

## Malmquist TFP Growth in Nationalised Banks in India

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### Abstract

Banking is an important segment of the tertiary sector and acts as the back bone of economic progress. Banking is the fulcrum of our economy. 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 of 2005-06 to 2010-11. TFP indices are estimated using Malmquist productivity index approach through Data Envelopment Analysis. Total Factor Productivity change indices are product of technical efficiency change and technical change. The technical 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 technical efficiency change than technical change. The analysis reveals that during the study period the Nationalised banks have experienced regressed technical efficiency change as well as technical change.

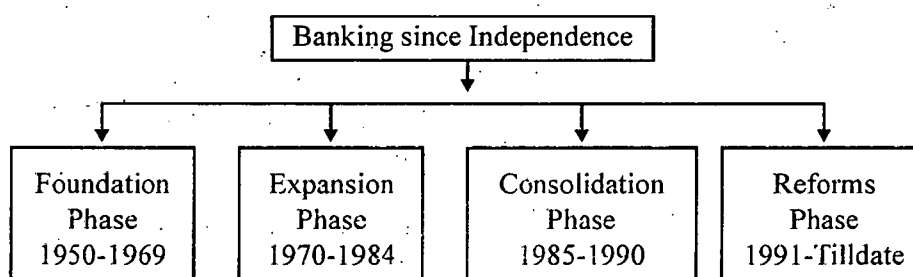
**Key Words:** Technical Efficiency Change, Data Envelopment Analysis, Malmquist Total Factor Productivity and Technical Change.

### 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 Govt. Promulgated Banking Companies (Acquisition and Transfer of Undertakings) ordinance 1969 to acquire 14 bigger commercial banks with paid up capital of Rs.2850 crores, deposits of Rs.2629 crores, loans of Rs.1813

crores and with 4134 branches accounting for 80% of all banks' deposits, advances and investments under the control of the Govt. 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 15<sup>th</sup> 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



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- (A) **Foundation Phase-** 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 nationalization of fourteen banks during 1969.
- (B) **Expansion Phase-** 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 nationalized in 1980.
- (C) **Consolidation phase-** This period was utilised by the banks in consolidating and systemizing the works done earlier. More attention was paid to improve house-keeping, customer service, credit management. Profitability and productivity were the areas of focus during this stage.
- (D) **Reforms phase-** 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 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 (DMU). 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, Cooper and Rhodes (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 organizational 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 (TEFCH), 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 indicates that total factor productivity has increased, and vice versa for a value smaller than 1.

To calculate the productivity of bank 'k' between period 't' and 't+1', four different linear programming problems need to be solved.  $D_o^t(x_t, y_t)$ ,  $D_o^{t+1}(x_t, y_t)$ ,  $D_o^t(x_{t+1}, y_{t+1})$ ,  $D_o^{t+1}(x_{t+1}, y_{t+1})$ . 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  $D_o^t(x_t, y_t)$  for each  $k=1, \dots, k$ , can be written as:

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

Sub. to.

$$-\phi y_{it} + Y_t \lambda \geq 0$$

$$x_{it} - X_t \lambda \geq 0,$$

$$\lambda \geq 0, \quad \dots \dots (3)$$

Where,  $y_{it}$  is a  $M \times 1$  vector of output of quantities for the observation k at time t;

$x_{it}$  is a  $N \times 1$  vector of input of quantities for the observation k at time t;

$Y_t$  is a  $K \times M$  matrix of output of quantities for all K observation at time t;

$X_t$  is a  $K \times N$  matrix of input of quantities for all K observation at time t;

$\lambda$  is a  $K \times 1$  vector of weights; and  $\phi$  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, next followed by foreign banks and least efficient were private banks. However, PSBs started showing a decline in efficiency after 1987 while 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.

**Shanmugm and Das (2004)** used Stochastic Frontier Production function model to measure technical efficiency of 94 banks of four groups among Indian Banking industry from 1992-1999. The results indicated that the efficiency of raising interest margin is time invariant while the efficiencies of other outputs were time varying. SBI&A 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 to 2005.

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

**Jha and Sarangi (2011)** analysed the performance of seven selected public sector and new private sector banks for the year 2009-10. They used three set of ratios namely Operating Performance Ratios, Financial Ratios and Efficiency Ratios. In all eleven ratios were used and ranked accordingly. Their results revealed that Axis Bank took the first position followed by ICICI Bank, next followed by BOI while PNB, SBI, IDBI and HDFC took fourth, fifth, sixth and seventh rank respectively.

