Technical Efficiency of Commercial Banks in India

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Abstract

Intensification of banking system has been one of the central issues in emerging markets and developing economies. This is because sound banking environment serves as an important channel for achieving economic growth through the mobilization of financial savings and putting them to productive use. Banks are the most important institutional and functional vehicle for economic transformation. Since long, the banks have been acting as key players in the financial system of a country. In India, during twentieth century, banking was generally subject to heavy regulation and financial repression. In 1990s, the process of globalization and liberalization has exerted its huge influence on the Indian banking sector. The ongoing banking sector reforms with their thrust on transparency, efficiency and sustainability have forced the Indian banking sector to adopt suitable strategies in order to compete in the market. So, in banking sector also, as elsewhere in business, competitive environment has become the main force behind efficiency and innovation. This paper is to measure and compare performance of public, private and foreign banks by using Data Envelopment analysis (DEA), a deterministic non-parametric approach. DEA was firstly applied by Sherman and Gold (1985) for assessing the efficiency of bank branches and thereafter. It provides a very promising tool for monitoring efficiency in banking industry (Berger and Humphery, 1997). In banking industry the DEA model is preferable to econometric approach of efficiency measurement because it has a number of advantages discussed in the latter part of this study.

1.0 Introduction

Strengthening banking system has been one of the central issues in emerging markets and developing economies. This is because sound banking environment serves as an important channel for achieving economic growth through the mobilization of financial savings and putting them to productive use. Banks are the most important institutional and functional vehicle for economic transformation. Since long, the banks have been acting as key players in the financial system of a country. In India, during twentieth century, banking was generally subject to heavy regulation and financial repression. In 1990s, the process of globalization and liberalization has exerted its huge influence on the Indian banking sector. The ongoing banking sector reforms with their thrust on transparency, efficiency and sustainability have forced the Indian banking sector to

adopt suitable strategies in order to compete in the market. So, in banking sector also, as elsewhere in business, competitive environment has become the main force behind efficiency and innovation. The present study is an attempt to measure the relative performance and efficiency of commercial banks in India.

2.0 Objective of This Paper

The objective of this paper is to measure and compare performance of public, private and foreign banks by using Data Envelopment analysis (DEA), a deterministic non-parametric approach. DEA was firstly applied by Sherman and Gold (1985) for assessing the efficiency of bank branches and thereafter. It provides a very promising tool for monitoring efficiency in banking industry [Berger and Humphery (1997)]. In banking industry the DEA model is preferable to econometric approach of efficiency measurement because it has a number of advantages discussed in the latter part of this study.

3.0 A Brief Review of Literature

In recent years a number of studies have been conducted to know the productivity, efficiency and performance of players in financial system. Berger and Humphrey (1997) pointed out that, out of the 130 efficiency analysis of depository financial institutions, covering 21 countries; only 5 per cent examined the banking sectors of developing countries. Majority of these studies (75 per cent) were based on US banks. In India, various research studies on performance and efficiency of Indian banking industry were conducted by applying different techniques like taxonomic method, multi comparison test, DEA analysis, zero sum method etc. Notable among these were Bhattacharya (1997), Das (1997, 1998, 2000), Chen (1998), Kumar and Verma (2003), Chaudhary and Tripathy (2004), Ram Mohan and Ray (2004) and Reddy (2006).

As regards Indian banks, Bhattacharya (1997) used DEA to study the impact of liberalising measures taken in 1980s. On the performance of various categories of banks. Their study covered 70 commercial banks in the period 1986-91. Because the Indian banking sector was overwhelmingly dominated by Indian public sector banks, it is no surprise that they found that public sector banks had the highest efficiency followed by foreign banks and private banks.

Das (1997) analyzed overall efficiency – technical, allocative and scale of Indian public sector banks and found a decline in overall efficiency. It has been concluded that inefficiency in public sector banks is due to underutilization or wasting of resources rather than incorrect input combination. Das (1998) found that one of the major factors of high cost of public sector banks in India are the high level of non-performing assets. In particular diseconomies of scale are likely to exist for large public sector banks, which have high non-performing asset.

