*International Journal of Operations Research*

International Journal of Operations Research Vol. 5, No. 2, 78–90 (2008)

# Dynamics of Productive Efficiency of Indian Banks

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*Received November 2005*; *Revised June 2007*; *Accepted July 2007*

***Abstract***—The Indian banking sector, which was predominantly controlled by the government, was liberalized in early 1990s. The resultant competitive forces, coupled with more stringent regulatory framework, have created pressure on the banks to perform. Efficiency has become critical for banks' survival and growth. This paper analyzes the performance of the Indian banking sector, measured and compared in two stages: Through the construct of productive efficiency using the non-parametric frontier methodology, DEA and finding the determinants of productive efficiency through TOBIT model. Inputs and outputs are measured in monetary value and efficiency scores determined for the period 1999-2003. The study shows that SBI and its group have the highest efficiency, followed by private banks, and the other nationalized banks. The results are consistent over the period, but efficiency differences diminish over period of time. The capital adequacy ratio is found to have a significantly positive impact on the productive efficiency.

***Keywords***—Data envelopment analysis, Efficiency, Indian banks, TOBIT model

## 1. INTRODUCTION

The performance of the financial institutions is a major concern for both, the regulators and the policy makers, since it has a strong linkage with the performance of the economy. The financial sector is reasonably well developed in India. Though small in comparison to, say, USA, it has a strong banking system, a set of large and small stock and commodity exchanges, strong equity culture, large number of mutual funds, development institutions like Industrial Development Bank of India, non-Banking finance companies, other specialized financial institutions, besides a large informal sector. India, since 1950s chose the mixed economy model, with strong emphasis on public sector.

The banking sector comprises three major segments: Scheduled Commercial banks, State Cooperative banks, and other banks like NABARD. The scheduled commercial banks include all major banks and account for more than 98% of all the assets in the banking sector. The Indian banking industry, which is a major channel of funding the productive sector, was largely in the private sector until 1969 when all the major Indian banks in private sector were nationalized. Another set of banks was nationalized in 1980s. Several private sector banks and some foreign banks did operate, but on a relatively small scale. By 1991, most banking assets were in public sector. Facing major economic crisis, India started liberalizing its economy in 1991, reducing or eliminating controls on many sectors, and allowing private sector to participate where it was earlier either denied or restricted. Financial sector, including banking sector was also liberalized. The government also decided to streamline the capital market, which was hitherto monopolized by one major stock exchange. A major new stock exchange and new regulatory body were established.

In 1992, the government constituted a committee under Dr. Narsimhan, to study and recommend reforms for the banking sector. Consequent on the recommendations, a series of reforms were introduced. The government allowed new private sector to enter the banking sector from 1993, and further, the foreign banks from 1994. Several new private sector banks were established in 1994-2005 period and several foreign banks established their branches or expanded existing network. The government also introduced more stringent and rigorous controls in line with Basle-I.

As a result of three major factors, more liberalized banking sector, stronger regulatory framework, and stronger capital market as a competitor, the banking sector has undergone a major metamorphosis in the last decade with public sector dominance and protection giving way to a competitive industry. New opportunities have also arisen in form of fund-based activity, and move towards universal banking. The Indian banks, which have long been protected, are suspected to be less efficient. Table 1, 2 and 3 show that the private sector bank (including foreign banks) deposits have increased from 10.3 percent of total deposits with the scheduled banks in 1991 to 21.8 percent

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in 2004-2005. The increase is largely due to contribution of new private sector banks, e.g., HDFC and ICICI bank. Net profits to total assets, net NPA to total assets and business per employee are lowest for public sector banks. Share of private sector banks in the total profits has increased from 19.5 per cent in 2001-02 to 26.4 percent in 2004-05. In fact, if old private sector banks (which existed before 1991 and which are generally small and inefficient) were excluded, the performance of the private sector banks would be even stronger. It is apparent that a strong and viable banking sector has emerged and banks that do not perform will not survive for long.

The obvious question that arises is whether the public sector banks are really inefficient. Which banks are consistently have done and have improved performance over time? Are private sector banks better placed to compete over a period of time? This paper is aimed at examining the recent performance of the Indian banks, in relation to each other. We focus on productive efficiency, using the DEA approach. This is done in two steps. First, the efficiency measures are determined, in terms of relative efficiency scores. Second, the determinants of the relative efficiency scores are established through truncated TOBIT analysis.

## 2. PRODUCTIVITY AND EFFICIENCY

The productivity is a concerned with real resource use, output from a given set of inputs and measured as the output per unit input (or a set of inputs). This simplistic approach is useful when there is only one technology, one input and one output.

However, for a firm, merely getting the maximum output from a given set of inputs is not adequate since different technologies, different inputs and different sets of outputs from the same set of inputs are obtained. Thus, more important is the change in productivity over a period of time, from one period to another. Productivity is hence,

Table 1. Summary performance data for scheduled banks, 2004-05

| | All Schedule Banks (excluding RRB) | Public Sector banks | Private Sector Banks | Foreign banks |
|---|---|---|---|---|
| Number of Commercial Banks | 88 | 28 | 29 | 31 |
| Number of Branches | 54063 | 47794 | 6128 | 141 |
| Total Deposits, Rs. Billion | 18350 | 14359 (78.2) | 3126 (17.0) | 865 (4.8) |
| Total loans and Advances, Rs. billion | 11503 | 8547 (74.3) | 2203 (19.2) | 753 (6.5) |
| Total assets, Rs. Billion | 23117 | 17790 (77) | 3791 (16.6) | 1536 (6.4) |
| Net Profit, Rs. Billion | 210.23 | 154.77 (73.6) | 35.64 (17) | 19.82 (9.4) |
| Average return on Assets (NP/TA) | -- | 0.87 | 0.94 | 1.29 |
| NNPA/TA | -- | 0.95 | 0.95 | 0.42 |
| Business per employee, Rs. M | -- | 30.6 | 57.7 | 94 |

