Original Research Paper

Volume - 14 | Issue - 09 | September - 2024 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Statistics

EFFICIENCY OF PUBLIC SECTOR BANKS IN INDIA : DEA APPROACH

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ABSTRACT Data envelopment analysis which has developed to measure the effectiveness of Decision-Making Unit and similar items of their products and services, is an efficiency measurement technique without parameters. This technique ensures to define how existing sources can be used effectively to create the outputs of DMU. The interest in the measurement of the performance and efficiency in banking has increasing day by day. Indian financial sector has observed various modifications in the policies and prudential norms to raise the banking standards in India to the international strength. Recently in many studies DEA method has been using to evaluate performance of banks. This present study makes an attempt to measure the efficiency scores of public sector banks operating in India during Financial Year(FY) 2021-2022. The main aim of this paper is to measure the technical efficiency and also to construct peer analysis for public sector banks in India.

KEYWORDS : DMU, Technical Efficiency (TE), DEA, Peer Analysis

INTRODUCTION:

Data Envelopment Analysis (DEA) is a non-parametric technique widely used for evaluating efficiency. Since its inception, DEA has been favoured by researchers and policymakers due to its capacity to handle large datasets and its applicability to both profit and non-profit organizations. This versatility has led to its extensive use in assessing the efficiency of banks.

This paper employs the BCC model of DEA to evaluate the efficiency of Public Sector Banks (PSBs) in India for the FY 2021-2022. The banking industry in India has experienced significant growth in recent years, presenting robust professional opportunities. Working in a public sector bank differs from working in a private sector bank in aspects such as work hours, competition levels, and professional development. PSBs are characterized by a well-organized structure and substantial customer base penetration. These banks are government-owned, with over 50% of their shares held by the government.

Throughout the 1980s, the share of public sector banks in the Indian banking sector increased, reaching 95% by 1991. Notable mergers occurred in 2020, such as Andhra Bank and Corporation Bank merging with Union Bank of India, and Syndicate Bank merging with Canara Bank, reducing the number of PSBs to 12. PSBs play a crucial role in India's economic development by providing financial services not solely for profit but also to foster economic growth. They operate under strict government regulations to protect consumer rights and instil trust in depositors. In the face of growing competition from private and foreign banks, it is essential for PSBs to continuously evaluate and improve their efficiency. This paper analyzes the efficiency levels of all PSBs, identifies benchmarks for each relatively inefficient bank, and provides insights into the sources of inefficiency.

OBJECTIVES:

The main aim of the study is to measure technical efficiency and Peer analysis of public sector banks in India during the FY 2021-2022.

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 xi and yi respectively for the ith firm. The KXN input matrix X, and KXM output matrix Y, represents the data of all KXN DMU's. 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 via the ratio form. For each DMU we would like to obtain a measure of the ratio of all outputs over all inputs, such as $uy_i / v' x_i$,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

$$Max_{u,v}(u'Y_i / v'X_i)$$

$$\text{Subject to} \quad u'Y_i / v'X_i \le 1, \ j=1,2,...N$$

$$u,v \ge 0 \qquad \ldots. (1)$$

Solving (1) will involve finding values for u and v, such that the efficiency measure for each firm is maximized. A notable difficulty with this particular model formulation is that it can have an infinite number of solutions. Thus, an additional constraint is added, $v' X_i=1$.so that this problem can be avoided. The new model, known as the transformation model, thus becomes:

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

$$\text{Subject to} \quad \mu'Y_i - v'X_j \ge 0,$$

$$\mu, v \ge 0. \qquad \ldots.. (2)$$

Where the notation changes from u and v to μ and v reflects the transformation. This is known as multiplier form of the Linear Programming Problem.