Das (2000) used DEA to analyze the technical and allocative efficiency of 27 public sectors banks using cross-section data for the year 1998. It has been found that public sector banks had the scope of producing 1.23 times as much output from the same inputs. The results further indicate that State Bank Group is more efficiency than Nationalized Group. Further more, the inefficiency that existed in public sector banks was more result of both technical and allocative inefficiency.

Chen (1998) used DEA approach to create a benchmark measure for the relative operating efficiency of publicly operated banks and their private counterparts in Taiwan. The estimated results show that there are significant differences in efficiency between both the groups and the efficiency gains from privatization may be substantial.

Kuman and Verma (2003) examined the extent of technical (in) efficiency of Indian public sector banks using DEA for the year 2000-01. It has been observed that overall level of inefficiency in public sector banks was around 17 per cent. It had the scope of producing 1.21 times as much output from the same inputs. Also the result shows that State Bank Group outperformed nationalized banks in terms of resources use efficiency.

Chaudhary and Tripathy (2004) evaluate the performance of public sector banks by using DEA. The performance is evaluated on the basis of profitability, financial, management, growth, productivity and liquidity indicators. The results of this analysis show that most of the banks form efficient frontier in profitability and financial indicators as compared to productivity, growth and liquidity indicators.

Rammohan and Ray (2004) compared the revenue maximizing efficiency of public, private and foreign banks during 1992-2000. They found that public sector banks were significantly better than private sector banks on revenue maximization efficiency, but between public and foreign banks the differences in efficiency was not significant.

Reddy (2006) examines total factor productivity, technical and scale efficiency changes in regional rural banks by using data from 192 banks for the period 1996 to 2002.Rural banks showed significant economies of scale in terms of assets and number of branches under each bank. Also the study concluded that banks located in economically developed as well as low banking density regions exhibited significantly higher productivity.

4.0 Data Envelopment Analysis (DEA)

DEA is a methodology used for assessing and comparing the relative performances of decision-making units (DMUs) where the presence of multiple inputs and outputs make comparison difficult. In this study, DMUs are commercial banks of India. Specifically, it is a tool for evaluating relative efficiency since it first identifies banks on the efficiency frontier and then compares other bank's input-output relationships with those of the frontier. It allows to rank

banks according to their technical efficiency scores and to single out the driving forces for inefficiencies.

DEA is a generalization of Farell's (1957) single input-single output technical efficiency measures to the multiple inputs-multiple output case. The methodology was originally developed by Charnes, Cooper and Rhodes (1978) and was further extended by Banker, Charnes and Cooper (1984). It is a linear programming, non-parametric, deterministic technique for determining the relative efficient frontier. It is also called extreme point method and compares each producer with only the 'best' producers. The advantage of DEA over regression based stochastic frontier methods has been its multiple inputs and multiple outputs environment and robustness with respect to the functional relationships between inputs and outputs. On the other hands, its main disadvantage is that due to its non-stochastic nature, it combines the group noises and inefficiency together and calls this combination inefficiency.

5.0 DEA Model

In the beginning, Farrell (1957) used this model to estimate the efficiency of US agricultural output relative to other countries by using single input and single output. In 1978, Charnes, cooper and Phodes (CCR) extended Forrell's idea and proposed a model that generalizes the single input, single output measure of efficiency of a Decision Making Unit to a multiple input and multiple output setting. DEA is based on fractional programming formulation, where a measure of efficiency for each DMU is obtained as a maximum of a ratio of weighted outputs to weighted inputs.

To illustrate CCR input-oriented DEA model, assume that there are j DMUs, utilizing quantities of inputs X_{ER} to produce quantities of outputs Y_{ER}. Each consumes different amounts of i^{th} inputs and produces r^{th} different outputs i.e. DMUj consumes Xij amounts of input to produce Yrj amounts of output. Assuming constant returns to scale, strong disposability of inputs and outputs and convexity of the production possibility set, the technical efficiency score of the kth DMU (h_k) can be obtained as :

$$\max.h_k \quad \frac{\sum_{r=1}^{s} U_r y_{rk}}{\sum_{i=1}^{m} V_i X_{ik}}$$

$$\text{Subject to:} \quad \frac{\sum_{r=1}^{s} U_r Y_{rk}}{\sum_{i=1}^{m} V_i X_{ij}}$$

$$U_r, v_i \geq \varepsilon$$

for j = 1, 2, 3, ..., n
r = 1, 2, 3, ..., s
i = 1, 2, 3,..... , m

Where y_{rk} = the amount of the output produced by the k^{th} DMU
X_{ik} = the amount of the input used by the k^{th} DMU
n = the number of decision-making units
s = the number of outputs
m = the number of inputs; and
ε = a non-Archimedean (infinitesimal) constant