### Objectives of the Study

The study has been conceived with the following objectives:

1. To examine the Total Factor Productivity growth of Nationalised Banks in India.
2. To study the Technical Efficiency Change and Technical Change of Nationalised Banks in India.

### Research Methodology

#### Period of study

The post-reform period of six years from 2005-2006 to

2010-2011 has been taken to analyse the performance of 19 Nationalised Banks in India.

### 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 Establishment Expenditure. The present study analysis has been performed with the help of DEAP 2.1. To calculate the Malmquist Factor Productivity Index the following five indices have been calculated.

1. Technical Efficiency Change (TEFCH).
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 bank 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 Technical Efficiency change. The average efficiency change index of the Nationalised Banks, during the period of study 2005-06 to 2010-11 is 0.996, which means that during the period, on an average, the TEFCH is decreased by 0.4%. Looking at individual years for the Nationalised Banks for the study period, results show that in three years (2007-08, 2008-09 and 2009-10) the TEFCH has declined to the tune of 1% and in two years (2006-07 and 2010-11) the TEFCH has increased. Bankwise analysis reveals that TEFCH in

four banks has increased and it has decreased in eleven banks. In case of four banks there is no change in TEFCH as compared to the respected previous years during the study period. Four banks' efficiency change output is higher than the Nationalized Group over the study period. Bank of India is at the top in case of TEFCH with 3.1% increase while PSB is at bottom level. Its efficiency has declined by 3.1% compared to the previous year. The analysis shows that there is no change in efficiency in COB and IB for all the years during the study period. In case of BOB the efficiency has increased in the very first year but there is no change in last four years as compared to the previous year. Overall TEFCH has increased in 2010-11.

**Table 1 : Technical Efficiency Change**

Banks	2006-07	2007-08	2008-09	2009-10	2010-11	G.Mean
ALLB	0.936	1.019	1.057	1.023	0.94	0.994
AB	1.062	0.956	0.961	1.026	0.989	0.998
BOB	1.047	1	1	1	1	1.009
BOI	1.17	1	1	0.922	1.079	1.031
BOM	1.046	1.027	1.028	0.952	0.985	1.007
CAB	0.975	0.91	1.088	1.013	0.977	0.991
CBI	1.011	1.023	0.915	0.935	1.014	0.978
COB	1	1	1	1	1	1
DB	1.018	1.012	0.978	0.89	1.061	0.99
IB	1	1	1	1	1	1
IOB	1.04	0.956	0.902	0.971	1.117	0.995
OBC	1	1	0.9	0.998	1.113	1
PSB	0.926	1.019	1.019	1.005	0.886	0.969
PNB	1	1	0.964	1.037	1	1
SB	0.989	0.948	1.07	0.876	1.061	0.986
UCOB	1.048	0.995	1.009	1.043	1.001	1.019
UBI	0.949	1.064	1	0.983	0.939	0.986
UTBI	1	1	0.974	1.022	0.946	0.988
VB	1	1	0.755	1.138	1.111	0.991
G.Mean	1.01	0.996	0.977	0.99	1.01	0.996

Source: Calculated

Table 2 deals with the Technology change. The average Technology change index of the Nationalised Banks, during the study period of 2005-06 to 2010-11 is 0.992, which means that on an average, the TECH is decreased by 0.8%. The year wise analysis of the Nationalised Banks reveals that in two years (2009-10, 2010-11) there is improvement in productivity due to increase in technology change while the productivity has deteriorated during three years (2006-07, 2007-08, 2008-09) due to decline in technology of Nationalised banks. Bank wise analysis reveals that there is a

substantial improvement in six banks and deterioration in eleven banks with respect to change in technology over the study period. OBC is, at the top in case of TECH with 6.6% increase while PSB is at bottom with decrease in TECH by 6.1% during the study period. The analysis shows that the productivity of Nationalised Banks has increased continuously during last two years. Year wise analysis further reveals that in the year 2009-10 all NBs have increased TECH whereas in the year 2010-11 except COB all NBs' the TECH has increased.

