EFFICIENCY EVALUATION OF PUBLIC SECTOR BANKS IN INDIA

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Abstract

Banks play an important role in all sectors of the economy. In this paper, the efficiencies of selected Public sector were calculated through Data Envelopment Analysis (DEA). The efficiency calculation of banks is done with three inputs and three outputs. The inputs are deposits, number of employees, operating expenses. The outputs are investments, other income and advances. The efficiencies on constant returns scale and variable returns scales are calculated with the CCR model. Data sources are from CMIE for eight public sector banks and RBI.

Keywords: Efficiency Evaluation, Data Envelopment Analysis, Decision Making Unit

1.Introduction:

The Banking sector plays an important role in the mobilization and allocation of savings in an economy. It has very prominent role in the economy thorough money and capital markets. The banking system in India is significantly different from that of other nations because of the country's unique economic, social and geographic characteristics. The Reserve Bank of India (RBI) was given broad regulatory authority over commercial banks in India. In 1959, the State Bank of India acquired the state-owned banks of eight former states. Thus, by July 1969, approximately 31 percent of scheduled bank branches throughout India were government controlled, as part of the State Bank of India. The Indian Banks development strategy was in many ways a socialist one, and the government felt that banks in private hands did not lend enough to those who needed it most. The government nationalized all banks whose nationwide deposits were greater than Rs.500 million, resulting in the nationalization of 54 percent more of the branches in India, and bringing the total number of branches under government control to 84 percent. Further, banks shall promote savings, investment, production, employment, and trade. The assessment and evaluation of public sector bank's performance efficiency is essential and attracted much attention of the researchers.

Wide-ranging reforms have been carried out in the Indian economy since mid-1991. Two decades of economic and financial sector reforms have strengthened the fundamentals of the Indian economy and transformed the operating environment for banks and financial institutions in the country. The most significant achievement of the financial sector reforms has been the marked improvement in the financial health of commercial banks in terms of capital adequacy, profitability and asset quality and also greater attention to risk management. Further, new economic policy has opened up new opportunities for banks to increase revenues by diversifying into investment banking, insurance, credit cards, depository services, mortgage financing, securitization, and so on. At the same time, liberalization has brought greater competition among banks, both domestic and foreign, as well as competition from mutual funds, NBFC's, and other financial institutions. Increasing competition is squeezing profitability and forcing banks to work efficiently on Shrinking spreads. Because banks still play an important role in the financial market, it is important to evaluate operational efficiently of banks. In order to compete with other financial institutions, banks must increase their levels of efficiency. A lot of research has been conducted over the past decade in the area of measuring efficiency of firms, companies, banks and other decision making units. Studies in the past used conventional ratios such as return on assets to evaluate efficiency. Most of these studies which look at the efficiency concentrate on cost, profit income or revenue efficiencies. Later research in the area used various measures of performance which include a non-parametric approach- Data Envelopment Approach Data Envelopment Analysis is a linear programming based technique for measuring the performance efficiency of organisational units which are termed as Decision Making Units (DMUs). This technique aims to measure how efficiently a DMU uses the resources available to generate a set of outputs (Charnes et al.1978).The efficiency measure proposed by Farrell in 1957 did not receive much attention until Charnes, Cooper and Rhodes formulated a mathematical programming approach to frontier estimation in 1978.They coined the term DEA for the first time. The DEA model developed by Charnes, Cooper, and Rhodes had an input orientation and assumed constant return to scale (CRS). The CRS model offers best solutions only when all firms are operating at optimum scale. Subsequent studies by Banker, Charnes and Cooper have considered alternative sets of assumption and introduced a variable return to scale (VRS) model. The VRS model measures technical efficiency devoid of scale efficiency (SE) effects.

