

Nationalised Banks in Liberalisation Era

R. C. Dangwal* Narinder Kaur and Reetu Kapoor***

* *Department of Commerce, HNB Garhwal University, Srinagar (Uttarakhand)*

** *Government Bikram College of Commerce, Patiala*

Abstract

Commercial banks are the back-bone of our financial system. This paper is a modest effort to evaluate the changes in the Total Factor Productivity (TFP) of 19 Nationalised banks for the post-reform period 2003-08. TFP indices are estimated using Malmquist productivity index approach through Data Envelopment Analysis. Total Factor Productivity change indices are decomposed into efficiency change and technical change. The efficiency change is further decomposed into pure efficiency change and scale efficiency change. The results reveal that, on an average, the TFP growth is more due to technological change than efficiency change. But this trend is not applicable to all the years. For TFP, growth is due to efficiency change during some years and due to technical change during some years. The analysis reveals that the Nationalised banks have experienced efficiency change as well as technical change.

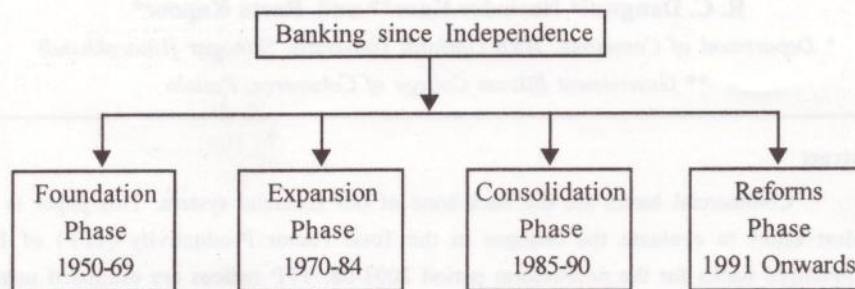
Key Words : Efficiency, DEA, Malmquist Productivity Index, Total Factor Productivity.

INTRODUCTION

The globalization of financial markets has gained momentum as a result of liberalization programmes by various countries. Indian banking system, over the years, has gone through various phases. The first phase of nationalisation of the banking sector took root in 1949 and culminated in the nationalisation of fourteen banks in the year 1969. On July 19, 1969, the government promulgated Banking Companies (Acquisition and Transfer of Undertakings) Ordinance, 1969 to acquire 14 bigger commercial banks with paid-up capital of Rs.2850 crore, deposits of

Rs. 2629 crore, loans of Rs.1813 crore and with 4134 branches accounting for 80% of all banks' deposits, advances and investments under the control of the government. These banks were nationalised with the prime motive to control the commanding heights of the economy and to meet progressively and serve better the needs of the economy in conformity with the national policy and objectives. Subsequently, on 15th April, 1980, six more commercial banks were nationalised which brought 91% of the deposits and 84% of the advances in Public Sector Banks. In these five decades since independence, banking in India has evolved through four distinct phases.

BANKING SECTOR DEVELOPMENTS IN INDIA



- (a) **Foundation Phase (1950-69)** : This phase witnessed the development of necessary legislative framework. A major development was transformation of Imperial Bank of India into State Bank of India in 1955 and nationalisation of fourteen banks during 1969.
- (b) **Expansion Phase (1970-84)** : During this phase, branch network of the banks was widened at a very fast pace covering rural and semi-urban population. Credit flows were guided towards the priority sector. This affected the profitability of banks. Six more banks were nationalised in 1980.
- (c) **Consolidation Phase (1985-90)** : This period was utilised by the banks in consolidating and systematizing the works done earlier. More attention was paid to improve house-keeping, customer service, and credit management. Profitability and productivity were the areas of focus during this stage.
- (d) **Reforms Phase (1991 Onwards)** : The macro-economic crises faced by the country in 1991 paved the way for extensive financial sector reforms which brought deregulation of interest rates, more competition, technological changes, prudential guidelines on asset classification and income recognition, capital adequacy, autonomy packages, etc.

The banking industry has witnessed a series of upheavals since 1991. The

first phase of reforms based on the recommendations of Narasimham Committee-I, is basically of curative nature, while the second phase of reforms again on the recommendations of Narasimham Committee - II aims at consolidation of the gains with emphasis on safety and soundness through strict prudential norms. The financial performance of the banking system depends on the relative efficiency of each unit of the banking system.

