

Technical Efficiency of Public Sector Banks in India : An Empirical Study

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Abstract

The purpose of the present paper is to analyse the performance of public sector banks in India for the period 2002-03 to 2011-12 with the help of non-parametric frontier approach. The technical efficiency of twenty five (25) public sector banks has been computed using Data Envelopment Analysis (DEA) model and the same has been further decomposed into pure technical efficiency and scale efficiency. The study reveals that on an average, technical efficiency score of the banks has turned out to be 0.963 and majority of the banks have obtained efficiency score within the range of (0.982-0.999). The empirical findings of the study conclude that performance of the public sector banks in respect of optimum utilization of inputs for producing the given level of output has improved over the period. However, the major source of technical inefficiency of public sector banks in India is found to be managerial inabilities in converting inputs into outputs optimally rather than inappropriate size of operation.

Keywords: *Technical Efficiency, Pure Technical Efficiency, Scale Efficiency, Data Envelopment Analysis*

1. INTRODUCTION

The present competitive banking environment, which is characterised by deregulation, entry of more players in the market, technology and diversification etc., is accounted for greater responsibility on the shoulder of bank management. Hence, the need of the hour is to concentrate more on efficient performance rather than only good performance. Otherwise, it will no longer survive in the competitive environment. The efficiency analysis of banks helps to identify two groups of banks, such as, efficient and inefficient banks or strongly efficient and weakly efficient banks. Thus, the study on efficiency analysis carried out on public sector banks in India will help managers and policymakers to determine as well as enhance the level of efficiency. Having this backdrop, the present study proposes to assess the efficiency of public sector banks in India.

However, the scope of the study is confined to assessment of technical efficiency only. Public sector banks are the most important group of financial intermediaries in Indian banking system as they have countrywide network of branches and strong presence in rural and semi-urban areas apart from urban areas. In the Indian banking industry, only this bank group sponsors the Regional Rural Banks and also localizes their activities. Further, it is burdened with social objective of fostering economic growth by providing credit facilities to priority sectors at subsidized cost such as agriculture, small industries, etc.

2. CONCEPT OF TECHNICAL EFFICIENCY

The concept of technical efficiency implies the ability of a firm to produce the existing level of output with the minimum inputs (input oriented) or to produce

maximal output from a given set of inputs (output oriented) (Kumar, 2013). Thus, the input oriented technical efficiency measure addresses the question: "By how much can input quantities be proportionately reduced without altering the output quantities produced" (Sangeeta and Jain, 2013)? In case of output oriented efficiency measure, the question is how much can the production increase while using the same available resources (Bernardes and Pinillos, 2004)?

In the context of banking industry, it can be defined as the ability of a bank to transform multiple resources such as employees, branches, capital, deposits and borrowings etc. into multiple banking products or services such as loans, investments, and fee based services etc. On the other hand, if the bank fails to produce the multiple outputs from their limited available resources and operates below the production frontier, it is considered to be technically inefficient (Sharma, Raina and Singh, 2012). Thus, it measures the potential of a bank in reducing quantities of inputs while producing the existing level of outputs or maximizing the level of output from a given set of inputs. The potential level of performance is given by the frontier which is the locus of best performing firm(s) within the sample (Mahesh, 2006).

Managerial practices and scale or size of operations affect technical efficiency, which is based on engineering relationships but not on prices and costs. Technical efficiency therefore consists of pure technical efficiency and scale efficiency (Baidya and Mitra, 2012). Pure technical efficiency exhibits improvements in productivity solely resulting from managerial and organizational skills at banks leading to efficient use of inputs while scale efficiency represents output elasticity with respect to inputs and provides a measure of bank's returns to scale (Aktar, 2010).

