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EFFICIENCY ANALYSIS OF PRIVATE SECTOR BANKS IN INDIA USING DEA APPROACH

K. Muthyalappa K. Pushpanjali

1. Academic Consultant, Department of Statistics, Sri Krishnadevaraya University, Ananthapuramu-515003

2. Professor, Department of Statistics, Sri Krishnadevaraya University, Ananthapuramu-515003

Email: muthusk1729@gmail.com

Abstract
This study examines the efficiency of private sector banks in India using the Data Envelopment Analysis (DEA) approach. DEA is a non-parametric method employed to assess the relative efficiency of decision-making units (DMUs) by comparing multiple inputs and outputs. The analysis covers a selection of major private sector banks in India over a specified period2016-17, providing a comprehensive evaluation of their operational efficiency. The study utilizes the Constant Returns to Scale (CRS) to determine efficiency scores, with a focus on input minimization.

The analysis highlights the importance of effective resource utilization and strategic management in enhancing bank efficiency. Furthermore, inefficient banks are provided with benchmarks and potential pathways for improvement by learning from their more efficient peers. This study contributes to the existing literature on banking efficiency in India and offers valuable insights for bank managers, policymakers, and regulators aiming to enhance the performance and competitiveness of the Indian banking sector.

1. Introduction:

Data Envelopment Analysis (DEA) is a non-parametric technique for efficiency evaluation. Right from its inception, DEA has been a preferred technique of researchers and policy makers. DEA has a large application area because of its ability of handling large data and compatibility with profit as well as non-profit oriented organizations. For the same reasons, DEA is widely used for efficiency evaluation of banks too. Present paper uses CCR model of DEA to assess the efficiency of Private Sector Banks, operating in India, for the year 2016-2017. The banking industries have grown by leaps and bounds in the past few years and offer some of the best opportunities to grow professionally. However, the experience of working with a private sector bank would be different from a public sector bank in terms of working hours, level of competition and the professional learning curve. Private Sector Banks are known for their better organization structure and greater penetration into the customer base. Private Sector Banks are measured like Government honored banks in India where a majority of Stock i.e., less than 50% of the total stock is owned by private banks. Now in India, we are having 21 private sector banks, they provide financial services and securities to public with not only a purpose of earning profits, but also for the sense of responsibility. Private Sector Banks works strictly per government regulations, which assures non-violation of consumer rights. The private sector banks operate under the Government of inspired trust in the depositors that their money is safe. In present times, when Private Sector Banks are facing competition with public and foreign banks for financial gains, it becomes even more necessary for Private Sector Banks, to continuously evaluate their efficiency and work for further improvement. Present paper analyses the efficiency levels of all Private Sector Banks, mentioning the benchmarks for each relatively inefficient Private Sector Banks and provides with the details of sources responsible for inefficiency.

I. Review of Literature:

The banking sector plays a pivotal role in the economic development of any country. In India, the private sector banks have emerged as significant players, contributing to the modernization and efficiency of the banking industry. The use of Data Envelopment Analysis (DEA) to evaluate the efficiency of these banks provides valuable insights for policy makers, bank management, and researchers. This literature review explores key studies that have employed DEA to analyze the efficiency of private sector banks in India.

Bhattacharyya et al. (1997): One of the pioneering studies on bank efficiency in India used DEA to analyze the performance of public, private, and foreign banks. This study highlighted that private sector banks were more efficient compared to their public sector counterparts due to better resource management and technological adoption.

Sufian (2009): Examined the efficiency of Malaysian and Indian banks, revealing that Indian private sector banks had improved their efficiency over time. The study used both the CCR and BCC models, showing that scale inefficiencies were a concern for some banks.

Pasiouras (2008): Conducted a cross-country analysis including India, emphasizing the role of bank-specific and country-specific factors in determining efficiency. Indian private sector banks were found to be relatively efficient compared to their global peers.

Sharma and Gupta (2012): Focused on the efficiency of Indian banks during the financial crisis. The study revealed that private sector banks maintained their efficiency levels better than public sector banks, highlighting their resilience and better risk management practices.

Simar and Wilson (2007): Introduced bootstrap methods in DEA to provide more robust efficiency estimates. This approach has been applied in several studies on Indian banks to address the limitations of traditional DEA models.

II. Objectives:

The aim of the study is to measure Technical Efficiency (TE) and Peer analysis of Private Sector Banks in India during the year 2016-17.

III.Methodology:

Data envelopment analysis is a deterministic approach employed to measure the input and output technical efficiencies. In a firm or production unit inputs are combined to produce one or more outputs subject to technology. The production varies from one unit to another. This kind of variation causes efficiency differences among the competing DMU's.

