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A Study on the Financial Analysis of the Indian Banking Sector

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Abstract – Indian financial services industry is dominated by the banking sector that contributes significantly to the level of economic activity, as empirically demonstrated by Jadhav and Ajit (1996). The banking structure in India is broadly classified into public sector banks, private sector banks and foreign banks. The public sector banks continue to dominate the banking industry, in terms of lending and borrowing, and it has widely spread out branches. Deregulation of the Indian financial system in 1991 followed by various financial sector reforms during the period 1990 through 1998 led to a major restructuring of the Indian banking industry. The reforms were based on the recommendations of the Committee on Financial Systems (CFS) (Narasimham 1991) first, followed by those of Committee on Banking Sector Reforms (BSR) (Narasimham 1998) in a phased manner. The reforms were comprehensive and led to sharp changes in various parameters of banking system. Further, on the basis of the recommendations of the Steering Committee set up by RBI, 'Ownership and Governance' and the implementation of the 'New Capital Adequacy Framework' were formulated and issued to banks on February 15, 2005. As a result, the restrictions on geographical expansion and ceiling on interest rates were removed. With increased competition, declining margins on current business operations, higher costs and greater risks, banking industry in general, had to face a two pronged challenge. They had on the one hand, to enhance their productivity and on the other, increase their ability to serve the nation in new ways with greater efficiency and effectiveness. In such a scenario, banking industry had to sustain itself by increased reliance on cost minimization and by ensuring greater efficiency. These reforms were broadly aimed to improve the performance of banks despite of the unexpected global recession and internal disturbances. At this juncture banking sector is immensely competitive and growing in the right trend.

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INTRODUCTION

With the introduction of financial reforms in India in 1991, banks have been given liberty to fix their own rates of interests on their assets as well as liabilities besides the charges quoted on their miscellaneous business. Private Banks have been permitted to open branches along with foreign banks resulting in competition among banks. To attract more and more customers, banks started to offer new products to suit the needs of the customers. The business hours have also been extended, and computerisation has been introduced resulting in 24 hours banking via Automatic Teller Machines (ATMs), online banking, core banking, etc. Now, the objective of the banks is growth with profit.

The banking industry is going with increased professionalism due to the emergence of the new private banks and the increased participation of the foreign players. The public sector banks of India were performing poorly before the advent of private and foreign banks. As the banking industry is an important financial sector of the Indian economy, it is very important for senior managers, regulators and investors to identify the major drivers of a bank's efficiency. Productivity and profitability are the major performance indicators besides many measures (financial ratios) on which we can depend on in order to analyse the efficiency of banks. In this paper an analysis of productivity of the Indian banking sector has been done. To measure the productivity, Data Envelopment Analysis (DEA) technique is used.

DEA was introduced in the early 1950 to measure efficiency and for its comparison, Koopmans (1951) defined a point in the commodity space as 'efficient' whenever, an increase in the net output of one good can be achieved only at the cost of a decrease in the net output of another good. It was very close to the concept of Pareto optimality, which was considered as Pareto-Koopmans technical efficiency. Farrell (1957) made a path-breaking contribution by constructing a LP model using actual input output data of a sample of firms, the solution of which yields a numerical measure of the technical efficiency of an individual firm in the sample.

In 1958, three branches of mathematical programming viz. game theory, input output analysis and linear programming were brought together and then linear programming was accepted as a computational method for measuring efficiency on different kinds of economic firms (Dorfman, Samuelson and Solow 1958).

DESCRIPTION OF THE METHOD

Charnes, Cooper and Rhodes (1978) introduced the method of Data Envelopment Analysis (DEA) to address the problem of efficiency measurement for Decision Making Units (DMUs) with multiple inputs and multiple outputs in the absence of market prices. They coined the phrase decision making units in order to include non-market agencies like schools, hospitals and courts, which produce identifiable and measurable outputs from measurable inputs but generally lack market prices of outputs (and often of some inputs as well). Hence, we take DMU as synonymous with a firm. DEA is used to measure the efficiency of DMU in comparison to the best possible efficiency using variety of data.