3. REVIEW OF LITERATURE

The importance of estimating efficiency level of financial institutions urge the academicians, economists, bankers and other researchers to conduct studies on several aspects of efficiency. The findings of some studies conducted on technical efficiency of banks are summarised as follows:

Sinha and Chatterjee (2008) concluded that

the public sector banks are less efficient as compared to private sector banks. Keshari and Paul (1994) examined the technical efficiency of Indian scheduled commercial banks and observed the higher amount of variation across foreign banks than the domestic banks. Baidya and Mitra (2012) measured technical efficiency of Indian scheduled commercial banks and found that management inefficiency is the major source of overall technical inefficiency and dominance of banking operation at rural and semi-urban areas is the major contributor of scale inefficiency of the Indian banks. On the other hand, Nandi (2013) and Kumar and Kumar (2012) concluded that scale inefficiency is the main reason of inefficiency. Trehan and Soni (2003) examined relationship between technical efficiency and profitability. The study concluded that profitability significantly influence the technical efficiency in Indian public sector banks. Besides, Gardener, Molyneux and Linh (2011), Ataullah and Le (2006) and Shobhana (2010) identified some other important determinants of bank efficiency, such as, size, capital, bank private credit, regulation, economic growth, inflation, bank ownership, year, return on advance adjusted to cost of fund, ratio of wage bill to total intermediation cost, ratio of intermediation cost to total assets and network of branches, staff strength, level of competition, and previous year efficiency, fiscal deficit, the ratio operating expenses to income, and the ratio of investment to total assets.

4. OBJECTIVES OF THE STUDY

- # To analyze the technical efficiency of public sector banks in India.
- # To analyse the components of technical efficiency of Public Sector Banks in India.

5. DATA AND METHODOLOGY

The present study covers a period of ten years, i.e. from 2002-03 to 2011-12 and the requisite secondary data have been collected from annual reports of the respective banks, Performance Highlights of Public Sector Banks in India published by Indian Banks' Association and Statistical Tables relating to Banks in India published by Reserve Bank of India. Public sector banks have been chosen for the study because these banks possess distinguishing

features of operation and more convergent towards social activities as the larger government stake involved in their existence. The efficiency study has been carried out on twenty five public sector banks operating in India during the study period.

In order to determine efficiency level of the banks Data Envelopment Analysis (DEA) has been employed. It is a mathematical linear programming technique most popularly used in analyzing relative efficiency of Decision Making Units (DMUs). A Decision Making Unit is regarded as the entity responsible for converting inputs into outputs (Ramanathan, 2003). In the present study, DMUs are the Indian public sector banks. DEA measures the degree to which the DMUs under analysis have produced more outputs for its given inputs levels (output orientation) or the degree to which it have used less amount of inputs for its given output levels (input orientation) as compared to the other DMUs in the sample. The 100% efficient DMUs are situated on the best-practice frontier retaining a value of 1 and all others are inefficient relative to them having values between 0 and 1. The orientation in which efficiency is measured affects the results obtained and the selection of orientation is based on whether the management has more control over inputs or output levels. Under the study, it is assumed that bank management has more control over inputs rather than over outputs.

In the present study, two models based on radial measure, namely, CCR model and BCC model have been considered in order to estimate technical efficiency level of the public sector banks in India. The basic difference between CCR and BCC lies on the fact that CCR model is based upon the assumption of constant returns to scale and measures the efficiency called overall technical efficiency, while BCC model is based upon the assumption of variable returns to scale and measures efficiency called pure technical efficiency and scale efficiency.

Let us consider there are n decision making units to be evaluated [(DMUs)_j (j=1, 2,.....,n)]. Each decision making unit consumes ‘m’ different inputs of identical nature for all decision making units [Inputs(x)_{ij} (i=1,2,.....,m)] to produce ‘s’ different outputs of identical nature for all decision making units [Outputs (y)_{rj}(r=1,2,.....,s)]. The technology is defined by the following production possibility set

$$P = \{(x, y) : y \text{ can be produced from } x\}$$

The underlying assumptions are as follows:

- All observed input-output combinations are feasible.
- The production possibility set P is convex.
- Inputs are freely disposable.
- Outputs are freely disposable