**Table 2 : Technical Change**

Banks	2006-07	2007-08	2008-09	2009-10	2010-11	G.Mean
ALLB	1.024	0.917	0.999	1.127	1.036	1.018
AB	0.937	0.869	0.972	1.076	1.103	0.988
BOB	0.928	0.871	1.007	1.14	1.079	1
BOI	0.949	0.912	0.988	1.089	1.034	0.992
BOM	0.946	0.876	0.98	1.099	1.034	0.984
CAB	0.971	0.914	0.977	1.104	1.047	1
CBI	0.912	0.88	0.997	1.12	1.019	0.982
COB	1.001	0.944	1.074	1.045	0.973	1.006
DB	0.946	0.879	0.979	1.128	1.022	0.987
IB	0.884	0.839	0.934	1.116	1.066	0.962
IOB	0.913	0.831	0.977	1.107	1.056	0.972
OBC	1.141	1.065	1.038	1.031	1.059	1.066
PSB	0.865	0.805	0.91	1.117	1.033	0.939
PNB	0.939	0.809	0.937	1.12	1.093	0.973
SB	0.955	0.919	0.967	1.107	1.092	1.005
UCOB	0.96	0.91	0.978	1.117	1.024	0.995
UBI	1.045	0.953	0.954	1.047	1.029	1.005
UTBI	0.903	0.851	0.914	1.119	1.033	0.959
VB	0.979	0.971	1.042	1.098	1.031	1.023
G.Mean	0.956	0.893	0.979	1.1	1.045	0.992

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 2005-07 to 2010-11 is 0.998, which means that on an average, the PECH is decreased by 0.2% as compared to respective previous years. The year wise analysis of the

Nationalised Banks reveals that in three years (2007-08, 2008-09 and 2009-10) the PECH has declined and in two years (2006-07, 2010-11) PECH has increased. Bank wise analysis reveals that PECH in four banks has increased and it has decreased in seven banks. In case of eight banks there is no change in PECH as compared to the respected previous years during the study period. Three banks' Pure efficiency change is higher than the

Nationalized Group over the study period. BOM is at the top in case of PECH with 1.8% increase while CBI is at bottom. It's Pure Efficiency has declined by 2.8% during the study period. The analysis reveals that there is no

change in pure efficiency in BOB, CAB, COB, DB, IB, OBC, PNB and VB over the period. from There is no change in PECH in six banks during the period of study.

**Table 3 : Pure Efficiency Change**

Banks	2006-07	2007-08	2008-09	2009-10	2010-11	G.Mean
ALLB	0.952	0.987	1.07	1	0.94	0.989
AB	1.059	0.974	0.994	1.033	0.984	1.008
BOB	1	1	1	1	1	1
BOI	1.05	1	1	0.996	1.004	1.01
BOM	1.049	1.044	1	0.977	1.023	1.018
CAB	1	1	1	1	1	1
CBI	1	1	0.984	0.91	0.971	0.972
COB	1	1	1	1	1	1
DB	1	1	1	1	1	1
IB	1	1	1	1	1	1
IOB	1.035	0.962	0.899	0.971	1.115	0.994
OBC	1	1	1	0.94	1.063	1
PSB	1	1	1	1	0.94	0.988
PNB	1	1	1	1	1	1
SB	1.036	0.953	1.017	0.876	1.118	0.997
UCOB	1.032	0.992	0.997	1.098	0.948	1.012
UBI	1	1	1	1	0.924	0.984
UTBI	1	1	0.981	1.019	0.992	0.998
VB	1	1	0.759	1.155	1.142	1
G.Mean	1.011	0.995	0.982	0.997	1.007	0.998

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 2005-06 to 2010-11 is 0.998, which means during this period, on an average, there is decline in SECH compared to respective previous years. The year wise analysis of the NBs for the study period, results show that in three years (2006-07, 2008-09 and 2009-10) the SECH has declined and in the year 2010-11 the SECH has increased whereas in the year 2007-08 there is no change in Scale Efficiency change index.

Bank wise analysis reveals that SECH in seven banks has increased and it has decreased in eight banks. In case of four banks there is no change in SECH as compared to the respective previous years. Seven banks' Scale efficiency change is higher than the Nationalized Group over the study period. BOI is at the top in case of SECH with 2.1% increase over the previous year while PSB is at bottom. It's Scale Efficiency has declined by 1.9% as compared to the previous year during the study period. The analysis reveals that there is no change in pure efficiency in COB, IB, OBC and PNB over the study period.

