

Efficiency Analysis of Public and Private Sector Banks in India Using Data Envelopment Analysis

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Abstract

This paper aims to empirically analyse the efficiency of public and private sector banks in India. The paper uses data envelopment analysis to measure and compare the efficiency of banks. Three measures of efficiency viz. total technical efficiency, pure technical efficiency and scale efficiency are computed. The paper evaluates and compares the efficiency of public and private sector banks by utilizing the RBI published data set for the period 2015 to 2019. The paper concludes with empirical results that public sector banks are less efficient in terms of total technical efficiency and pure technical efficiency than private sector banks. However, both these sectors have equal scale efficiency.

Keywords: public sector banks, private sector banks, efficiency of banks, DEA model.

I. Introduction

Efficient performance of the economy depends upon the efficiency of its financial system. The performance of financial system of a country determines its economic growth indicators. Indian financial system mainly consists of Indian banking industry and the capital market. The Indian commercial banks have traditionally been playing the most important role as financial intermediaries. Public and private sector banks are the lead players in the Indian banking system. The public sector banks comprise more than three- fifth of financial system's assets and dominate the whole banking sector in India and played a central role in mobilizing savings in growth process (Anil K. Sharma et al., 2012). In the recent years private sector banks are growing very fast and proving to be significant in the banking system. Managementsof banks always lookfor the effectiveness and efficiency in the performance of banks and thereby largelyensure the success of the strategic objectives and goals of the banks.

II. Literature review

Indian financial sector has been on the reforms path over a period of time for the betterment of the economy. Reforms introduced in the banking sector gave birth to private and foreign banks along with the freedom to manage both quality and pricing of services (Sanjeev. 2006). Adoption of new information technology and thereby erosion of geographical boundaries, product, and declining processing cost have played a major role in improving the competition among the banks (Chaudary, K. et al. 2011). Mathur (2002) argues that the probability of facing the crises by the private sector

banks will be large if the legal and regulatory structure were not sound. Razvania et al. (2008) suggest the policymakers to create policies to cheer the private & foreign banks and encourage mergers & acquisitions among the banks. Kumar (2009) claims that in the post reforms period, banks with less efficiency at the beginning are growing faster than the highly efficient banks.

Of late data envelopment analysis is popularly used in measuring performance of banks. Saha, A. (2000) proposes that data envelopment analysis is a suitable approach for measuring the relative efficiency of banks in India. Profitability is one of the important benchmarks in addition to productivity, financial efficiency and operational efficiency to measure the efficiency of banks (Bodla et al. 2006). The overall efficiency of banks will be negatively influenced by the non-performing assets and non-approved investments (Reddy, .A 2004). However, scale efficiency has less influence on the overall efficiency of banks (Kumar, S., & Gulati, R. 2008). Sensarma, R. (2006) observed the improvement in the efficiency of Indian banks during the period 1986 to 2000. In contrast, Bapat (2012) found the decline in the efficiency of Indian banks in the year 2008-09 but in the upcoming year i.e., 2009-10 Indian banks were on the path of recovery.

A number of studies have focused on the efficiency of public sector banks either alone or in comparison with private and foreign banks in India. Studies made by Ray, S. C et al.(2010)and Karimzadeh M. (2012) found that public sector banks are more efficient than the private sector counterparts. Moreover, private sector banks are most inefficient in comparison with state-owned banks (Varadi, V.K. et al. 2006). State bank of India (SBI) group and foreign banks are performing better than nationalized banks and private banks in comparison to technical efficiency (Shanmugam, K.R. 2004). SBI group is more efficient than nationalized banks (Kumar, S. 2008). And Domestic banks are 1 percent more efficient than foreign banks (Kesari, P. K. et al. 1994). Likewise, the study based on the size of the banks derived that large and small banks are efficient than the medium-size state-owned banks (Debnath, R. M. et al. 2008). Although some studies come with positive judgment in favor of private and foreign banks, for instance, foreign/ joint venture banks and private banks are more efficient than public sector banks (Margono, H. et al. 2010). Foreign banks are efficient than private and public sector banks (Fujii et al. 2014).

III. Data and methodology

The study focuses on Indian commercial banks. The sample of the study consists of 20 banks; 10 public sector banks and 10 private sector banks¹. The data for the study are extracted from financial statements and profit and loss accounts of each bank for the period 2015 to 2019. This time-frame of the study is comfortable enough to investigate and compare the efficiency of public and private sector banks.