OVERVIEW OF DATA ENVELOPMENT ANALYSIS

Data Envelopment Analysis (DEA) has become increasingly popular in measuring efficiency of different financial institutions like banks, insurance and mutual funds. Particularly in the banking sector, it has been applied to benchmark the performance of different banks or to study the efficiency estimates of different branches of a particular bank. The Post-liberalization era in Indian banking has witnessed a host of financial reforms leading to stiff competition among banking units. DEA is a non-parametric, deterministic methodology for determining the relatively efficient production frontier, based on empirical data on chosen inputs and outputs of a number of entities, called Decision-Making Units (DMUs). In banking, a bank constitutes a DMU. One of the earliest studies on DEA was conducted by Farrell (1957) who attempted to measure the efficiency of production in the single input and output case. Charnes et al. (1978) proposed a model that generalizes the single-input, single-output measure of a decision-making unit (DMU). Productivity refers to the output produced per unit of input, while efficiency implies a comparison of the actual output/input to the best output/input ratio. The best output/input ratio means the best practicing DMU. DEA is a linear programming-based technique for measuring the relative performance of organisational units, where the presence of multiple inputs and outputs make the comparison difficult. Usually, the total number of DMUs should be at least twice the number of inputs plus output factors. This study uses 6 factors or variables (inputs and outputs) and 19 DMUs (Banks). The Malmquist index is a summary measure of the change in TFP of a given unit over time. This overall measure can be split into the product of three different components: the change in technical efficiency, the change in scale efficiency and change in pure efficiency. Each unit is identified by its inputs-outputs bundle x, y with the superscript indicating whether it is observed at time t or $t+1$. The distance is defined as D_t or D_{t+1} depending on whether the reference frontier is that of time t or $t+1$. More in detail, the output based Malmquist productivity index can be computed as :

$$M_o(x_{t+1}, y_{t+1}, x_t, y_t) = \left[\frac{D_o^t(x_{t+1}, y_{t+1})}{D_o^t(x_t, y_t)} \times \frac{D_o^{t+1}(x_{t+1}, y_{t+1})}{D_o^{t+1}(x_t, y_t)} \right]^{1/2} \dots\dots(1)$$

An equivalent way of writing this productivity index is :

$$M_o(x_{t+1}, y_{t+1}, x_t, y_t) = \frac{D_o^{t+1}(x_{t+1}, y_{t+1})}{D_o^t(x_t, y_t)} \left[\frac{D_o^t(x_{t+1}, y_{t+1})}{D_o^{t+1}(x_{t+1}, y_{t+1})} \times \frac{D_o^t(x_t, y_t)}{D_o^{t+1}(x_t, y_t)} \right]^{1/2} \dots\dots(2)$$

Where, the ratio outside the bracket measures the change in the output-oriented measure of Farrell technical efficiency between the years t and t+1. It represents the change in technical efficiency (EFFCH), and it will be >1 if over time the unit has moved closer to the frontier. The geometric mean of the two ratios inside the bracket captures shift in technology between the two periods evaluated at the input level x_{t+1} and input level realized at x_t . A value >1 indicates technological improvement. The index of TFP is given by the product of the two components, so that index bigger than 1 indicator that total factor productivity has increased, and vice versa for a value smaller than 1.

To calculate the productivity of bank 'k' between the period 't' and 't+1', four different linear programming problems need to be solved. $D_o^t(x_k, y_t)$, $D_o^{t+1}(x_k, y_t)$, $D_o^t(x_{t+1}, y_{t+1})$, $D_o^{t+1}(x_{t+1}, y_{t+1})$. Making use of the fact that output distance function is reciprocal to the output-based Farrell measure of technical efficiency the linear programming formulation for the distance function $D_o^t(x_k, y_t)$ for each $k = 1, \dots, k$, can be written as :

$$[d_o^t(x_k, y_t)]^{-1} = \max_{\phi} \lambda \phi,$$

Sub. to.

$$\begin{aligned} -\phi y_{it} + Y_t \lambda &\geq 0 \\ x_{it} - X_t \lambda &\geq 0, \\ \lambda &\geq 0, \end{aligned} \dots\dots(3)$$

Where, y_{kt} is a M x 1 vector of output of quantities for the observation k at time t;

x_{kt} is a N x 1 vector of input of quantities for the observation k at time t;
 Y_t is a K x M matrix of output of quantities for all K observations at time t;
 X_t is a K x M matrix of input of quantities for all K observations at time t;
 λ is a K x 1 vector of weights; and
 ϕ is a scalar.