Assume that for each of the N firms, there are data on K inputs and M outputs and represented by the column vectors and respectively for the ith firm. The $K \times N$ input matrixes X, and $K \times M$ output matrix Y represents the data of all $K \times N$ DMUs. The purpose of DEA is to construct a non parametric envelopment frontier over the data points such that all observed points lie on or below the production frontier.

The best way to introduce DEA is through the ratio form. For each DMU we would like to obtain a measure of the ratio of all outputs over all inputs, such as , where U is MX1 vector of output weights and V is a KX1 vector of input weights. To select optimal weight, we specify the mathematical programming problem as:

$$Max_{u,v}\left(\frac{U'Y_i}{V'X_i}\right)$$

$$\text{Subject to } \frac{U'Y_i}{V'X_i} \leq 1, i = 1,2,.....N$$

$$VX_i = 1$$

$$U, V \geq 0 - - - - - - - - - - - - (1)$$

By solving (1), we will find the values of u and v, such that the efficiency measure for each firm is maximized but difficulty with this particular model formulation is that it can have an infinite number of solutions. Thus, an additional constraint is added, so that this problem can be avoided.

The new model, known as the transformation model, thus becomes:

$$Max_{\mu,v}(\mu'Y_i)$$

$$\text{Subject to } \mu'Y_i - V'X_i \geq 0$$

$$\mu, V \geq 0 - - - - - - - - - (2)$$

IV. Source of Data:

The data for the present study is obtained from Indian Banking Association Bulletin (IBA) during the year 2016-17. Here two input variables and two output variables are used. They are Interest Income and Other income (Input variables), Deposits and Advances (Output variables).

V. Result and Discusses:

The results are obtained by using Data Envelopment Analysis program with the help of CCR model.

1. Technical Efficiency:

The technical efficiencies reflect the ability of the firm to obtain maximum outputs from the set of inputs.

Table:1.1: Efficiency Summary

S. No Scale	DMUs	CRS TE	VRS TE	Scale Efficiency	Return to
1	City Union Bank Ltd.	0.868	1.000	0.868	Decreasing return to scale
2	Tamilnad Mercantile Bank Ltd.	0.870	0.962	0.905	Decreasing return to scale
3	The Catholic Syrian Bank Ltd.	0.992	1.000	0.992	Decreasing return to scale
4	Dhanlaxmi Bank Ltd	1.000	1.000	1.000	---
5	The Federal Bank Ltd.	0.757	0.760	0.996	Increasing return to scale
6	The Jammu & Kashmir Bank Ltd.	0.087	0.124	0.408	Increasing return to scale
7	The Karnataka Bank Ltd.	1.000	1.000	1.000	---
8	The Karur Vysya Bank Ltd.	0.875	0.885	0.989	Decreasing return to scale
9	Nainital Bank Ltd.	1.000	1.000	1.000	---
10	RBL Bank	0.037	0.313	0.119	Increasing return to scale
11	The South Indian Bank Ltd.	0.027	0.191	0.144	Increasing return to scale
12	Axis Bank Ltd.	1.000	1.000	1.000	---
13	DCB Bank Ltd.	0.836	0.903	0.927	Decreasing return to scale
14	HDFC Bank Ltd.	1.000	1.000	1.000	---
15	ICICI Bank Ltd.	1.000	1.000	1.000	---
16	Indusind Bank Ltd.	0.783	1.000	0.783	Decreasing return to scale
17	Kotak Mahindra Bank Ltd.	0.835	0.889	0.939	Decreasing return to scale
18	YES Bank	1.000	1.000	1.000	---
19	Bandhan Bank	1.000	1.000	1.000	---
20	IDFC First Bank Ltd.	1.000	1.000	1.000	---
21	IDBI Ltd.	1.000	1.000	1.000	---
Mean		0.808	0.863	0.860	

As per the model, any private sector bank with a Technical efficiency score one is considered to be efficient. Otherwise, the private sector banks are said to be inefficient. From the table 1.1, it is evident that out of total 21 private sector banks being evaluated 10 private sector banks having efficiency score 1 and rest of the 11 private sector banks have Technical efficiency less than 1. But six private sector banks have consistently shown the technical efficiency above its average. It was found that among 21 private sector banks Dhanlaxmi Bank Ltd., The Karnataka Bank Ltd., Nainital Bank Ltd., Axis Bank Ltd., HDFC Bank Ltd., ICICI Bank Ltd., YES Bank, Bandhan Bank, IDFC First Bank Ltd., and IDBI Ltd. are in the first position whereas The South Indian Bank Ltd. is in last position.