In literature, the banking efficiency is often measured by using parametric approach (Financial Ratios Analysis) or non-parametric approach (Data Envelopment Analysis). Hasan (2005) opines that the FRA has certain disadvantages, such as it assumes cost minimization and profit maximization. In contrast, non-parametric approach viz. data envelopment analysis (DEA) does not assume any particular optimization objective with respect to the firm, and it is commonly used in measuring the relative efficiency of the firms. The present study uses DEA to conduct a comparative analysis of the input-oriented efficiency of Indian commercial banks for the period 2015 to 2019.

Data envelopment analysis (DEA)

¹ List of sample banks under study has been shown in the appendix.

DEA is a linear programming, originated by Charnes et al. (1978). DEA offers two assumptions: constant return to scale (CRS) and variable return to scale (VRS). CRS considers that there is no association between scale of operation and efficiency of a firm. This assumption is used to measure the overall technical efficiency (OTE) of a firm. CRS assumption is applicable only when, all decision making units (DMU) operate at an optimal level. Practically, a bank or firm or DMU might face increasing return to scale (IRS) or decreasing return to scale (DRS). BCC (Banker, Charnes and Cooper) model proposed by Banker et al. (1984) is an extension of CCR model which assumes VRS rather than CRS to measure the efficiency of bank or firm or DMU. VRS provides pure technical efficiency (PTE). The variance between OTE and PTE score of DMU indicates the presence of scale efficiency (SE). Thus, CCR and BCC model can be used to estimate scale efficiency. DEA model can be constructed using either an input orientation (IO: same level of output with minimum input) or output orientation (OO: maximization of output with given input).

As a standard approach, DEA uses both CRS and VRS assumptions to estimate scale effects. Isik and Hassan (2002) suggest that estimating efficiency for each year is more appropriate than constructing multi-year analysis for the target banks. Keeping in mind several studies in literature, the present study prefers to measure the annual efficiency frontier for each type of bank separately. Indeed, the business environment is changing continuously; for instance, a bank that is technically more efficient in one year may not be efficient the next year.

IV. Results and discussion

This section presents details of estimated results. The technical efficiency of public and private sector banks in India is explained, using the DEA technique that further divides technical efficiency into pure technical efficiency and scale efficiency. Table-I provides descriptive statistics of variables used in DEA.

Table-I Description of variables

Variables	Notation	Description	Treatment
Total Assets	Y_1	Total assets	Output
Total Loans and Advances	Y_2	Total loans and advances	Output
Interest Income	Y_3	Interest income	Output
Deposits	X_1	Deposits of customers	Input
Gross Fixed Assets	X_2	Gross fixed assets	Input
NO of Employees	X_3	Total number of employees	Input
Interest on Deposits	P_1	Interest on deposits	Input price
Depreciation	P_2	Depreciation on fixed assets	Input price
Employee cost	P_3	Total compensation paid to employee	Input price

**Table II. Statistics of output, input and input price variables used in DEA
(Rs.Crores)**

Variables	Output			Input			Input price		
	Y_1	Y_2	Y_3	X_1	X_2	X_3	P_1	P_2	P_3
Public sector banks									
Mean	716490	421614	46277	577798	10436	56864	31357	511	6302

SD	60473	22678	6259	53475	2693	3379	1456	127	910
Private sector banks									
Mean	343598	212536	23356	223186	3680	32291	11917	324	2273
SD	76782	52604	3219	59746	1006	4543	3634	54	410

Source: Authors' calculations based on annual reports of 20 banks in India during 2015-2019; all variables are reported in Indian Rs crores.

Over the tenure of research (2015 - 2019), total assets (Y1), total loans and advances (Y2) and interest income (Y3) for sample public sector banks are Rs. 7,16,490 crores, Rs. 4,21,614 crores and Rs. 46,277 crores respectively. These are approximately 2.08, 1.98 and 1.98 times higher respectively than the values for private sector banks. Similarly, input variables; deposits (X1), gross fixed assets (X2) and number of employees (X3) and input price variables; interest on deposits (P1), depreciation (P2) and employee cost (P3) are typically higher for public sector banks as compared to private sector banks. It is because the number of public sector bank branches is much higher as compared to private sector banks.