(a) **Envelopment Form of CCR Input-Oriented Model**

$$\text{Mini } \theta_{j_0} - \varepsilon \left(\sum_{r=1}^s S_r^+ + \sum_{t=1}^m S_t^- \right)$$

Subject to

$$\sum_{j=1}^n \lambda_j x_{ij} + S_i^- = \theta_{j_0} x_{ij_0} \quad i = 1, 2, \dots \dots m$$

$$\sum_{j=1}^n \lambda_j y_{rj} - S_r^+ = y_{rj_0} \quad r = 1, 2, \dots \dots s$$

$$\lambda_j \geq 0 \quad j = 1, 2, \dots \dots n$$

$$S_r^+ S_i^- \geq 0$$

(b) **Envelopment Form of BCC Input-Oriented Model**

$$\text{Mini } \theta_{j_0} - \varepsilon \left(\sum_{r=1}^s S_r^+ + \sum_{t=1}^m S_t^- \right)$$

Subject to

$$\sum_{j=1}^n \lambda_j x_{ij} + S_i^- = \theta_{j_0} x_{ij_0} \quad i = 1, 2, \dots \dots m$$

$$\sum_{j=1}^n \lambda_j y_{rj} - S_r^+ = y_{rj_0} \quad r = 1, 2, \dots \dots s$$

$$\lambda_j \geq 0 \quad j = 1, 2, \dots \dots n$$

$$\sum_{j=1}^n \lambda_j = 1$$

$$S_r^+ S_i^- \geq 0$$

Where,

θ_{j_0} = Efficiency score of observed DMU being evaluated

x_{ij} = Amount of input *i* utilized by *j*th DMU

y_{rj} = Amount of output *r* produced by *j*th DMU

x_{ij_0} = Amount of input *i* utilized by observed DMU being evaluated

y_{rj_0} = Amount of output *r* produced by observed DMU being evaluated

λ_j = Weights of banks

S_r^+, S_i^- = Slack variables for all inputs and outputs

The selection of input and output variables for efficiency measurement is based on role played by the banks as financial intermediaries in an economy. Thus, present study has followed intermediation approach for the same. Accordingly, labour, physical capital and

loanable funds are considered as input variables, which are assumed to produce output variables, such as, earning assets and non-interest income (used as a proxy of off-balance sheet exposure).

In addition to above, mean, standard deviation, coefficient of variation, rank, quartiles and log linear growth rate have been used for the analysis of efficiency score of the banks.

6. RESULTS AND DISCUSSION

Table 1 shows the comparative values of inputs and outputs for the two extreme periods of the study. In the beginning year, i.e. 2002-03, on an average, the public sector banks possessed total earning assets amounting to ₹ 43011.64 crore and earned total non-interest income of ₹ 830.19 with the employment of 29660 employees (labour), loanable funds of

Table 1: Descriptive Statistics of Variables used

| Variables | 2002-03 | | 2011-12 | |
|----------------------------------|----------|----------|-----------|-----------|
| | Mean | SD | Mean | SD |
| Inputs | | | | |
| Labour (in Nos.) | 29660 | 39743 | 30238 | 40638 |
| Physical Capital (₹ in Crore) | 420.12 | 483.85 | 1411.12 | 1256.8 |
| Loanable Fund (₹ in Crore) | 43312.52 | 58083 | 207994.22 | 227381.04 |
| Outputs | | | | |
| Earning Assets (₹ in Crore) | 43011.64 | 58845.19 | 204722.21 | 227461.1 |
| Non-Interest Income (₹ in Crore) | 830.19 | 1090.97 | 1929.56 | 2785.91 |

Note : Based on relevant data obtained from

- (i) Annual Reports of the respective banks (various issues)
- (ii) Performance Highlights of Public Sector Banks in India published by IBA, Mumbai (various issues)
- (iii) Statistical Tables Relating to Banks in India published by RBI, Mumbai (various issues)

₹ 43312.52 crore and physical capital of ₹ 420.12 crore.

