under variable returns to scale assumption and measures efficiency without considering scale of operation. In this model, only 2 banks PNB and BMB (bolded in BCC score column of Table: 1) in addition to 2 CCR efficient banks ANB and IDB are getting fully technical efficient status but not fully scale efficient. It is also to be mentioned that PNB (99.9%) is very close to 100% scale efficiency. The BCC scores discriminate well the nationalized banks with regard to efficiency under managerial operation as indicated by high range of PTE scores (16.9% to 100%) and SD 16.9%.

Scale efficiency (SE) is an another type of efficiency which measures whether a firm has the right size. It is defined by the ratio of CCR Score / BCC Score and exhibits that the nationalized bank group (92.9%) is relatively more scale efficient than managerial performance (78.9%).

Decomposition of Efficiency in DEA literature from the relationship among these three types of DEA efficiencies ie OTE = PTE × SE depicts the sources of inefficiency. For example, CBI has a low BCC efficiency (40.8%) but relatively high scale efficiency (99.7%) meaning that overall inefficiency (100% - 40.8% = 59.2%) is mainly caused by inefficient operation of the bank itself whereas overall inefficiency of BMB which is fully BCC efficient but having lowest scale efficiency(17.5%) is mainly attributed to disadvantageous conditions underwhich it operates. However, it is observed in general that the inefficiency of nationalized banks is mainly caused by the managerial inefficiency of the banks themselves rather than the disadvantageous condition under which they are operating.

Returns to scale analysis as identified by the input oriented BCC model and shown in 'RTS' column of Table:1 suggests that 2 out of 21 banks are operating in CRS region ie operating at most productive scale size. Besides another 10 banks are very close to 100% scale efficiency. So majority of the nationalized banks except 5 banks (BMB, DNB, VJB, UBI and PSB) are operating at appropriate scale of operation. Banks with IRS have the possibility to improve their efficiency by scaling up their activities, whereas banks with DRS scaling down the operation to gain efficiency. IRS is the predominant form of scale inefficiency of the Indian banks.

Efficiency improvement plan for inefficient banks

DEA methodology provides how an inefficient DMU (bank) becomes fully efficient by indicating the level of inputs to be utilized and level of outputs to be produced. This is called

projection in DEA literature which shows input and output improvement or input and output target for inefficient banks. Table: 2 shows the CCR projection i.e., input output improvement plan for inefficient banks by reducing their present level of inputs and enhancing present level of outputs by the % mentioned in each of respective bank column in Table:2.

For interpreting the content of Table 2, let us consider the case of BOB (Bank of Boroda). BOB can be 100% CCR efficient through the three phases of input output improvements plan. OTE of this bank is 83.34% and OTIE = 16..66%

Phase I - It has to reduce its all inputs level by 16.66%. This proportional reduction is also known as radial adjustment in DEA. By this adjustment BOB becomes weakly efficient (fulfil the 'Farrell' or 'week' efficiency, W. Cooper et al., 2007).

Phase II – It has to reduce in addition to 16.66%, Input-II (Net Worth) by 17.93% (34.59% - 16.66%). No further reduction is required for Input I and III since slack values corresponding to these inputs are nil. Thus, the two inputs- 'No. of Employee' and 'Earning Assets' have the positive impact; whereas present level of input- 'Net Worth' has no any effect on efficiency evaluation of BOB during the study period.

Phase III - It has not required to enhance the present output level 'operating profit' as because of presence of zero slack corresponding to this output. Thus, present 'Operating profit' level play a positive role on the efficiency estimation procedure. This case is also same for other banks since we consider single output and follow inpit oriented technical efficiency model, that is, ability to avoid waste by using as little input as output allows or minimization of input producing the given level of output.

Phase II & III are known as slack adjustments in DEA. However these slack adjustments in Phase II & III after radial adjustment in Phase-I makes BOB strongly efficient (fulfil the 'Pareto- Koopmans' or 'strong' efficiency, Cooper et al., 2007). The similar explanation can also be extended for other inefficient banks.