Data Envelopment Analysis (DEA) is an alternative non-parametric method of measuring efficiency that uses mathematical programming rather than regression. Here, one can avoid the problem of specifying an explicit form of the production function and makes only a minimum number of assumptions about the underlying technology. DEA is a methodology directed to frontiers rather than central tendencies. Efficiency as given in Pareto and Koopman's (1973) definition is stated as follows efficiency

Efficiency= $^{Output}/_{Input}$

Relative efficiency is defined in the following way. A DMU is to be rated as fully (100 percent) efficient on the basis of available evidence, if and only if, the performances of other DMUs does not show that, some of its inputs or outputs can be improved without worsening some of its other inputs or outputs (Cooper 2004). DEA uses linear programming to determine the 'efficiency' with which this production function operates for each unit.

Yue (1990) gives concept of economic efficiency in comparison to the concept of engineering efficiency. Engineering efficiency is defined as ratio of the work performed by a machine to the amount of energy consumed by it in the process. On the other hand, economic efficiency is used to compare the relative efficiency of firms. A firm is said to be economically efficient if it produces the same output with minimum inputs. It is measured by adding technical and allocative efficiency. Technical efficiency is defined as the ratio of actual output to maximum possible output.

TE =Y / Y* (output oriented method)

TE =X*/ X (input oriented method)

On the other hand, allocative efficiency is defined as a firm having a combination of inputs enabling it to produce the desired output at minimum cost [1] (Yuel990).

In DEA, a benchmark technology is constructed from the observed input-output bundles of the firms in the sample.. For this, following general assumptions are made about the production technology without specifying any functional form. These are fairly weak assumptions and hold for all technologies represented by a quasi-concave and weakly monotonic production function

THE METHOD

To evaluate the input oriented TE, we see the extent to which we can reduce the input and still produce the same level of output. In multiple inputs we check the TE by reducing the inputs equi-proportionately. To show the output oriented model the technique is same.

In DEA we start with measuring average productivity, which requires aggregation of inputs and outputs. If prices are not available we can take shadow prices of inputs and outputs, (v and u are used as shadow prices for outputs and inputs respectively).

$$AP = \frac{v_{it} y_t}{u_{it} x_t}$$

The mathematical programming can be constructed from above is as follows,

$$M\ ax\ u\ u_i\ /v\ x_i$$

$$s.t.u\ y_j\ /v\ x_j \leq$$

$$u, v \geq 0$$

This problem can be converted into LPP as follows

$$Max\ u\ '\ y_i$$

$$s.t.u'.y_i - v'x_j \leq 0$$

$$v'x_j = 1$$

$$u', v' \geq 0$$

Above problem can be solved with the simplex method to get optimal solution.

Several important points require emphasis. First, the shadow prices of inputs cause the value of the observed input bundle x of the firm under evaluation to equal unity. As a result, the value of the output bundle itself (u', yi) becomes a measure of its average productivity. Secondly, at prices (v, xi) the observed

input-output bundle of no firm in the sample would result in a positive surplus of revenue over cost. If one interpreted the input prices as the imputed values of these scarce resources, then if the prices chosen are such that the imputed value of any input bundle is less than the imputed valuation of the output bundle it produces, clearly the resources are being under-valued and the imputed input prices should be revised upwards. Similarly, if the output prices reflect the cost of the inputs drawn away from other uses to produce one unit of the output produces, then the total imputed value of the output bundle exceeding the total imputed cost of the input bundle used would imply that the output bundle is overvalued.

The dual of the programme is as under:

Min $v'x_i$

s.t.$u'\ y_j - v'x_j \geq 0$

$u'\ y_j = 1$

$u', v' \geq 0$

Optimal values of primal and dual function are equal and it represents the efficiency of the firm. The number of constraints of the primal depends upon the number of DMUs, while the number computational of constraint of the dual depends upon the number of inputs and outputs. The efficiency of LP depends upon the number of constraints rather than the number of variables. Hence, the dual formulation is computationally more efficient than the primal. Primal provides optimal weights to input and outputs; the dual provides weights to DMUs. The constraint states that the dual variable should be chosen such that the weighted combination of all the output of all the firms should be at least equal to the output of the reference firm. If the firm is efficient, the strict equality holds, with no slack in the constraint.

