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Technical Efficiency Change : A Study of Selected Commercial Banks in India Using Malmquist Productivity Index

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Abstract

The banking industry constitutes the core of the financial system and plays the very important role in the growth and progress of the country. Productivity evaluation of the banks becomes more important with the introduction of second reform phase. The Technical Efficiency Change (TEFCH) is one of the important components of total factor productivity change. Technical Efficiency Change (TEFCH) is described as the efficiency in reaching to the production limit. It is the product of Pure Technical Efficiency Change (PTECH) and Scale Efficiency Change (SECH). Pure Technical Efficiency Change (PTECH) measures change in technical efficiency under the assumption of Variable Return to Scale (VRS) whereas Scale Efficiency Change (SECH) measures the changes in efficiency due to movement toward or away from the point of optimal scale. Therefore, the present study made an attempt to evaluate the productivity of banks with reference to technical efficiency change after the second reform phase. The sample of thirty-two banks i.e., sixteen public and sixteen private banks, is taken for the study purpose under constant return to scale assumption. The Malmquist Productivity Growth Index which is a part of Data envelopment Analysis (DEA) model is used to measure TEFCH change of the banks. The research finds that the average technical efficiency change score of all the banks is 0.997 showing the decline of 0.3%. The study, further, reveals that the public sector banks have TEFCH score of 0.996 showing the decline of 0.4% and private sector banks score 0.998 showing the decline of 0.2%. The comparative analysis of public and private sector banks indicates that private sector banks are at better position than the public sector banks. The study further reveals that among all the banks IVB is at first rank with

TEFCH score 1.013 and UBI with score 1.010 and RB 1.007 occupying the second and third rank respectively.

Key Words

Banking Industry, Malmquist Productivity Index, Pure Efficiency Change, Scale Efficiency Change, Second Reform Phase, Technical Efficiency Change.

INTRODUCTION

The second phase of the banking sector reforms i.e., post liberalization era introduce the banking sector with new challenges and opportunities. The main motive behind the banking sector reforms has been the development of banking industry and to induce the financial discipline into their operations. As the banks' Technical Efficiency Change determines the very existence and growth of banking sector. Therefore, it is important to analyze whether technical efficiency change of banks has improved after the second reform phase.

Banks' Technical Efficiency Change (TEFCH) is the vital indicator of economic performance of an economy. It is defined as the efficiency in reaching to the production limit and is the product of Scale Efficiency Change (SECH) and Pure Technical Efficiency Change (PTECH). The Technical Efficiency Change (TEFCH) is measured with the help of Malmquist Productivity Growth Index. This index is defined on a benchmark technology satisfying constant return to scale, which is to be distinguished from a best practice technology allowing for variable return to scales. This convention enables it to incorporate the influence of scale economies, as a departure of the best practice technology from the benchmark technology.

If Mo > 1 denotes productivity growth,

Mo < 1 denotes productivity decline,

Mo = 1 denotes stagnation.

Here, Mo denotes Malmquist Index.

The Technical Efficiency Change (TEFCH) becomes vital area of concern for management of banks. Therefore, in the present study, the attempt has been made to determine the Technical Efficiency Change of public and private sector banks. The purpose of the study is to evaluate the variables affecting the Technical Efficiency Change of the banks.

REVIEW OF LITERATURE

By studying various studies related to productivity of banking sector, an insight is developed regarding the factors which have impact on banks' performance. Some of the important studies are reviewed here :

Kumbhakar and Kapoor (2003) studies the relationship between deregulation and Total Factor Productivity (TFP) growth in the Indian banking industry using a generalized shadow cost function approach. Data contain 27 PSB and 23 Private Sector Banks over 1985–96 that covers both pre and post-deregulation periods. Study reveals that a significant decline in regulatory distortions and the anticipated increase in TFP growth have not yet materialized following deregulation. While private sector banks have improved their performance mainly due to the freedom to expand output, public sector banks have not responded well to the deregulation measures.

Reddy (2005) analysed changes in bank productivity growth through employing the Malmquist Total Factor Productivity (TFP) Index. Data used in the study contains 27 public sector banks, 21 old private banks, 6 new private banks and 26 foreign banks totaling 80 banks for the period 1996 to 2002. Overall TFP of banks was almost stagnant during the period. The highest TFP has been observed among public sector banks, followed by old private banks, while both new private banks and foreign banks recorded decline in TFP growth.