In the last year, i.e. 2011-12, input quantities increased, for example, labour, loanable fund and physical capital increased to 30238 number of employees, ₹ 227381.04 crore and ₹ 1256.8 crore. At the same time, on an average, earning assets and non-interest income increased to ₹ 204722.21 crore and ₹ 1929.56 crore. It is to be noted that, the deviation among the banks increases in line with the expanded value of the variables as indicated by higher standard deviation in the last year as compared to the first year of the study period.

Table 2 reveals descriptive statistics of technical efficiency score of public sector banks in India during 2002-03 to 2011-12. It is found that, in 2002-03, an average public sector bank obtained technical efficiency score of 0.944 with standard deviation of 0.044 which increased to 0.974 with standard

deviation of 0.022 in 2011-12. On the whole, the banks performed worst in 2003-04 which is evident from lowest average technical efficiency score of 0.939 along with highest standard deviation of 0.050 and highest range value of 0.178, while performed best in the last year of the study period as indicated by highest efficiency score. Further, lowest variation among the banks is observed in the year 2010-11 as indicated by lowest standard deviation of 0.021 as well as lowest range value of 0.075. During the ten years of study period, the technical efficiency score of the banks is resulted to 0.963 with standard deviation of 0.013. Thus, on an average, 3.7 per cent decrease in input quantities is feasible with current technology and given level of outputs indicating thereby the banks have the scope of producing 1.038 times (i.e. 1/0.963) more as much outputs from the same level of inputs. The log linear growth rate of technical efficiency of the industry has been computed and it grew at the rate of 0.372 per cent per annum over the entire study period.

Moreover, during the study period, the number of technically efficient banks ranges from five to nine. The efficiency score of the banks are observed to be concentrated highly between 0.934 and 1.002 in 2004-05 as exhibited by the highest percentage of banks falling within this interval of efficiency score due to lower variation across the banks.

Table 3 provides bank wise analysis of technical efficiency score. It is found that three banks, namely, Corporation Bank, Oriental Bank of Commerce and State Bank of Travancore are found to be efficient nine times during the study period. Thus, on the count of optimum utilization of inputs, these banks have outperformed the other public sector

Table 2: Technical Efficiency Score of Public Sector Banks in India

| Year | Mean | SD | Range | No. of Efficient Banks | Interval (Mean-SD, Mean + SD) | % of banks in the interval |
|--------------------------------|--------------|--------------|-------|------------------------|-------------------------------|----------------------------|
| 2002-03 | 0.944 | 0.044 | 0.118 | 6 | (0.900-0.989) | 52 |
| 2003-04 | 0.939 | 0.050 | 0.178 | 6 | (0.889-0.990) | 60 |
| 2004-05 | 0.968 | 0.034 | 0.109 | 8 | (0.934-1.002) | 84 |
| 2005-06 | 0.950 | 0.047 | 0.157 | 9 | (0.904-0.997) | 48 |
| 2006-07 | 0.966 | 0.031 | 0.089 | 9 | (0.935-0.997) | 48 |
| 2007-08 | 0.972 | 0.027 | 0.088 | 8 | (0.945-0.999) | 44 |
| 2008-09 | 0.966 | 0.032 | 0.096 | 7 | (0.933-0.998) | 52 |
| 2009-10 | 0.975 | 0.024 | 0.078 | 6 | (0.952-0.999) | 64 |
| 2010-11 | 0.972 | 0.021 | 0.075 | 5 | (0.951-0.993) | 60 |
| 2011-12 | 0.974 | 0.022 | 0.084 | 6 | (0.952-0.997) | 68 |
| 2002-03 to 2011-12 | 0.963 | 0.013 | 0.036 | -- | -- | -- |
| Growth Rate (%) = 0.372 | | | | | | |