2. Review of literature

There have been a lot of studies analyzing bank efficiency in India. In some studies, bank efficiency was measured by a number of financial indicators and compared over various categories of banks. Kumar and Gulati (2007) studied the technical efficiency of public sector banks in India using two data envelopment analysis models like the CCR model and

Andersen and Petersen's super-efficiency models. The analysis was performed for twenty seven public sector banks in the year 2004-05. The results show that the technical efficiency scores range from 0.632 to 1, with an average of 0.885. Thus, the overall level of technical inefficiency in Indian public sector banking industry has been found to be around 11.5%. Finally, foreign banks are found to be more cost-efficient but less profit-efficient relative to domestically owned private banks and state-owned banks. The banks affiliated with SBI group were found to outperform the nationalized banks in terms of operating efficiency.

Sanjeev (2006) studied efficiency of private, public, and foreign banks operating in India during the period 1997-2001 using data envelopment analysis. He also studied if any relationship can be established between the efficiency and non-performing assets in the banks. He found that the there is an increase in the efficiency in the post-reform period, and that non-performing assets and efficiency are negatively related

Shanmugam and Das (2004) studied banking efficiency using stochastic frontier production function model during the reform period, 1992-1999. The study considers four input variables (viz. deposits, borrowings, labor and fixed assets) and four output variables (viz. net interest income, non-interest income, credits and investments). They found that deposits are dominant in producing all outputs and the technical efficiency of raising interest margin is varied across the banks. In particular, they found that the reform measures that had been introduced since 1992 have not helped the banks in raising their interest margin. Also, in general, they found that private/foreign banks performed better than public banks.

Das et al (2004) analyzed the efficiency of Indian banks using data envelopment analysis using four input measures (viz. borrowed funds (i.e. deposits and other borrowings), number of employees, fixed assets and equity), and three output measures (investments, performing loan assets and other non-interest fee based incomes), and found that, despite liberalization measures aimed at strengthening and improving the operational efficiency of the financial system, Indian banks were still not much differentiated in terms of input- or output-oriented technical efficiency and cost efficiency; however, they found that there were significant differences in terms of revenue and profit efficiencies. They also found that bank size, ownership, and the fact of its being listed on the stock exchange had a positive impact on the average profit efficiency and to some extent revenue efficiency scores. Also, they found that there was a general improvement in efficiency during the post-reform period.

Rammohan and Ray (2004) compared the revenue maximizing efficiency of public, private and foreign banks in India, using physical quantities of inputs and outputs in the 1990's, using deposits and operating costs as inputs, and loans, investments and other income as outputs. They found that public sector banks were significantly better than private sector banks on revenue maximization efficiency, but difference in efficiency between public sector banks and foreign banks was not significant.

Kumbhakar and Sarkar (2003) found evidence on Indian banks that public sector banks have not responded well to the deregulation measures while private sector banks have improved their performance mainly due to the freedom to expand output.

Necmi Kemal Avkiran(2003) used DEA model, taking interest expense and non-interest expense as input variable and interest income and non-interest income as output variables to examine the efficiency of Australian trading banks for the period 1986 to 1995 and found that their efficiency rose in the post regulation period and acquiring banks were more efficient than target banks.

Rammohan (2002, 2003) also used financial measures for comparing operational performance of different categories of banks over a period of time. But, most studies emphasised at the efficiency of Indian commercial banks concentrate on cost, profit, income or revenue efficiencies, using DEA as a technique of analysis. While few studies concentrate on the efficiency of only public sector banks, others look at the relationship between ownership and efficiency.

Sathye (2001) studied the relative efficiency of Indian banks in the late 1990's and compared the efficiency of Indian banks with that of foreign banks. He found that the public sector banks have a higher mean efficiency score as compared to the private sector banks in India, but found mixed results when comparing public sector banks and foreign commercial banks in India. He also found that most banks on the efficient frontier are owned by foreign company.

Sarkar et al. (1998) compared public, private and foreign banks in India to find the effect of ownership type on different efficiency measures.