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Table III. Descriptive statistics of efficiency estimates

Efficiency scale	2015	2016	2017	2018	2019	Mean	SD
<i>Public sector banks</i>							
Technical efficiency	0.896	0.895	0.908	0.792	0.721	0.842	0.082
Pure technical efficiency	0.923	0.916	0.932	0.857	0.799	0.885	0.057
Scale efficiency	0.971	0.977	0.973	0.928	0.908	0.951	0.031
<i>Private sector banks</i>							
Technical efficiency	0.931	0.940	0.963	0.95	0.872	0.931	0.035
Pure technical efficiency	0.967	0.981	0.989	0.984	0.977	0.980	0.008
Scale efficiency	0.962	0.958	0.974	0.965	0.894	0.951	0.032

Source: Authors' calculations based on annual reports of 20 banks in India.

Results in Table III suggest that the efficiency of both the types of banks viz. public sector banks and private sector banks, show declining trend after 2017. During the study period, public sector banks unveil lower mean technical efficiency of 84 per cent as compared to 93 per cent for private sector banks. It implies that private sector banks work well in maximizing output with the given number of input.

While examining total technical inefficiency, it is found from Table III that pure technical inefficiency is higher than scale inefficiency for public sector banks. However, it is in contrast to the private sector banks. These empirical results imply that although public sector banks are operating at the optimal scale of operation, they are managerially inefficient in controlling the cost and full utilization of resources. However, private sector banks are found to be more pure technically efficient. It attributes to their decreasing cost due to economies of scale.

The results further reveal that public sector banks have the highest technical efficiency only during 2017. It is noted that public sector banks overcome pure technical inefficiencies during the same period. Certainly, this proposes that total technical efficiency is influenced by pure technical efficiency of public sector banks.

Moreover, scale inefficiencies are lower than technical inefficiencies for both public and private sector banks. This indicates that these two types of banks are operating relatively at the optimal scale of operation. It is suggested that being an emerging industry, public sector banks should not waste their resources, rather choose the correct combination of inputs that minimize their cost. However, certain scale inefficiencies for public sector banks are attributed to their diseconomies of scale.

All in all the results reveal that private sector banks are most efficient in India, recording a mean efficiency score of 93 per cent followed by public sector banks with a mean efficiency score of 84 per cent. This implies that private sector banks are more efficient in minimizing cost vis-à-vis output. The gap between the efficiency score of both the categories of banks is sizeable in nature.

The researchers found that there is an additional scope for inefficient private sector banks that by adopting best operational and managerial practices, on an average they can reduce their inputs of deposits, gross fixed assets and number of employees by at least 2.3($1-0.977*100$) percent and continue to produce the same level of outputs. Alternatively, private sector banks have the scope of producing 1.023 times more (i.e. $1/0.977$) outputs from the same level of inputs (Table III).

Similarly, in case of public sector banks that by adopting best operational and managerial practices, on an average they can reduce their inputs of deposits, gross fixed assets and number of employees by at least 11.5 ($1-0.885*100$) percent and continue to produce the same level of outputs. Alternatively, public sector banks have the scope of producing 1.129 times more (i.e. $1/0.885$) outputs from the same level of inputs (Table III).

V. Conclusion

This study analyzes the efficiency of public and private sector banks in India during the period of 2015 to 2019. The efficiency is estimated by utilizing DEA. The empirical evidence suggests that private sector banks are more efficient in terms of total technical efficiency and pure technical efficiency than public sector banks. It implies that public sector banks are managerially inefficient due to the misallocation of resources. However, results show that scale inefficiency is equal for both public as well as private sector banks. It indicates that public as well as private sector banks operate at the optimal scale of operation. In sum, it is concluded that the private sector banks are more efficient in technical and pure technical efficiency than the public sector banks.

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Appendix

List of sample banks under study

Sl. No	Public sector banks	Sl. No	Private sector banks
1	Andhra bank	1	Axis bank
2	Bank of Baroda	2	Federal bank
3	Bank of India	3	Housing Development Finance Corporation Limited (HDFC) bank
4	Bank of Maharashtra	4	Industrial Credit and Investment Corporation of India (ICICI) bank
5	Canara bank	5	Kotak Mahindra bank
6	Central bank of India	6	Yes bank
7	Corporation bank	7	Development Credit Bank Ltd (DCB)
8	Indian bank	8	Indusind bank
9	Punjab National bank	9	Ratnakar Bank Limited (RBL)
10	State bank of India	10	City Union bank