PRE-MERGER PERFORMANCE MEASURES OF STATE BANK OF INDIA AND ITS ASSOCIATE BANKS USING DATA ENVELOPMENT ANALYSIS

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Abstract

As all the remain five associates banks of State Bank of India (SBI) has been merged to SBI with effect from April 1, 2017 as per direction of the regulator. In this regards a study has been conducted by the researchers whether the before merger all these associates and SBI are operating at efficiency level or at inefficiency level. Using data envelopment analysis (DEA), with three output variables (deposit, advance and total income) and four input variables (number of bank branches, number of ATMs, total assets and gross non-performing asset), the present study aims to measure the extent of overall technical efficiency (OTE), pure technical efficiency (PTE), and scale efficiency (SE) of SBI and five associates' banks. Different DEA have been run, for each year during the period 2011-2016 and another with the average data of the selected five years period. The results reveal that SBI, State Bank of Bikaner & Jaipur (SBBJ), State Bank of Hyderabad (SBH), State Bank of Patiala (SBP) and State Bank of Travancore (SBT) attained the OTE score equal to 1 and lie on the efficient frontier under constant return scale (CRS) assumption based on CCR model and also attained the PTE score equal to 1 and lie on the efficient frontier under variable return scale (VRS) assumption based on BCC model. The group State Bank of Mysore (SBM) only attained the OTE and PTE score equal to 1 and lie on the efficient frontier during 2012-13. So we conclude that before mergers took place most of the associate banks of SBI operated at efficient level. These mergers will decrease unhealthy competition between SBI and its associate banks, mitigate the risk and can better focus on defaulter.

Key Words: State Bank of India, Merger, Date Envelopment Analysis

1.1 INTRODUCTION

State Bank of India (SBI), with a 200 year history, is the largest commercial bank in India in terms of assets, deposits, profits, branches, customers and employees. The origins of State Bank of India date back to 1806 when the Bank of Calcutta (later called the Bank of Bengal) was established. In 1921, the Bank of Bengal and two other banks (Bank of Madras and Bank of Bombay) were amalgamated to form the Imperial Bank of India. In 1955, the Reserve Bank of India acquired the controlling interests of the Imperial Bank of India and SBI was created by an act of Parliament to succeed the Imperial Bank of India.

Majority of the mergers in India have been crafted to bail out weak banks to safeguard depositors' interest and to protect the financial system. The report of the Committee on Banking Sector Reforms (the Second Narasimham Committee, 1998), however, discouraged this practice. It recommended mergers among strong banks, both in the public and private sectors and even with financial institutions and non-banking financial companies. Before the recent mergers with five associates and Bharatiya Mahila Bank (BMB), State Bank of Saurashtra amalgamation took place in August 2008 while State Bank of Indore merged with the parent in 2010. Following the merger, the SBI group consists of SBI and five associate banks, State Bank of Bikaner and Jaipur, State Bank of Travancore, State Bank of Patiala, State Bank of Mysore and State Bank of Hyderabad which have been merged on April 1, 2017 (Table 1.1.1).

Table 1.1.1 Mergers of SBI Associates

	Year	Associate Banks
Recent Mergers	2017	State Bank of Bikaner & Jaipur State Bank of Hyderabad State Bank of Mysore State Bank of Patiala State Bank of Travancore
Previous Mergers	2008 2010	State Bank of Saurashtra State Bank of Indore

Source: RBI

The group has an extensive network; with over 25000 plus branches and 58, 688 ATMs in India and its combined assets base reach at □ 37 lakh crore. Their status of deposit, advance, total income, number of branches, number ATMs, total assets and gross NPA of SBI and

associates as shown in the **Table 1.1.3**. The table shows that there are minimal growths of different parameters of all the associate banks except SBI has found with higher growth rate.

There are many reasons behind mergers of banks. The most crucial concern is management of risk. The financial industry of every country is expected to make a proper risk analysis to balance the deposit and credit portfolios. Mergers can diversify these risks to a significant extent. Synergy effects, drastic increase in market competition, geographical diversification, innovation of new financial products, cost efficiency, advanced technology, improvement in operational efficiency, tax shields and financial safeguards and consolidation of regional financial systems and national financial systems are the other major reasons for which banks are going for mergers.

In the present study we analyze the performance of SBI and five associate banks before the merger took place with the data period of March 2002 to March 2016 according to availability of data. To analyze the performance we have used DEA model of Charnes, Cooper and Rhodes (1978) and Banker, Charnes and Cooper (1984). First efficiency scores (OTE, PTE and SE) have been measured of the six banks for the years 2011-12, 2012-13, 2013-14, 2014-15 and 2015-16 with the selected variables. Also OTE, PTE and SE have been measured with the average value of five years data of the identical variables.