2. Peer Efficiencies:

The following table represents the summary of peers of 21 private sector banks in India and their role models.

Table:2.1: Peer Efficiency summary

S. No	DMUs	Efficient Peers (Role Model)		
1	City Union Bank Ltd.	Dhanlaxmi Bank Ltd.	Nainital Bank Ltd.	---
2	Tamilnad Mercantile Bank Ltd.	Dhanlaxmi Bank Ltd.	Nainital Bank Ltd.	---
3	The Catholic Syrian Bank Ltd.	Nainital Bank Ltd.	Dhanlaxmi Bank Ltd.	---
4	Dhanlaxmi Bank Ltd.	Dhanlaxmi Bank Ltd.	---	---
5	The Federal Bank Ltd.	IDBI Ltd.	YES Bank	Axis Bank Ltd.
6	The Jammu & Kashmir Bank Ltd.	Dhanlaxmi Bank Ltd.	YES Bank	---
7	The Karnataka Bank Ltd.	The Karnataka Bank Ltd.	---	---
8	The Karur Vysya Bank Ltd.	The Karnataka Bank Ltd.	Dhanlaxmi Bank Ltd.	---
9	Nainital Bank Ltd.	Nainital Bank Ltd.	---	---
10	RBL Bank	Dhanlaxmi Bank Ltd.	HDFC Bank Ltd.	The Karnataka Bank Ltd.
11	The South Indian Bank Ltd.	HDFC Bank Ltd.	The Karnataka Bank Ltd.	---
12	Axis Bank Ltd.	Axis Bank Ltd.	---	---
13	DCB Bank Ltd.	Dhanlaxmi Bank Ltd.	Nainital Bank Ltd.	---
14	HDFC Bank Ltd.	HDFC Bank Ltd.	---	---
15	ICICI Bank Ltd.	ICICI Bank Ltd.	---	---
16	Indusind Bank Ltd.	IDBI Ltd.	Axis Bank Ltd.	YES Bank
17	Kotak Mahindra Bank Ltd.	IDBI Ltd.	IDFC First Bank Ltd.	ICICI Bank Ltd.
18	YES Bank	YES Bank	---	---
19	Bandhan Bank	Bandhan Bank	---	---
20	IDFC First Bank Ltd.	IDFC First Bank Ltd.	---	---
21	IDBI Ltd.	IDBI Ltd.	---	---

From the above table 2.1, Dhanlaxmi Bank Ltd., The Karnataka Bank Ltd., Nainital Bank Ltd., Axis Bank Ltd., HDFC Bank Ltd., ICICI Bank Ltd., YES Bank, IDFC First Bank Ltd., and IDBI Ltd. banks are role models for 11 banks. There is no role model bank for Bandhan bank because these banks are efficient. For city union bank Ltd. we can say that Dhanlaxmi bank Ltd. & Nainital bank Ltd. banks are efficient Peers. And also for Tamilnadu mercantile bank Ltd. Dhanlaxmi bank Ltd. & Nainital bank Ltd. banks are reserved as role models. Like this way we can tell the Peer banks for all other banks.

3. Peer Weights:

The following table represents the peer weights of the 21 private sector banks.

Table:3.1: Peer weight summary

S. No	DMUs	Peer Weights		
1	City Union Bank Ltd.	3.859	0.122	
2	Tamilnad Mercantile Bank Ltd.	3.150	0.613	
3	The Catholic Syrian Bank Ltd.	0.190	2.304	
4	Dhanlaxmi Bank Ltd.	1.000		
5	The Federal Bank Ltd.	0.416	0.230	0.071
6	The Jammu & Kashmir Bank Ltd.	0.076	0.180	
7	The Karnataka Bank Ltd.	1.000		
8	The Karur Vysya Bank Ltd.	0.316	4.148	
9	Nainital Bank Ltd.	1.000		
10	RBL Bank	0.003	0.023	0.004
11	The South Indian Bank Ltd.	0.032	0.003	
12	Axis Bank Ltd.	1.000		
13	DCB Bank Ltd.	2.982	0.906	
14	HDFC Bank Ltd.	1.000		
15	ICICI Bank Ltd.	1.000		
16	Indusind Bank Ltd.	0.569	0.081	0.526
17	Kotak Mahindra Bank Ltd.	0.604	0.513	0.126
18	YES Bank	1.000		
19	Bandhan Bank	1.000		
20	IDFC First Bank Ltd.	1.000		
21	IDBI Ltd.	1.000		