Sathye (2005) examines the effect of bank privatization on bank performance and efficiency. For this data published by IBA for five years i.e., 1998-2002 are analysed using the difference of means test. The synchronic approach is used and comparison is made between India's gradual privatization strategy with that of other countries like Poland, Mexico and Mozambique. The result reveals that partially privatized banks performed better than fully public sector banks.

Rao (2007) examines the impact of reform measures on the efficiency, profitability and overall performance of banks vis-à-vis bank groups in public and private sector during the period 1992-93 to 2002-03. The study reveals that the private sector banks are much ahead of public sector banks in respect to efficiency and in all profitability indices except Net Interest Margin. It appears that all public sector banks have not responded to the process of reforms in the same degree and spirit. The analysis also reveals that the new private sector banks are better than old private banks and even better than various groups of public sector banks in performance.

Donatos and Giokas (2008) discuss the limitation of using Accounting Ratio Analysis for assessing performance and, presents and interprets the results from the application of mathematical programming models in a sample of branches of a Greek bank. Data Envelopment Analysis Model (DEA) is used to do the analysis. The analysis reveals that the large branches have higher operational efficiency than small branches and that there is not a close relationship between the efficiency and profitability of a bank branch.

Bhandari (2010) considered overall (Malmquist) total factor productivity improvement achieved by 68 Indian commercial banks from 1998-99 to 2006-07, the true liberalised era in some sense, and decomposed it into the three of its economically meaningful components, namely technical change, technical efficiency change and scale (efficiency) change factor using Data Envelopment Analysis (DEA) methodology. Results suggest that public sector banks are, on an average, adjusting themselves to the changing environment better and improving their performance relative to their counterparts under private and foreign ownership. To be specific, the government should more cautiously approach liberalizing the banking sector and should not blindly invite more foreign players to it.

Bhatnagar and Sharma (2010) attempt to find out the performance of Indian banking sector amidst the Global Financial Turmoil. The period covered under the study stretches over 2007-2008. The banks selected for study are State Bank of India, ICICI Bank, Punjab National Bank, HDFC Bank and Bank of Baroda. Study reveals that all the five leading banks have shown growth, but the most important challenge faced by the government during this period is to ensure a balance between inflation and growth.

Chander and Chandel (2010) examine the financial viability, efficiency and performance of four District Central Cooperative Banks (DCCB) operating in Gurgaon division in Haryana for a period of twelve years (1997-98 to 2008-2009) by financial analysis and z-score analysis. The results reveal that four DCCB with approximately fifty branches have not been performing well on all financial parameters taken for study.

Dangwal and Vaishali (2014) made an attempt to analyse the operational efficiency of Indian banking sector from 2002-03 to 2011-12. The comparative analysis is being done between public sector, private sector and foreign banks. The study focused on the factors affecting the operational efficiency of banks with reference to net profit as a percentage of total assets, spread as a percentage of total assets, provision and contingencies as a percentage of total liabilities, net NPA as a percentage of net advances with the help of Median, Chi Square Test, Mean and Standard Deviation. The study has revealed that the operational efficiency of foreign banks is better than public and private sector banks. The study also indicates that there is significant difference in the operational efficiency of Indian banking industry with respect to variables selected for the study except net NPA as a percentage of net advances.

The above review of literature indicates that there are a number of valuable studies related to technical efficiency change, but there is a need to conduct a

systematic and comprehensive research for the period 1998-99 to 2012-13 to fill the gap. The research gap is noticeable because after the second reform phase the productivity is among the important factors which enhance the growth of banking sector. Furthermore, the banking industry has not been fully explored to this aspect. The previous studies have been reviewed critically to identify the gaps that existed in the literature in this area. Hence, the proposed study has been selected for the research purpose.

OBJECTIVES OF THE STUDY

The objectives of the study are :

- To evaluate the technical efficiency change of public and private sector banks in India during the period selected for the study i.e., 1998-99 to 2012-13.
- To investigate the factors affecting the technical efficiency change of public and private sector banks in India.