REVIEW OF LITERATURE

Evaluation of banking system has caught the eyes of many researchers, administrators, departments and committees. Oral and Yolalan (1990) measured the operating efficiencies of a set of 20 bank branches of a major Turkish Commercial Bank offering relatively homogeneous products in a multi-market business environment through Data Envelopment Analysis (DEA). The results of the study

indicated that the service-efficient bank branches were the most profitable ones, suggesting the existence of a relationship between service efficiency and profitability.

Schmid (1994) studied the technical efficiency from pooled time-series cross-sectional data of Austrian commercial banks from 1987-91 to find reasons for applicability of law of increasing returns in Austrian banking industry after European financial integration. The sample covered banks of all size classes, among them the largest 18 banks as well as some of the very small banks. He used intermediation approach and DEA empirical technique to analyse the performance of Austrian banks.

Sherman and Ladino (1995) used Data Envelopment Analysis (DEA) to review the productivity of 33 branches of a bank by taking five inputs and five outputs. They compared branches objectively to identify the best-practice branches, the less productive branches, and the changes which the less productive branches need to make to reach the best-practice level and to improve their profitability.

Bhattacharyya et al. (1997) studied the impact of the limited liberalizations and examined the productive efficiency of 70 commercial banks from 1986-91 with the help of Data Envelopment Analysis. They constructed one grand frontier for the entire period and measured technical efficiency. They found Public Sector Banks had the highest efficiency, followed by foreign banks and the least efficient private banks. However, PSBs started showing a decline in efficiency after 1987, private banks showed no change and foreign banks showed a sharp rise in efficiency.

Saha and Ravisankar (2000) evaluated the efficiency and productivity of 25 public sector banks in India from 1991-95. They used intermediation approach of DEA with the help of four inputs and six outputs. The results indicated that the efficiency of the PSBs improved during the study period.

Shanmugani and Das (2004) used Stochastic Frontier Production function model to measure technical efficiency of 94 banks of four groups among Indian banking industry from 1992-99. The results indicated that the efficiency of raising interest margin is time invariant, while the efficiencies of other outputs were time varying. SBI & Associated banks and foreign banks were more efficient than their counterparts.

Sathye (2005) studied the impact of partially privatized banks on the financial performance and efficiency of fully public sector banks from 1998-2002. He used Synchronic Approach and compared India's gradual privatization strategy with that of the other countries like Poland, Mexico and Mozambique. The results

revealed that partially privatized banks performed better than fully public sector banks.

Sinha (2008) compared the technical efficiency of 20 public sector and 8 private sector commercial banks on the basis of 3 major indicators using DEA and revealed that the observed private sector banks had higher mean technical efficiency score across ownership groups as compared to public sector counterparts. Most of the observed commercial banks exhibited decreasing returns to scale during 2002-05.

Tandon et al. (2009) revealed that Punjab National Bank was 100% technically efficient, while Bank of Baroda and Corporation Bank were 95% technically efficient. In relative inefficiency level, Bank of Maharashtra and Oriental Bank of Commerce came under the score of 80% to 85%. Global Trust Bank's merger with OBC resulted in a downward shift in its efficiency.

OBJECTIVES OF THE STUDY

The study has been conceived with the following objectives :

1. To examine the Total Factor Productivity Change of Nationalised banks in India.
2. To study the efficiency change and technical change of Nationalised banks in India.

RESEARCH METHODOLOGY

Period of Study

The post-reform period of six years from 2002-03 to 2007-08 has been taken to analyse the performance of 19 Nationalised Banks in India. As a matter of simplicity, the data for financial year 2002-03 is stated as year 2003 and so on.

Variable Measurement

The study has used four Output variables and two Input variables. Output variables are Deposits, Advances, Investments and Spread. Input variables are Interest Expenditure and Operating Expenditure. To calculate the Malmquist Factor Productivity index the following five indices have been calculated :

1. Efficiency Change (EFCH).
2. Technical Change (TECH)
3. Pure Efficiency Change (PECH)
4. Scale Efficiency Change (SECH)
5. Total Factor Productivity Change (TFPCH).