Using the duality in linear programming, one can derive an equivalent envelopment form of this problem:

$$Min_{\theta,\delta}\theta$$

$$\text{Subject to} \quad -Y_i + Y\lambda \ge 0,$$

$$\lambda \ge 0.$$

Where θ is a scalar and δ is N×1 vector of constants. This envelopment form involves fewer constraints than the multiplier form (K+M < N+1), and hence generally the preferred form to solve. The value of θ obtained will be the efficiency score for the i^thDMU. It will satisfy θ≤1,with a value of 1 indicating a point on the frontier and hence, technically efficient DMU, according to the Farrell (1957) definition.

SOURCE OF DATA:

The data for the present study is obtained from Indian Banking Association Bulletin (IBA) during the FY 2021-2022. Here two input variables and two output variables are used, they are Deposits and Operating Expenses (Input variables), Return on Assets and Net Profit (Output variables).

EMPIRICAL RESULTS:

The empirical results are obtained by using Data Envelopment

Analysis Program software with the help of CCR and BCC models.

TECHNICAL EFFICIENCY:

Technical efficiency assesses how effectively a Decision Making Unit (DMU) uses inputs to produce outputs, with a score of 1 indicating optimal efficiency.

Table 3.1

DMU	TECHNICAL EFFICIENCY
Bank Of Baroda	0.96 (3)
Bank Of India	0.794 (7)
Bank Of Maharashtra	0.736 (8)
Canara Bank	0.82 (4)
Central Bank Of India	0.413 (10)
Indian Bank	0.986 (2)
Indian Overseas Bank	0.812 (5)
Punjab & Sindh Bank	1 (1)
Punjab National Bank	0.488 (9)
UCO Bank	0.495 (9)
Union Bank Of India	0.808 (6)
State Bank Of India	1 (1)

According to the model, a Public Sector Bank (PSB) with a technical efficiency score of 1 is deemed efficient; otherwise, it is considered inefficient. Table 3.1 reveals that out of the 12 PSBs evaluated, only 2 achieved a technical efficiency score of 1, while the remaining 10 banks had scores below 1. Notably, six of these banks consistently performed above their average efficiency levels. Among the 12 PSBs, Indian Bank and Punjab and Sindh Bank are identified as the top performers, whereas Central Bank of India ranks lowest in terms of efficiency.

ROLE MODEL BANKS:

The following are the summary of peers of 12 Public Banks in India and their role models

Table 3.2

S.NO	DMU	ROLE MODELS (EFFICIENT PEERS)	
1	Bank Of Baroda	State Bank of India	Punjab & Sind Bank
2	Bank Of India	State Bank of India	Punjab & Sind Bank
3	Bank Of Maharashtra	State Bank of India	Punjab & Sind Bank
4	Canara Bank	State Bank of India	Punjab & Sind Bank
5	Central Bank Of India	State Bank of India	Punjab & Sind Bank
6	Indian Bank	State Bank of India	Punjab & Sind Bank
7	Indian Overseas Bank	Punjab & Sind Bank	State Bank Of India
8	Punjab & Sind Bank	Punjab & Sind Bank	-
9	Punjab National Bank	State Bank Of India	Punjab & Sind Bank
10	UCO Bank	State Bank Of India	Punjab & Sind Bank
11	Union Bank Of India	State Bank Of India	Punjab & Sind Bank
12	State Bank Of India	State Bank Of India	-

According to the table 3.2, SBI and Punjab and Sind Bank serve as role models for the other 10 banks, as they are themselves efficient. Since SBI and Punjab and Sind Bank have achieved the efficiency score 1, there are no role model banks for them. For Bank of Baroda, SBI and Punjab and Sind Bank are considered efficient peers. Similarly, for Bank of India, SBI and Punjab and Sind Bank are designated as role models. This approach can be applied to identify peer banks for all other banks as well.

PEER WEIGHTS:

In DEA, peer weight represents the degree of influence that each peer Decision Making Unit (DMU) has on the efficiency evaluation of another DMU.

The following are the peer weights of the 12 PSBs.