The DEA programs involving weights of inputs and outputs (u, v) are called multiplier DEA programs. A general envelopment DEA program corresponding to the output maximizing multiplier model is written as

Min θ_m

$$\text{s.t..} \sum y_{jn} = \lambda_n \geq y_{jm}$$

$$\sum x_{in} \geq \lambda_n \ \theta_m x_{im};$$

$\lambda_n \geq 0$, θ_m = unrestricted

Those involving weights of firms (6, A) are called envelopment DEA programs.

With input-oriented DEA, the linear programming model is configured so as to determine how much the input use of a firm could contract if used efficiently, in order to achieve the same output level. For the measurement of capacity, the only variables used in the analysis are the fixed factors of production. As these cannot be reduced, the input-oriented DEA approach is less relevant in the estimation of capacity utilization. Modifications to the traditional input-oriented DEA model, however, could be done such that it would be possible to determine the reduction in the levels of the variable inputs conditional on fixed outputs and a desired output level. In contrast, with output-oriented DEA, the linear program is configured to determine a firm's potential output given its inputs if it operated efficiently as firms along the best practice frontier. This is more analogous to the SPF approach, which estimates the potential output for a given set of inputs and measures capacity utilization as the ratio of the actual to potential output. Output-oriented models are very much in the spirit of neo-classical production functions defined as the maximum achievable output given the input quantities (Fare, Grosskopf and Lowell, 1994).

OBJECTIVE

The objective is to analyze the productivity of the Indian banking sector in post reform period and comparison of capital efficiency of individual and group banks from 1991 till 2007.

REVIEW OF LITERATURE

Many studies have been undertaken to measure the productivity in banking. Bhattacharya, Lovell and Sahay (1997) examined the productive efficiency of Indian commercial banks during 1986-1991 and reported a marginal increase in overall average performance after 1987 and the average efficiency of publicly owned banks being much higher than the privately owned or foreign owned banks. Sathye (2001) compared productive efficiency of publicly owned, privately owned and foreign owned banks operational in India in the year 1997/1998 (the data selected was cross-sectional data). Here, two input and two output variables, namely, interest expenses, non-interest expenses (inputs) and net interest income and non-interest income (outputs) have been used. In second approach, DEA analysis was run with deposits and staff members as inputs and net loans and non-interest income as outputs. The two models have been used to show how efficiency scores differ when inputs and outputs are changed. Galagedera and Edirisuriya (2003) examined efficiency performance of Indian commercial banks for the period of (1995-2002) using total deposits and operating expenses as input and loans and other earning assets as output in the DEA analysis. They found no significant growth in productivity during the

sample period. Trippe (2004) has measured the efficiency of banks in New Zealand with the non-parametric method i.e. DEA. Here the New Zealand banks' efficiency is compared with the efficiency of Australian banks. The model took intermediary role of commercial banks where inputs are interest and non-interest expenses (reflects staff expenses) and the output are interest income and other incomes earned from service and agency. By considering the difference in scale and size of equity, no big difference was found in selected banks but the difference in the efficiency was reported due to the pattern of regulation and degree of competition in the efficiency of Australian banks compared with banks from New Zealand. Besides this, an attempt has been made to explain the impact of environmental factors (like market share, asset quality, exposure to off-balance sheet activities, size, and profitability) on the overall technical efficiency of the PSBs. attributed by pure technical inefficiency rather than scale inefficiency. The results indicate that the 7 PSBs scored OTE score of unity and, thus, defined the efficient frontier. The resource utilization process in these banks is functioning well. In DEA terminology, these banks are called peers and set an example of good operating practices for inefficient banks to emulate. The remaining 20 banks can improve their efficiency by reducing inputs. The results of logistic regression analysis provides that the factors like market share, profitability, and asset quality do not have any significant impact on the overall technical efficiency of Indian public sector banking industry. Also, the efficiency of PSBs is positively influenced by their exposure to off-balance sheet activities.