The efficiency score of different DMUs is computed by determining the values of weights (u_r, v_i). However, this problem has an infinite number of solutions since if (u^*,v^*) is optimal than (hu^*, hv^*) is also optimal for each positive scalar. To avoid this problem, the above model may be transformed into another linear programming model by restricting the denominator of the objective function h_k to unity and adding this as a constraint to the problem, which can be written as:

$$\max h_k = \sum_{r=1}^{s} U_r Y_{rk}$$

$$\text{subject to :} \quad \sum_{i=1}^{m} V_i X_{ik} = 1$$

$$\sum_{r=1}^{s} U_r Y_{ri} - \sum_{i=1}^{m} V_i X_{ij} = 0$$

$$U_r, V_i \geq ; \text{ for } j = 1,2, ..., n,\ r = 1, 2,..... , s,\ i = 1, 2, ..., m$$

For the above linear programming, the dual can be written as:

$$\min Z_k = \Theta_k$$

$$\text{Subject to:} \quad \sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{rk}$$

$$\Theta_k x_{ik} - \sum_{j=1}^{n} \lambda_j x_{ij} = 0$$

$\lambda_j = 0$ for j = 1, 2, ... n, ; r = 1, 2, ...,s; i = 1, 2, ..., m

Both the above problems yield an optimal solution $È_k$ which is efficiency score for particular DMUs and efficiency scores for all $È^{\otimes}$ of them are obtained by repeating them for each DMUj, the value of $È^{\otimes}$ is always less than or equal to unity-DMUs for which $È$ = 1 are relatively efficient.

5.1 Methodology

In banking literature, there is considerable disagreement among researchers about what constitute inputs and outputs of banking industry. The existing literature can be classified into three approaches viz. production, intermediate and modern approach. The selection of inputs and outputs in productivity and efficiency related studies, in light of these approaches significantly affects the results. In this classification, the first two approaches apply the classical micro-economic theory to the banking sector; they differ only in specification of bank's activities. The third approaches include the modification of classical theory and incorporates some specificities of bank's activities.

The production approach initiated by the contribution of Benston (1965) and Bell and Murphy (1968), assumes that a bank by using traditional production factors like land, labour and capital produces desired output in the form of loans and other financial services. It recognizes the multi-product role of the bank as a firm.

The intermediation approach is based on intermediary role of the bank assuming banking activities as transforming the fund borrowed from depositors into the money lent to borrowers. It considers funds generated through deposits and borrowing from financial markets as inputs and loans and investment outstanding as outputs.

The modern approach integrate the specific activities of bank like risk management and information processing, agency problem into classical theory of the firm (Mester 1991).

Taking into account the advantages and disadvantages of each approach, the production approach was employed; which enables classification of inputs and outputs based on their perceived value addition. In analyzing the functions performed by commercial banks, David and Manole (2002), mentions two fundamental goals of an efficient bank namely, profit maximization and service provision. In fact, any bank operation combines the elements of the above two functions, since it is hard to imagine a bank which is not trying to produce profits or establish a good rapport with its clients. Accordingly the following outputs and inputs have been selected:

Inputs

y_1 - Staff
y_2 - Branches
y_3 - Total assets

Outputs

x_1 - Deposits
x_2 - Advances
x_3 - Total Income

All these inputs and outputs are measured in terms of rupees in crores except staff and branches which are in numbers. The data on these variables is taken from official website of RBI i.e. www.rbi.org.in. This study is based on a sample of 67 commercial banks comprising 27 public sector banks, 24 private sector banks and 16 foreign banks. The study period is year 2005-06.

5.2 Empirical Results

The efficiency measures calculated in this study are relative in nature. A bank's performance is not judged relative to some absolute standard, but relative to the best available in the sample.