Note : Based on relevant data obtained from

- (i) Annual Reports of the respective banks (various issues)
- (ii) Performance Highlights of Public Sector Banks in India published by IBA, Mumbai (various issues)
- (iii) Statistical Tables Relating to Banks in India published by RBI, Mumbai (various issues)

banks. On the other hand, total nine banks, viz., Allahabad Bank, Bank of Maharashtra, Canara Bank, Central Bank of India, Indian Overseas Bank, Syndicate Bank, UCO Bank, United Bank of India and Vijaya Bank could not able to obtain score 1 in any year. Thus, these banks are proved to be consistently inefficient throughout the study period. Besides, the growth analysis shows that the technical efficiency score of Punjab National Bank grew at a comparatively highest rate of 1.002 per cent per annum over the study period. The growth rates of seven banks, viz., Andhra Bank, Dena Bank, Oriental Bank of Commerce, State Bank of Bikaner and Jaipur, State Bank of Mysore, State Bank of Patiala and State Bank

of Travancore have shown negative result. It is noticed that the average growth rates of Oriental Bank of Commerce and State Bank of Travancore are resulted to be negative instead of being most consistently efficient banks during the study period.

Further it is observed that among the banks, on an average, Corporation Bank (0.999) has obtained highest technical efficiency score followed by State Bank of Travancore (0.998). On the other hand, Central Bank of India (0.916) has obtained lowest average efficiency score followed by UCO Bank (0.916) and Punjab & Sind Bank (0.916). The Punjab National Bank has shown highly inconsistent

Table 3: Bank wise Technical Efficiency Score of Public Sector Banks in India

| Sl. No. | Name of Banks | No. of times of being Efficient | Mean | CV (%) | Growth Rate (%) |
|---------|---|---------------------------------|-------|--------|-----------------|
| 1 | Allahabad Bank (ALB) | 0 | 0.953 | 3.34 | 0.937 |
| 2 | Andhra Bank (ANB) | 2 | 0.973 | 2.34 | -0.289 |
| 3 | Bank of Baroda (BOB) | 1 | 0.941 | 3.16 | 0.131 |
| 4 | Bank of India (BOI) | 1 | 0.947 | 3.29 | 0.465 |
| 5 | Bank of Maharashtra (BOM) | 0 | 0.936 | 3.27 | 0.855 |
| 6 | Canara Bank (CNB) | 0 | 0.957 | 2.74 | 0.616 |
| 7 | Central Bank of India (CBI) | 0 | 0.916 | 2.69 | 0.777 |
| 8 | Corporation Bank (COB) | 9 | 0.999 | 0.38 | 0.051 |
| 9 | Dena Bank (DNB) | 2 | 0.971 | 2.63 | -0.436 |
| 10 | Indian Bank (INB) | 5 | 0.969 | 4.01 | 0.987 |
| 11 | Indian Overseas Bank (IOB) | 0 | 0.948 | 3.02 | 0.670 |
| 12 | Oriental Bank of Commerce (OBC) | 9 | 0.997 | 1.08 | -0.147 |
| 13 | Punjab & Sind Bank (P&SB) | 1 | 0.942 | 4.60 | 0.923 |
| 14 | Punjab National Bank (PNB) | 1 | 0.951 | 5.22 | 1.002 |
| 15 | State Bank of India (SBI) | 7 | 0.989 | 2.07 | 0.528 |
| 16 | State Bank of Bikaner and Jaipur (SBBJ) | 3 | 0.990 | 1.04 | -0.098 |
| 17 | State Bank of Hyderabad (SBH) | 7 | 0.995 | 0.91 | 0.154 |
| 18 | State Bank of Mysore (SBM) | 6 | 0.993 | 1.04 | -0.258 |
| 19 | State Bank of Patiala (SBP) | 6 | 0.982 | 2.68 | -0.613 |
| 20 | State Bank of Travancore (SBOT) | 9 | 0.998 | 0.76 | -0.132 |
| 21 | Syndicate Bank (SYB) | 0 | 0.929 | 4.62 | 0.982 |
| 22 | UCO Bank | 0 | 0.929 | 3.68 | 0.989 |
| 23 | Union Bank of India (UBOI) | 1 | 0.974 | 1.67 | 0.268 |
| 24 | United Bank of India (UNBI) | 0 | 0.938 | 3.68 | 0.755 |
| 25 | Vijaya Bank (VIB) | 0 | 0.954 | 2.64 | 0.512 |