Chen and Yeh (1998) calculated the operating efficiencies of 34 commercial banks of Taiwan's banks using the DEA model where in input variables included staff employed, interest expense and output variables include loans investment and interest revenue, non-interest revenue and bank assets. The study concluded that a bank with better efficiency does not always mean that it has better effectiveness.

Bhattacharya et al (1997) used DEA to measure the productive efficiency of Indian commercial banks in the late 80s to early 90s and studied the impact of policy on liberalizing measures taken in 1980s on the performance of various categories of banks. They found that Indian Public banks were the best performing banks as the banking sector was overwhelmingly dominated by Indian public sector banks while the new private sector banks were not emerged fully in the Indian banking sector.

3. Objective:

To analyze the results of the bank's Technical efficiencies through Constant Returns Scale (CRS) and Variable Returns Scale (VRS) for 8 public sector banks.

4. Research methodology:

The present study considers eight public sector commercial banks as decision making units. This paper considers three inputs they are- deposits, number of employees, operating expenses and the three outputs are investments, other income and advances. In this study the data related to various input and outputs over the period 2013 - 2017 have been taken from RBI website (www.rbi.org.in). The ten decision making units (banks) considered in the present study are as follows:

The efficiency scores would be based on the CCR model of DEA. DEA-SOLVER Software developed by Cooper, Seiford and Tone is used for analysis.

Efficiency = <u>Weighted sum of outputs</u>
                 Weighted sum of inputs

The weights for the ratio are determined by the restriction that the similar ratios for every DMU have to be less than or equal to unity, thus reducing multiple inputs and outputs to a single "virtual" input and single "virtual" output without requiring pre-assigned weights. Therefore, the efficiency score is a function of the weights or the "virtual" input-output combination. Suppose that there are n DMUs, each with n inputs and s outputs, relative efficiency score of a given DMU_0 is obtained by solving the following linear programming model.

$$max \ \left(\theta = \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}}\right)$$

subject to

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \le 1 \ ; j = 1,2,\dots,n$$

where

$$v_i \ge 0; i = 1,2,\dots,m$$
$$u_i \ge 0; r = 1,2,\dots,s$$

x_{ij} = the amount of input i utilized by the jth DMU

y_{rj} = t the amount of output r produced by the jth DMU

v_i = weight given to input i

u_r = weight given to output r

Following the Charnes – Cooper transformation (1962), one can select a representative solution (v,u) for which

$$\sum_{r=1}^{m} v_i x_{i0} = 1$$

Hence, the

Denominator in the efficiency score θ shown above is set equal to one, the transformed linear programming model for DMU_0 can be written as follow.

Hence, the denominator in the efficiency score θ shown above is set equal to one, the transformed linear programming model for DMU_0 can be written as follow.

$Max \ \theta$
= Subjectt to,
And

$$\sum_{r=1}^{s} u_r y_{r0}$$
$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0 \ ; j = 1,2,\dots,n$$
$$\sum_{i=1}^{m} v_i x_{i0} = 1$$

And $v_i \ge 0, \ i = 1, 2, 3, \dots m,$
$u_i \ge 0, \ r = 1, 2, 3, \dots s$

The linear programming model shown above will be run n times in identifying the relative efficiency score of all the DMUs. Each DMU selects input and output weights that maximize its efficiency score. Generally, a DMU is considered to be efficient if it obtains a score of 1.00, implying 100% efficiency; whereas a score of less than 1.00 implies that it is relatively inefficient. Eight public sector banks under study are, State Bank of India, Punjab National Bank ,Corporation bank Canara Bank, Vijaya Bank, Syndicate bank ,Indian Bank and Bank of India.

5. Results and analysis:

The efficiency scores of major banks commercial banks show a great variety and no two banks can be said to have a same trend throughout.