The sources of inefficiency can be determined by comparing the relative sizes of various efficiency measures. Table-1 presents the average efficiency estimates of commercial banks for the year 2005-06. During 2005-06, foreign bank group was found to be technical efficient (91.20 per cent). The average technical efficiency score of 91.20 per cent means that foreign bank has the scope of producing 1.10 (100÷91.20) times as much output from the same input.

Table-1. Average Efficiency Estimates

Bank Group	Technical Efficiency	Pure Technical Efficiency	Scale Efficiency
State Bank Group	57.30	64.60	91.50
Nationalized Banks	58.40	78.40	76.76
Public Sector Banks	58.10	74.30	81.10
Private Sector Banks	66.40	68.00	97.90
Foreign Bans	91.20	97.20	93.60
Total	**77.50**	**69.20**	**90.10**

Further the table indicates that foreign bank group was found to be more efficient in each of the efficiency estimates followed by private and public sector bank group. In case of pure technical efficiency, public sector banks found to be more efficient than private sector banks.

It can be seen from the table that in all the groups except nationalized bank group and foreign bank group, pure-technical was the main source of technical inefficiency. That is except nationalized and foreign bank group, other bank groups were losing very little output due to scale inefficiency. Instead, much of the lost output was the result of under-utilization of resources. Under-utilization of resources may be in the form of staff and branches, because most of the banks in these groups are, in general overstaffed and / or having excess branches.

A bank-wise disaggregated analysis is presented in Table-2. In this, results of input oriented CCR model have been provided. It presents the technical, pure technical and scale efficiency scores obtained from DEA model for individual

public, private and foreign banks, their peer set, returns to scale and peer count.

The results indicate the presence of a marked deviation of the efficiency scores from the best practice frontier. The average technical efficiency scores is 0.690, this implies that the overall level of technical inefficiency in Indian commercial banking industry to the tune of 31 per cent during 2005-2006. This suggests that of adopting best practices, these 67 banks can, on an average, reduce their inputs of staff and branches by at least 31 per cent.

