AN EMPIRICAL ANALYSIS OF BANKS, FINANCIAL EFFICIENCY IN INDIA USING DATA ENVELOPMENT ANALYSIS (DEA)

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ABSTRACT

The main objective of this study is to measure the financial performance efficiency of public sector banks and private sector banks in India by using the Data Envelopment Analysis (DEA), to measure the efficiency of the banks the following three different parameters have been used.

- *The efficiency of Total Income to Total Investments*

- *The efficiency of Total Income to Total Expenses*

- *The efficiency of Total Expenses to Total Liabilities*

The efficiency calculated for 21 public sector banks and 21 private sector banks using the Data Envelopment Analysis, individual banks wise.

KEYWORDS: Data Envelopment Analysis, Bank Efficiency, Financial Efficiency

INTRODUCTION

Banks efficiency studies are not new, many studies have evaluated the performance of the banking sector; very few of those studies evaluated the performance of the banking sector in developing countries. The main objective of an organization is to maximize the profits in a proper way by utilizing the resources efficiently and effectively. Enhancing the efficiency is helpful to an organization as it decreases the cost of production and increases the profits of an organization. The higher profit of an organization helps to increase the value of the firm. The profit performance of an organization directly reflects the market price of the organization. The profit directly depends on the lower cost of production or higher production output, indirectly on higher prices and high customer satisfaction.

The service sector industries, mainly face problems in terms of efficiency. The problems occur in service sector industries due to the continuous changes in government regulations, competition, technology and global economy, etc. The banking sectors, Tourism, hotels, etc are the main services sector facing efficiency problems. The present study focuses on the financial performance efficiency of the banking industry in India. It is important to the banking sector to increase the efficiency of utilization of their financial resources as it helps the banks increase their profitability. The basic benefit of enhanced efficiency is a reduction in spreads between lending and deposit rates and this will likely

stimulate both greater loan demand for industrial investment and greater mobilization of financial savings through the banking system (Ikhide, 2000). The public sector banks are dominating the total banking industry in India. The financial performance and efficiency is the only indication of the success of the banks. Proper efficiency measuring tools help to the policymakers, industry leaders, others relating to the sector. It helps them in proper planning and decision-making process to increase the efficiency of the banking industry.

Banking Sector in India

The banking system of a country plays a pivotal role in the economic development of any country and plays a crucial role in developing countries like India. The banking system initiated in India in the 18th century, The General Bank of India was the first bank started in 1770 followed by Bank of Hindustan started in 1786. State Bank of India exists in 1806. The banking industry had become an important tool to facilitate the development of the Indian economy in 1960. In 1969 the Government of India issued an ordinance of *"Banking Companies (Acquisition and Transfer of Undertakings) Ordinance, 1969"* to banking companies, and nationalized 14 largest commercial banks on July 19, 1969, the Parliament passed the banking companies bill and received precedential approval on 9th August 1969. 6 more banks followed nationalization in the 1980's. In the early 1990s, the liberalization policy of banking embarked by the P.V NarsimhaRao's Government, licensing the private banks. This move helped to grow private sector banks in India. It led to a rapid growth in the banking sector as well as Indian economy. After that, the newly proposed relaxation of norms which exceeds the capital of 10% to 74% with some restrictions on Foreign Direct Investment (FDI). The Reserve Bank of India is an autonomous regulatory body, with minimal pressure from the government.

The banking sector in India is segmented into 27 Public sector banks 21 Private sectors and 34 Foreign Banks with both individual and mixed ownership. The number of bank branches increased from 8,620 in 1969 to 72,170 in 2007 and the population covered by a branch decreased from 63,800 to 15,000 during the same period. The total deposits increased from Rs. 5,910 Crore (US$ 1.08 billion) in 1970 – 1971 to Rs. 3,830,922 Crore (US$ 697.23 billion) in 2008-09 (Datt & Sundharam, 2009), (Jayati Ghosh, 2011). India's gross domestic saving in 2006-07 as a percentage of GDP stood at a high 32.7 % (Datt & Sundharam, 2009). The public sector banks hold over 75% of total assets of the banking industry, with the private and foreign banks holding 18.2% and 6.5% respectively (Jeetha D'silva, 2011). Since liberalization, the government has approved significant banking reforms. While some of these relate to nationalized banks, like encouraging mergers, reducing government interference and increasing profitability and competitiveness, other reforms have opened up the banking and insurance sectors to private and foreign players.

Literature

Only a few studies have done on the Data Envelopment Analysis (DEA), here some of those studies reviewed for this paper.