RESEARCH METHODOLOGY

Sample Size

For the analysis purpose, sample of thirty-two banks (sixteen public and sixteen private sector banks) is selected from the universe of banks in India. Among the sixteen public sector banks there are twelve banks from nationalized bank group, four banks from SBI and its associates. The sample of private sector banks includes new private sector and old private sector banks. There are five new private sector banks and eleven old private sector banks selected in the study. Random Sampling Technique is used for the study.

The samples of the banks selected in the study are as follows :

S. No.	Public Sector Banks (PUSB)	Private Sector Banks (PRSB)
1.	Allahabad Bank (AB)	Axis Bank (AXB)
2.	Bank of Baroda (BOB)	City Union Bank (CUB)
3.	Bank of India (BOI)	Dhanlaxmi Bank (DB)
4.	Canara Bank (CAB)	Development Credit Bank (DCB)
5.	Central Bank of India (CBI)	Federal Bank (FB)
6.	Corporation Bank (COB)	HDFC Bank (HDFC)
7.	IDBI Bank Ltd. (IDBI)	ICICI Bank (ICICI)

8.	Indian Overseas Bank (IOB)	IndusInd Bank (IIB)
9.	Oriental Bank of Commerce (OBC)	ING Vysya Bank (IVB)
10.	Punjab National Bank (PNB)	Jammu and Kashmir Bank (JKB)
11.	Syndicate Bank (SB)	Karnataka Bank (KB)
12.	State Bank of Bikaner and Jaipur (SBBJ)	Karur Vysya Bank (KVB)
13.	State Bank of Hyderabad (SBH)	Lakshmi Vilas Bank (LVB)
14.	State Bank of India (SBI)	Nainital Bank (NB)
15.	State Bank of Patiala (SBP)	Ratnakar Bank (RB)
16.	Union Bank of India (UBI)	South Indian Bank (SIB)

* The name of UTI Bank has been changed to Axis Bank from July 30, 2007.
* ING Vysya Bank formed in 2002 by purchase of an equity stake in Vysya Bank by Dutch ING Group.
* IDBI continued to serve as Development Financial Institution till the year 2004 when it was transformed into a bank. In 2008, name of IDBI Ltd. changed to IDBI Bank Ltd.

Period of the Study

The time period for study is from 1998-99 till 2012-13 i.e., Post-Liberalization Era. The reason for selection of this period is that the second phase of banking sector reforms started in 1998-99.

Data Collection

The study is based on the secondary data. The data was collected through Report on Trend and Progress of Banking in India and Statistical Tables relating to banks in India.

Tools of Analysis

The Malmquist Productivity Growth Index which is a part of Data Envelopment Analysis (DEA) model is used to measure Technical Efficiency Change (TEFCH) of the public and private sector banks. The productivity growth through Malmquist productivity index is relative to the previous year. Therefore, no data exists for the initial sample year i.e., 1998-99.

The description of the model and input and outputs are as follows :

- Approach : Intermediation Approach
- Model : Output Oriented Model
- Output Variables : Advances, Interest Income, Non-interest Income and Investment.
- Input Variables : Branches, Employees, Interest Expenditure and Deposits.

DATA ANALYSIS AND FINDINGS

Pure Technical Efficiency Change (PTECH): The empirical finding of the component of technical efficiency i.e., PTECH is shown in Table 1 of thirty-two banks (sixteen public and sixteen private sector banks) from 1998-99 to 2012-13. It has been observed that the average pure technical efficiency change score of all the banks is 1.003. This indicates that PTECH score has increased by 0.3%. The public sector banks have PTECH score of 0.994 showing the decline of 0.6% and private sector banks scores 0.998 showing the decline of 0.2%. The comparative analysis of public and private sector banks indicates that private sector banks are at better position than the public sector banks in terms of PTECH. Among the public sector banks in terms of PTECH, the highest geometric mean score is obtained by Bank of Baroda, State Bank of India and IDBI Bank, all with score 1.000 obtaining the first rank followed by Punjab National Bank (0.997) obtaining the second rank and Bank of India, Indian Overseas Bank and Syndicate Bank, all with score 0.996 obtaining the third rank. Among the private sector banks, in terms of PTECH, the highest geometric mean score is obtained by Dhanlaxmi Bank (1.007) followed by ING Vysya Bank (1.001) and Axis Bank, City Union Bank, Development Credit Bank, HDFC Bank, ICICI Bank, IndusInd Bank, Ratnakar Bank and South Indian Bank, all with score (1.000) obtaining the first, second and third rank respectively.