Table 2. Summary performance data for scheduled banks, 2001-02

| | All Schedule Banks (excluding RRB) | Public Sector banks | Private Sector Banks | Foreign banks |
|---|---|---|---|---|
| Number of Commercial Banks | 97 | 27 | 30 | 40 |
| Number of Branches | 51889 | 46384 | 5311 | 194 |
| Total Deposits, Rs. Billion | 11997 | 9657 (80.5) | 1694 (14.1) | 645 (5.4) |
| Total loans and Advances, Rs. Billion | 6447 | 4807 (74.6) | 1184 (18.3) | 456 (7.1) |
| Total assets, Rs. Billion | 16040 | 12030 (75) | 2780 (17.3) | 1230 (7.7) |
| Net Profit, Rs. Billion | 116 | 83.3 (75.7) | 17.8 (10.7) | 14.9 (13.6) |
| Average return on Assets (NP/TA) | -- | 0.72 | 0.65 | 1.32 |
| NNPA/TA | -- | 2.42 | 2.49 | 0.79 |
| Business per employee, Rs. M | -- | 19.2 | 39.7 | 81.5 |

Table 3. Summary performance data for scheduled banks, 1991

| | All Schedule Banks (excluding RRB) | Public Sector banks | Private Sector Banks | Foreign banks |
|---|---|---|---|---|
| Number of Commercial Banks | 79 | 32 | 23 | 24 |
| Number of Branches | 47021 | 42932 | 3939 | 150 |
| Total Deposits, Rs. Billion | 1957 | 1756 (89.7) | 87.3 (4.5) | 113.7 (5.8) |
| Total loans and Advances, Rs. Billion | 1204 | 1061.1 (88.1) | 49.7 (4.1) | 93.6 (7.8) |
| Total assets, Rs. Billion | 3120 | NA | NA | NA |
| Net Profit, Rs. Billion | 12.16 | NA | NA | NA |
| Average return on Assets (NP/TA) | 0.39 | 0.32 | 0.57 | 1.57 |
| NNPA/TA | NA | NA | NA | NA |
| Business per employee, Rs. M | NA | NA | NA | NA |

Notes:

1. Scheduled banks include Regional Rural Banks (RRB). However, they are not included here since they number almost 70 percent of all scheduled banks but have less than 2 percent of deposits of all scheduled banks.
2. Figures in brackets indicate percentage of the total.
3. NA = not available.

(Source: Reserve Bank of India (www.rbi.org.in) and Indian Bank Association (www.iba.org.in))

both, static and dynamic in nature: a measure of, both, the change in technology over time, and optimal use of resources, for the best available technology, at a given time. Moreover, if the objective of the firm is to maximize profits, the productivity measured as ratio of physical units may not be the best criterion. Hence, in addition to conventional measure of productivity, a "monetized value of productivity" may be a better performance measure.

Productivity of a firm is thus derived from the efficiency of the firm in using optimal technology from a set of available technologies (production function), optimal set of inputs given input prices (cost function), optimal conversion of a given set of inputs for a given technology into an optimal set of outputs (production function), shifts in the production function (technology changes) and changes in the scale of operations (scale and scope). Concepts of efficiency relate to how well a firm employs its resources relative to the existing production possibilities frontier (or, in other words, relative to current 'best practice') – how an institution simultaneously minimizes costs and maximizes revenue, based on an existing level of production technology. The analysis of a firm efficiency, therefore, relies on intra-sector comparisons, involves both technological and relative pricing aspects, and has partial indicator value for analyzing productivity performance.

## 3. MEASUREMENT OF EFFICIENCY OF A FIRM USING NON-PARAMETRIC APPROACH

There are two approaches for determining efficiency of a firm: Parametric (econometric) and non-parametric (or, based on mathematical programming). These methods differ in several important ways. The parametric approach is based on the underlying relationship between the parameter under study and various observed independent variables. It therefore requires a specific pre-specified function form of the production or cost function.

Non-parametric approach is based on the optimizing behavior of the firms under study. It is based on the concept of efficiency similar to one in the parametric approach but differs from it since this approach does not require any pre-specified function. It takes the data of the actual operations of the firms under study and frontier is formed as the piecewise linear combination of the "most efficient observations." Thus, efficiency so determined is relative to the "observed best", rather than an absolute value.

### 3.1 The data envelopment analysis (DEA) models

A major such non-parametric method is Data Envelopment Analysis (DEA). DEA is a non-parametric mathematical programming approach to determine efficiency of different firms in an industry. DEA model was first proposed by Charnes et al. (1978) based on earlier work initiated by Farell (1957). It was later extended by Banker et al. (1984).

In a standard non-parametric approach, for determining efficiency of a firm, firms under the study are called decision-making units (DMUs). A typical firm may use many inputs and produce several outputs. A single virtual input and single virtual output are calculated and ratio of virtual output to virtual input is defined as a relative measure of efficiency. If it is a CRS technology, the measure of inefficiency includes both technical inefficiency and scale inefficiency. They are not separately determined (and cannot be separately determined).

DEA assigns weights, different for different firm, to

each input and output such that a firm maximizes efficiency relative to others. Based on the optimization, DEA constructs a piecewise efficient frontier. All the firms fall on the frontier or below the frontier. The distance from the frontier denotes inefficiency of the firm. The efficiency scores lie between zero and one. The most efficient unit has score of one. There could be more than one firm on the efficiency frontier.

Since, the efficiency scores are not absolute, and are in relation to other firms, the most efficient firm may be inefficient if the domain changes. Hence, larger the domain, covering more diverse conditions could result in a different efficient frontier, and could result in a better analysis.

### 3.1.1 CCR model in fractional programming form

Assume that there are $n$ DMUs to be evaluated. Each consumes different amounts of inputs and produces $r$ different outputs, i.e. DMU$_j$ consumes $x_{ij}$ amounts of input to produce $y_{jr}$ amounts of output. It is assumed that these inputs, $x_{ij}$, and outputs, $y_{jr}$, are non-negative, and each DMU has at least one positive input and output value.

The CCR model aims to maximize the ratio of weighted outputs for given weighted inputs of the bank under the study. The objective function, defined by $h_j$, for $j$th bank, is maximized subject to the constraint that any other bank in the sample cannot exceed unit efficiency by using the same weights.

Hence, the objective function is,

$$\text{Max } h_j = \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \tag{1}$$

$$\text{subject to (a.) } \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \le 1$$

$$\text{(b.) } u_r, v_i \ge 0$$

where

$r$ = $r$th output, $r = 1, ..., s$;
$i$ = $i$th input, $i = 1, ..., m$;
$j$ = $j$th bank, $j = 1, ..., n$;
$h_j$ = objective measure of efficiency for $j$th bank;
$j$ = a specific bank to be evaluated;
$y_{rj}$ = the amount of output $r$ from bank $j$;
$x_{ij}$ = the amount of input $i$ to bank $j$;
$u_r$ = weight chosen for output $r$;
$v_i$ = weight chosen for input $i$;
$n$ = the number of banks;
$s$ = the number of outputs;
$m$ = the number of inputs.