Ferrier and Lovell (1990) analyze the 575 banks cost structure for the year 1984 using the SFA and DEA. They conclude that the DEA is sufficiently flexible to envelop the data more closely than the Translog cost frontier. However, efficiency scores are not significantly correlated indicating that other factors not controlled for many drivers that obtained between the two measures.

Kraft and Tirtiroglu (1998) examined the efficiency of newly established private banks and older state institutions in Croatia in the mid – 1990; s by using stochastic frontier analysis (SFA) and concluded that the newly established private banks were more efficient rather than the older state institutions.

The Chu and Lim (1998) evaluated DEA using three inputs and two outputs of six Singapore listed banks during the period 1992 – 1996, Chu and Lim concluded that the change in share price reflects in the profit of the organization rather than the cost efficiency.

Haslem et al (1999) analyzed the efficiency of U.S. banks using data envelopment analysis (DEA), and suggested that banks should focus on the overall efficiency and attention to the inputs like cash and capital.

Claessens et al. (2001) examined the domestic and foreign banks performance differences of developed and developing countries in the period of 1990's to 2000 and concluded that competition from the foreign banks helps to improve the efficiency of domestic banks.

Jemric and Vujcic (2002) analyzed the banking efficiency of Croatia in the 1990's using Data Envelopment Analysis (DEA) and found that the new banks and foreign banks are more efficient than the older banks and Domestic Banks.

Beccalli et al., (2006) examined the relationship between share performance and bank efficiency, and estimate by using as the output parameters deposits, loans, and securities, input parameters are labor and capital. Using these parameters he estimates the relationship between efficiency and performance in the stock market. He concluded that the changes in the stock price influence the changes in cost efficiency.

Kirkwood and Nahm (2006) evaluated Australian banks cost efficiency in producing the banking services from 1995 to 2002. The authors found that the retinol banks cost efficiency of Australian banks in producing banking services and profit between 1995 and 2002. Empirical findings indicate that major banks have improved their efficiency in producing banking services and profit, while the regional banks have experienced little change in the efficiency of producing banking services and a decline in the efficiency of producing the profit. They further relate the changes in efficiency to stock returns and found that changes in bank efficiency are reflected in stock returns.

Izah Mohd Tahir et al (2009) estimates the overall, pure technical and scale efficiencies for Malaysian commercial banks during the period 2000-2006. The results suggest that domestic banks were relatively more efficient than foreign banks.

Fadzlan Sufian and Razali Haron (2009) examine the efficiency of the Malaysian banking sector, by using the non-parametric data envelopment analysis methodology to measure the efficiency of banks which are listed on the KLSE. The main conclusion of this paper is that the most efficient bank is also highly ranked in terms of returns with relatively low standard deviation and beta. The results also suggest that all the banks which have managed to appear on the efficiency frontier are mainly based on the relatively higher mean returns rather than lower standard deviations and/or beta.

Domestic Studies

Bhattacharya et al (1997) measures the productive efficiency of Indian commercial banks from the 1980's to 1990's using DEA. Author concluded that the public sector bank's performance is the best, and public sector banks are

dominating the total Indian banking sector. The private sector banks need to emerge fully in the Indian banking.

Sathye (2001) examined the relative efficiency of Indian banks from 1990's and compared the efficiency of Indian banks with the banks in other countries. 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.

Ram mohan and Ray (2004) compared Indian public, private and foreign bank's revenue maximizing efficiency by using physical quantities of inputs and outputs in the 1990's. He found that public sector banks were significantly better than private sector banks on revenue maximization efficiency, but between public sector banks and foreign banks the difference was not significant.

Shanmugam and Das (2004) analyzed the efficiency of banking using stochastic frontier production function model from period, 1992-1999. Using 4 inputs and 4 outputs and found that private/foreign banks performed better than public banks.

Das et al (2004) examined the efficiency of Indian banks with four inputs and 3 output variables using data envelopment analysis and found that, 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.

Sanjeev (2006) studied the efficiency of public, private and foreign banks operating in India during the period 1997-2001 using data envelopment analysis and also studied the relationship between the efficiency and non-performing assets. 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.

Kumar and Gulati (2007) studied the efficiency of public sector banks in India using DEA, CCR model and Andersen and Petersen's super-efficient models were used from in the year 2004-05. He found that 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 the SBI group were found to outperform the nationalized banks in terms of operating efficiency.

Objective of the Study

The main objective of this paper is to know the financial performance efficiency of the banking sector in India. The other subsidiary objectives are to analyze the financial performance of banks both public sector and private sector using DEA analysis.

METHODOLOGY

Data

The data of 24 public sector banks and 16 private sector bank data used for the study. The required data collected from financial statements of banks (Balance Sheet & Profit and Loss a/c) for the five year period 2007 to 2012 were obtained from the internet sources. The average total of Total Income, Total Investment, Total Liabilities and Total Expenses had been taken for calculating the financial performance efficiency of the banks.