Scale Efficiency Change (SECH)

The empirical finding of the component of technical efficiency i.e., SECH is shown in Table 2 of thirty-two banks (sixteen public and sixteen private sector banks from 1998-99 to 2012-13. It has been observed that the average scale efficiency change score is 1.000. This indicates that SECH score is constant. The public sector banks have SECH score of 1.001 showing the improvement of 0.1% and private sector banks scores 1.000 showing no change. The comparative analysis of public and private sector banks indicates that public sector banks are at better position than the private sector banks, in terms of SECH. Among the public sector banks, in terms of SECH, the highest geometric mean score is obtained by Union Bank of India (1.010) obtaining the first rank, followed by Central Bank of India and Oriental Bank of Commerce both with score 1.007 obtaining the second rank and Indian Overseas Bank (1.006) obtaining the third rank. Among the private sector banks, in terms of SECH, the highest geometric mean score is obtained by Federal Bank (1.014) followed by ING Vysya Bank (1.012) and Ratnakar Bank (1.007) obtaining the first, second and third rank respectively.

Table 1

Pure Technical Efficiency Change

Sr. No.	Year/ Bank	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	G. M.
1.	AB	1.021	0.994	1.004	1.025	0.960	0.952	1.004	1.043	0.977	1.052	0.937	1.061	1.018	0.891	0.994
2.	BOB	1.000	1.000	0.994	0.986	1.020	0.953	1.010	1.039	0.987	1.014	1.000	1.000	1.000	1.000	1.000
3.	BOI	1.000	1.000	1.000	1.000	1.000	0.988	0.931	1.080	1.006	0.987	0.978	1.036	0.937	1.019	0.996
4.	CAB	1.000	1.000	1.000	0.984	1.016	0.976	1.009	0.952	0.932	1.053	1.015	1.015	0.910	1.072	0.994
5.	CBI	0.989	0.993	0.985	1.018	0.996	0.979	0.951	0.980	1.022	0.943	0.955	1.099	0.940	0.969	0.986
6.	COB	1.000	0.998	0.995	1.007	0.987	0.989	1.024	1.000	0.961	0.978	0.964	1.103	0.875	0.965	0.987
7.	IDBI	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
8.	IOB	0.996	1.020	1.009	1.004	1.029	1.010	0.991	0.987	0.972	1.004	0.938	1.140	0.888	0.983	0.996
9.	OBC	1.000	1.000	1.000	1.000	0.995	0.860	1.034	1.061	0.963	1.013	1.038	1.037	0.909	0.990	0.991
10.	PNB	0.978	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.993	0.995	1.012	0.987	0.978	0.997
11.	SB	1.064	1.000	1.000	0.987	0.997	0.926	1.073	0.930	0.959	1.036	1.062	1.022	0.948	0.960	0.996
12.	SBBJ	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.972	0.967	0.999	1.020	0.984	0.994	0.931	0.990
13.	SBH	1.000	1.000	1.000	0.996	1.004	0.866	1.011	1.042	0.976	1.008	1.017	1.038	0.971	1.013	0.994
14.	SBI	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
15.	SBP	1.000	1.000	1.000	1.000	1.000	0.891	1.012	1.083	0.908	0.964	1.017	1.100	0.927	1.016	0.992
16.	UBI	0.920	1.075	1.007	0.969	0.980	0.970	1.030	1.014	0.975	1.019	0.967	1.050	0.990	1.049	1.000
	PUSB	0.997	1.006	0.999	0.998	0.998	0.958	1.004	1.010	0.974	1.003	0.993	1.042	0.954	0.989	0.994

Contd.