Most of the inefficient banks have slack value corresponding to input – II and then input- I. Thus, efficiency improvement plan as a whole indicates that banks which are using more Net worth are relatively less efficient so far as profit earning concerned.

Ranking is a well established approach in social science and thus it is a pertinent issue in the banking efficiency study. In DEA context, ranking of organizational units has become also a

well established approach in the last decade. Present study , therefore, categorizes the Indian Nationalized banks with ranking with respect to profit creating technical efficiency based on the three types of DEA efficiency scores. Number in parenthesis indicates the ranking position of the banks in the respective category.

Category -I: Most technical as well as scale efficient banks –(1) ANB, (2) IDB (3) PNB

Category -II: Most management inefficient banks – (1) CBI (2) DNB (3) IOB (4) BOI (5)VJB

Category -III: Most scale inefficient banks – (1) BMB,(2) DNB, (3)VJB, (4) UBI (Far below the average score)

Category- IV: Most management inefficient as well as scale inefficient Banks: (1)VJB, (2) DNB

Conclusion

The present study has measured profit-earning capacity of the nationalized banks in India under DEA methodology. The study has revealed that Indian banks still have the scope of increasing on an average by 37.4% of the present profit levels using the present level of resources. The results also indicate that there is still asymmetry between Indian nationalized banks as regards their OTE and PTE. ANB, IDB and PNB are found to be the model bank in this regard. Profit generating inefficiency is mainly caused by the managerial under performance of the banks themselves rather than disadvantageous condition under which they are operating. Increasing Returns to Scale (IRS) is found to be predominant form of scale inefficiency. The present study suggests that all the inefficient banks should follow their good operating practices of three leading banks namely ANB, IDB and PNB for profit maximization. Banks of Category II should emphasis on managerial performance whereas banks of Category III on bank size for overall improvement of efficiency level. Bank with IRS may go for opening new branches for getting the advantage of scale of operation.

We sincerely hope that this research opens a broad horizon for further researches to evaluate the efficiency of Indian banking sector, using frontier approach and in turn will contribute for the development of Indian banks. The future research could extend our works by considering data for a longer period, more banks in the sample and other DEA models.

References

1. Banker, R.D., Charnes, A. and Cooper, W.W. (1984). Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. Journal of Management Science, 30(9), 1078-1092.
2. Barr, R.S., Killgo, K.A., Siems, T.E. and Zimmel, S. (1999). Evaluating the productive efficiency and performance of U.S. Commercial Banks. Available at <http://www.dallasfed.org/banking/fiswp/fiswp9903.pdf> [Accessed on 5th July, 2010].
3. Berger, A.N. and Humphrey, D.B. (1997). Efficiency of financial institutions: international survey and directions for future research. European Journal of Operational Research, 98, 175-212.
4. Bhattacharyya, A., Lovell, C.A.K. and Sahay, P. (1997). The impact of liberalization on the productive efficiency of Indian commercial banks. European Journal of Operational Research, 98, 332-345.
5. Charnes, A., Cooper, W.W and Rhodes, E. (1978). Measuring the efficiency of decision making units. European Journal of Operations Research, 2(6), 429-444.
6. Cooper, W. W., Seiford, L. M. and Tone, K. (2007) Data envelopment analysis: a comprehensive text with models, applications, references and DEA-Solver software. 2nd ed., New York: Springer Science + Business Media.
7. Das, A., Nag, A. and Ray, S. (2004). Liberalization, ownership, and efficiency in Indian banking: a nonparametric approach. Department of Economics, University of Connecticut. Working Paper Series, October, 2004. Available at http://www.econ.uconn.edu/working/2004-29.pdf [Accessed on 5th May, 2009].
8. Das, A. (1997). Technical, allocative and scale efficiency of public sector banks in India. Reserve Bank of India. Occasional Papers, 18 (2-3), 279-301.
9. Debasish, S.S. (2006). Efficiency performance in Indian banking: use of Data envelopment analysis. Global Business Review, 7, 325-335.
10. Kumar, S. and Gulati, R. (2008). An examination of technical, pure technical, and scale efficiencies in Indian Public sector banks using data envelopment analysis. Eurasian Journal of Business and Economics, 1(2), 33-69.