Sample Size

It covers all nineteen Nationalised banks in India.

Data Collection

The study is primarily based on secondary data which has been obtained from the various sources, viz. IBA-Bulletins annual issues, Statistical tables relating to banks in India, Performance Highlights of Public Sector Banks and RBI reports on trend and progress of Banking in India.

Empirical Analysis

As explained earlier, if the value of the Malmquist TFP index (and its components) is more than one then it indicates as improvement in the performance and if it is less than one then it indicates deterioration in the performance, as compared to the previous year. Since in the present study, the indices estimated are output-oriented, if the index of a particular bank is more than one it means the output has increased, and if the index is less than one it means output has declined. The improvement or deterioration is measured in relation to the best performance, where the best performance is given by the frontier. Thus, the improvement in the performance of a particular bank is due to efficiency change (i.e., moving closer to the frontier) or technical change (shift in the frontier itself) or both. The indices which are averaged over Nationalised banks for each year are presented as under. All indices are relative to previous year. Hence, Malmquist Productivity analysis' results are revealed from second year taking the first year as base. All Malmquist averages are based on Geometric Mean.

Table 1 deals with the efficiency change. The average efficiency change index of the Nationalised banks, during the period of study 2003-08 is 1.003, which means that during the period, on an average, the EFFCH has increased by 0.3%. Looking at individual years for the Nationalised banks for the study period, results show that in two years (2004, 2008) the EFFCH has declined to the tune of 1% and in three years (2005-07) the EFFCH has increased. Bank-wise analysis reveals that EFFCH in 7 banks has increased and it has decreased in 4 banks. In the case of 8 banks, there is no change in EFFCH as compared to the respected previous years during the study period. Seven banks' efficiency change output is higher than the Nationalized Group over the study period. Dena Bank is at the top in the case of EFFCH with 3% increase, while CAB is at the bottom level. Its efficiency has declined by 2.4% compared to the previous year. The analysis shows that there is no change in efficiency in PNB and UTBI for all the years during the study period. In the case of COB, IB and UBI the efficiency has declined in the very first year and increased in second year but there is no change in the last three years as compared to the previous year.

Table 1
Efficiency Change

| Banks | 2004 | 2005 | 2006 | 2007 | 2008 | Mean |
|-------|-------|-------|-------|-------|-------|-------|
| ALLB | 1.033 | 1.049 | 1.045 | 0.981 | 0.977 | 1.017 |
| AB | 0.964 | 1.107 | 1.000 | 1.038 | 0.956 | 1.012 |
| BOB | 1.020 | 1.000 | 0.945 | 1.058 | 1.000 | 1.004 |
| BOI | 1.000 | 0.978 | 0.868 | 1.178 | 1.000 | 1.000 |
| BOM | 1.000 | 0.897 | 1.054 | 1.001 | 1.011 | 0.991 |
| CAB | 1.005 | 0.985 | 1.036 | 0.976 | 0.885 | 0.976 |
| CBI | 1.033 | 0.970 | 1.022 | 0.996 | 1.014 | 1.007 |
| COB | 0.963 | 1.038 | 1.000 | 1.000 | 1.000 | 1.000 |
| DB | 1.009 | 0.989 | 1.169 | 0.991 | 1.004 | 1.030 |
| IB | 0.986 | 1.014 | 1.000 | 1.000 | 1.000 | 1.000 |
| IOB | 0.958 | 0.979 | 1.085 | 1.000 | 0.984 | 1.000 |
| OBC | 1.000 | 1.000 | 0.984 | 1.016 | 1.000 | 1.000 |
| PSB | 0.928 | 1.178 | 1.070 | 0.929 | 1.028 | 1.022 |
| PNB | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| SB | 1.000 | 0.946 | 1.003 | 1.027 | 0.981 | 0.991 |
| UCOB | 0.982 | 1.039 | 0.938 | 1.044 | 0.981 | 0.996 |
| UBI | 0.955 | 1.073 | 1.000 | 1.000 | 1.000 | 1.005 |
| UTBI | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| VB | 0.989 | 1.012 | 0.995 | 1.005 | 1.000 | 1.000 |
| Mean | 0.990 | 1.012 | 1.009 | 1.012 | 0.990 | 1.003 |