It is important to note that the unknown weights $u_r$ and $v_i$, are obtained through optimization. For each bank, optimization is performed separately in order to compute the weights and the efficiency measure $h_j$. Thus, the weights are such as to give maximum efficiency of a bank relative to other banks.

### 3.1.2 The CCR model in form of restricted linear program

The above problem in Section 3.1.1 is a fractional program and it can be converted into a linear program (LP) form by restricting the denominator of the objective function $h_j$ to unity, and adding this as a constraint to the problem. The LP version of the fractional setting is shown in model (2).

$$\text{Max } h_j = \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \tag{2}$$

$$\text{subject to (a.) } \sum_{i=1}^{m} v_i x_{ij} = 1$$

$$\text{(b.) } \sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0$$

$$\text{(c.) } u_r, v_i \ge 0$$

$r = 1, ..., s$, $i = 1, ..., m$ and $j = 1, ..., n$

The solution for the above LP gives $h_j$ for bank $j$, which is the efficiency score, $0 \le h_j \le 1$. The maximizing LP, used here, assumes constant returns to scale technologies.

## 4. CONCEPTUAL ISSUES IN PRODUCTIVITY AND EFFICIENCY STUDIES FOR BANKING INDUSTRY USING NON-PARAMETRIC METHODS

Banks, like any other production unit, can be represented by a production function, $Y = f(X)$, where, $Y$ = Vector of outputs and $X$ = Vector of inputs. Normally, and in competitive markets, all firms would operate optimally and on efficiency frontier. However, in reality, banks may operate inefficiently due to policy, due to inadequate capital or other factors such as managerial inefficiency, poor and inadequate information, etc.

### 4.1 Definition and measurement of inputs and outputs for banking industry

Unlike the manufacturing industry, inputs and outputs are not well defined in a service industry. Service is produced using certain inputs and technology, and has an associated production function. Thus, one approach, in banking industry, is Production approach for measuring inputs and outputs. Philosophically it is based on real resource model. In this approach banks are assumed to use physical inputs to produce outputs like deposits and loans. In this approach, inputs are number of employees, average number of employees per branch, capital employed, number of branches, number of deposit accounts, etc. The

outputs are number of loanee accounts, number of transactions, number of deposit accounts, etc. (Some researchers take deposit accounts as inputs, others take them as outputs.)

Many researchers take a different approach, an Intermediation Approach, also called as an Asset Approach. It is based on activity model. A typical bank borrows money in form of a deposit and lends it in form of a loan. This is the primary function of a bank. Thus banks act as intermediaries between owners of funds and users of funds. The contribution of physical inputs to value addition is minimal. Hence, in this approach, unlike production approach, inputs and outputs are considered in monetary values. Typically, inputs are monetary value of inputs such as labour, capital and funds. Thus interest cost, labour cost, other operating costs are considered inputs. The outputs are the monetary value of earning assets such as value of advances, value of deposits, investments, gross income, etc.

Both approaches have their limitations. Major problem is how to aggregate output (input) in a single index. Also, whatever be the method, cross comparison with other banks is not easy. In either approach, there is no unanimity on what exactly should be the inputs and the outputs. In intermediation approach, the choice of inputs and outputs is arbitrary. Whether deposits are inputs or outputs is not clear and different authors have used deposits as either inputs or outputs. Some consider labour cost as a separate input; others take operating cost and interest cost alone as inputs. On the output side fee-based income may or may not be considered as separate output. The intermediation approach ignores other services provided by the banks, e.g., withdrawal facility to deposit holders. Banks also have other assets differentiated by liquidity and risk. Similarly, in production approach, number of bank branches may or may not be taken as input. In the production approach, there is no clarity on how to account for, say, foreign deposits and government securities.

In this paper, we have adopted the intermediation approach. Data on physical units are not easily available whereas the monetary values of inputs and outputs may be deduced from annual account statements. Also, we believe that the monetary values rather than physical units better capture the transformation and value addition by banks.

### 4.2 Technology in banking industry

Specification of what type of technology a bank operates with is important in constructing an efficiency frontier. Bank may operate with constant returns to scale (CRS) technology, variable returns to scale (VRS) technology or even increasing returns to scale (IRS) technology.

Charnes et al. (1978), who first used DEA, assumed CRS technology. Banker et al. (1984) were the first to assume VRS technology. CRS can be used if all the units are operating optimally and there is no scale inefficiency.

However, if the industry is not competitive then different units may operate at different optimality. Then assumption of VRS may be more appropriate. In CRS approach, conical hull envelops all data points whereas in VRS approach convex hull envelops all data points.

Figure 1 explains the two different approaches. In CRS technology, for any given input, $x_i$, output, $y_i$, lies on or below *o-b-c*, which constitutes an efficiency frontier. Any input-output combination, $(x_i, y_i)$ lying on line *obc* represents an efficient operation. All combinations, $(x_j, y_j)$ lying below *obc* represent inefficient operation. Similarly, if the technology is VRS, curve *f-a-b-d-e* constitutes an efficient frontier. All input-output combinations, $(x_i, y_i)$ lie on or below *f-a-b-d-e*. $b(x_b, y_b)$ is the efficient outcome.

In our case, we assume that the Indian banking industry, with a large number of firms is competitive in nature. Hence we have assumed constant returns to scale technology in banking industry.

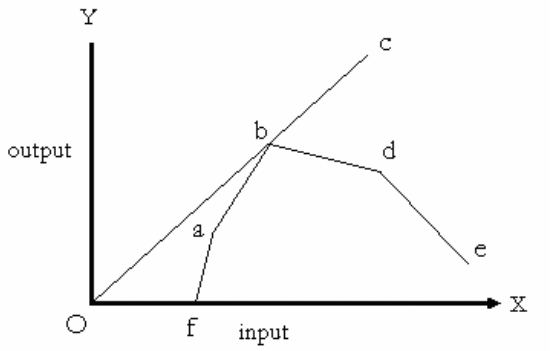

Figure 1.

## 5. LITERATURE REVIEW OF STUDIES ON EFFICIENCY OF BANKS

Many researchers using different methods have analyzed the performance of the banking sector. The standard method of comparing financial parameters and financial ratios has its limitations, as it fails to capture long-term trends and also does not identify the determinants. Comparisons based on the cost, allocative, and technical efficiency, using various techniques, has attracted the attention of several researchers, particularly in the USA.