Note : Based on relevant data obtained from

- (i) Annual Reports of the respective banks (various issues)
- (ii) Performance Highlights of Public Sector Banks in India published by IBA, Mumbai (various issues)
- (iii) Statistical Tables Relating to Banks in India published by RBI, Mumbai (various issues)

Table 4 : Classification of Public Sector Banks based on Average Technical Efficiency Score

| Categories | Range | Name of Banks | No. of Banks |
|--------------------|---------------|------------------------------------|--------------|
| Best Performers | 0.982 - 0.999 | COB, OBC, SBI, SBBJ, SBH, SBM, SBT | 7 (28%) |
| Good Performers | 0.966 - 0.982 | ANB DNB, INB, SBP, UBOI | 5 (20%) |
| Average Performers | 0.949 - 0.966 | ALB, CNB, PNB, VIB, | 4 (16%) |
| Poor Performers | 0.933 - 0.949 | BOB, BOI, BOM, IOB, P&SB, UNBI | 6 (24%) |
| Worst Performers | 0.916 - 0.933 | CBI, SYNBN, UCO | 3 (12%) |

Note : Based on relevant data obtained from

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performance as indicated by its highest coefficient of variation (5.22 per cent) followed by the Syndicate Bank (4.62 per cent).

Table 4 depicts classification of banks based on average technical efficiency score. Out of total twenty five banks, the highest 28 per cent of banks are found to be best performers as their efficiency score fall within the highest range of (0.982-0.999). On the other hand, lowest percentage of banks, i.e. 12 per

cent, have shown themselves as the worst performers as depicted by their efficiency score falling within the lowest range of (0.916-0.933).

The banks those have shown on an average better performance in respect of optimum usage of inputs or minimum possible wastage of inputs are Corporation Bank, Oriental Bank of Commerce, State Bank of India, State Bank of Bikaner and Jaipur, State Bank of Hyderabad, State Bank of Mysore and State

Table 5: Decomposition of Technical Efficiency of Public Sector Banks in India

| Sl. No. | Name of Banks | Pure Technical Efficiency | | Scale Efficiency | |
|------------------|---|---------------------------|--------|------------------|--------|
| | | Mean | CV (%) | Mean | CV (%) |
| 1 | Allahabad Bank (ALB) | 0.963 | 2.91 | 0.990 | 0.71 |
| 2 | Andhra Bank (ANB) | 0.984 | 1.73 | 0.994 | 0.80 |
| 3 | Bank of Baroda (BOB) | 0.982 | 2.55 | 0.959 | 2.82 |
| 4 | Bank of India (BOI) | 0.983 | 2.34 | 0.963 | 2.49 |
| 5 | Bank of Maharashtra (BOM) | 0.938 | 3.20 | 0.998 | 0.20 |
| 6 | Canara Bank (CNB) | 0.994 | 0.91 | 0.962 | 2.91 |
| 7 | Central Bank of India (CBI) | 0.932 | 2.15 | 0.983 | 1.53 |
| 8 | Corporation Bank (COB) | 1.000 | 0.00 | 0.999 | 0.40 |
| 9 | Dena Bank (DNB) | 0.998 | 0.30 | 0.973 | 2.36 |
| 10 | Indian Bank (INB) | 0.974 | 3.29 | 0.994 | 0.91 |
| 11 | Indian Overseas Bank (IOB) | 0.958 | 2.51 | 0.989 | 1.01 |
| 12 | Oriental Bank of Commerce (OBC) | 0.997 | 1.00 | 1.000 | 0.10 |
| 13 | Punjab & Sind Bank (P&SB) | 1.000 | 0.00 | 0.942 | 4.56 |
| 14 | Punjab National Bank (PNB) | 0.970 | 3.81 | 0.980 | 1.94 |
| 15 | State Bank of India (SBI) | 1.000 | 0.00 | 0.989 | 2.02 |
| 16 | State Bank of Bikaner and Jaipur (SBBJ) | 0.999 | 0.20 | 0.991 | 1.11 |
| 17 | State Bank of Hyderabad (SBH) | 0.998 | 0.40 | 0.997 | 0.80 |
| 18 | State Bank of Mysore (SBM) | 1.000 | 0.00 | 0.993 | 1.01 |
| 19 | State Bank of Patiala (SBP) | 0.987 | 2.13 | 0.994 | 0.91 |
| 20 | State Bank of Travancore (SBOT) | 1.000 | 0.00 | 0.998 | 0.80 |
| 21 | Syndicate Bank (SYB) | 0.941 | 3.83 | 0.988 | 1.11 |
| 22 | UCO Bank | 0.941 | 3.08 | 0.987 | 1.11 |
| 23 | Union Bank of India (UBOI) | 0.990 | 0.91 | 0.984 | 1.22 |
| 24 | United Bank of India (UNBI) | 0.942 | 3.40 | 0.996 | 0.50 |
| 25 | Vijaya Bank (VIB) | 0.966 | 2.38 | 0.988 | 0.61 |
| All Banks | | 0.978 | | 0.985 | |