Data Envelope Analysis

Data Envelopment Analysis (DEA) developed by Chames, Cooper and Rhodes (1978) to evaluate nonprofit and public sector organizations. DEA has been proved that to improve service not visible with other techniques, even though DEA has not been widely adopted by banks. The DEA helps to measure and compares the banks/branches in that sample with the best practice in the sample. DEA is a method that can generate new paths to improve profits and not used when other are less powerful techniques continue, in use, every service organization can benefit from DEA in different ways and DEA can be adapted to help improve service productivity. Increased use by service managers will identify new strengths and benefits that can be derived from DEA along with gaps and weaknesses. Linear programming is the underlying methodology that makes the DEA particularly powerful compared with alternative productivity management tools. DEA has been widely studied, used and analyzed by academicians who understood linear programming.

Inputs and Outputs

The major problem in the process of efficiency calculation of banks using DEA is a specification of inputs and outputs. Different researchers/authors have different opinions on taking inputs and outputs. The Deposit variable some researcher Elyasiani and Median (1990), Lang and Welzel (1996), Izah Mohd Tahir et al (2009), treat them as inputs, but researchers such as Berger and Humphrey (1991), and Ferrier and Lovell (1990), and (Haron, 2009) treated deposits as output variable. Other variables like Incomes, Expenditure, Investments and Liabilities etc., also considered differently.

In the present study four different variables have been considered in evaluating the financial performance of the banks.

Financial Performance Efficiency1

X1: Total Income

Y1: Total Investments

Financial Performance Efficiency 2

X2: Total Income

Y2: Total Expenses

Financial Performance Efficiency 3

X3: Total Expenditure

Y3: Total Liabilities

Note:

X1, X2 and X3 – Input Variables

Y1, Y2 and Y3 – Output Variables

Data Analysis

All 24 public sector and 16 private sector banks Data Envelopment Analysis (DEA) efficiency computation has been done using the Ms-Excel 2007 (Solver) software.

RESULTS

All computation has been performed using the Data Envelopment Analysis (DEA) program. Individual efficiency of Private and Public sector banks are first examined by calculating the five years average (2007 – 2012) of Incomes, Expenditure, Investments and Total Liabilities. Using the average values a separate calculation of DEA is done for public and private banks. The following table shows the efficiency scores of the individual banks.

Table 1: Public Sector Banks Efficiency Scores

S. No	Bank Name	Efficiency Scores of Income to Investment	Efficiency Scores of Income to Expenses	Efficiency Scores of Expenses to Liabilities
1	Allahabad Bank	0.77	0.95	0.94
2	Andhra Bank	0.98	0.96	0.96
3	Bank of Baroda	0.92	0.99	0.77
4	Bank of India	0.87	0.95	0.86
5	Bank of Maharastra	0.76	0.90	0.94
6	Canara Bank	0.85	0.96	0.93
7	Central Bank of India	0.76	0.90	0.93
8	Corporation Bank	0.71	0.95	0.86
9	Dena Bank	0.81	0.95	0.89
10	Indian Bank	0.85	1.00	0.95
11	Indian Overseas Bank	0.85	0.92	0.97
12	IDBI Bank	0.74	0.91	0.92
13	Oriental Bank of Commerce	0.84	0.93	0.97
14	Punjab National Bank	0.86	0.98	0.91
15	Punjab and Sind Bank	0.77	0.94	0.93
16	State bank of India	0.85	0.94	0.92
17	Syndicate Bank	0.93	0.92	0.94
18	UCO Bank	0.78	0.91	0.92
19	Union Bank of India	0.85	0.95	0.91
20	United Bank of India	0.68	0.90	0.91
21	Vijaya Bank	0.75	0.91	0.98
22	State bank of Bikhanur and Jaipur	1.00	0.94	1.00
23	State bank of Mysore	0.93	0.93	1.00
24	State bank of Travencore	0.87	0.95	0.95

