Comparative Study of the Efficiency of Old and New Private Sector Banks Based on the DEA Approach

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Abstract

It is commonly known that the rise of banking systems promotes economic expansion. Distribution and keeping of liquid capital are the main functions of banks. It channelizes funds from the surplus sector to the deficit sector for this reason; banks need to be financially stable. This study aims to evaluate the technological effectiveness of Indian banking. The current study spans five years, from 2017 to 2021, in its scope the first step in investigate the technical efficiency of selected old private sector banks and new private sector banks based on CRS and VRS using Data envelopment analysis .and in the second step is study try to understand the difference the which type of banks is more efficient. A total of 16 banks are considered in this study technical efficiency under the CCR (Charnes cooper Rhodes) model of old private sector banks is found 95.8 % and for new private sector banks, it is 96.20%. technical efficiency under BCC is found under old private sector banks is 97.4 and for new private sector banks it is 98.3% technical efficiency under scale efficiency is observed at 98.3 % which is observed the same for both types of banks. This study indicated that there is no significant difference in the efficiency of old private sector banks and old private sector banks under CRS, VRS, and SCE.

Keywords: CRS (constant returns to scale), VRS (Variable Returns to Scale), DEA (Data Envelopment Analysis), CCR (Charnes, Cooper, Rhodes), BCC (Banker, Cooper, Rhodes), SCE (scale efficiency), DMUs (Decision-making units).

1. Introduction

Private sector banks emerged as a strong competitor of public sector banks In 2021 private sector annual growth rate of credit was 9.1 percent while public sector banks growth rate was 3.6 percent. the annual growth rate of debit in 2021 of public sector banks was 10.4 while private sector banks were 16.6 percent and this is not only the story of 2021 but afterward, 90s reform private sector banks are increasing their share in debit and credit slowly but steadily. Following the reforms of the 1990s, private banking entities opened for private sector banks and they have emerged as a formidable rival to public sector banks. Private sector banks are ones where the majority of the capital is owned privately. Old and New Private Sector Banks are the two different categories of private sector banks in India. Old private sector banks are those that were present in India at the time the large banks were nationalized but were not nationalized due to their size or for another reason. Following the financial reforms, these banks

received permission to operate and coexist in India with new commercial banks and government banks[2].so study of private sector banks is necessary to know the status of private sector banks.

Traditionally for measuring efficiency financial ratio was used later frontier approach of efficiency measurement came into existence frontier approach of efficiency measurement can be divided into the parametric approach and non parametric approach, DEA which is non parametric approach to measuring efficiency is widely used in the banking sector due to it simple properties in this study we used the approach to measure efficiency of private sector banks.

DEA (Data envelopment analysis)

The estimation of production frontiers is done using the nonparametric technique known as data envelopment analysis (DEA) in operations research and economics. A wide range of industries, such as international banking, economic sustainability, operations of police departments, and logistical applications, have used the DEA approach for measuring efficiency[4].

Data Envelopment Analysis (DEA), a very successful service management and benchmarking technique, was first developed by Charnes, Cooper, and Rhodes (1978) to evaluate the effectiveness of nonprofit and public sector organizations .it is a method for studying the relative efficiency of various inputs and outputs by evaluating each decision making unit's (DMU) performance and comparing it to best practice banks, which establish the so-called efficient frontier. The fundamental advantage of DEA is that it eliminates the requirement for prior assumptions about the production function's analytical form. DEA does, however, share some serious disadvantages with the other models. Additionally, it is vulnerable to extreme findings since it does not distinguish between the components of the bank's departure from the efficient production frontier caused by inefficiency and random error.DEA is a linear programming technique that converts multiple inputs

Different models of DEA are available. We choose to use the two most frequently applied models, the CCR and BCC models. Cooper and Rhodes developed the CCR model in Charnes et al. (1978). This premise states that the DMU operates under constant returns to scale (CRS). In their study from 1984, Banker, Charnes, and Cooper defined the BCC model. It determines efficiency using the variable returns to scale (VRS) premise. The goal of efficiency is the highest possible output while favoring the method that makes the most of the input composition.

Objectives

- Calculate the overall technical efficiency of old and new private sector banks.
- Calculate the pure technical efficiency of old and new sector banks.
- Calculate the scale efficiency of old and new private sector banks.

Hypothesis

- There is no significant difference in the overall technical efficiency score of old and new private sector banks.
- There is no significant difference in the pure technical efficiency score of old and new private sector banks.
- There is no significant difference in scale efficiency of old and new private sector banks.

2. Literature review

Aly et al. (1990) investigated various efficiency metrics for 322 independently picked banks in 1986. They find that scale inefficiency is a minor issue when compared to pure technical inefficiency using three inputs (i.e., labor, capital, and loanable funds) and five outputs (i.e., commercial and industrial, consumer, real estate, and other loans; and demand deposits). Technical, scales, and pure technical efficiencies, respectively, are 0.75, 0.97, and 0.77. Once more, the second stage regression analysis shows a positive correlation between bank size and efficiency and a negative correlation between product diversification and efficiency.