Contd. Table 1

Sr. No.	Year/ Bank	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	G. M.
17.	AXB	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
18.	CUB	1.159	0.978	0.992	0.933	1.025	1.029	1.012	0.919	1.067	0.945	0.953	1.084	0.955	0.984	1.000
19.	DB	1.188	1.014	0.994	1.014	0.972	0.914	0.991	0.934	1.044	1.073	0.987	0.959	1.110	0.951	1.007
20.	DCB	1.000	1.000	1.000	1.000	0.902	0.963	1.008	1.143	1.000	1.000	1.000	1.000	1.000	1.000	1.000
21.	FB	1.000	1.000	1.000	0.905	0.978	0.970	1.036	1.070	1.012	1.040	0.972	1.029	0.960	0.901	0.989
22.	HDFC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
23.	ICICI	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
24.	IIB	1.000	1.000	1.000	1.000	1.000	1.000	0.965	0.953	1.019	0.962	1.110	1.000	1.000	1.000	1.000
25.	IVB	1.134	0.902	1.109	1.000	1.000	0.831	1.133	1.063	0.979	1.022	0.950	1.031	0.933	0.984	1.001
26.	JKB	0.923	0.996	1.078	0.967	0.922	0.898	1.075	1.177	0.914	1.007	0.989	1.099	1.000	0.867	0.990
27.	KB	1.017	1.009	1.132	0.854	1.032	0.970	0.973	1.004	1.044	1.147	0.816	1.185	0.849	1.017	0.997
28.	KVB	1.125	1.000	1.000	0.961	1.041	0.941	1.027	0.959	1.048	0.911	1.005	1.013	0.964	1.012	0.999
29.	LVB	1.000	1.000	1.000	0.933	0.982	0.966	0.996	0.931	1.061	1.022	0.983	1.061	0.942	1.012	0.991
30.	NB	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.997	1.003	1.000	1.000	1.000	1.000	0.999
31.	RB	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
32.	SIB	1.115	0.978	0.996	0.972	1.043	0.921	1.033	0.974	1.047	0.984	0.972	0.999	1.016	0.975	1.000
	PRSB	1.038	0.991	1.017	0.970	0.992	0.961	1.015	1.005	1.014	1.005	0.981	1.027	0.981	0.980	0.998
	G. M.	1.115	0.999	1.009	0.984	0.996	0.960	1.010	1.008	0.994	1.005	0.988	1.035	0.968	0.985	1.003

Source : Calculated

Table 2
Scale Efficiency Change

Sr. No.	Year/ Bank	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	G. M.
1.	AB	0.989	0.998	1.007	1.010	0.983	1.017	1.006	0.934	1.078	1.000	1.001	1.000	1.000	0.999	1.001
2.	BOB	0.993	0.985	1.007	1.007	1.002	1.009	1.017	1.024	1.023	1.013	1.000	1.000	1.000	0.840	0.993
3.	BOI	0.909	1.100	0.905	1.105	0.944	0.876	1.186	0.952	1.070	0.999	0.996	0.940	1.061	0.928	0.994
4.	CAB	0.997	1.022	0.983	0.992	0.981	0.969	1.070	1.017	1.044	1.010	0.996	0.973	1.030	0.897	0.997
5.	CBI	1.033	0.991	1.013	1.036	0.998	0.999	1.027	0.918	1.101	0.999	1.001	0.996	1.003	1.000	1.007
6.	COB	1.052	1.011	1.000	1.012	0.996	1.014	1.001	0.964	1.036	0.998	1.000	1.004	0.999	0.999	1.005
7.	IDBI	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
8.	IOB	1.051	1.005	1.005	1.008	0.969	1.034	1.005	0.951	1.068	1.000	1.000	1.000	0.999	0.999	1.006
9.	OBC	1.068	0.955	1.087	1.008	0.970	1.001	1.027	0.983	1.019	0.999	0.999	1.002	1.000	0.999	1.007
10.	PNB	0.938	1.017	0.995	1.046	0.983	0.950	1.013	1.008	1.071	0.996	0.999	1.005	1.004	0.912	0.994
11.	SB	0.953	1.039	0.979	1.040	0.998	1.007	1.012	0.953	1.060	1.000	1.000	0.975	1.024	0.998	1.002
12.	SBBJ	1.059	1.000	1.000	1.000	1.000	1.000	1.000	0.925	1.078	1.002	1.000	0.991	1.009	0.985	1.002
13.	SBH	1.000	1.000	0.999	1.001	1.000	1.000	0.999	0.952	1.050	1.000	1.000	1.001	0.999	0.997	0.999
14.	SBI	1.027	0.975	1.052	0.960	0.993	0.974	1.059	0.963	1.055	1.001	0.990	1.008	1.003	0.939	0.999
15.	SBP	1.000	1.000	1.000	1.000	1.000	0.999	0.999	0.970	1.032	1.001	1.000	1.000	1.000	0.989	0.999
16.	UBI	1.057	1.005	1.019	1.015	0.993	1.002	1.050	0.941	1.066	0.998	1.004	0.998	1.003	1.001	1.010
	PUSB	1.007	1.006	1.002	1.014	0.988	0.990	1.028	0.965	1.052	1.000	0.999	0.993	1.008	0.966	1.001