SAMPLE AND METHODOLOGY

The accounts balance sheet performance of different groups of banks in India is compared here. The tables give an idea about the performance and the efficiency of different groups of banks. The balance sheet of the bank is computed with assets on one side and liabilities on the other side. The liabilities of the banks are the capital ploughed in reserves, borrowings of the banks and the deposits accumulated by the banks. Capital includes bank's owned capital and their share capital. Reserves include statutory reserves, capital reserves, share premium and balance of profit. The advances issued by the banks, investment made by the banks and the fixed assets of the banks constitute the assets of the banks.

The balance sheet data is used to compare capital efficiency in individual and group banks. DEA: a non-parametric approach is used to estimate the efficiency scores and to construct the Malmquist productivity index. Firstly, the efficiency of groups of banks is measured with the balance sheet data of the banks. The capital efficiency of banks using inputs and output selected from balance sheet structure of data is compared using CRS and VRS model.

The data of total 63 banks (including NPB) is collected to compare the group efficiency of the banks. Investments and loans are taken as the output of the banks. The capital, reserves and deposits are taken as inputs of the banks. Here, it is necessary to mention that the foreign banks were not allowed to bring their capital till 1992 (nil capital makes the objective function unbounded). Hence, the inputs for the foreign banks were taken as reserves and the deposits only. The foreign banks are selected on the basis of their existence in the business and their volume of the business in India. The working of the foreign banks was under the restrictions imposed by the RBI.

The OB group is classified as old and new private banks. The new private banks (NPB) are those, which started after the year 1995. In the given comparison, OB group shows old private sector banks. They are in the business on the similar standards with the other groups of banks.

ANALYZING THE CAPITAL EFFICIENCY OF THE BANKS

Comparison of Compound Annual Growth Rate (CAGR) of Different Groups of Banks

Table 1.1: CAGR of Liabilities and Assets in Banks in India during

1991-2007 (Percent)

Group of Banks	Capital	Reserves	Borrow	Deposits	Total Liabilities	Advances	Investment	Fixed asset
SBI(8)	9.01*	21.85*	-3.73	20.21*	13.80*	12.50*	18.79*	17.18*
NB(19)	7.90*	22.36*	3.36*	13.69*	13.43*	13.82*	14.82*	9.22*
FB	39.00*	17.39*	19.50	32.50*	15.48*	17.43*	15.41*	12.88*
Others	30.15*	35.81*	37.34*	25.31*	27.39*	27.72*	30.19*	26.78*
All Banks (average)	11.61*	23.40*	13.29*	16.10*	15.12*	15.15*	17.55*	13.77*

Significant at 5 percent level

(Numbers in bracket indicate total numbers of the Banks.)

Table 1.1 shows the liabilities and assets of all banks. Maximum growth in liabilities of banks is shown in the reserves of all banks at 23.4 percent, out of this; mainly domestic banks have shared the rate of growth at 35.84 percent. Banks have been investing in government securities on their own in excess of their statutory requirement because of the low credit off-take in the commercial sector and also because of the safety considerations (i.e. interest earned on Government securities without risk). Unlike domestic banks, foreign banks have least rate of growth in .the reserves. These banks are multitalented in earning the

income. They earn the income mainly from services provided. However, the reserves maintained by the foreign banks are not increasing at faster rate.

The number of foreign banks and the other Banks vary over the period of time. In 1991, the number of foreign sector Banks was 18.The number have increased to 31 in the year 2007 .The number of other scheduled commercial banks in 1991 were 24, which is increased to 28 in the year 2007.

Foreign banks have shown a very fast growth in raising capital (39 percent) compared to any other group of banks. This is because of relaxation of some of the restrictions and they are still with the potential available to rise. It also shows that they are able to make efficient use of their own funds as capital and reserves are mainly maintained from ploughing back their profit. Their initial size was very small. That is the major thing that explains the high CAGR.