Table 2. Technical Efficiency

Sr. No.	Bank Name	Code	TE-CRS	TE-VRS	SE	IRS/DRS	Peer Count	Peer Set
State Bank Group	SBI	B1	0.612	1.000	0.612	drs	5	1
	SBOBJ	B2	0.479	0.496	0.965	drs	0	51 36 34 60
	SBOH	B3	0.613	0.700	0.875	drs	0	34 36 14
	SBOI	B4	0.599	0.616	0.974	drs	0	34 57 38 60
	SBOM	B5	0.479	0.480	0.999	-	0	60 56 34
	SBOP	B6	0.661	0.722	0.916	drs	0	34 51 36
	SBOS	B7	0.549	0.554	0.991	drs	0	56 34 60
	SBOT	B8	0.594	0.599	0.991	drs	0	60 34 36
Nationalized Bank	AB	B9	0.622	0.844	0.737	drs	0	34 14 36
	AMB	B10	0.609	0.696	0.876	drs	0	34 14 36
	BOB	B11	0.583	0.922	0.633	drs	0	34 36 14
	BOI	B12	0.591	0.934	0.633	drs	0	14 36 34
	BOM	B13	0.506	0.549	0.922	drs	0	36 34 14
	CB	B14	0.683	1.000	0.683	drs	15	14
	CBOI	B15	0.485	0.890	0.545	drs	0	1 34 14
	COB	B16	0.670	0.727	0.921	drs	0	34 51 36 60
	DB	B17	0.583	0.604	0.965	drs	0	38 34 51 60
	IB	B18	0.522	0.716	0.729	drs	0	1 36 34 14
	IOB	B19	0.562	0.816	0.689	drs	0	1 14 36 34
	OBOC	B20	0.720	0.899	0.801	drs	0	34 14 36
	P&SB	B21	0.482	0.488	0.988	drs	0	51 34 38
	PNB	B22	0.525	0.945	0.556	drs	0	1 14 34
	SB	B23	0.557	0.823	0.676	drs	0	34 14 36
	UBOI	B24	0.672	0.949	0.708	drs	0	14 36 34
	UNDOI	B25	0.435	0.532	0.818	drs	0	1 36 34 14
	UCO	B26	0.704	0.930	0.757	drs	0	14 36 34
	VB	B27	0.594	0.635	0.937	drs	0	34 51 36
Private Bank	BOR	B28	0.568	0.574	0.989	drs	0	57 34 38
	BOVB	B29	0.673	0.676	0.996	drs	0	34 57 53
	CSB	B30	0.428	0.429	0.998	drs	0	57 34 53
	CTB	B31	0.619	0.620	0.999	drs	0	34 53 56 60
	CUB	B32	0.554	0.556	0.998	drs	0	57 34 38 60 53
	DLB	B33	0.494	0.495	0.999	drs	0	34 57 53
	FB	B34	1.000	1.000	1.000	-	46	34
	GBOK		NA	NA	NA	NA	0	
	HDFC	B35	0.888	0.916	0.969	drs	20	34 36 60
	ICICI	B36	0.977	1.000	0.977	drs	0	36
	IDBI	B37	0.967	1.000	0.967	drs	11	37
	IIB	B38	0.987	1.000	0.987	drs	0	38
	INGVB	B39	0.621	0.654	0.950	drs	0	38 34 60 57
	J&KB	B40	0.754	0.773	0.975	drs	0	34 38 51 60
	KB	B41	0.690	0.699	0.987	drs	0	34 38 57
	KVB	B42	0.705	0.815	0.864	drs	0	34 59 60
	LVB	B43	0.581	0.582	0.997	drs	0	57 34 53
	LKB	B44	0.517	0.517	0.999	drs	0	53 34 57
	NB	B45	0.482	0.486	0.992	irs	0	34 67 53
	RB	B46	0.450	0.466	0.965	irs	0	65 34 67
	SAB	B47	0.288	0.291	0.991	irs	0	53 34 67
	SIB	B48	0.624	0.629	0.991	drs	0	34 38 57
	TMB	B49	0.565	0.591	0.956	drs	0	34 53 60 38
	UWB	B50	0.550	0.553	0.994	drs	0	57 34 38
	UTI	B51	0.959	1.000	0.959	drs	7	51
Foreign Bank	ABNAB	B52	1.000	1.000	1.000	-	1	52
	ADCB	B53	1.000	1.000	1.000	-	11	53
	AEB	B54	1.000	1.000	1.000	-	1	54
	BOA	B55	1.000	1.000	1.000	-	1	55
	BOB&K	B56	1.000	1.000	1.000	-	3	56
	BONS	B57	1.000	1.000	1.000	-	13	57
	BOT	B58	0.828	0.854	0.970	irs	0	57 52 55 65
	BB	B59	1.000	1.000	1.000	-	2	59
	CIB	B60	1.000	1.000	1.000	-	16	60
	DB(A)	B61	0.956	1.000	0.956	drs	0	61
	H&SB	B62	0.806	0.897	0.898	drs	0	60 34 54
	OIB	B63	0.629	0.903	0.696	irs	0	65 67 59 53
	SG	B64	0.827	1.000	0.827	irs	0	64
	SOB	B65	0.639	1.000	0.639	irs	3	65
	SCB	B66	0.900	0.903	0.997	drs	0	36 60 34
	SBOMS	B67	1.000	1.000	1.000	-	4	67
			0.690	0.775	0.901			
			0.192	0.201	0.133			

However; the potential reduction in inputs from adopting best practices varies from bank to bank. Alternatively these banks have the scope of producing 1.45 times (i.e. 1/0.690) as much outputs from the same inputs. Of the 67 commercial banks, 10 banks have been identified as "relatively efficient" with technical efficiency score equal to one. The remaining 57 banks have been found to be "relatively inefficient" with efficiency score less than unity. The inefficient banks can improve their efficiency by decreasing resource inputs and increasing outputs.