Note : Based on relevant data obtained from

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- (ii) Performance Highlights of Public Sector Banks in India published by IBA, Mumbai (various issues)
- (iii) Statistical Tables Relating to Banks in India published by RBI, Mumbai (various issues)

Bank of Travancore. On the other hand, the worst performed banks in this respect are Central Bank of India, Syndicate Bank and UCO Bank. Besides, 20 per cent, 16 per cent and 24 per cent of the total banks have occupied position as good performers, average performers and poor performers based on their average technical efficiency score.

Table 5 presents decomposition of technical efficiency of public sector banks in India. With regard to pure technical efficiency, it is found that Corporation Bank, Punjab & Sind Bank, State Bank of India, State Bank of Mysore and State Bank of Travancore have been able to obtain score 1 and thus, proved to be consistently efficient banks during the study period.

On the other hand, Central Bank of India (0.932) has obtained lowest average score during the study period followed by Bank of Maharashtra

(0.938). Syndicate Bank has been found to be the most inconsistent as evident by its highest coefficient of variation (3.83 per cent) followed by Punjab National Bank (3.81 per cent). Further, on scale efficiency front, it is found that among the total banks, Oriental Bank of Commerce has obtained highest average efficiency score (1.000) with lowest value of coefficient of variation (0.10 per cent) followed by Corporation Bank (0.999) during the study period. On the other hand, Punjab & Sind Bank is found to be the most inefficient as well as inconsistent bank as indicated by its lowest average scale efficiency of 0.942 and highest coefficient of variation of 4.56 per cent. Finally, it is observed that on an average, scale efficiency score (0.985) is greater than the pure technical efficiency score (0.978) to the extent of 0.70 per cent.

Table 6 provides classification of banks based

Table 6:
Classification of Public Sector Banks based on Average Pure Technical and Scale Efficiency Score

| Quartiles | Pure Technical Efficiency | | | Scale Efficiency | | |
|----------------|---------------------------|--|--------------|------------------|---|--------------|
| | Range | Name of Banks | No. of Banks | Range | Name of Banks | No. of Banks |
| Q ₁ | 0.932 - 0.963 | CBI, BOM, IOB, SYNB, UCO, UNBI | 6 (24%) | 0.942-0.983 | P&SB, BOB, BOI, CNB, DNB, PNB | 6 (24%) |
| Q ₂ | 0.963 - 0.984 | ALB, BOB, BOI, INB, PNB, VIB | 6 (24%) | 0.983-0.989 | CBI, SBI, SYNB, UCO, UBOI, VIB | 6 (24%) |
| Q ₃ | 0.984 - 0.998 | ANB, CNB, OBC, SBP, UBOI | 5 (20%) | 0.989-0.994 | ALB, ANB, IOB, SBBJ, SBM | 5 (20%) |
| Q ₄ | 0.998 - 1.000 | COB, DNB, P&SB, SBI, SBBJ, SBH, SBM, SBT | 8 (32%) | 0.994-1.000 | BOM, COB, INB, OBC, SBH, SBP, SBT, UNBI | 8 (32%) |