The growth in advances, investment and accumulation of fixed assets, the other commercial banks are in the top rank (27.72 percent, 30.19 percent and 26.78 percent respectively). This growth is the result of the policy of liberalization adopted by the Indian government. The supportive reforms have helped this group of banks to grow faster. On the other hands the rate of growth of advances for SBI group was the lowest during this period at 12.50 percent. This shows that SBI group is not concentrating on advances for the growth of interest income. The private sector banks have the higher rate of growth in their liabilities as well as their assets. The main reason behind this growth is that the size of asset and liabilities of private banks was negligible in 1991 and after the new policy reforms of 1991, the private sector commercial banks were exposed to more volume of business.

The investment taken is restricted to investment in India only, e.g. investment in government securities, other approved securities, shares, debentures and bonds, subsidiaries or joint ventures etc. Foreign banks and nationalized banks are having almost similar growth at 15.8 percent and 14.5 percent, respectively. It shows that foreign banks are not concentrating on such types of investments for earning their sources of income. These bank's fixed assets have shown slight increase. They have their branches mainly in the urban metropolitan areas.

The nationalized banks also had a very low rate of growth in their fixed assets during 1991-2007. It is observed that the nationalized banks already expanded their branches, offices, furniture used in the offices etc. earlier to the mentioned period. Hence, their slow rate of growth in fixed assets in post-reforms is apparent.

Use of DEA to Compare the Capital Efficiency of Different Banks in India

The table 1.2 shows that the public sector banks i.e. SBI group and NB group have been viewing impressive efficiency when compared with the private sector banks. Due to non-availability of data for 1995-96, we measured efficiency of NPB after 1997.

The average efficiency shows that the SBI is ranked first, after that NB group followed by the OB and FB respectively. The efficiency of the FB is adamantly low. The average efficiency of NPB is 0.838, which is less than the OB group efficiency.

Table 1.2: 'Average Efficiency' Comparison of Different Groups of Banks (CRS) (Using Assets and Liability Data)

Years	NB (19)	SBI (8)	OB (14)	FB(13)	NPB (9)
1991	0.976	0.961	0.988	0.838	-
1992	0.980	0.968	0.975	0.753	-
1993	0.969	0.959	0.978	0.773	-
1994	0.974	0.963	0.960	0.814	-
1995	0.950	0.964	0.964	0.722	-
1996	0.970	0.999	0.959	0.711	-
1997	0.967	0.972	0.964	0.591	0.946
1998	0.975	0.964	0.98	0.693	0.823
1999	0.978	0.975	0.973	0.739	0.928
2000	0.977	0.985	0.974	0.794	0.880
2001	0.976	0.990	0.956	0.778	0.856
2002	0.933	0.966	0.979	0.719	0.870
2003	0.991	0.966	0.981	0.661	0.930
2004	0.988	0.980	0.923	0.689	0.949
2005	0.992	0.991	0.912	0.634	0.926
2006	0.935	0.996	0.922	0.622	0.930
2007	0.957	0.988	0.908	0.602	0.918
Avg.	0.9717	0.9723	0.9681	0.7339	0.898

NPB show new private sector banks.

Figures in the bracket shows the numbers of banks selected from each group

CONCLUSION

DEA technique enables to compare different types of efficiencies as scale efficiency, technical efficiency etc. The results with the available data show that if a bank is scale efficient it may not be technically efficient. If a DMU is productive efficient then it needs not be scale efficient. Though DEA gives comparison of different efficiencies, it does not explain why the efficiencies are different.

In our studies, we have observed from the results that, there is a definite and positive effect of reforms experienced by the banks. Of course the degree and intensity of the effect is different for different groups as well as for an individual bank, e.g. the NB group and SBI group are better than the FB and OB group in capital efficeincy. The FB group is showing poor efficiency due to their limited knowledge of the local industry and branch network. FB group is very conscious about their asset quality and a major shift in the share of foreign banks may result in neglect of the credit requirements of small and medium-sized businesses, whose development is crucial for emerging markets, but which are perceived as carrying relatively higher risks.

DEA technique gives the efficiency or the benchmark but does not specify how it can be improved. In future we intend to find out these factors responsible for the differences in the efficiencies of banks in the same group working on same exterior conditions.

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