Contd.

Contd. Table 2

Sr. No.	Year/ Bank	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	G. M.
17.	AXB	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
18.	CUB	1.040	0.959	1.022	1.005	0.997	0.995	1.019	0.976	1.008	1.014	0.987	1.015	0.988	0.982	1.000
19.	DB	0.980	1.000	1.040	1.001	0.925	1.046	1.027	0.980	0.998	0.991	1.028	0.998	0.941	0.997	0.996
20.	DCB	1.092	1.000	1.000	0.886	1.012	1.053	1.020	0.967	1.074	1.000	0.881	1.132	0.925	0.913	0.994
21.	FB	1.228	1.000	1.000	0.999	1.001	0.997	1.000	0.986	1.013	1.005	0.995	1.004	0.998	0.992	1.014
22.	HDFC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999	0.999
23.	ICICI	0.970	1.031	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
24.	IIB	1.000	1.000	1.000	1.000	1.000	1.000	0.942	0.993	1.025	0.993	0.991	1.060	1.000	0.992	0.999
25.	IVB	1.185	0.992	1.020	1.000	1.000	0.996	0.999	0.950	1.045	1.013	0.992	0.982	1.021	0.994	1.012
26.	JKB	0.986	1.016	0.999	1.001	0.993	1.007	0.999	1.002	0.997	1.002	0.997	1.005	1.000	0.988	0.999
27.	KB	1.032	1.011	0.988	1.008	0.994	0.998	1.010	0.998	0.994	1.009	0.988	0.987	1.018	0.989	1.001
28.	KVB	1.002	1.000	1.000	0.996	1.004	0.990	0.997	0.982	1.021	1.006	0.989	1.010	1.001	0.987	0.998
29.	LVB	1.000	1.000	1.000	0.995	0.962	1.023	0.990	1.022	0.992	1.002	1.000	1.015	0.983	0.966	0.996
30.	NB	0.978	0.986	1.037	1.000	0.978	0.925	1.106	1.000	0.925	1.060	0.918	1.030	1.019	0.893	0.987
31.	RB	1.014	1.005	1.094	0.956	0.883	1.047	0.992	1.139	0.990	1.010	0.949	1.053	1.000	1.000	1.007
32.	SIB	1.023	1.005	0.994	1.004	0.985	1.011	0.998	0.986	1.014	1.005	1.001	0.996	1.002	0.990	1.000
	PRSB	1.031	1.000	1.012	0.990	0.983	1.005	1.006	0.998	1.005	1.006	0.981	1.017	0.993	0.979	1.000
	G. M	1.019	1.003	1.007	1.002	0.985	0.998	1.017	0.982	1.029	1.004	0.990	1.005	1.001	0.973	1.000

Source : Calculated

Technical Efficiency Change (TEFCH)