Table 3. Actual, Slacks and Targets

Sr. No.			Branches			Staff			Assets		
	Bank Name	Code	Actual	Slacks	Target	Actual	Slacks	Target	Actual	Slacks	Target
State Bank Group	**SBI**	B1	9143	0	9143	198774	0	198774	493870	0	493870
	SBOBJ	B2	816	23	382	12089	0	6000	27514	0	13657
	SBOH	B3	930	123	528	13108	0	9181	40630	0	28457
	SBOI	B4	436	11	257	6647	0	4091	20711	0	12748
	SBOM	B5	634	0	304	9744	15	4660	19337	0	9278
	SBOP	B6	753	79	464	11350	0	8190	41417	0	29885
	SBOS	B7	425	0	235	7257	285	3735	16530	0	9157
	SBOT	B8	694	0	416	11642	105	6871	31862	0	19091
Nationalized Bank	**AB**	B9	1932	745	885	18742	0	15814	55292	0	46655
	AMB	B10	1148	271	528	13169	0	9161	40669	0	28291
	BOB	B11	2687	538	1938	38737	0	35702	113393	0	104508
	BOI	B12	2563	450	1944	41808	3233	35815	112274	0	104862
	BOM	B13	1287	222	484	14052	0	7709	31215	0	17126
	CB	B14	2551	0	2551	46893	0	46893	132822	0	132822
	CBOI	B15	3143	1295	1502	37241	6372	26767	74681	0	66454
	COB	B16	794	130	448	10754	0	7820	40507	0	29454
	DB	B17	1039	220	408	10156	0	6139	26545	0	16045
	IB	B18	1395	119	880	21302	0	15254	47635	0	34110
	IOB	B19	1523	187	1056	24178	0	19732	59358	0	48443
	OBOC	B20	1161	347	697	14962	0	13447	58937	0	52968
	P&SB	B21	780	57	324	9542	0	4659	19043	0	9298
	PNB	B22	4028	1146	2659	58047	4772	50060	145267	0	137222
	SB	B23	1897	396	1166	24624	0	20275	61077	0	50289
	UBOI	B24	2095	786	1201	24510	0	23249	89126	0	84541
	UNDOI	B25	1316	0	700	25421	2123	11399	33248	0	17685
	UCO	B26	1749	774	853	17319	0	16114	61839	0	57536
	VB	B27	924	131	455	11494	0	7293	31534	0	20009
Private Bank	**BOR**	B28	383	63	157	3990	0	2290	9854	0	5657
	BOVB	B29	103	20	49	1098	0	743	3730	0	2523
	CSB	B30	312	47	86	2863	0	1228	4774	0	2048
	CTB	B31	237	0	147	4471	379	2392	11330	0	7024
	CUB	B32	141	17	61	1605	0	892	4127	0	2293
	DLB	B33	178	40	48	1385	0	685	2849	0	1410
	FB	B34	466	0	466	6366	0	6366	2064	0	2064
	GBOK		NA	NA	NA	NA	NA	NA	NA	NA	NA
	HDFC	B35	515	0	472	14878	2516	11114	73506	0	67336
	ICICI	B36	557	0	557	25479	0	25479	251389	0	251389
	IDBI	B37	173	0	173	4548	0	4548	88565	0	88565
	IIB	B38	137	0	137	2365	0	2365	17623	0	17623
	INGVB	B39	369	50	192	4892	0	3200	16767	0	10967
	J&KB	B40	435	2	334	6833	0	5282	26449	0	20447
	KB	B41	400	78	202	4346	0	3039	14953	0	10457
	KVB	B42	243	52	146	2908	0	2370	9008	0	7342
	LVB	B43	223	56	74	1873	0	1091	4919	0	2864
	LKB	B44	112	16	42	1163	0	602	2599	0	1345
	NB	B45	79	16	22	624	0	303	1321	0	642
	RB	B46	77	16	20	544	0	254	978	0	456
	SAB	B47	186	6	48	NA	0	643	2151	0	625
	SIB	B48	424	109	158	3709	0	2334	10827	0	6814
	TMB	B49	174	17	86	2295	0	1357	6103	0	3607
	UWB	B50	228	10	116	3062	0	1694	7167	0	3966
	UTI	B51	349	0	349	6553	0	6553	49731	0	49731
Foreign Bank	**ABNAB**	B52	16	23	0	23	0		23540	0	23540
	ADCB	B53	2	2	0	2	0	38	689	0	689
	AEB	B54	5	8	0	8	0	1773	3655	0	3655
	BOA	B55	5	4	0	4	0	282	5993	0	5993
	BOB&K	B56	2	2	0	2	0	68	419	0	419
	BONS	B57	5	5	0	5	0	182	3701	0	3701
	BOT	B58	3	3	0	3	0	130	1905	0	1627
	BB	B59	1	1	0	1	0	46	1878	0	1878
	CIB	B60	30	28	0	28	0	3250	45437	0	45437
	DB(A)	B61	5	6	0	6	0	678	12050	0	12050
	H&SB	B62	33	36	0	32	1538	2933	37473	0	33605
	OIB	B63	2	2	0	2	0	36	428	0	387
	SG	B64	2	2	0	2	0	113	1812	0	1812
	SOB	B65	1	1	0	1	0	45	30	0	30
	SCB	B66	60	85	0	77	1063	3802	48182	0	43492
	SBOMS	B67	3	3	0	3	0	20	448	0	448
	Total				129		**334**			0	