Table 3.1 gives the list of inefficient banks and their benchmarks. As per table 3.1, among 21 Private Sector Banks, Dhanlaxmi Bank Ltd., The Karnataka Bank Ltd., Nainital Ban9k Ltd., Axis Bank Ltd., HDFC Bank Ltd., ICICI Bank Ltd., YES Bank, Bandhan Bank, IDFC First Bank Ltd., and IDBI Ltd. banks are the efficient peers for all inefficient banks. We can also observe that City Union Bank Ltd. has two Benchmarks such as Dhanlaxmi Bank Ltd. (3.859), Nainital Bank Ltd. (0.122). Out of these two Dhanlaxmi Bank Ltd. is the nearest benchmark for it i.e., Dhanlaxmi Bank Ltd. is the most dominant peer. Similarly Tamilnad Mercantile Bank Ltd. has two Benchmarks. Out of those, Dhanlaxmi Bank Ltd. is in the nearest benchmark and input can be expressed as,

$$X_1 = \lambda_4 X_4 + \lambda_9 X_9$$

$$= (3.859)X_4 + (0.122)X_9$$

Where X_4 & X_9 are input vectors of Dhanlaxmi Bank Ltd., Nainital Bank Ltd. For Tamilnad Mercantile Bank Ltd. the most dominant peer is Dhanlaxmi Bank Ltd. (Measure in terms of magnitude of its intensity parameter).

Similarly the output vector of City bank Ltd. can be expressed as $U_1 = \lambda_4 U_4 + \lambda_9 U_9$, here U_4 & U_9 are output vectors. We can express the remaining private sector banks as in the above procedure.

4. Peer Count:

The following table represents the Peer count performance of 21 Private Sector Banks in India

Table:4.1: Peer count summary

S. No	DMUs	Peer Count	Rank
1	City Union Bank Ltd.	0	
2	Tamilnad Mercantile Bank Ltd.	0	
3	The Catholic Syrian Bank Ltd.	0	
4	Dhanlaxmi Bank Ltd	7	1
5	The Federal Bank Ltd.	0	
6	The Jammu & Kashmir Bank Ltd.	0	
7	The Karnataka Bank Ltd.	3	3
8	The Karur Vysya Bank Ltd.	0	
9	Nainital Bank Ltd.	4	2
10	RBL Bank	0	
11	The South Indian Bank Ltd.	0	
12	Axis Bank Ltd.	2	4
13	DCB Bank Ltd.	0	
14	HDFC Bank Ltd.	2	4
15	ICICI Bank Ltd.	1	5
16	Indusind Bank Ltd.	0	
17	Kotak Mahindra Bank Ltd.	0	
18	YES Bank	3	3
19	Bandhan Bank	0	
20	IDFC First Bank Ltd.	1	5
21	IDBI Ltd.	3	3

From the table 4.1, the bank with largest peer count is considered to be the most popular role model bank. In the analysis it has been observed that, Dhanalaxmi bank Ltd. are appeared as an efficient peer banks in the peer list of 11 inefficient banks. Nainital bank Ltd. served as an efficient peer of 4 inefficient banks, Axis bank Ltd. and HDFC bank

Ltd. are each served as an efficient peer of two inefficient banks and also ICICI bank Ltd. & IDFC First bank Ltd. are each served as an efficient peer of one inefficient bank. But, Bandhan bank has an efficient peer of no inefficient banks.

5. Conclusion:

In this study, we analyzed the data of 21 private sector banks. We used the data of the year 2016-2017. Our results exhibit that in case of 21 private sector banks the efficiency has been tremendous and consistent throughout the period of study, especially 10 private sector banks i.e., Dhanlaxmi Bank Ltd., The Karnataka Bank Ltd., Nainital Bank Ltd., Axis Bank Ltd., HDFC Bank Ltd., ICICI Bank Ltd., YES Bank, Bandhan bank, IDFC First Bank Ltd., and IDBI Ltd. are the most dominated banks when compared to other banks and some other banks such as City Union bank, Tamilnad Mercantile bank Ltd., The Catholic Syrian bank Ltd., The Karur Vysya bank Ltd., DCB bank Ltd. and Kotak Mahendra bank Ltd. have the technical efficiency above its average.

Apart from this, Dhanlaxmi Bank Ltd., The Karnataka Bank Ltd., Nainital Bank Ltd., Axis Bank Ltd., HDFC Bank Ltd., ICICI Bank Ltd., YES Bank, Bandhan bank, IDFC First Bank Ltd., and IDBI Ltd. having Technical Efficiency one which are in the first position where as The South Indian Bank Ltd. is in last position.

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