It is one of the important components of productivity growth. Table 3 indicates technical efficiency change of thirty-two banks (sixteen public and sixteen private sector banks) from 1998-99 to 2012-13 under constant return to scale assumption. It has been observed that the average technical efficiency change score of all the banks is 0.997. This indicates that TEFCH score has declined by 0.3%. The eighteen banks i.e., IDBI, IOB, OBC, SB, SBI, UBI, AXB, CUB, DB, FB, HDFC, ICICI, IIB, IVB, KB, KVB, RB, SIB have recorded higher TEFCH score than the average TEFCH score. Out of these banks, eleven banks, namely IDBI, IOB, UBI, AXB, CUB, DB, FB, ICICI, IVB, RB, SIB have TEFCH score one or more than one. The public sector banks have TEFCH score of 0.996 showing the decline of 0.4% and private sector banks' score 0.998 showing the decline of 0.2%. The comparative analysis of public and private sector banks indicates that private sector banks are at better position than the public sector banks. The year-wise analysis of total banking sector reveals that in seven years (2003, 2004, 2005, 2007, 2010, 2012, 2013) TEFCH score has declined and in seven years (2000, 2001, 2002, 2006, 2008, 2009, 2011) TEFCH score has increased. The bank-wise analysis indicates that average TEFCH score among public sector banks has increased in two banks, namely IOB and UBI and TEFCH score for IDBI is 1. The score for remaining thirteen public sector banks has declined. Among the private sector banks, TEFCH score for five banks i.e., DB, FB, IVB, RB, SIB has increased and for three banks the score is 1. For the remaining eight private banks, the TEFCH score has decreased. Among all the banks, IVB is at first rank with TEFCH score 1.013 and UBI with score 1.010 and RB 1.007 occupying the second and third rank respectively. The LVB and NB have the lowest score 0.987 occupying the last rank, followed by JKB with score 0.989 and BOI with score 0.990.

CONCLUSION

The present study analyzes and compares the productivity of public and private sector banks with respect to Technical Efficiency Change (TEFCH). TEFCH is one of the important components of total factor productivity change and is the product of Scale Efficiency Change (SECH) and Pure Technical Efficiency Change (PTECH). Therefore, the present study made an attempt to evaluate the productivity of banks with reference to technical efficiency change after the second reform phase. The sample of thirty-two banks i.e., sixteen public and sixteen private banks is taken for the study purpose during the period 1998-

Table 3

Technical Efficiency Change

Sr. No.	Year/ Bank	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	G. M.
1.	AB	1.009	0.992	1.012	1.035	0.944	0.969	1.010	0.974	1.054	1.052	0.938	1.061	1.018	0.890	0.995
2.	BOB	0.993	0.985	1.002	0.993	1.022	0.962	1.028	1.064	1.009	1.026	1.000	1.000	1.000	0.840	0.993
3.	BOI	0.909	1.100	0.905	1.105	0.944	0.866	1.105	1.028	1.077	0.987	0.974	0.974	0.994	0.946	0.990
4.	CAB	0.997	1.022	0.983	0.976	0.997	0.946	1.079	0.968	0.973	1.064	1.011	0.988	0.938	0.961	0.992
5.	CBI	1.022	0.984	0.998	1.055	0.994	0.978	0.977	0.899	1.125	0.942	0.956	1.094	0.943	0.969	0.993
6.	COB	1.052	1.009	0.995	1.019	0.983	1.003	1.026	0.964	0.996	0.977	0.963	1.107	0.875	0.964	0.993
7.	IDBI	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
8.	IOB	1.047	1.025	1.014	1.013	0.998	1.044	0.996	0.938	1.038	1.004	0.938	1.140	0.888	0.982	1.002
9.	OBC	1.068	0.955	1.087	1.008	0.965	0.861	1.062	1.043	0.982	1.012	1.038	1.039	0.909	0.990	0.999
10.	PNB	0.917	1.040	0.995	1.046	0.983	0.950	1.013	1.008	1.071	0.989	0.994	1.017	0.991	0.892	0.992
11.	SB	1.014	1.039	0.979	1.026	0.995	0.933	1.087	0.886	1.016	1.036	1.062	0.997	0.972	0.959	0.998
12.	SBBJ	1.059	1.000	1.000	1.000	1.000	1.000	1.000	0.899	1.041	1.001	1.020	0.975	1.003	0.917	0.993
13.	SBH	1.000	1.000	0.999	0.997	1.004	0.865	1.011	0.992	1.025	1.008	1.017	1.038	0.970	1.010	0.994
14.	SBI	1.027	0.975	1.052	0.960	0.993	0.974	1.059	0.963	1.055	1.001	0.990	1.008	1.003	0.939	0.999
15.	SBP	1.000	1.000	1.000	1.000	1.000	0.890	1.011	1.051	0.936	0.964	1.016	1.100	0.927	1.005	0.991
16.	UBI	0.972	1.080	1.027	0.984	0.973	0.973	1.082	0.954	1.039	1.017	0.970	1.048	0.993	1.050	1.010
PUSB		1.004	1.012	1.002	1.013	0.987	0.949	1.033	0.975	1.026	1.004	0.992	1.035	0.963	0.956	0.996

Contd.