### 5.1 Research studies on efficiency of banks in global context

Several studies have analyzed the performance of the banking industry in developed and other countries. Both the parametric models (e.g., stochastic frontier, free disposal hull) and non-parametric approach (e.g., DEA) have been used extensively. Berger et al. (1993) and Berger and Humphrey (1997) review the empirical studies of efficiency of banking industry in the world.

Few studies have been using censored regression techniques, e.g., TOBIT, to determine and analyze the determinants of efficiency of industries, including banking. Of particular interest is application of the two-stage procedure, DEA and TOBIT. Some of the reported studies are by Jackson and Fethi (2000) on Turkish banks, Casu and Molyneux (2003) on European Banks, Mackay

(2003) on financial structure, Luoma et al. (1996) and Chilingerian (1995) on health sector applications, Viitala and Hanninen (1998) on the public forestry organizations.

Jackson and Fethi study on Turkish banks found that the profitable banks are more likely to operate at higher levels of technical efficiency and the capital adequacy ratio has a statistically significant adverse impact on the performance of banks. Casu and Molyneux study concluded that debt equity ratio had no effect on efficiency; more profitable banks were more efficient, listed banks were more efficient than non-listed banks and commercial banks were more efficient than cooperative banks.

### 5.2 Literature review of productivity and efficiency of banks in indian context

Efficiency of the banking sector has been a major concern especially since 1970s. Though relatively few in numbers, there have been efficiency studies, especially of the public sector banks in India. These studies can broadly be classified in three groups: (i) Studies based on comparison of financial and operational performance, (ii) studies that have compared and ranked banks on the basis of efficiency determined using techniques like factor analysis, and (iii) more recent studies that use parametric or non-parametric techniques. .

Most of the earlier studies are based on the comparison of the financial and operational performance. The pioneering studies on analyzing the performance of the Indian banks, and comparison among them, are Rangrajan and Mempilly (1972) and Thyagrajan (1975). Later Angadi (1983) used data on operating costs and output (measured in terms of total deposits and deposit accounts and total credit and credit accounts) to construct and determine operational efficiency. Angadi (1987) ranked twenty-eight public sector banks by accounting and economic profits. Subrahmanyam (1993) studied the productivity growth of Indian public sector banks for the period 1970 to 1989. Swami and Subrahmanyam (1993) combined certain items of income and expenditure to construct an index of performance of banks. Chatterji (1997) examined the scale economies in Indian banks. Sathye (2005) used financial ratios to study the effect of privatization on the performance and efficiency of banks. Efficiency is defined in terms of net profit per employee and deposit and loans per employee. The study concluded that the financial performance of partially privatized banks were significantly better than that of the fully public sector banks. There was no significant difference in performance of partially privatized banks and fully private banks.

After 1975, there was a trend to study the efficiency of banks through a construct, using factor analysis. In 1977, the Reserve Bank of India set up a committee to study the efficiency, productivity and profitability of the nationalized banks. This, popularly known as Luther Committee, has studied the performance of the nationalized banks for the period 1969-1975. The study measured operational efficiency using defined efficiency indicators. Divatia and Venkatachalam (1978) used factor analysis to construct a composite index of efficiency and productivity for fifteen major public sector banks. Hansda and Venkatachalam (1995) used principal component analysis to construct a composite index of performance of twenty eight public sector banks. Sarkar and Das (1997) developed a composite index of bank efficiency using principal component analysis. The study examines the interbank difference in the productivity and profitability for 73 major banks (public, private and foreign) for the year 1994-95.

Probably the first published study on efficiency of Indian banks using parametric approach was Keshari and Paul (1994). They applied frontier approach to one year cross sectional data to determine the technical efficiency of foreign and domestic banks. Sum total of advances plus deposits was taken as a measure of output, and labour, capital and materials as inputs. Their conclusion was that the efficiency of foreign banks was slightly lower than that of domestic banks.

De (2004) used an econometric approach to determine the technical efficiency of the Indian banks, relationship between ownership and efficiency and impact of reforms on efficiency. Panel data for the years 1985 to 1995-96 were used in a stochastic frontier production function. Two alternative measures of output (gross income and total earning assets) and four inputs (sum of deposits and borrowings, fixed capital, number of officers and number of other employees) were used for a Cobb-Douglas technology. The study concluded that the efficiency did not improve after liberalization, and the foreign banks, as a group, had the highest efficiency.

Kumbhakar and Sarkar (2003) and Kumbhakar and Sarkar (2004) used the parametric method to evaluate the efficiency of the Indian banking system using panel data for the period 1986-2000. Postulating a cost function and using stochastic cost frontier, they determined the changes in efficiency over time. Using dummy variables, they also found contribution of reforms and role of ownership to the change in efficiency. They found the Indian banking system to be cost inefficient but the tendency for inefficiency to decline over time. They found the private sector banks to be more cost efficient than public sector banks. The deregulation resulted in increase in inefficiency and there was no significant difference in impact of deregulation on private sector banks and public sector banks.

One of the first published studies using non-parametric production frontier approach was Noulas and Ketkar (1996). Using intermediation approach with three inputs and two outputs, they determined the technical and scale efficiency of public sector banks for 1993. They found average technical inefficiency of 3.75 percent, of which two thirds was due to scale inefficiency. Hence they concluded that efficiency of banks in India could increase by increasing the scale.

Bhattacharya et al. (1997) examined the efficiency of Indian banks using a two step procedure, DEA technique to determine the technical efficiency and then applying stochastic frontier approach to explain variation in calculated efficiency. They applied intermediation approach

using two inputs (interest expense and operating expense) and three outputs (deposits, advances and investments) on five-year data of 70 banks, for the period 1986-1991. They constructed one grand frontier on the entire data set for DEA analysis and found that the public sector banks were more efficient than foreign banks, which in turn were marginally more efficient than private sector banks. The average efficiency of the sector as a whole was found to be 80.35 percent, ranging from an average of 75.37 percent for private sector banks and 87.40 percent for public sector banks. They also found that 78 percent of banks operated with decreasing returns to scale while 16 percent showed increasing returns to scale. For the second stage, regression analysis, they used a set of variable to account for time, ownership and regulatory policy. They concluded that public sector bank efficiency declined over time whereas that of foreign sector banks improved over time. The performance of private sector banks remained almost unchanged.