Table 1 Technical Efficiency of Banks

Serial Number	DMU (Banks)	Efficiency 2013	Efficiency 2014	Efficiency 2015	Efficiency 2016	Efficiency 2017
1	State Bank of India	0.891611	0.9390914	0.940034	0.9582734	0.9110883

2	Punjab National Bank	0.801143	0.8884662	0.936514	0.9335176	0.9115408
3	Corporation bank	0.909733	0.916731	0.929731	0.939731	1
4	Canara Bank	0.939842	1	1	0.96882	0.977542
5	Vijaya Bank	0.9850875	0.9860875	0.9870875	0.992568	0.9146577
6	Syndicate bank	0.985309	0.8937566	1	0.8436847	0.8379867
7	Indian Bank	0.954321	0.963421	1	1	0.9896454
8	Bank of India	0.9715689	0.979486	0.9814755	0.9714755	0.875286

In 2013, 4 banks banks, namely Vijaya Bank, Syndicate Bank, Indian Bank , Bank of India showed scores ranging above 0.95 which are considered to be good scores and these banks can be called as efficient. They have produced their outputs in an efficient manner. Performance of other banks are in a satisfactory level, but still have a scope for improvement in the efficiency .In 2014, all the sample size, except one shows a positive trend as compared to 2013. The efficiency Canara bank increased to1.In 2015, all the sample size, shows a positive trend, this should be considered as positive signal for bank. So, the year 2015 has been comparatively efficient year for most of the banks. In 2016, three banks showed a negative trend. All other five banks have been comparatively efficient. In 2017, only two banks, shows a positive trend. All other six banks showed a negative trend in efficiency now this should be considered as negative signal for bank. So, the year 2017 has been comparatively less efficient year for most of the banks.

Table 2 Mean Efficiency of Banks

Serial Number	DMU (Banks)	Mean Efficiency
1	State Bank of India	0.92802
2	Punjab National Bank	0.894236
3	Corporation bank	0.939185
4	Canara Bank	0.970741
5	Vijaya Bank	0.972698
6	Syndicate bank	0.912147
7	Indian Bank	0.981477
8	Bank of India	0.955858

The overall performance of commercial banks can be analysed from the averages of their efficiency scores. India bank is the best performing bank with an average efficiency of 0.9814 and Panjab national bank is the least performing bank with the mean efficiency of 0.89.Considering various factors affecting the efficiency, still it ranges in between satisfactory level. A point to be noted is that the poor performers are those with high figures of Deposits and Advances. The banks with lower deposits and advances have shown efficiency, whereas banks with huge deposits and advances are not that efficient.

Table 3
Period wise Average Efficiency scores of Banks

Serial No	Period	Average Efficiency score
1	2013	0.929827
2	2014	0.94588
3	2015	0.967543
4	2016	0.951009
5	2017	0.927218

The results suggest that the mean technical efficiency improved from 2013 to 2015 and then technical efficiency declined during the period 2016 and 2017. The result also shows that the banks like Canara Bank , Indian bank, Syndicate bank, Corporation bank Vijaya bank and Bank of India are efficient and they have shown consistency in their performance.

6. Conclusion:

In this research DEA was used to analyse the efficiency of major Public sector commercial banks in India and it can be seen that most of the banks are satisfactorily efficient. The average performance of the banking sector ranges above 90%, which indicates the appropriate conversion of inputs into outputs. The result also shows that the banks like Canara Bank , Indian bank, Syndicate bank, Corporation bank ,Vijaya bank and Bank of India are efficient and they have consistency in their performance.. Performance of Punjab National bank is a matter of concern as its efficiency scores are below 0.9 level . The major factor resulting in the less efficient performance by the two banks, State Bank of India and Punjab National bank is their huge amounts of deposits, advances and other assets. So here either these banks possess blocked/non-performing assets or are not able to make a set off between the deposits and advances. Being major banks in the country this problem deserves to be paid a better attention of the regulators and the administrators. Overall the banking sector of India portrays a picture of a continuous efficiency improvement.

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