Contd. Table 3

Sr. No.	Year/ Bank	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	G. M.
17.	AXB	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
18.	CUB	1.205	0.937	1.015	0.938	1.022	1.023	1.031	0.897	1.075	0.958	0.941	1.100	0.944	0.966	1.000
19.	DB	1.164	1.014	1.033	1.015	0.899	0.956	1.018	0.915	1.042	1.063	1.015	0.957	1.044	0.948	1.003
20.	DCB	1.092	1.000	1.000	0.886	0.912	1.014	1.028	1.105	1.074	1.000	0.881	1.132	0.925	0.913	0.994
21.	FB	1.228	1.000	1.000	0.904	0.979	0.967	1.035	1.055	1.025	1.045	0.966	1.034	0.958	0.894	1.003
22.	HDFC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999	0.999
23.	ICICI	0.970	1.031	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
24..	IIB	1.000	1.000	1.000	1.000	1.000	1.000	0.909	0.946	1.045	0.955	1.100	1.060	1.000	0.992	0.999
25.	IVB	1.344	0.895	1.132	1.000	1.000	0.827	1.132	1.009	1.023	1.035	0.942	1.013	0.952	0.978	1.013
26.	JKB	0.910	1.012	1.077	0.968	0.915	0.905	1.073	1.179	0.911	1.009	0.986	1.105	1.000	0.857	0.989
27.	KB	1.049	1.021	1.118	0.862	1.026	0.968	0.982	1.002	1.038	1.156	0.806	1.169	0.864	1.006	0.999
28.	KVB	1.127	1.000	1.000	0.957	1.045	0.932	1.024	0.941	1.070	0.916	0.994	1.024	0.965	0.999	0.998
29.	LVB	1.000	1.000	1.000	0.928	0.945	0.988	0.987	0.951	1.052	1.023	0.983	1.076	0.926	0.977	0.987
30.	NB	0.978	0.986	1.037	1.000	0.978	0.925	1.106	1.000	0.922	1.063	0.918	1.030	1.019	0.893	0.987
31.	RB	1.014	1.005	1.094	0.956	0.883	1.047	0.992	1.139	0.990	1.010	0.949	1.053	1.000	1.000	1.007
32.	SIB	1.141	0.983	0.990	0.976	1.027	0.931	1.031	0.960	1.061	0.989	0.973	0.995	1.018	0.966	1.001
	PRSB	1.070	0.992	1.030	0.960	0.975	0.966	1.020	1.003	1.019	1.012	0.963	1.045	0.975	0.961	0.998
	G. M	1.037	1.002	1.016	0.986	0.981	0.958	1.027	0.989	1.023	1.009	0.978	1.040	0.969	0.958	0.997

Source : Calculated

99 to 2012-13 under constant return to scale assumption. The Malmquist Productivity Growth Index which is a part of Data Envelopment Analysis (DEA) model is used to measure TEFCH change of the banks. The empirical finding of the component of technical efficiency change i.e., PTECH and SECH is analysed. The public sector banks have PTECH score of 0.994 showing the decline of 0.6% and private sector banks' score 0.998 showing the decline of 0.2%. The comparative analysis of public and private sector banks indicates that private sector banks are at better position than the public sector banks in terms of PTECH. The public sector banks have SECH score of 1.001 showing the improvement of 0.1% and private sector banks' score 1.000 showing no change. The comparative analysis of public and private sector banks indicates that public sector banks are at better position than the private sector banks in terms of SECH. The research further reveals that the average technical efficiency change score of all the banks is 0.997. This indicates that TEFCH score has declined by 0.3%. The public sector banks have TEFCH score of 0.996 showing the decline of 0.4% and private sector banks' score 0.998 showing the decline of 0.2%. The comparative analysis of public and private sector banks indicates that the private sector banks are at better position than the public sector banks. The study further reveals that among all the banks, IVB is at first rank with TEFCH score 1.013 and UBI with score 1.010 and RB 1.007 occupying the second and third rank respectively.

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