11. Kumar, S. and Gulati, R. (2009). Technical efficiency and its determinants in the Indian domestic banking industry: an application of DEA and Tobit analyses. American Journal of Finance and Accounting, 1(3), 256-229.

12. Miller, S.M. and Noulas, A.G. (1996).The technical efficiency of large bank production. Journal of Banking and Finance, 20, 495-509.

13. Mohan, R. (2006). Reforms, productivity and efficiency in banking: the Indian experience. Reserve Bank of India Bulletin, March- 2006. Available at < http://rbidocs.rbi.org.in/rdocs/Speeches/PDFs/69198.pdf > [Accessed on 12th May, 2010].

14. Mohan Ram, T.T. and Ray, S.C. (2003). Productivity and efficiency at public and private sector banks in India" [Abstract only]. Indian Institute of Management, Ahmedabad. Available at < http://ideas.repec.org/p/iim/iimawp/wp01497.html > [Accessed on 19th May, 2008].

15. Noulas, A.G. and Ketkar, K.W. (1996). Technical and scale efficiency in the Indian banking sector. International Journal of Development Banking, 14(1), 19-27

16. Rangan, N., Grabowski, R., Aly, H.Y. and Pasurka, C. (1988). The technical efficiency of U.S. banks. Economics Letters, 28, 169-175.

17. Reserve Bank of India. (2008). Efficiency, productivity and soundness of the banking sector. Report on Currency Finance, 2, 393–446.

18. Saha, A. and Ravishankar, T.S. (2000). Rating of Indian commercial banks: A DEA approach. European Journal of Operational Research, 124,187-203.

19. Sathye, M. (2003). Efficiency of banks in a developing economy: the case of India. European Journal of Operational Research, 148, 662-671.

20. Yeh, Quey-Jen. (1996). The application of data envelopment analysis in conjunction with financial ratios for bank performance evaluation. The Journal of the Operational Research Society, 47(8), 980-988.

Table 1: Efficiency Scores and Returns to Scale

No.	Banks	Code	OTE Score	PTE Score	SE Score	RTS
1	ALLAHABAD BANK	ALB	0.927	0.927	1.000	DRS
2	ANDHRA BANK	ANB	**1.000**	**1.000**	1.000	CRS
3	BANK OF BARODA	BOB	0.833	0.852	0.978	DRS
4	BANK OF INDIA	BOI	0.600	0.617	0.973	DRS
5	BANK OF MAHARASHTRA	BOM	0.822	0.848	0.970	IRS
6	BHARATIYA MAHILA BANK LTD.	BMB	0.175	**1.000**	0.175	IRS
7	CANARA BANK	CRB	0.714	0.714	0.999	DRS
8	CENTRAL BANK OF INDIA	CBI	0.406	0.408	0.997	IRS
9	CORPORATION BANK	COB	0.821	0.832	0.987	IRS
10	DENA BANK	DNB	0.367	0.470	0.782	IRS
11	IDBI BANK LIMITED	IDB	**1.000**	**1.000**	1.000	CRS
12	INDIAN BANK	INB	0.776	0.777	0.998	IRS
13	INDIAN OVERSEAS BANK	IOB	0.560	0.562	0.998	IRS
14	ORIENTAL BANK OF COMMERCE	OBC	0.827	0.828	0.999	IRS
15	PUNJAB AND SIND BANK	PSB	0.661	0.713	0.928	IRS
16	PUNJAB NATIONAL BANK	PNB	0.999	**1.000**	0.999	DRS
17	SYNDICATE BANK	SYB	0.749	0.762	0.983	IRS
18	UCO BANK	UCB	0.863	0.871	0.991	IRS
19	UNION BANK OF INDIA	UNB	0.765	0.791	0.967	DRS
20	UNITED BANK OF INDIA	UBI	0.861	0.957	0.901	IRS
21	VIJAYA BANK	VJB	0.564	0.646	0.873	IRS
	Average Score		**0.728**	**0.789**	**0.929**	
	Standar Deviation (SD)		**0.213**	**0.169**	**0.177**	
	Min Score		**0.175**	**0.408**	**0.175**	