Das (1997) has studied technical, allocative and scale efficiency of different public sector banks for the period 1990-96 using non-parametric DEA approach. He used the intermediation approach with two inputs-labour and loanable funds – and one output measures. The efficiencies were calculated for each year for all the banks. The study found decline in overall efficiency over time, decline in technical efficiency with slight improvement in allocative efficiency. Thus, change in inefficiency was due to technical inefficiency rather allocative inefficiency. The State bank was found to be more efficient than other public sector banks.

Saha and Ravishankar (2000) have analyzed the performance of Indian banks using DEA approach. They have analyzed performance of 25 public sector banks over a period 1992-1995. The analysis is done in two stages. In the first stage, efficiency is measured as a ratio of certain output to input. Number of branches, number of employees, establishment expenses and non-establishment expenses were taken as inputs. Deposits, advances, investments, spread, total income, interest income, non-interest income and working funds were taken as measures of outputs. The ratios were plotted and extreme points were joined to form linear efficiency frontier. In the second stage, DEA was used on the same data to determine the efficiency frontier. They concluded that DEA is useful technique in determining relative efficiency. Their findings indicated that efficiency of public sector banks improved over the time period.

Sathye (2003) has measured the productive efficiency of 94 banks in India, including public sector and private sector banks and foreign banks, assuming VRS technology, applying DEA. The efficiency is calculated for 1996-97. In one model, he used interest expense and non-interest expense as inputs and interest income and non-interest income as outputs. A second DEA analysis was also run using deposits and staff members as inputs and loans and non-interest income as outputs. The study found that the average efficiency score of 0.83, and that the public sector banks were on average more efficient than foreign banks, which in turn were more efficient than private banks.

Ram Mohan and Ray (2003) have studied productivity and efficiency of public and private sector banks in India, using non-parametric DEA, for the period 1992-2000. They studied 27 public sector banks, 21 old private sector banks and 14 foreign banks. They employed three measures: Tornquist total factor productivity growth, Malmquist efficiency index and revenue maximization efficiency. They assumed CRS technology and used intermediation approach with interest cost and operating cost as inputs and loan income, investment income and non-interest income as outputs. They found public sector banks to be more efficient and productive compared to their private sector competitors.

Our present study evaluates the performance in the more recent period. It examines the productive efficiency on a cross sectional data over several years. Since we are trying to compare different groups of banks, we believe that the efficiency scores need to be weighted by the asset size. This study also extends the focus of the past studies by establishing the determinants of productive efficiency through TOBIT model.

## 6. METHODOLOGY

This research uses Data Envelopment Analysis (DEA) model for measuring efficiency scores, followed by second step of TOBIT regression. The analysis covers all scheduled public sector and Indian private sector banks. The foreign banks, which constitute almost 37 percent of all scheduled banks in India, have less than 5 percent of total deposits. Their Indian operations are small compared to their worldwide operations. Since they operate in urban areas and for selected clients, their operations are not strictly comparable to that of other Indian banks. Since their inclusions in this study could vitiate the results, they are not included.

### 6.1 DEA analysis for efficiency ranking

The first step is the determination of the efficiency score for each bank. The data for inputs and outputs of 57 banks (56 banks for 2003, since data for one bank was not available), for four years, 1999-2003, were compiled. DEA was applied to this data to establish efficiency score for each bank. The scores were then modified by the respective asset weights to arrive at the asset weighted efficiency score.

#### 6.1.1 The selection of indicative variables

For using the DEA approach, it is necessary to be clear about what we should regard as outputs and inputs. There is no consensus on what best measures the inputs and outputs for a bank. We have selected Interest Expenses and Operating Expenses as two input variables and Interest Income, Fee based Income (commission, brokerage etc.) and Investment Income as three output variables.

### 6.2 Determinants of efficiency score

The major limitation of DEA approach is its inability to draw statistical inference. This is taken care by a two-step procedure. In the second step, determinants of the efficiency scores are found through regression analysis. A regression analysis is performed on the efficiency scores determined in the first DEA step. Efficiency scores are regressed on several "environmental" factors. Since the data could be truncated, TOBIT model may be used. If the factor is found to be significant, its sign can indicate the direction of influence on the efficiency score.

#### 6.2.1 Tobit model

The standard Tobit model can be defined as follows for observation (bank) *i*:

$$y_i^* = \beta' x_i + \varepsilon_i$$
$$y_i = y_i^* \quad \text{if } y_i^* > 0 \text{ and}$$
$$y_i = 0 \quad \text{otherwise}$$

where $\varepsilon_i \sim N(0, \sigma^2)$, $\beta$ and $x_i$ are vectors of explanatory variables and unknown parameters respectively. The $y_i^*$ is a latent variable and $y_i$ is the DEA score. The likelihood function ($L$) is maximized to solve $\beta$ and based on 57 observations (banks) of $x_i$ and $y_i$ as

$$L = \prod_{y_i=0} (1 - F_i) \prod_{y>0} \frac{1}{\sqrt{2\pi\sigma^2}} \times e^{-\frac{1}{2}\frac{(y_i - \beta x_i)^2}{\sigma^2}} \qquad (3)$$

where

$$F_i = \int_{-\infty}^{\frac{\beta x_i}{\sigma}} \frac{1}{\sqrt{2\pi}} e^{-\frac{t^2}{2}} dt$$

The first product is over the observations for which the banks are 100% efficient ($y = 0$) and the second product is over the observations for which banks are inefficient ($y > 0$). $F_i$ is the distribution function of the standard normal evaluated at $\beta' x_i / \sigma$.

#### 6.2.2 Selection of determinants of the efficiency measure

The TOBIT model is applied using five independent variables, profitability, productivity, size, regulatory measures and asset quality.

The following are the variables used for Tobit analysis:

- Productivity: Business Per Employee (BPE)
- Regulatory: Capital Adequacy Ratio (CAR)
- Asset Quality: Net NPA per Net Advances (NNPANAD)
- Profitability: Operating Profit per Total Assets
- Size: Total Asset of the Bank (TA)

Hence, efficiency score of bank $j = h_j = f(\text{BPE}_j, \text{CAR}_j, \text{NNPANAD}_j, \text{OPTA}_j, \text{TA}_j)$ where,

| | | |
|---|---|---|
| $\text{BPE}_j$ | = | Business per employee for bank *j* |
| $\text{CAR}_j$ | = | Capital adequacy ratio for bank *j* |
| $\text{NNPANAD}_j$ | = | Net NPA per net advances for bank *j* |
| $\text{OPTA}_j$ | = | Operating profit to total assets for bank *j* |
| $\text{TA}_j$ | = | Total assets of bank *j* |
| $\varepsilon_j$ | = | A stochastic error term. |

The regression analysis uses cross sectional data. The analysis is repeated for all the five years.