Elyasiani and Mehdian (1990) look into bank efficiency and technological advancement for a sample of 191 banks with assets over $300 million in both 1980 and 1985. Using four inputs (labor, capital, demand deposits, and savings and time deposits) and four outputs (commercial and industrial, real estate, and other loans, and investments), they discover that between 1980 and 1985, technological advancements allowed for the production of the same level of output with 10.45 to 22.29 percent fewer inputs.

For a sample of 575 banks in 1984, Ferrier and Lovell (1990) evaluated bank efficiency using both linear programming and econometric methods. They report an overall technical inefficiency of 16.04 percent using three inputs (i.e., the total number of employees, occupancy costs, expenditure on furniture and equipment, and expenditure on materials) and five outputs (i.e., the number of demand deposits and time deposit accounts, as well as the number of real estates, installment, and industrial loans). This was calculated using the non-stochastic production frontier. Surprisingly, they discovered that tiny banks—defined as those with assets under $25 million—are the most effective, contrary to the previous research referenced.

Yue (1992) assesses the effectiveness of the 60 biggest banks in Missouri from 1984 to 1990. He claims that pure technical inefficiency is the main cause of technical inefficiency using four inputs (interest and non-interest expense, transactions and non-transaction deposits, and total loans) and three outputs (interest and non-interest income, transactions and non-transaction deposits, and total loans).

Das and Kumhakar (2012) analyzed Indian banks' productivity and efficiency using the hedonic aggregator function. The efficiency of public sector banks performed better than that of private sector banks from 1996 to 2005, according to the study's conclusions.

Manas Baidya (2012) The researcher employed the DEA and super-efficiency models to determine and assess the technical efficiency of 26 public sector banks in India's financial year 2009–2010. This study was based on a cross-section database. According to the study's findings, public sector banks might save up to 23% of their inputs for use in totally efficient activity. SBI was found to be the most effective bank on this basis, whereas PNB was found to be the least successful.

3 Research Methodology

In the current article, 16 private sector banks are chosen as 8 banks are classified as the old private sector and 8 banks as belonging to the new private sector. It is not determined by researcher censuses or any other criterion, but choosing the factors to measure efficiency is a challenging task. Three input variables and two outcome variables have been chosen for this investigation. Deposits, the number of employees, non-interest revenue are regarded as input variables, while output variables include , earning assets, and other income . The yearly bank report compiles data for all of these indicators from 2017 through 2021.

The list of every bank that was chosen is provided below. The efficiency of banks is calculated by the CRR Model and BCC model using output orientation.

Table 1.1 Selected old and new private sector bank list banks

Selected DMUs for the study			
Code	OLD PRIVATE-SECTOR BANKS	Code	NEW PRIVATE-SECTOR BANKS
A	City Union Bank	I	AXIS Bank
B	The Catholic Syrian Bank	J	DEB Bank
C	Dhanlaxmi Bank	K	HDFC Bank
D	The Federal Reserve Bank	L	ICICI Bank
E	The Jammu and Kashmir Bank	M	Kotak Mahindra Bank
F	The Karnatka Bank	N	YES Bank
G	The South Indian Bank	O	IDBI Ltd. Bank
H	The Karur Vasya Bank	P	IndusInd Bank

4. Data analysis

Based on input output set using DEA approach .we measure the technical efficacy of banks using DEAP 2.1 software based on CCRV model and BCC model .detail of technical efficiency of old and new private sector banks are given below.

Table 4.1 Table Technical efficiency of old private sector banks

Code	2021			2020			2019			2018			2017		
	CCR	BCC	SCE	CCR	BCC	SCE	CCR	BCC	SCE	CCR	BCC	SCE	CCR	BCC	SCE
A	.975	.978	.997	1	1	1	1	1	1	1	1	1	1	1	1
B	1	1	1	1	1	1	.914	.998	.916	.835	.910	.918	1	1	1
C	.969	1	.969	.893	1	.893	.924	1	.924	.876	1	.876	.906	1	.906
D	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E	.912	.914	.998	.853	.858	.993	.945	.945	1	.915	.941	.973	.944	.944	1
F	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
H	.943	.945	.998	.981	.982	.999	.710	.714	.994	.918	.921	.996	.890	.903	.987
Mean	.975	.980	.995	.966	.980	.986	.937	.957	.979	.943	.971	.970	.968	.981	.987

Source: Calculated using DEAP 2.1

In the above-given table, we can observe the overall technical efficiency, pure technical efficiency, and scale efficiency of old private sector banks for the year 2017-2021 Details of fully efficient DMUs under the CCR model and BCC model are given below.

Iin 2021 DMUs B, D, F, and G are technologically efficient under the CCR model. B, C, D, F, and G are technically efficient under the BCC model, and firms B, D, F, and G are scale-efficient DMUs.