Table 3.3

DMU	PEER WEIGHT	
Bank Of Baroda	0.787	0.213
Bank Of India	0.894	0.106
Bank Of Maharastra	0.983	0.017
Canara Bank	0.808	0.192
Central Bank Of India	0.049	0.951
Indian Bank	0.905	0.095
Indian Overseas Bank	0.035	0.965
Punjab & Sindh Bank	1	0.965
Punjjab National Bank	0.803	-
UCO Bank	0.973	0.197
Union Bank Of India	0.823	0.027
State Bank Of India	1	-

Table 3.3 lists the inefficient banks and their benchmarks. According to the table, SBI and Punjab and Sind Bank are the efficient peers for all the inefficient banks among the 12 PSBs. For instance, Bank of Baroda has two benchmarks: SBI (0.787) and Punjab and Sind Bank (0.213). Among these, SBI is the closer benchmark and thus the most dominant peer. Similarly, Bank of India also has two benchmarks, with SBI being the nearest. The input can be expressed as follows:

$$X_1 = \lambda_{12}X_{12} + \lambda_8 X_8$$
$$= (0.787)X_{12} + (0.213)X_8$$

Where X_{12},X_8 are input methods of SBI and Punjab and Sind Bank, the most dominant periods SBI (measure in terms of magnitude of its intensity parameter λ=0.787. Similarly, the output vector of Bank of Baroda can be expressed as,

$$U_1 = \lambda_{12}U_{12} + \lambda_8 U_8$$

Where U_{12},U_8 are output vectors. Similarly, we can express the remaining banks as above procedure.

PEER COUNT:

Table 3.4

DMU	PEER COUNT
Bank Of Baroda	0
Bank Of India	0
Bank Of Maharastra	0
Canara Bank	0
Central Bank Of India	0
Indian Bank	0
Indian Overseas Bank	0
Punjab & Sindh Bank	10
Punjjab National Bank	0
UCO Bank	0
Union Bank Of India	0
State Bank Of India	10

Here the bank with largest peer count is considered to be the most popular role model bank. In the analysis it has been observed that, the SBI & Punjab and Sind banks are appeared as efficient peer banks in the list of 12 banks. Both SBI and Punjab and Sind banks are served as the efficient peer of 10 inefficient banks.

CONCLUSION:

In this study, we analyzed data from 12 public sector banks for the FY 2021-2022. Our results show that overall efficiency has been outstanding and consistent across the study period. Notably, State Bank of India and Punjab and Sind Bank emerged as the top performers, consistently leading compared to other banks. Conversely, the Central Bank of India ranked at the bottom in terms of efficiency.

REFERENCES:

1. Charnes A, Cooper WW, Rhodes E. (1978). Measuring the efficiency of decision-making units. European Journal of Operational Research 2: 429-44.
2. Coelli, T.J., D.S.P Rao, C.J. O'Donnel, and G.E. Batesse (2005). An introduction to efficiency and productivity analysis.
3. Emrouznejad, A., and G.L. Yang. (2018). A survey and analysis of the first 40 years of scholarly litera ture in DEA: 1978–2016. Socio-Economic Planning Sciences 61: 4–8.
4. Favero, C. A., & Papi, L. (1995). Technical efficiency and scale efficiency in the Italian banking sector: a non-parametric approach. Applied Economics, 27(4), 385–395.
5. Ganesan N (2009), Data Envelopment Analysis of state and District Co-operative Banks in India: Exploratory Results, The IUP Journal of Bank Management Vol. VIII, Nos. 3 & 4, pp. 37-53
6. Hollingsworth, B., Dawson, P. J., & Maniadakis, N. (1999) Efficiency measurement of health care: a review of non-parametric methods and applications.

Health Care Management Science, 2(3),161–172.
7. Rajput Gupta (2010), Efficiency, Productivity and Soundness of the Bankingf Sector in India:Data Envelopment Analysis, BVIMR, Management Edge , December issue 2011
8. Suresh S, Sunita M and Venkataramanaiah M (2015), "Technical Efficiency of Indian Commercial Banking Using Translog Distance Function", South Asian Academic Research Journal, Vil.5, Issue-2(February 2015)