### 6.3 Data sample

This paper is based on a study of 57 banks in India. These are grouped as:

a. State Bank and its 7 subsidiaries (8)
b. Other Public Sector Banks (19)
c. Old and New Private Banks (30)

The data, for the years 1999-2003, have been compiled from the published annual reports of individual banks, various publications of RBI, and from the web site www.rbi.org.in.

## 7. THE RESULTS AND ANALYSIS

### 7.1 Productive efficiency measures

The efficiency scores of banks, as determined by DEA analysis, for five years, are given in Annexures 1 and 2. The summary statistics are given in Table 4.

The average efficiency of all banks has increased by about 2.4% in the last five years. However, the asset-weighted efficiency has remained static over the same years. This indicates that the efficiency increase has come from smaller banks and large banks have not necessarily become more efficient, since the sample remains more or less unchanged.

The State bank group is, contrary to popular belief, most efficient in all the years, followed by the private banks. The other nationalized banks are, relatively, the least efficient. On an average the State bank group is 2.5% more efficient than private banks and private banks are 5.0% more efficient than the other nationalized banks. But the differences were 6% and 3% respectively in 1999. This indicates that the private sector banks have, despite being small in size, managed to reduce the efficiency gap vis-à-vis the State Bank group.

The average efficiency has increased for the nationalized banks (other than State Bank group) in general, but the increase is more for the private banks. Since the measure is relative, indications are that the gap between the nationalized banks and private banks has widened. Since the average score of the nationalized banks has not significantly changed, the efficiency gains are from the private sector banks.

Table 4. Summary statistics of efficiency scores

| | Period | | | | | Avg. of 5 yrs. |
|---|---|---|---|---|---|---|
| | 1999 | 2000 | 2001 | 2002 | 2003 | |
| Average Efficiency Score ($\mu$) | 0.901 | 0.886 | 0.914 | 0.905 | 0.925 | 0.906 |
| Maximum Efficiency Score | 1 | 1 | 1 | 1 | 1 | 1 |
| Minimum Efficiency Score | 0.692 | 0.717 | 0.761 | 0.717 | 0.698 | 0.717 |
| Std. deviation ($\sigma$) of Efficiency | 0.074 | 0.075 | 0.068 | 0.070 | 0.071 | 0.072 |
| Average Inefficiency ($(1-\mu)/\mu$) | 0.109 | 0.129 | 0.094 | 0.105 | 0.081 | 0.104 |
| No. of banks in $\mu+\sigma$ | 35 | 34 | 30 | 37 | 34 | 34 |
| % of banks in $\mu+\sigma$ | 61.40 | 59.65 | 52.63 | 64.91 | 60.71 | 59.86 |
| Asset Weighted Efficiency Score | 0.904 | 0.853 | 0.885 | 0.897 | 0.904 | 0.879 |
| Avg. Efficiency Score- State Banks | 0.965 | 0.917 | 0.939 | 0.955 | 0.949 | 0.945 |
| Avg. Efficiency Score- Other Nationalized Banks | 0.873 | 0.832 | 0.873 | 0.863 | 0.903 | 0.869 |
| Avg. Efficiency Score- Private Banks | 0.903 | 0.912 | 0.934 | 0.918 | 0.934 | 0.920 |

Note:

1. Rounded up to three decimal points.

Table 5. The determinants of productive efficiency: tobit analysis

| | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|
| | Estimate (t stat) | Estimate (t stat) | Estimate (t stat) | Estimate (t stat) | Estimate (t stat) |
| Intercept | 0.747 (29.409) | 0.713 (16.129) | 0.730 (22.268) | 0.668 (26.188) | 0.714 (16.988) |
| OPTA | 0.087 (7.107) | 0.045 (4.576) | 0.077 (7.433) | 0.074 (9.449) | 0.084 (5.894) |
| BPE | 0.00 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) |
| CAR | 0.001 (0.545) | 0.008 (2.533) | 0.005 (2.300) | 0.005 (3.059) | 0.001 (0.323) |
| NNPANAD | 0.001 (0.563) | –0.001 (–0.545) | 0.00 (0.00) | 0.000 (–0.091) | –0.002 (–0.783) |
| ASSETS | 0.00 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) |
| SCALE | 0.041 | 0.047 | 0.042 | 0.038 | 0.049 |

In general, the variance in the output efficiency of Indian banks is lower than the variance in the operational efficiency of these banks (Angadi (1983)). This is an indication that allocative efficiency and technical efficiency of nationalized banks is much poorer than that in the private banks.

### 7.2 The determinants of productive efficiency

The results of the Tobit analysis are indicated in Table 5. These are based on censored data. The dependent variable is efficiency score.

## 8. CONCLUSIONS

Our study shows that the productive efficiency of the Indian banks has increased in the last five years, in the sense that the average efficiency scores have risen (0.901 to 0.925). However, the rise is not consistent and shows large deviation form year to year. Besides, asset weighted efficiency scores have not changed. Thus, the increase in efficiency has come from smaller private banks. As the individual banks scores show, UTI Bank, HDFC Bank and IndusInd Bank have been among the most efficient banks. Equally there are several inefficient private banks, which reduce the average score of private banks compared to the State Bank group.

The number of banks, which are poor performing, has remained almost unchanged at about 20% (efficiency score below 1 SD). The most inefficient bank is about 30% less efficient. This is an indication that restructuring of the banking sector is desirable.

State Bank of Indore and Jammu and Kashmir Bank have consistently been most efficient. UTI Bank, IndusInd Bank and HDFC bank have been almost efficient (4 out of 5 years). Indian Bank has shown most and consistent increase in efficiency over the five years (0.6924 to 0.8444). The Global Trust Bank has shown serial decline in its performance. It was most efficient in 1999 and became second least efficient bank in 2003, indicating serious operational problems. Number of banks on efficiency frontier has been 10, 9, 11, 10 and 13 respectively from 1999 to 2003. The non-SBI group nationalized banks, as a group, have not improved their efficiency level over the period of study.