Source : Calculated

Table 2 deals with the Technology change. The average Technology change index of the Nationalised banks, during the study period of 2003-08 is 1.024, which means that on an average, the TECH has increased by 2.4%. The year-wise analysis of the Nationalised banks reveals that in two years (2004, 2005) there is improvement in productivity due to increase in technology change, while the productivity has deteriorated during three years (2006-08) due to decline in technology of Nationalised banks. Bank-wise analysis reveals that there is a substantial improvement in 14 banks and deterioration in 5 banks with respect to change in technology over the study period. The productivity of ten banks is higher than the Nationalized Group due to technological changes over the study period. UBI is at the top in the case of TECH with 7.3% increase, while BOM is

at the bottom with decrease in TECH by 3.1% during the study period. The analysis shows that the productivity of Nationalised banks is deteriorating continuously during the last three years. In the year 2008, except OBC and VB all NBs, the TECH has declined. In the case of AB, BOB, CBI, DB, IB, PSB, PNB and UTBI, the TECH has improved in the first two years but has deteriorated in the last three years.

Table 2

Technical Change

| Banks | 2004 | 2005 | 2006 | 2007 | 2008 | Mean |
|-------|-------|-------|-------|-------|-------|-------|
| ALLB | 1.256 | 1.047 | 0.939 | 1.061 | 0.997 | 1.052 |
| AB | 1.182 | 1.168 | 0.982 | 0.974 | 0.886 | 1.032 |
| BOB | 1.225 | 1.053 | 0.930 | 0.951 | 0.892 | 1.004 |
| BOI | 1.130 | 1.162 | 1.015 | 0.977 | 0.948 | 1.043 |
| BOM | 1.139 | 0.982 | 0.838 | 1.003 | 0.907 | 0.969 |
| CAB | 1.191 | 1.135 | 1.015 | 1.032 | 0.988 | 1.070 |
| CBI | 1.216 | 1.063 | 0.931 | 0.956 | 0.934 | 1.015 |
| COB | 1.158 | 1.189 | 1.005 | 0.963 | 0.947 | 1.048 |
| DB | 1.185 | 1.037 | 0.944 | 0.985 | 0.896 | 1.005 |
| IB | 1.217 | 1.072 | 0.913 | 0.900 | 0.846 | 0.981 |
| IOB | 1.195 | 1.099 | 0.916 | 1.021 | 0.904 | 1.021 |
| OBC | 1.144 | 0.993 | 0.943 | 1.116 | 1.047 | 1.046 |
| PSB | 1.240 | 1.049 | 0.993 | 0.885 | 0.824 | 0.988 |
| PNB | 1.201 | 1.067 | 0.960 | 0.942 | 0.829 | 0.992 |
| SB | 1.293 | 1.014 | 0.974 | 1.007 | 0.971 | 1.045 |
| UCOB | 1.236 | 1.088 | 0.982 | 1.046 | 0.999 | 1.067 |
| UBI | 1.168 | 1.084 | 1.091 | 1.033 | 0.997 | 1.073 |
| UTBI | 1.169 | 1.052 | 0.903 | 0.926 | 0.918 | 0.989 |
| VB | 1.214 | 1.077 | 0.854 | 1.042 | 1.028 | 1.037 |
| Mean | 1.197 | 1.074 | 0.952 | 0.989 | 0.932 | 1.024 |

Source : Calculated

Table 3 deals with the Pure Efficiency Change index. Efficiency change index is decomposed into Pure Efficiency change and scale efficiency change. The average Pure Efficiency Change index of the Nationalised banks, during the study period 2003-08 is 1.003, which means that on an average, the PECH has increased by 0.3% as compared to respective previous years. The year-wise analysis of the

Nationalised banks reveals that in two years (2004, 2005) the PECH has declined and in three years (2006-08) it has increased. Bank-wise analysis reveals that PECH in 3 banks has increased and it has decreased in 4 banks. In the case of 12 banks, there is no change in PECH as compared to the respective previous years during the study period. The Pure efficiency change of three banks is higher than the Nationalized Group over the study period. Dena Bank is at the top in the case of PECH with 3.4% increase, while SB is at the bottom. Its Pure Efficiency has declined by 0.7% during the study period. The analysis reveals that there is no change in pure efficiency in BOB, BOI, CAB, CBI, COB, IB, OBC, PSB, PNB, UBI, UTBI and VB over the study period. There is no change in PECH in seven banks during the period of study. Analysis reveals that increase in PECH has an impact of increase in Efficiency Change at Nationalised banks' Group Level.