Table-4. Performance-wise Classification of Banks for the year 2005-06

	Excellent (A)	Very Good (B)	Below Average (C)	Poor (D)
TE-CRS	FB, HDFC, ICICI, IDBI ,IIB, UTI, ABNAB, ADCB, AEB, BOA, BOB&K, BONS, BOT, BB, CIB, DB, SCB, SG, SBOMS	OBOC, UCO, J&KB, KVB, H&SB	SBI, SBOH, SBOI, SBOP, SBOT, AB, ANB, BOB, BOI, CB, COB, DB, IOB, UBOI, VB, BOR, BOVB, CTB, INGVB, LVB, SIB, TMB, OIB, SOB	SBOBJ, SBOM, SBOS, BOM, CBOI, IB, P&SB, PNB, SB, UNBOI, CSB, CUB, DLB, LKB, NB, RB, SAB, UWB
TE-VRS	SBI, BOB, BOI, CB, PNB, UBOI, UCO, FB, HDFC, ICICI, IDBI, IIB, UTI, ABNAB, ADCB, AEB, BOA, BOB&K, BONS, BB, CIB, DB(A), SG, SOB, SBOMS	AB, CBOI, IOB, OBOC, SB, KVB, BOT, H&SB, OIB, SCB,	SBOH, SBOP, ANB, COB, IB, BOVB, INGVB, J&KB, KB	SBOBJ, SBOI, SBOM, SBOS, SBOT, BOM, DB, P&SB, UNBOI, VB, BOR, CSB, CTB, CUB, DLB, LVB, LKB, NB, RB, SAB, SIB, TMB, UWB
SE	SBOM, BOVB, CSB, CTB, CUB, DLB, FB, LVB, LKB, NB, UWB, ABNAB, ADCB, AEB, BOA, BOB&K , BONS, BB, CIB, SCB, SBOMS	SBOBJ, SBOI, SBOP, SBOS, SBOT, BOM, CUB, BB, P&SB, VB, BOR, HDFC, ICICI, IDBI, IIB, INGVB, J&KB, KB, RB, SAB, SIB, TMB, UTI, BOT, DB(A)	SBOH, ANB, UNBOI, KVB, H&SB, SG	SBI, AB, BOB, BOI, CB, CBOI, IB, IOB, OBOC, PNB, SB, UBOI, UCO, OIB, SOB

The results for the DEA run with *variable returns to scale* for 67 banks indicates that average size of efficiency scores was higher in the variable returns 0.775 compared with 0.690 for constant returns. There were now 19 banks achieving an efficiency score of 1, although of the nine additional efficient banks compared with constant returns, two does not appear in any peer counts. This indicates that these banks namely Deutsche Bank (Asia) Ltd. and Societe Generate Ltd. – were found apparently efficient by default because there were no other banks of comparable size.

The average scale efficiency score is 0.901. The banks that are not of optimal size comprise 57 banks. Out of which only seven banks have increasing returns to scale, while all others have decreasing returns to scale. It shows that except these seven banks, all other 50 banks were over resourced. They should try to minimize their inputs in terms of staff and branches.

Of the 67 commercial banks, Federal Bank Ltd was found to be most efficient for the year 2005-06, as it becomes a peer count of 46 banks followed by HDFC Bank Ltd., Citi Bank Ltd. and Canara Bank. These banks are well managed and have healthy input-output ratio.