The most important parameter for the output efficiency is the Operating Profit per Total Asset (OPTA) followed by the Capital Adequacy Ratio (CAR). Other factors do not appear to be significant. Operating profit to total assets has a positive and significant effect on efficiency. The coefficient is about 0.08. That is, every 1 percent increase in OPTA improves efficiency score by 0.08.

Assets size has no significant influence. Thus, bank efficiency is independent of the size of the bank. Thus, a bank does not appear to have benefits of economies scale or, in Indian industry, this advantage, if any, seems to be nullified. Similarly, level of NPA or business per employee has no effect on the productivity. Thus, banks with larger business per employee seem to have larger costs per employee.

The results of the analysis on capital adequacy ratio (CAR) are interesting. CAR was not significant in 1999 and was not found to be significant in 2003. However, in the intervening period, CAR has a positive and significant effect on efficiency. Since average CAR has gone up, this result indicates that effect of CAR is decreasing with increasing value. It appears that there is an optimal CAR beyond which it does not have significant effect on efficiency. This result is in line with Doshit et al. (2003).

The study finds that profitable banks are more productively efficient. A significant increase in CAR in the last 2-3 years has resulted in higher productive efficiency. Thus for given inputs, a higher capital, or, a reduced debt component, has a significant impact on the output. Berger et al. (1993) have shown that higher CAR results in better risk management and lower risk, and results in higher earnings. Hence, higher CAR as a policy objective is justified. But capital adequacy ratio seems to have reached a level where it does not influence the efficiency. The gains from CAR are already realized.

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## APPENDIX

**Annexure-1**

| | DEA-Efficiency Score | | | | | |
|---|---|---|---|---|---|---|
| Year | 1999 | 2000 | 2001 | 2002 | 2003 | Average |
| | State Bank of India and Its Subsidiaries | | | | | |
| State Bank of Bikaner and Jaipur | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.8613 | 0.9723 |
| State Bank of Hyderabad | 0.9792 | 0.9242 | 0.9649 | 1.0000 | 1.0000 | 0.9737 |
| State Bank of India | 0.9307 | 0.8382 | 0.8520 | 0.9219 | 0.9585 | 0.9003 |
| State Bank of Indore | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| State Bank of Mysore | 0.9380 | 0.8938 | 0.9216 | 0.9049 | 0.9486 | 0.9214 |
| State Bank of Patiala | 0.9755 | 0.9661 | 1.0000 | 1.0000 | 1.0000 | 0.9883 |
| State Bank of Saurashtra | 0.9664 | 0.8717 | 0.8911 | 0.9077 | 0.9284 | 0.9130 |
| State Bank of Travancore | 0.9285 | 0.8396 | 0.8797 | 0.9045 | 0.8949 | 0.8894 |
| | Nationalized Banks (Other than State Bank Group) | | | | | |
| Allahabad Bank | 0.8758 | 0.8272 | 0.8572 | 0.8445 | 0.9076 | 0.8624 |
| Andhra Bank | 0.8880 | 0.8775 | 0.8826 | 0.8834 | 0.9489 | 0.8961 |
| Bank of Baroda | 0.9078 | 0.8945 | 0.8796 | 0.8555 | 0.8681 | 0.8811 |
| Bank of India | 0.8757 | 0.7980 | 0.8586 | 0.8570 | 0.9106 | 0.8600 |
| Bank of Maharashtra | 0.9333 | 0.8447 | 0.9055 | 0.8691 | 0.8555 | 0.8816 |
| Canara Bank | 0.9111 | 0.8329 | 0.9036 | 0.8602 | 0.8567 | 0.8729 |
| Central Bank of India | 0.8900 | 0.8275 | 0.8772 | 0.8435 | 0.8828 | 0.8642 |
| Corporation Bank | 0.9582 | 0.9541 | 0.9653 | 1.0000 | 0.9562 | 0.9668 |
| Dena Bank | 0.8704 | 0.8333 | 0.7795 | 0.8321 | 0.8701 | 0.8371 |
| Indian Bank | 0.6924 | 0.7177 | 0.7613 | 0.7627 | 0.8744 | 0.7557 |
| Indian Overseas Bank | 0.8075 | 0.7885 | 0.8346 | 0.8362 | 0.8507 | 0.8235 |
| Oriental Bank of Commerce | 0.9488 | 0.9791 | 0.9555 | 0.9992 | 1.0000 | 0.9765 |
| Punjab & Sind Bank | 0.8219 | 0.7847 | 0.8682 | 0.7878 | 0.8568 | 0.8239 |
| Punjab National Bank | 0.9627 | 0.8311 | 0.9093 | 0.8681 | 0.9586 | 0.9057 |
| Syndicate Bank | 0.8825 | 0.8323 | 0.9244 | 0.9149 | 0.9721 | 0.9054 |
| UCO Bank | 0.8580 | 0.7980 | 0.8314 | 0.8364 | 0.8539 | 0.8355 |
| Union Bank of India | 0.8013 | 0.8007 | 0.8738 | 0.8991 | 0.8946 | 0.8539 |
| United Bank of India | 0.8191 | 0.7788 | 0.8344 | 0.8479 | 0.9050 | 0.8370 |
| Vijaya Bank | 0.8848 | 0.8145 | 0.8431 | 0.8405 | 0.9575 | 0.8681 |
| | Private Indian Banks | | | | | |
| Bank of Punjab | 1.0000 | 0.8552 | 0.8838 | 0.8437 | 0.9750 | 0.9116 |
| Bank of Rajasthan | 0.7407 | 0.7462 | 0.8436 | 0.8276 | 1.0000 | 0.8316 |
| Bharat Overseas Bank | 0.8360 | 0.8395 | 1.0000 | 0.9262 | 0.8737 | 0.8951 |
| Catholic Syrian Bank | 0.7681 | 0.8085 | 9.9303 | 0.9024 | 1.0000 | 0.8819 |
| Centurion Bank | 0.8143 | 0.8797 | 1.0000 | 0.7173 | 0.7948 | 0.8412 |