Note: OTE - Oveall Technical Efficiency; PTE – Pure Technical Efficiency, SE- Scale Efficiency, RTS- Returns-to-scale, CRS – constant returns-to-scale, IRS – Increasing returns-to-scale , DRS- Decreasing returns-to-scale

Table 2 Input & Output Improvement Plan for CCR inefficient Banks

No.	DMU I/O	Score Data	Projection	Difference	%
1	ALLAHABAD BANK	0.926602			
	No. of Employees	24137	20894.98	-3242.016	-13.43%
	Net Worth	140640.4	114772	-25868.39	-18.39%
	Earning Assets	2080300	1927609	-152690.6	-7.34%
	Operating Profit	41339.03	41339.03	0	0.00%
2	ANDHRA BANK	1			
	No. of Employees	20016	20016	0	0.00%
	Net Worth	109943.9	109943.9	0	0.00%
	Earning Assets	1846521	1846521	0	0.00%
	Operating Profit	39600.03	39600.03	0	0.00%
3	BANK OF BARODA	0.833392			
	No. of Employees	51837	43200.53	-8636.474	-16.66%
	Net Worth	401989.9	262929.4	-139060.4	-34.59%
	Earning Assets	5042207	4202134	-840073.5	-16.66%
	Operating Profit	88155.76	88155.76	0	0.00%
4	BANK OF INDIA	0.600274			
	No. of Employees	49458	29688.33	-19769.67	-39.97%
	Net Worth	310135.7	178531.2	-131604.6	-42.43%
	Earning Assets	4780379	2869535	-1910843	-39.97%
	Operating Profit	60356.2	60356.2	0	0.00%
5	BANK OF MAHARASHTRA	0.822344			
	No. of Employees	13765	11319.56	-2445.437	-17.77%
	Net Worth	87871.44	72260.53	-15610.9	-17.77%
	Earning Assets	1437935	1129528	-308407.6	-21.45%
	Operating Profit	23451.77	23451.77	0	0.00%
6	BHARATIYA MAHILA BANK LTD.	0.175351			
	No. of Employees	470	20.89699	-449.103	-95.55%
	Net Worth	10344.29	114.783	-10229.51	-98.89%

No.	DMU I/O	Score Data	Projection	Difference	%
	Earning Assets	10993.93	1927.794	-9066.131	-82.46%
	Operating Profit	41.343	41.343	0	0.00%
7	CANARA BANK	0.713546			
	No. of Employees	54008	36123.07	-17884.93	-33.12%
	Net Worth	316032	198416.8	-117615.2	-37.22%
	Earning Assets	4670241	3332434	-1337807	-28.65%
	Operating Profit	71466.55	71466.55	0	0.00%
8	CENTRAL BANK OF INDIA	0.406229			
	No. of Employees	37685	11839.88	-25845.12	-68.58%
	Net Worth	176791.4	65034.12	-111757.3	-63.21%
	Earning Assets	2688771	1092256	-1596515	-59.38%
	Operating Profit	23424.25	23424.25	0	0.00%
9	CORPORATION BANK	0.820987			
	No. of Employees	18383	15092.21	-3290.794	-17.90%
	Net Worth	113658.8	93312.42	-20346.4	-17.90%
	Earning Assets	2036029	1480349	-555679.8	-27.29%
	Operating Profit	30950.17	30950.17	0	0.00%
10	DENA BANK	0.367029			
	No. of Employees	13906	4676.95	-9229.05	-66.37%
	Net Worth	71414.76	25689.55	-45725.21	-64.03%
	Earning Assets	1175546	431459.1	-744086.4	-63.30%
	Operating Profit	9252.966	9252.966	0	0.00%
11	IDBI BANK LIMITED	1			
	No. of Employees	17570	17570	0	0.00%
	Net Worth	277217.9	277217.9	0	0.00%
	Earning Assets	3148929	3148929	0	0.00%
	Operating Profit	53700.67	53700.67	0	0.00%
12	INDIAN BANK	0.776246			
	No. of Employees	20074	15325.84	-4748.163	-23.65%