**Table 4 : Scale Efficiency Change**

Banks	2006-07	2007-08	2008-09	2009-10	2010-11	G.Mean
ALLB	0.984	1.032	0.988	1.023	1	1.005
AB	1.003	0.981	0.967	0.993	1.006	0.99
BOB	1.047	1	1	1	1	1.009
BOI	1.114	1	1	0.925	1.075	1.021
BOM	0.997	0.984	1.028	0.975	0.962	0.989
CAB	0.975	0.91	1.088	1.013	0.977	0.991
CBI	1.011	1.023	0.93	1.027	1.045	1.006
COB	1	1	1	1	1	1
DB	1.018	1.012	0.978	0.89	1.061	0.99
IB	1	1	1	1	1	1
IOB	1.005	0.994	1.004	1	1.002	1.001
OBC	1	1	0.9	1.061	1.047	1
PSB	0.926	1.019	1.019	1.005	0.942	0.981
PNB	1	1	0.964	1.037	1	1
SB	0.955	0.995	1.052	1	0.949	0.989
UCOB	1.016	1.003	1.012	0.95	1.055	1.007
UBI	0.949	1.064	1	0.983	1.017	1.002
UTBI	1	1	0.992	1.003	0.953	0.989
VB	1	1	0.995	0.986	0.973	0.991
G.Mean	0.999	1	0.995	0.992	1.003	0.998

Source: Calculated

**Table 5** deals with the Total Factor Productivity change index. The average TFP index of the Nationalised Banks, during the study period 2005-06 to 2010-11 is 0.989, which means that on an average, the TFPCH is decreased by 1.1% as compared to respective previous years. The year wise analysis for the Nationalised Banks reveals that in three years (2006-07, 2007-08 and 2008-09) the TFPCH has declined and in two years (2009-10, 2010-11) TFPCH has increased at group level. Bank wise analysis reveals that TFPCH in seven banks has

increased and it has decreased in twelve banks over the study period. Eleven banks' TFPCH is higher than the Nationalized Group over the study period. Oriental Bank of Commerce is at the top in case of TFPCH with 6.6% increase while Punjab and Sind Bank is at bottom. Its TFPCH has declined by 8.9% during the study period. The analysis reveals that on an average Total Factor Productivity decline is caused mainly by Technical Efficiency Change (Catching up effect which is 0.996) than Technical Change (frontier effect which is 0.992).



**Table 5 : Total Factor Productivity Change**

Banks	2006-07	2007-08	2008-09	2009-10	2010-11	G.Mean
ALLB	0.959	0.934	1.056	1.153	0.974	1.012
AB	0.995	0.831	0.934	1.103	1.092	0.986
BOB	0.971	0.871	1.007	1.14	1.079	1.009
BOI	1.11	0.912	0.988	1.004	1.116	1.023
BOM	0.99	0.9	1.007	1.047	1.018	0.991
CAB	0.946	0.832	1.063	1.118	1.023	0.991
CBI	0.922	0.9	0.912	1.047	1.033	0.961
COB	1.001	0.944	1.074	1.045	0.973	1.006
DB	0.964	0.889	0.957	1.004	1.084	0.978
IB	0.884	0.839	0.934	1.116	1.066	0.962
IOB	0.949	0.794	0.881	1.075	1.18	0.966
OBC	1.141	1.065	0.934	1.029	1.179	1.066
PSB	0.801	0.82	0.928	1.122	0.916	0.911
PNB	0.939	0.809	0.904	1.162	1.093	0.973
SB	0.945	0.871	1.035	0.97	1.158	0.991
UCOB	1.006	0.906	0.987	1.165	1.024	1.014
UBI	0.992	1.013	0.954	1.029	0.966	0.991
UTBI	0.903	0.851	0.89	1.144	0.977	0.947
VB	0.979	0.971	0.786	1.25	1.145	1.014
G.Mean	0.966	0.89	0.957	1.088	1.055	0.989

Source: Calculated

**Conclusion**

Total Factor Productivity change is the product of technical efficiency change and technical change. Malmquist productivity growth of Nationalised Banks during the study period has been regressed. Year wise analysis reveals that the productivity has regressed in the years 2006-07, 2007-08 and 2008-09 while it has increased in the years 2009-10 and 2010-11. Bank wise results reveal that during the study period seven banks namely ALLB, BOB, BOI, COB, OBC, UCOB and VB have experienced increased Productivity and eleven banks have experienced regressed productivity. The analysis further reveals that during the 2010-11 the productivity growth index has increased in all the five indicators. During this particular year Total Factor Productivity growth is caused mainly by Technical Change (frontier effect by 4.5%) than Technical Efficiency Change (Catching up effect by 1%). Overall analysis favours the fact that Total Factor Productivity growth index is more affected by Technical Efficiency Change rather than Technical Change.

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