Table 3
Pure Efficiency Change

| Banks | 2004 | 2005 | 2006 | 2007 | 2008 | Mean |
|-------|-------|-------|-------|-------|-------|-------|
| ALLB | 1.040 | 1.042 | 1.042 | 0.982 | 0.976 | 1.016 |
| AB | 0.999 | 1.067 | 1.000 | 1.058 | 0.954 | 1.015 |
| BOB | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| BOI | 1.000 | 1.000 | 0.936 | 1.069 | 1.000 | 1.000 |
| BOM | 1.000 | 0.934 | 1.027 | 1.006 | 1.022 | 0.997 |
| CAB | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| CBI | 1.000 | 0.993 | 1.007 | 1.000 | 1.000 | 1.000 |
| COB | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| DB | 1.056 | 0.968 | 1.157 | 1.000 | 1.000 | 1.034 |
| IB | 0.989 | 1.011 | 1.000 | 1.000 | 1.000 | 1.000 |
| IOB | 0.943 | 1.061 | 1.000 | 1.000 | 0.991 | 0.998 |
| OBC | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| PSB | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| PNB | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| SB | 1.000 | 0.947 | 1.005 | 1.050 | 0.966 | 0.993 |
| UCOB | 0.981 | 1.048 | 0.929 | 1.044 | 0.980 | 0.995 |
| UBI | 0.975 | 1.025 | 1.000 | 1.000 | 1.000 | 1.000 |
| UTBI | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| VB | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Mean | 0.999 | 1.005 | 1.005 | 1.011 | 0.994 | 1.003 |

Source : Calculated

Table 4 deals with the Scale Efficiency Change index. Efficiency change index is decomposed into Pure Efficiency Change and Scale Efficiency Change. The average Scale Efficiency Change Index in the NBs, during the study period 2003-08 is 1.000, which means during the period 2003-08, on an average, there is no change in SECH compared to respective previous years. The year-wise analysis of the NBs for the study period, results show that in two years (2004, 2008) the SECH has declined and three years (2005-07) the SECH has increased. Bank-wise analysis reveals that SECH in 5 banks has increased; and it has decreased in 5 banks. In the case of 9 banks, there is no change in SECH as compared to the respective previous years. The Scale Efficiency Change of five banks is higher than the Nationalized Group over the study period. PSB is at the top in the case of SECH with 2.2%

Table 4
Scale Efficiency Change

| Banks | 2004 | 2005 | 2006 | 2007 | 2008 | Mean |
|-------|-------|-------|-------|-------|-------|-------|
| ALLB | 0.993 | 1.006 | 1.003 | 0.999 | 1.001 | 1.000 |
| AB | 0.965 | 1.038 | 1.000 | 0.981 | 1.003 | 0.997 |
| BOB | 1.020 | 1.000 | 0.945 | 1.058 | 1.000 | 1.004 |
| BOI | 1.000 | 0.978 | 0.928 | 1.102 | 1.000 | 1.000 |
| BOM | 1.000 | 0.960 | 1.026 | 0.995 | 0.989 | 0.994 |
| CAB | 1.005 | 0.985 | 1.036 | 0.976 | 0.885 | 0.976 |
| CBI | 1.033 | 0.977 | 1.015 | 0.996 | 1.014 | 1.007 |
| COB | 0.963 | 1.038 | 1.000 | 1.000 | 1.000 | 1.000 |
| DB | 0.955 | 1.022 | 1.010 | 0.991 | 1.004 | 0.996 |
| IB | 0.997 | 1.003 | 1.000 | 1.000 | 1.000 | 1.000 |
| IOB | 1.016 | 0.924 | 1.085 | 1.000 | 0.993 | 1.002 |
| OBC | 1.000 | 1.000 | 0.984 | 1.016 | 1.000 | 1.000 |
| PSB | 0.928 | 1.178 | 1.070 | 0.929 | 1.028 | 1.022 |
| PNB | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| SB | 1.000 | 0.999 | 0.998 | 0.978 | 1.015 | 0.998 |
| UCOB | 1.000 | 0.991 | 1.010 | 0.999 | 1.001 | 1.000 |
| UBI | 0.98 | 1.046 | 1.000 | 1.000 | 1.000 | 1.005 |
| UTBI | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| VB | 0.989 | 1.012 | 0.995 | 1.005 | 1.000 | 1.000 |
| Mean | 0.992 | 1.007 | 1.005 | 1.001 | 0.996 | 1.000 |

Source : Calculated

increase over the previous year, while CAB is at the bottom. Its Scale Efficiency has declined by 2.4% as compared to the previous year during the study period. The analysis reveals that there is no change in pure efficiency in ALLB, BOI, COB, IB, OBC, PNB, UCOB, UTBI and VB over the study period.