1.2 LITERATURE REVIEW

The application of DEA can be found in several services and industries since its inception in 1978 (by Chames, Cooper and Rhodes). In the public sector and private sector, this technique has been used widely to measure the efficiency. Here, we surveyed the literature of the application of DEA to acknowledge that the DEA has been used as a performance assessment tool.

Elyasiani and Mehdian (1995) investigated the trends in technical efficiency and technological change for small and large US commercial banks during 1979-86 based on the intermediation approach. Although the efficiency measures declined over this period, small banks emerged as more efficient in the deregulated regime.

Saha and Ravisankar (2000) in their analysis an attempt was made to quantify the relative efficiency using DEA in the form of a total weighted output by total weighted input. The results of the analysis indicate that, except few exceptions, the PSBs have in general improved their efficiency scores over the years 1992 to 1995.

Sathye (2003), measure the productive efficiency of Indian banks using DEA and the study shows that the mean efficiency score of banks in India compares well with the world mean

efficiency score and the efficiency of private sector commercial banks as a group is, paradoxically lower than that of public sector banks and foreign banks in India.

Angelidis and Lyroudi (2006) investigated the productivity of 100 large Italian banks for the period 2001-2002 by using DEA.

Das and Gosh (2006) examined the performance of commercial banks in India during post reform period 1992-2002. Medium sized PSBs were found to be performing at higher level of technically efficiency.

Kumar and Gulati (2008), evaluate the extent of OTE, PTE, and SE in Indian public sector banking industry using cross-sectional data for 27 banks in the year 2004/05.

Valadkhani and Moffat (2009) measured the technical and pure technical efficiencies of ten major financial institutions in Botswana for each year during the period 2001-2006 using DEA.

Chander and Chandel (2010) analyzed the financial efficiency and viability of HARCO Bank and found poor performance of the bank on capital adequacy, liquidity, earning quality and the management efficiency parameters.

Feroze (2012) employed DEA to assess the efficiency of DCCBs in Kerala during 2005-2009. The empirical results of the study revealed that the level of efficiency in DCBs was 74 per cent and the magnitude of inefficiency was 26 per cent. 6 DCBs obtained efficiency score equal to 1 and formed the efficiency frontier.

Burgstaller (2013) in his studies considered total funds, fixed assets and total costs as inputs and outputs produced comprise total loans, other earning assets and non-interest income to measure the efficiency in regional banking market through DEA.

Sinha and Jain (2015) in their study uses owned funds, deposits, borrowings and employee cost as inputs, and advances, investments and other income as outputs to measure the potential gains from merger of SBI with its associates.

The above studies show that there have been widely used of DEA applications to measures the efficiency of financial institutions or banks by considering different parameters as input variables and output variables. Such rapid growth and widespread acceptance of the methodology of DEA is testimony to its strengths and applicability.

1.3 OBJECTIVES OF THE STUDY

The main objective of this paper is to examine the efficiency of SBI and the five associate's banks before merger on April 1, 2017 by using popular DEA model. BCC model and CCR

model of DEA have been used to measure and compare the performance of SBI and five associate's banks with three output variables and four input variables.

1.4 STUDY PERIOD

For the present analysis we have collected the required data of five years during April 2011 to March 2016.

1.5 DATA AND METHODOLOGY

Data has been sourced from various Annual data of Reserve Bank of India. To analyze the efficiency of SBI and five associates banks CCR model under CRS assumption, named after its developers Charnes, Cooper, and Rhodes (1978) and BCC model under VRS assumption, named after its developers Banker, Charnes and Cooper (1984) have been used. Banks on the efficiency frontier have an efficiency score of 1. Lower scores indicate inefficiency. MaxDEA 5.2 package has been used to measure the performance of banks through DEA.

1.6 VARIABLES OF THE STUDY

Three outputs have been selected as deposits, advance and total income. The total income is the sum of interest and non-interest income. The other two outputs, deposits is the amount of deposits balance and advance is the amount of advance outstanding. To get the three outputs we have selected four inputs viz. number of branches, number of ATMs, total assets of banks, gross non-performing assets. According to Saha and Ravisankar (2000) the performance of any institution is often evaluated in terms of its efficiency in the use of its resources. Their input variables are number of branches, number of employees, establishment expenditure, non-establishment expenditure (excluding interest expenditure), and output variables are deposits, advances, investments, spread (i.e., interest income minus interest expenditure), total income, interest income, non-interest income and working funds. Sathye (2003) in his analysis used interest expenses, non-interest expenses, deposits and staff members as input variables and interest income, non-interest income and net loans as output variables to measures the performance of banks. Here, we would like to assert that the choice of the variables followed two criteria: relevance and availability.