**Annexure-1 (contd.)**

| DEA-Efficiency Score | | | | | | |
|---|---|---|---|---|---|---|
| Year | 1999 | 2000 | 2001 | 2002 | 2003 | Average |
| City Union Bank | 0.9578 | 0.9754 | 0.9958 | 0.9698 | 1.0000 | 0.9798 |
| Development Credit Bank | 0.8182 | 0.8852 | 0.8993 | 0.9212 | 0.7517 | 0.8551 |
| Dhanalakshmi Bank | 0.8604 | 0.8937 | 0.8382 | 0.8962 | 1.0000 | 0.8977 |
| Federal Bank | 0.8990 | 0.8670 | 0.9045 | 0.9365 | 0.9170 | 0.9048 |
| Ganesh Bank of Kurundwad | 0.8189 | 0.8782 | 0.8208 | 0.8306 | 0.8068 | 0.8311 |
| Global Trust Bank | 1.0000 | 0.9198 | 0.8981 | 0.7954 | 0.6989 | 0.8624 |
| HDFC Bank | 1.0000 | 1.0000 | 1.0000 | 0.9594 | 0.9967 | 0.9912 |
| ICICI Bank | 1.0000 | 1.0000 | 0.9335 | 0.9135 | 0.9297 | 0.9553 |
| IDBI Bank | 0.9150 | 0.9621 | 0.8990 | 0.8422 | 0.9227 | 0.9082 |
| IndusInd Bank | 0.9686 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9937 |
| Jammu & Kashmir Bank | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| Karnataka Bank | 0.9206 | 0.8880 | 0.9957 | 0.9927 | 1.0000 | 0.9594 |
| Karur Vysya Bank | 0.9631 | 0.9768 | 1.0000 | 0.9920 | 1.0000 | 0.9864 |
| Lakshmi Vilas Bank | 0.9061 | 0.9297 | 0.9952 | 0.9408 | 0.9379 | 0.9419 |
| Lord Krishna Bank | 0.8613 | 0.8718 | 0.8778 | 1.0000 | 1.0000 | 0.9222 |
| Nainital Bank | 1.0000 | 0.9202 | 0.9513 | 0.9474 | 0.9555 | 0.9549 |
| Nedungadi Bank | 0.8097 | 0.8302 | 0.7677 | 0.8639 | 1.0000 | 0.6543 |
| Ratnakar Bank | 0.8715 | 0.9386 | 0.9951 | 1.0000 | 0.9756 | 0.9562 |
| Sangli Bank | 0.8731 | 0.8765 | 0.8635 | 0.8835 | 0.8557 | 0.8704 |
| SBI Commercial & Intl. Bank | 1.0000 | 1.0000 | 0.9944 | 0.9278 | 0.9313 | 0.9707 |
| South Indian Bank | 0.8327 | 0.8672 | 0.9561 | 0.9138 | 0.9204 | 0.8980 |
| Tamilnad Mercantile Bank | 0.9337 | 0.9169 | 1.0000 | 1.0000 | 0.9926 | 0.9686 |
| United Western Bank | 0.8736 | 1.0000 | 0.8746 | 0.9393 | 0.8592 | 0.9093 |
| UTI Bank | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9875 | 0.9975 |
| Vysya Bank | 0.8496 | 0.8305 | 0.8874 | 0.8507 | 1.0000 | 0.8836 |

**Annexure-2**

| Rank Based on Average Efficiency Scores of Five years | | |
|---|---|---|
| Rank | Average Efficienc | Bank |
| 1 | 1 | State Bank of Indore |
| 2 | 1 | Jammu & Kashmir Bank |
| 3 | 0.997507 | UTI Bank |
| 4 | 0.99372 | IndusInd Bank |
| 5 | 0.991226 | HDFC Bank |
| 6 | 0.988309 | State Bank of Patiala |
| 7 | 0.986366 | Karur Vysya Bank |
| 8 | 0.97976 | City Union Bank |
| 9 | 0.976533 | Oriental Bank of Commerce |
| 10 | 0.973671 | State Bank of Hyderabad |
| 11 | 0.97225 | State Bank of Bikaner and Jaipur |
| 12 | 0.970694 | SBI Commercial & Intl. Bank |
| 13 | 0.968634 | Tamilnad Mercantile Bank |
| 14 | 0.966764 | Corporation Bank |
| 15 | 0.95941 | Karnataka Bank |
| 16 | 0.956167 | Ratnakar Bank |
| 17 | 0.955348 | ICICI Bank |
| 18 | 0.95487 | Nainital Bank |
| 19 | 0.941922 | Lakshmi Vilas Bank |
| 20 | 0.922185 | Lord Krishna Bank |
| 21 | 0.921367 | State Bank of Mysore |
| 22 | 0.913049 | State Bank of Saurashtra |
| 23 | 0.911572 | Bank of Punjab |

**Annexure-2 (contd.)**

| Rank Based on Average Efficiency Scores of Five years | | |
|---|---|---|
| Rank | Average Efficienc | Bank |
| 24 | 0.909326 | United Western Bank |
| 25 | 0.908202 | IDBI Bank |
| 26 | 0.905747 | Punjab National Bank |
| 27 | 0.905439 | Syndicate Bank |
| 28 | 0.90478 | Federal Bank |
| 29 | 0.900274 | State Bank of India |
| 30 | 0.898024 | South Indian Bank |
| 31 | 0.8977 | Dhanalakshmi Bank |
| 32 | 0.89608 | Andhra Bank |
| 33 | 0.895093 | Bharat Overseas Bank |
| 34 | 0.889428 | State Bank of Travancore |
| 35 | 0.883638 | Vysya Bank |
| 36 | 0.881865 | Catholic Syrian Bank |
| 37 | 0.881619 | Bank of Maharashtra |
| 38 | 0.881074 | Bank of Baroda |
| 39 | 0.872884 | Canara Bank |
| 40 | 0.870449 | Sangli Bank |
| 41 | 0.868075 | Vijaya Bank |
| 42 | 0.864187 | Central Bank of India |
| 43 | 0.862437 | Allahabad Bank |
| 44 | 0.862426 | Global Trust Bank |
| 45 | 0.859989 | Bank of India |
| 46 | 0.855104 | Development Credit Bank |
| 47 | 0.853922 | Union Bank of India |
| 48 | 0.8412 | Centurion Bank |
| 49 | 0.837067 | Dena Bank |
| 50 | 0.837032 | United Bank of India |
| 51 | 0.835547 | UCO Bank |
| 52 | 0.83162 | Bank of Rajasthan |
| 53 | 0.831076 | Ganesh Bank of Kurundwad |
| 54 | 0.82386 | Punjab & Sind Bank |
| 55 | 0.823495 | Indian Overseas Bank |
| 56 | 0.755704 | Indian Bank |
| 57 | 0.65431 | Nedungadi Bank |