No.	DMU I/O	Score Data	Projection	Difference	%
	Net Worth	162597.8	84181.77	-78416	-48.23%
	Earning Assets	1821384	1413843	-407541.1	-22.38%
	Operating Profit	30320.92	30320.92	0	0.00%
13	INDIAN OVERSEAS BANK	0.560494			
	No. of Employees	32020	14584.66	-17435.34	-54.45%
	Net Worth	156658.2	80110.6	-76547.55	-48.86%
	Earning Assets	2400502	1345467	-1055035	-43.95%
	Operating Profit	28854.56	28854.56	0	0.00%
14	ORIENTAL BANK OF COMMERCE	0.827106			
	No. of Employees	21469	17757.13	-3711.866	-17.29%
	Net Worth	149411.4	113657.6	-35753.79	-23.93%
	Earning Assets	2145378	1774455	-370923.5	-17.29%
	Operating Profit	36820.69	36820.69	0	0.00%
15	PUNJAB AND SIND BANK	0.661402			
	No. of Employees	9403	6219.166	-3183.834	-33.86%
	Net Worth	59702.18	37927.87	-21774.3	-36.47%
	Earning Assets	915611.1	605587.3	-310023.8	-33.86%
	Operating Profit	12698.95	12698.95	0	0.00%
16	PUNJAB NATIONAL BANK	0.999066			
	No. of Employees	65991	61748.03	-4242.974	-6.43%
	Net Worth	383101.4	339169.6	-43931.81	-11.47%
	Earning Assets	5701717	5696394	-5323.14	-0.09%
	Operating Profit	122163.5	122163.5	0	0.00%
17	SYNDICATE BANK	0.748559			
	No. of Employees	32091	16814.2	-15276.8	-47.60%
	Net Worth	123379.8	92357.04	-31022.77	-25.14%
	Earning Assets	2699904	1551148	-1148756	-42.55%
	Operating Profit	33265.53	33265.53	0	0.00%
18	UCO BANK	0.86341			

No.	DMU I/O	Score Data	Projection	Difference	%
	No. of Employees	24724	18213.46	-6510.535	-26.33%
	Net Worth	115869.5	100042.9	-15826.61	-13.66%
	Earning Assets	2098796	1680233	-418562.8	-19.94%
	Operating Profit	36033.86	36033.86	0	0.00%
19	UNION BANK OF INDIA	0.765092			
	No. of Employees	35473	27140.11	-8332.89	-23.49%
	Net Worth	228912.1	175138.8	-53773.27	-23.49%
	Earning Assets	3565623	2724127	-841496.9	-23.60%
	Operating Profit	56426.18	56426.18	0	0.00%
20	UNITED BANK OF INDIA	0.861455			
	No. of Employees	14884	9157.799	-5726.201	-38.47%
	Net Worth	58391.85	50301.96	-8089.889	-13.85%
	Earning Assets	1127836	844827.5	-283008.4	-25.09%
	Operating Profit	18117.96	18117.96	0	0.00%
21	VIJAYA BANK	0.563984			
	No. of Employees	14544	7828.827	-6715.173	-46.17%
	Net Worth	76247.24	43002.19	-33245.05	-43.60%
	Earning Assets	1308295	722226.9	-586067.6	-44.80%
	Operating Profit	15488.7	15488.7	0	0.00%