1.7 RESULTS AND DISCUSSIONS

To increase the validity in present analysis, the researcher examines the assumptions of the "isotonicity" relationship (Golany and Roll, 1989) by the correlation among the selected input and output factors. The isotonicity relationship express a rise in any input should not

results in a loss in any output. The correlation matrix results as presented in Table 1.1.2 does not violet the isotonicity assumptions.

Table 1.1.2: Correlation among the Input and Output Factors

Variables	Deposit	Advance	Total Income	Branch	ATM	Total Asset	Gross NPA
Deposit	1						
Advance	0.99999	1					
Total Income	0.99999	0.99999	1				
Branch	0.99988	0.99992	0.99992	1			
ATM	0.99976	0.99979	0.99971	0.999716	1		
Total Asset	0.99999	0.99999	0.99998	0.999870	0.99979	1	
Gross NPA	0.99981	0.99988	0.99983	0.999826	0.99962	0.99986	1

Source: Researcher's calculation

In DEA, technical efficiency (TE) can be viewed from two perspectives. First, input-oriented TE focuses on the possibility of reducing inputs to produce given output levels. And the Second one, output-oriented TE considers the possible expansion in outputs for a given set of input quantities.

In a number of studies, analysis have tended to select input-oriented models because many organizations or institutions have particulars orders to fill and, hence, the input quantities appear to be the primary decision variables, although this argument may not be as strong in all industries or institutions. In some cases, the firms may be given a fixed quantity of resources and asked to produce as much output as possible. In this case, an output orientation would be more appropriate. Essentially, one should select the orientation according to which quantities (inputs or outputs) the managers have most control over (Kumar and Gulati, 2008). In the present study we have considered input-oriented model.

The TE measure corresponding to CRS assumption represents overall technical efficiency (OTE) which measures inefficiencies due to the input/output configuration and as well as the size of operations. The efficiency measure corresponding to VRS assumption represents pure technical efficiency (PTE) which measures inefficiencies due to only managerial underperformance. The relationship SE = OTE /PTE provide a measure of scale efficiency. Scores are 1 for efficient banks (on the frontier), and lower for relatively inefficient ones.

Table 1.7.1: Showing Year-wise Overall Technical Efficiency (OTE), Pure Technical Efficiency (PTE) and Scale Efficiency (SE) Scores of SBI and Associates

DMUs	2011-12			2012-13			2013-14			2014-15			2015-16		
	OTE	PTE	SE	OTE	PTE	SE	OTE	PTE	SE	OTE	PTE	SE	OTE	PTE	SE
SBI	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBBJ	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBH	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBM	0.992	1.000	0.992	1.000	1.000	1.000	0.991	1.000	0.991	0.983	1.000	0.983	0.996	1.000	0.996
SBP	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SBT	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Source: Researcher's own calculation

The efficiency scores of all the six selected banks are given in the Table 1.7.1. The Table 1.7.1 provides OTE, PTE and SE scores of all the six banks of SBI and associates for the years 2011-12, 2012-13, 2013-14, 2014-15 and 2015-16. The results obtained by employing the CCR model on each year data reveal subtle fluctuations in the efficiency scores of SBM. It can be easily observed from the results that SBI, SBBJ, SBH, SBP and SBT are quiet consistent in their performances in the five years period of study. These five banks emerged as the best performing banks in all the five years period of the study. Whereas, SBM has been able to plays a benchmark only once (2012-13) during the years of the study. It is noteworthy to mention that the overall technical efficiencies obtained by employing CCR model can further be decomposed into pure technical efficiencies and scale efficiencies. The pure technical efficiencies obtained by employing BCC model on the data of five years of six SBI and associates and finally the scale efficiencies are obtained by taking the ratio of OTE over PTE.