Note : Based on relevant data obtained from

- (i) Annual Reports of the respective banks (various issues)
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- (iii) Statistical Tables Relating to Banks in India published by RBI, Mumbai (various issues)

on average pure technical efficiency and scale efficiency score. It is crystal clear from the table that highest 32 per cent of banks have occupied their position into fourth quartile, while lowest 20 per cent of banks into the third quartile based on both pure technical and scale efficiency score. In the remaining quartiles, 6 banks each have placed themselves. United Bank of India is

not found to be pure technically efficient to the same extent as it is in case of scale efficiency because it is found in the first quartile based on pure technical efficiency measure, while fourth quartile based on scale efficiency measure. On the other hand, the contradictory result is observed in case of Punjab & Sind Bank. However, Corporation Bank, State Bank

of Hyderabad and State Bank of Travancore are found to be relatively efficient on the count of both pure technical and scale efficiency as evident by their position in the fourth quartile of each component of technical efficiency.

Finally, Table 7 lists out banks in accordance with major source of technical efficiency score obtained during the study period. The pure technical efficiency is found to be the major source of overall technical efficiency in case of 12 banks, i.e. 48 per cent of total banks.

Table 7:
Bank wise Major Source of Technical Efficiency

Thus, during the study period, these banks are

| Major Source | Name of Banks | No. of Banks |
|---------------------------|--|--------------|
| Pure Technical Efficiency | BOB, BOI, CNB, COB, DNB, P&SB, SBI, SBBJ, SBH, SBM, SBT, UBOI | 12 (48%) |
| Scale Efficiency | ALB, ANB, BOM, CBI, INB, IOB, OBC, PNB, SBP, SYN, UCO, UNBI, VIB | 13 (52%) |

Note : Based on relevant data obtained from

- (i) Annual Reports of the respective banks (various issues)
- (ii) Performance Highlights of Public Sector Banks in India published by IBA, Mumbai (various issues)
- (iii) Statistical Tables Relating to Banks in India published by RBI, Mumbai (various issues)

found to be in the position of better utilization of inputs relative to the frontier banks due to better managerial

practices. On the other hand, in case of 13 banks, the scale efficiency is found to be the major source of overall technical efficiency. Such empirical finding implies that in case of 52 per cent of the total banks, the decision regarding the right scale of operation has worked better than the managerial expertise and skills towards the result of overall technical efficiency.

6. SUMMARY OF FINDINGS AND CONCLUSION

The findings of the study reveals that technical efficiency score of the public sector banks on an average ranges from 0.939 to 0.975 and has turned out to be 0.963 during the study period. Thus, it is suggested that, the banks, on an average, could have reduced wastage of inputs to the extent of 3.7 per cent by means of following best practices while producing the same level of output. Moreover, during the study period, on an average, the technical efficiency of the banks grew at the rate of 0.372 per cent per annum. As regards the components of technical efficiency, the average pure technical efficiency score of the banks is noted to be 0.978, which in turn implies that average pure technical inefficiency to the tune of about 2.2 per cent is due to the inappropriate management practices in converting inputs into outputs. On the other hand, during the study period, the banks have experienced average scale efficiency to the tune of about 0.985 and therefore, an increase in the magnitude of scale inefficiency by 1.5 per cent is due to the choice of wrong scale of operation. Thus, the empirical findings conclude that managerial irregularities are found to be the main cause of technical inefficiency during the study period.

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