The banks which performed very poorly were South Indian Bank Ltd. followed by United Bank of India, Ratnakar Bank Ltd, Catholic Syrian Bank Ltd. and State Bank of Mysore. All these banks have decreasing returns to scale. It means that they are grossly over-resourced.

In Table-4, the banks are grouped into four categories viz. Excellent (A), Very Good (B), Below Average (C) and Poor (D). The Excellent banks (A) are those whose efficiency scores lies in the 25 per cent extreme right side of normal distribution curve. Poor (D) banks are those banks whose efficiency scores lies in the 25 per cent extreme left side of the normal distribution curve. The banks whose efficiency scores lies between 'X and 'X+ks have been placed in the (B) Very Good category. While the banks whose efficiency scores likes between'X and'X-ks are grouped in the Below Average (C) category. Here'X is the mean value of the efficiency score of all the banks in a particular years and S is the standard deviation of the efficiency score 'k' is the values, which divided the area under normal distribution curve into 25 per cent and its value is 0.67 (Normal Distribution Table).

An examination of this table bring forth the fact that out of 16 foreign banks included in the study, 10 banks continue to appear in the Excellent (A) category in all the efficiency scores. In case of public and private sector banks, most of banks figured in Below Average (C) and Poor (D) category. Ten foreign banks have the efficiency score of one in case of technical as well as scale efficiency. The other banks falling under different categories show a lot of diversity existing in terms of functioning and efficiency in the banking sector at aggregate level.

5.3 Target Setting

Each of the inefficient banks can become overall efficient by adjusting its operation to the associated target point determined by the efficient banks that define its reference frontier. The DEA produces diagnostic information about the sources of inefficiency for each bank with respect to the variables included in the calculation. The inefficiency scores and the optimal slack values provide the target points on the efficiency frontier that the inefficient banks can reach by adjusting their input and output levels.

Table-3 presents the target values of inputs for inefficient banks along with actual number of inputs. It can be observed that, on an average, approximately 334 numbers of staff and 129 numbers of branches could be theoretically reduced if all the inefficient banks operate at the same level as the best practice banks.

The table showed that Central Bank of India was the worst performer and should reduce its staff by 6372 and branches by 1295. The other worst performer banks were Punjab National Bank followed by Bank of India, United Bank of India, HDFC Bank Ltd., Hongcong & Shanghai Bank Ltd. and Standard Chartered Bank Ltd.

On contrast, Federal Bank Ltd. followed by State Bank of India, ICICI Bank Ltd., IDBI Bank Ltd., IIB Bank Ltd., UTI Bank Ltd. were the excellent banks having no slacks of inputs. Out of foreign banks except. Hongcong & Shanghai Bank Ltd. and Standard Chartered Bank Ltd., all other have no input slacks. One most noticeable point in this table is regarding asset slacks. The table shows that none of the 67 commercial banks have asset slacks. It means that assets of every bank were optimum according to the current output for 2005-06.

6.0 Conclusions

The objective of this paper is to investigate recent efficiency record of commercial banking industry. This is done by implementing data envelopment analysis on a cross –section of 67 commercial banks taken in year 2005-06. The overall level of technical efficiency in these banks has been found to be 31 per cent. This implied that these banks had the scope of producing 1-45 times as much output from the same inputs. The inefficiency that exists in these banks was more a result of both technical and pure technical efficiency. The Federal Bank Ltd, ABN Amro Bank Ltd., ADCB Bank Ltd., American Express Bank Ltd, Bank of America Ltd., Bank of Baharain & Kuwait Ltd., Bank of Nova Scotia Ltd., Barclays Bank Ltd., Citi Bank Ltd., and State Bank of Mauritius Bank Ltd. scored unity in all the efficiency measures and thus form the efficiency frontier. The worst performance on efficiency front is recorded by South Indian Bank Ltd, which is closely followed by Catholic Syrian Bank Ltd., Ratnakar Bank Ltd., United Bank of India Ltd., and State Bank of Mysore. From the target setting exercise it can be observed that on an average, approximately. 334 numbers of staff and 129 numbers of branches per bank could be reduced theoretically, if all the inefficient banks operate at the same level as the best practice banks. Group wise analysis of banks states that foreign bank group was the most efficient group for the period 2005-2006, followed by private sector bank group and public sector bank group.

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