Table 1.7.2: Results of CCR and BCC Model of SBI and Associates

DMUs	CCR Model (OTE)	BCC Model (PTE)	SE	Return to scale
SBI	1.0000	1.0000	1.0000	Constant returns to scale
SBBJ	1.0000	1.0000	1.0000	Constant returns to scale
SBH	1.0000	1.0000	1.0000	Constant returns to scale
SBM	0.9963	1.0000	0.9963	Increasing returns to scale
SBP	1.0000	1.0000	1.0000	Constant returns to scale
SBT	1.0000	1.0000	1.0000	Constant returns to scale

Source: Researcher's own calculation

Table 1.7.2 presents the results obtained with the average data of five years of all the input and output variables during the period under study. The columns labeled CCR and BCC indicate the efficiency scores of the SBI and associate banks with constant returns to scale and variable returns to scale. The table depicts that according to the CCR model SBI and four associate banks (except SBM) are on the efficiency frontier and have an efficiency score of 1. SBM has lower score under CCR model which indicates inefficiency. The table also depicts that under BCC model all the selected banks are on the efficiency frontier have an efficiency scores of 1. The five overall efficient banks are SBI, SBBJ, SBH, SBP and SBT of the selected six banks. They have the equal OTE and PTE and thus presenting constant returns to scale (CRS). Only SBM is inefficient bank present increasing returns to scale (IRS) that can increase the scales to effectively improve efficiency. The SBM have the PTE score equal to 1 while SE score is less than 1. A DMU may be scale inefficient if it is smaller than the most productive scale size i.e., not taken the full advantage of IRS.

1.8 CONCLUSION

This piece of research adopts an input-oriented DEA efficiency methodology to assess the performance of SBI and its five associate banks before the merger took place. Based on the CCR model under CRS assumptions, SBI and other four associate banks (except SBM found efficient only in the year 2012-13) have found efficient in all the five years of study and with the average data. Again based on BCC model under VRS assumption we have found all the six banks have been found efficient. The overall efficient banks have the equal OTE and PTE and thus presenting constant returns to scale. So, based on the results of CCR and BCC model with average data of the five years study period we may conclude that before the merger took place SBI, SBBJ, SBH, SBP and SBT are the five overall efficient banks. And SBM can reduce inputs by at least 0.37 per cent and still generate the identical level of outputs or increase the level of output to 1.004 (1/0.9963) times with the same level of inputs. These mergers will decrease unhealthy competition between SBI and associates and mitigate the risk. Now the SBI can better focus on defaulter. Many people had availed multiple finances from different associates. With these mergers they can be bought under one roof which makes recovery easier.

One important weakness of the study is the non-inclusion of other financial parameters, viz., net profit, operating and other expenses. Incorporation of such factors could well be the agenda for further research. Further study may be conducted of SBI in pre-merger and post-merger period with other scheduled commercial banks.

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Table 1.1.3: Input and Output details in DEA Analysis of SBI and Associates

(□ Billion)

Bank	Year	Deposit	Advance	Total Income	Branch (No.)	ATM (No.)	Total Assets	Gross NPA
SBI	2012	10,436	8,676	1,209	15,064	22,141	13,355	397
	2013	12,027	10,456	1,357	15,796	27,175	15,662	512
	2014	13,944	12,098	1,549	16,820	43,515	17,927	616
	2015	15,768	13,000	1,750	17,192	45,502	20,481	567
	2016	17,307	14,637	1,918	17,869	49,724	22,591	982
SBBJ	2012	616	492	69	1,044	1,057	725	17
	2013	721	575	82	1,135	1,060	860	21
	2014	739	642	90	1,249	1,554	909	27
	2015	842	695	99	1,378	1,843	1,023	29
	2016	940	729	106	1,445	1,954	1,103	36
SBH	2012	987	771	117	1,504	1,371	1,183	20
	2013	1,133	899	134	1,586	1,584	1,361	32
	2014	1,195	957	144	1,722	2,321	1,415	58
	2015	1,302	1,051	151	1,848	2,404	1,545	54
	2016	1,372	1,111	156	2,073	2,380	1,646	66
SBM	2012	502	398	56	788	802	604	15
	2013	570	449	66	831	853	672	21
	2014	616	495	69	995	1,107	740	28
	2015	661	520	77	1,064	1,334	795	21
	2016	706	540	79	1,118	1,416	830	36
SBP	2012	794	629	89	1,131	843	985	19
	2013	887	738	103	1,202	954	1,086	25
	2014	897	759	110	1,290	1,279	1,141	38
	2015	927	786	114	1,380	1,437	1,167	44
	2016	1,070	822	116	1,438	1,507	1,310	68
SBT	2012	715	553	75	911	929	860	15
	2013	846	675	93	1,045	965	1,016	17
	2014	893	694	106	1,153	1,352	1,053	31
	2015	911	687	106	1,181	1,602	1,056	24
	2016	1,011	655	108	1,247	1,707	1,145	32

Source: RBI