- In 2020 A, B, D, F, G are overall technical efficient DMUs while A, B, D, C, D, E, F, G are pure technical efficient DMUs and A, B, D, F, G are scale efficient DMUs.
- In 2019 the study observed that DMUs B, C, E, and H are overall technologically inefficient. B, E, and H are found pure technical inefficient DMUs, and B, C, and H are found to scale inefficient DMUs.
- In 2018 DMUs A, D, F, and G DMUS are overall technical efficient DMUs and pure technical efficient DMUs.
- In 2017 DMUs A, B, D, F, Gand A, B, C, D, G, G, are pure technical efficient DMUs and A, B, D, E, F, and G are scale efficient DMUs.

Table 4.2 Table Technical Efficiency of New Private Sector Banks

	2021			2020			2019			2018			2017		
	CCR	BCC	SCE	CCR	BCC	SCE	CCR	BCC	SCE	CRR	BCC	SCE	CRR	BCC	SCE
I	1	1	1	.969	.979	.991	1	1	1	.799	.805	.994	.877	.889	.987
J	.954	1	.954	.904	1	.904	1	1	1	.817	1	.817	.879	1	.879
K	1	1	1	1	1	1	1	1	1	1	1	1	.984	1	.984
L	.992	1	.992	.925	.941	.982	.899	1	.899	1	1	1	1	1	1
M	1	1	1	1	1	1	1	1	1	.898	.899	.999	.902	.902	1
N	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
O	1	1	1	1	1	1	.895	.957	.935	1	1	1	1	1	1
P	1	1	1	1	1	1	1	1	1	1	1	1	.927	.938	.988
Average	.993	1	.993	.975	.990	.985	.974	.995	.979	.939	.963	.976	.927	.966	.980

Source: Calculated using DEAP 2.1

In the given table we observed the technical efficiency of new private sector banks under the CCR and BCC model for the period of 2021-2017 and observed in 2021 J, L DMUs are scale inefficient 2020 I, J, L DMUs are overall technical efficient DMUs are under CCR model, I, L are pure technical inefficient under BCC model and I, J, L are scale inefficient DMUs. In 2019 l, and o are scale inefficient DMUs .in 2018 I, J, M are overall technical inefficient firms and I, M are pure technical inefficient DMUs and I, J,

M are scale inefficient DMUs .in 2017 L, N, O are overall technical efficient DMUs and J, K, L, N, O are pure technical efficient DMUs and L, N, O are scale efficient DMUs.

Table 4.3 Average technical efficiency score

Year	CRS		VRS		SCE	
	OPSB	NPSB	OPSB	NPSB	OPSB	NPSB
2021	.975	.993	.980	1	.995	.993
2020	.966	.975	.980	.990	.986	.985
2019	.937	.974	.957	.995	.979	.979
2018	.943	.939	.971	.963	.970	.976
2017	.968	.927	.981	.966	.987	.980
Average	**.958**	**.962**	**.974**	**.983**	**.983**	**.983**

Source: Calculated using DEAP 2.1

Table 4.3 average technical efficiency of old private sector banks and new sector banks is measured by using DEAP 2.1 software tables shows overall technical efficiency of old private sector banks decreased after 2017 till 2019 and shows an increasing trend after 2019 while new private sector banks overall technical efficiency score shows the increasing trends after 2017 .in pure technical efficiency score old private sector banks average efficiency score is decreased till 20 and after 2019 it shows uprising trend while new private sector banks uptrend till 2017 to 2019 and 2021 shows fully average pure efficient Year for new private sector banks .in reference of scale efficiency old private sector banks year 2018 and 2019 shows average efficiency score below the average score while for new private sector banks year 2017,2018,2019 year having the average score value below the average score.

Table 4.4 Hypothesis- test

	t-test	P-value	Significance	Results
CRS	-0.264	.3992	.05	Rejected
VRS	-1.0095	.1711	.05	Rejected
SCE	0.1553	.4402	.05	Rejected

Source: Calculated using t-test by spss

Table 4.4 Using parametric t–test differences among old sector and private sector banks found results indicated in terms of CRS, VRS, AND SCE old private sector banks and new private sector banks have no significant difference.

5. Conclusion

This study tries to attempt to compare the technical efficiency of old and new private sector banks based on the CCR mode and BCC model. Study focused on the overall technical efficiency 16 banks are used as DMUs in the study.

This study finds that old private sector banks convert their input into output with a 95.5 % efficiency level while new private sector banks are doing this function with an efficiency level of 96.2 %. Managerial efficiency of old private sector banks is observed 97.4 % and for new private sector banks, it

is 98.3 %. Old private sector banks are operating a optimally scale with efficiency level of 98.3 percent followed by the new private sector banks. So if we compare the efficiency score of new and old private sector banks the study finds old private sector banks have more scope to increase managerial efficiency of banks. Hypothesis testing by using a parametric t-test shows there is no significant difference between the new and private sector banks in overall technical efficiency, pure technical efficiency, and scale efficiency.

So we can conclude for the year 2017-2021 the study finds new and old private sector banks are operating at the same level of efficiency or no significant difference is seen among these banks.

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