Table 2: Private Sector Banks Efficiency Scores

S. No	Bank Name	Efficiency Scores of Income to Investment	Efficiency Scores of Income to Expenses	Efficiency Scores of Expenses to Liabilities
1	Axis Bank	0.73	1.00	0.74
2	City Union Bank	1.00	0.99	0.83
3	Development Credit Bank	0.87	0.83	1.00
4	Dhanalaxmi Bank	0.83	0.85	0.86
5	Federal Bank	0.83	0.85	0.82
6	HDFC Bank	0.84	0.99	0.80
7	ICICI Bank	0.77	0.97	0.80
8	IndusInd Bank	0.92	0.94	0.89
9	ING Vysya Bank	0.79	0.93	0.80
10	Jammu & Kashmir Bank	0.65	0.99	0.71
11	Karnataka Bank	1.00	0.93	0.82
12	Karur Vysya Bank	0.87	1.00	0.78
13	Kotak Mahindra Bank	0.80	0.99	0.87
14	Lakshmi Vilas Bank	0.94	0.90	0.89
15	South Indian Bank	0.85	0.95	0.77
16	Yes Bank	0.71	0.99	0.77

Table 3: Proportion wise Comparison of Efficiency Scores of Income to Investment:

Public Sector Banks

Classes (%)	No. of Banks in Each Class	Total Banks	Efficiency Proportion
Below 80	9	24	37.5%
80-85	7	24	29.2%
85-90	3	24	12.5%
90-95	3	24	12.5%
95-100	2	24	8.3%
Total	**24**	**24**	**100.0%**

Private Sector Banks

Classes (%)	No. of Banks in Each Class	Total Banks	Proportion
Below 80	6	16	37.5%
80-85	4	16	25.0%
85-90	2	16	12.5%
90-95	2	16	12.5%
95-100	2	16	12.5%
Total	**16**	**16**	**100.0%**

The efficiency scores of Income to Investment suggest that: there are 37.5% public sector and private sector banks below the 80% efficiency score. The public sector banks are marginally highly inefficient compared to private sector banks in the next level class that is 80% to 85%, the public sector banks are 29.5% and the private sector is 25%. The next two classes are 85% to 90% and 90% to 95% both the private sector banks and public sector banks performance proportion is the same. At the next level the private sector banks are marginally in higher proportion of 12.5 compared to 8.3 of public sectors.

Overall in the efficiency scores of Income to Investment private sector banks marginally showing higher performance compare to the and public sector banks.

Table 4: Proportion wise Comparison of Efficiency Scores of Income to Expenses

Public Sector Banks				Private Sector Banks			
Classes (%)	No. of Banks in Each Class	Total Banks	Proportion	Classes (%)	No. of Banks in Each Class	Total Banks	Proportion
Below 80	0	24	0.0	Below 80	0	16	0.0
80-85	0	24	0.0	80-85	3	16	18.8
85-90	3	24	12.5	85-90	1	16	6.3
90-95	16	24	66.7	90-95	4	16	25.0
95-100	5	24	20.8	95-100	8	16	50.0
Total	**24**	**24**	**100.0**	**Total**	**16**	**16**	**100.0**

The efficiency scores of Income to Expenses suggest that: there are no banks with performance efficiency below the 80 %. The Private sector banks are highly placed in the next level class that is 80% to 85%, but there are no banks from the public sector. In the next level classes of 85% to 90% the private sector banks are lower than the public sector banks. The public sector banks proportion is 12.5% and the private sector banks proportion is 6.3%. At the next level the public sector bank's performance higher than the private sector banks, public sector banks proportion is 66.7% whereas private sector only 25%. In the next class, 90% to 95% the private sector proportion is higher than the public sector banks, the private sector banks proportion is 50% where are public sector proportion is 20.8%.

Overall in the efficiency scores of Income to Expenses public sector banks overall performance is comparatively higher in public sector banks than private sector bank's performance.

Table 5: Proportion wise Comparison of Efficiency Scores of Expenses to Liabilities

Public Sector Banks				Private Sector Banks			
Classes (%)	No. of Banks in Each Class	Total Banks	Proportion	Classes (%)	No. of Banks in Each Class	Total Banks	Proportion
Below 80	1	24	4.2	Below 80	8	16	50.0
80-85	0	24	0.0	80-85	3	16	18.8
85-90	3	24	12.5	85-90	4	16	25.0
90-95	14	24	58.3	90-95	0	16	0.0
95-100	6	24	25.0	95-100	1	16	6.3
Total	24	24	100.0	Total	16	16	100.0

It is found that the lowest efficiency scores indicate the higher efficiency of performance. most private sector banks are having the lowest score so the private sector bank's performance efficiency is better than the public sector banks.

CONCLUSIONS

The public sector banks are dominating in terms of total asset investment in the Indian Banking sector compared to the private and foreign banks. The public sector has the 75% of the total assets of total banking industry in India. But financial performance, efficiency scores using DEA suggest that the private sector bank's financial performance efficiency is marginally higher than the public sector banks. After 1990s, the liberalization policy of banking embarked by the P.V Narsimharao the then Pri-minister, helped the growth of private sector banks in India and it led to a rapid growth in the banking sector as well as Indian economy.

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