Table 5 deals with the Total Factor Productivity Change index. The average TFP index of the Nationalised banks, during the study period 2003-08 is 1.027, which means that on an average, the TFPCH has increased by 2.7% as compared to respective previous years. The year-wise data for the Nationalised banks reveals that in two years (2006, 2008) the TFPCH has declined and in two years (2004, 2005) TFPCH has increased and in the year 2007 there is no change at the Group level. Bank-wise analysis reveals that TFPCH in 15 banks has increased; and it has decreased

Table 5
Total Factor Productivity Change

| Banks | 2004 | 2005 | 2006 | 2007 | 2008 | Mean |
|-------|-------|-------|-------|-------|-------|-------|
| ALLB | 1.298 | 1.098 | 0.981 | 1.040 | 0.974 | 1.072 |
| AB | 1.139 | 1.292 | 0.982 | 1.011 | 0.848 | 1.044 |
| BOB | 1.249 | 1.053 | 0.879 | 1.007 | 0.892 | 1.008 |
| BOI | 1.130 | 1.136 | 0.881 | 1.151 | 0.948 | 1.043 |
| BOM | 1.139 | 0.881 | 0.883 | 1.004 | 0.917 | 0.960 |
| CAB | 1.197 | 1.118 | 1.051 | 1.007 | 0.874 | 1.044 |
| CBI | 1.256 | 1.031 | 0.952 | 0.952 | 0.947 | 1.021 |
| COB | 1.116 | 1.235 | 1.005 | 0.963 | 0.947 | 1.048 |
| DB | 1.196 | 1.026 | 1.103 | 0.976 | 0.899 | 1.035 |
| IB | 1.201 | 1.087 | 0.913 | 0.900 | 0.846 | 0.981 |
| IOB | 1.145 | 1.077 | 0.994 | 1.021 | 0.890 | 1.022 |
| OBC | 1.144 | 0.993 | 0.928 | 1.134 | 1.047 | 1.046 |
| PSB | 1.151 | 1.237 | 1.063 | 0.822 | 0.847 | 1.011 |
| PNB | 1.201 | 1.067 | 0.960 | 0.942 | 0.829 | 0.992 |
| SB | 1.293 | 0.959 | 0.977 | 1.035 | 0.952 | 1.036 |
| UCOB | 1.213 | 1.130 | 0.921 | 1.092 | 0.980 | 1.062 |
| UBI | 1.116 | 1.162 | 1.091 | 1.033 | 0.997 | 1.078 |
| UTBI | 1.169 | 1.052 | 0.903 | 0.926 | 0.918 | 0.989 |
| VB | 1.201 | 1.090 | 0.850 | 1.047 | 1.028 | 1.037 |
| Mean | 1.186 | 1.087 | 0.961 | 1.000 | 0.923 | 1.027 |

Source : Calculated

in 4 banks over the study period. TFPCH of eleven banks is higher than the Nationalised Group over the study period. UBI is at the top in the case of TFPCH with 7.8% increase while BOM is at the bottom. Its TFPCH has declined by 4% during the study period. The analysis reveals that on an average TFP growth is caused mainly by Technical Change (frontier effect which is 1.024) than Efficiency Change (Catching up effect which is 1.003).

CONCLUSION

Total Factor Productivity Change is the product of efficiency change and technical change. Total Factor Productivity measurement of Nationalised banks has been discussed using Malmquist productivity index through Data Envelopment Analysis. The study period of 2003-08 has a balanced panel data. The results reveal that TFP change is positive in all the NBs except BOM, IB, UTBI and PNB. The TFP change index has decreased in BOM by 4%, in IB by 1.9%, in UTBI by 1.1% and in PNB by 0.7%. The technological change has more impact than efficiency change in Total Factor Productivity growth.

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