Productivity Change in Nationalised Banks Operating in India:
A Malmquist Productivity Index Approach

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ABSTRACT

The present study endeavours to examine the change in productivity of nationalised banks operating in India. The data were collected from the Statistical Tables Related to Banks in India published by the Reserve Bank of India for the period of 21 years starting from the year 1997-98 i.e. after second generation reforms till the year 2017-18. Using Data Envelopment Analysis (DEA) based Malmquist Productivity Index (MPI) approach, it was found that only six banks including the Indian Bank, the Vijaya Bank, the Andhra Bank, the Bank of Baroda, the Indian Overseas Bank and the Bank of India showed positive productivity change. Majority of the banks showed deterioration in productivity. It was concluded that the productivity change was negative due to inability of Indian nationalised banks to adopt technology. But, on the other hand, these banks were able to achieve high level of efficiency improvement. It is strongly recommended that Indian nationalised banks should invest more in technology in order to improve productivity growth.

Keywords: Malmquist productivity Index, Indian Nationalised Banks, Data Envelopment Analysis, Technological Change, Efficiency Change.

INTRODUCTION:

Due to ever changing environment of the banking sector across globe, measurement of productivity has been area of continuous interest for researchers. India is not an exception. Since independence of the country in the year 1947, Indian banks have witnessed a drastic change in the environment in which it operates. After independence, other than the State Bank of India, these banks were owned and operated by the private sector. The move from privatisation towards nationalisation of the banking sector started with the issuance of Banking Companies (Acquisition and Transfer of Undertakings) Ordinance, 1969. Fourteen largest private sector banks with the share of 85% in deposits of the country were nationalised. In order to have more control on flow of credit, the Government of India took second step towards nationalisation. Six more private sector banks were nationalised in the year 1980 which gave Government a control over 91% of the entire banking business in India. Later on in the year 1993 two banks were merged and the count of nationalised banks came to 19 in total. In order to fulfil the developmental needs of the Indian economy, these nationalised banks started lending for social welfare, priority sector including agriculture and allied areas. These banks also opened branches in rural area in order to fill the rural-urban financial development gap. During this period these banks were working under the full support of the Reserve Bank of India and were channelizing funds towards most productive and much desired areas for the growth of the Indian economy.

Then in the year 1991, the Government of India took another initiative by adopting policy of nationalisation, privatisation and liberalisation. The banking sector scenario was analysed and financial sector reforms were introduced under in two phases. First generation reforms focused on lowering of cash reserve ratio, statutory liquidity ratio, provisioning for non-performing assets, maintenance of capital adequacy ratio, strengthening

supervision of banks and giving freedom of operations. Second generation reforms were introduced in the year 1998 in order to review the performance of first generation reforms and to strengthen the financial system of India. These reforms advocated mergers of strong banks, narrow banking, review of functions of board and banking laws alongwith other initiatives. These reforms resulted into emergence of technology driven and mnuch advanced new private sector banks on the financial map of Indian economy. Through reforms the Government of India also tried to improve productivity, competitiveness and efficiency of the banking sector. Keeping this changing operating environment of the banking sector in India into consideration, the present research endeavors to measure the productivity change amongst the nationalised banks group during this span of 21 years since the second generation reforms were introduced.

REVIEW OF LITERATURE:

There are numerous studies conducted on the topic abroad, it shows that the subject has been the continuous interest area for the researchers. The section reviews only those studies that have measured productivity of the banking sector using the Malmquist Productivity Index approach in India and abraod. Jahan (2019) examined productivity change in 29 Bangladeshi listed commercial banks including six Islamic and 23 conventional banks during 2011-2015. Islamic banks were found to be relatively better in exhibiting total factor productivity. This was due to progress in efficiency change as compared to technological change. Further, it was found that conventional banks failed to incorporate technological innovations and later their managed to streamline their operations. Jiang and He (2018) found improved technological efficiency in 12 out of 17 Chinese banks during 2012-2017. It was concluded that macro prudential framework as adopted by the Chinese government post financial crises played positive role in bringing about financial stability and economic development on China. Basri et.al.(2018) examined 16 Malaysian Islamic banks and found that least efficient banks improved their technical efficiency and total factor productivity during the period of study i.e. 2008-2015. Similarly studying the Islamic banks of 13 countries Ganouati and Essid (2017) found them to be productive during the period 2005-2014. It was concluded that subprime crises had a slightly negative effect on productivity of Islamic banking industry. Junwen et.al. (2017) studied the Chinese banks during 2012-14 and found the performance of the state-owned banks to be stable with high efficiency. Joint stock banks followed state owned banks with declined pure technology efficiency. The Rural Chinese banks were better as compared to the City commercial banks. Palečková (2017) found positive efficiency change in the Czech Commercial Banks during the period 2004-2013. Sufian and Kamarudin (2017) found higher total factor productivity during postmerger period in the Malaysian banking industry due to technological progress. Alinezhad and Sadeghloo (2016) observed infeasible productivity growth of five Iranian banks during the period 2009-2013. Lema (2016) found 80% banks exhibited productivity progress out of from 13 private sector and 2 government owned Ethiopian banks using MPI. Further efficiency changes showed regress and technological change showed progress during the period of study. Marković et.al. (2015) did not find any change in average efficiency in entire Serbian banking sector during 2007-2010 on year on year basis. Kofi et.al. (2015) examined 6 retail banks and 2 small domestic banks operating in New Zealand during 2007-2011 using DEA and MPI approach. It was found that retail banks demonstrated high level of efficiency. Overall banks showed modest productivity growth with high technology growth and declined efficiency growth. Raphael (2013) found improved productivity change in most of the Tanzanian commercial banks under study during the period of 7 years. It was concluded that with the objective to reduce cost of innovation, small banks have invested in technological innovation.

On measuring productivity change in Indian banking sector, Gulati and Kumar (2016) used unbalanced panel data from the year 1991-92 till 2007-08 to examine total factor productivity change. Modest uptrend was found during post deregulation period. Private sector banks outperformed and Public sector banks showed stable growth. Further, foreign banks emerged as leading technology innovators in Indian banking system. Galagedera and Edirisuriya (2004) found no significant productivity in private sector banks operating in India during 1995-2002. However, public sector banks demonstrated modest positive productivity change. Private sector banks showed negative technology change. Smaller banks were found to be less efficient. Other studies like Kumar and Thamilselvan (2018), Maiti and Jana (2017), Pandey and Singh (2015) examined only efficiency using DEA models. Here, it is concluded here that MPI approach has been used widely across globe to study productivity change but handful of the research studies have analysed productivity change in Indian nationalised banking sector using MPI approach. Moreover, recent data has not been analysed. Thus there is a need to study productivity change in Nationalised Banks operating in India.

METHODOLOGY:

The present study is conducted with the following objectives:
- To examine the change in productivity of nationalised banks operating in India after second generation reforms.
- To analyse the reason behind change in productivity growth.

The data of nineteen nationalised banks (as shown in Table-1) operating in India were obtained from the Statistical Tables Related to Banks in India, an annual publication of the Reserve Bank of India for the period of 21 years i.e. starting from the year 1997-98 till 2017-18.

The change in efficiency of nationalised banks was measured using Malmquist Productivity Index (MPI) which uses panel data to measure productivity difference between two firms or one firm over two time periods. MPI has been widely used technique to measuring change in productivity and has several advantages over other techniques (Kaur and Aggarwal, 2016).

For the purpose of present study three input variables and two output variables were selected as shown in table-2 based on combination of mix of production approach (Sherman and Gold, 1985), assets approach (Favero and Papi, 1995) and intermediation approach (Sealey and Lindley, 1977).

Table 1: List of Banks under Study

Sr. No	Name of Bank
1	Allahabad Bank
2	Andhra Bank
3	Bank of Baroda
4	Bank of India
5	Bank of Maharashtra
6	Canara Bank
7	Central Bank of India
8	Corporation Bank
9	Dena Bank
10	Indian Bank
11	Indian Overseas Bank
12	Oriental Bank of Commerce
13	Punjab and Sind Bank
14	Punjab National Bank
15	Syndicate Bank
16	UCO Bank
17	Union Bank of India
18	United Bank of India
19	Vijaya Bank

Table 2: Description of Input and Output Variables

For Efficiency Measurement	Variables	Description
Input Variables	Owned funds	Sum of Capital and Reserves
	Deposits	Total deposits
	Borrowings	Total Borrowings
	Wage Bills	Salaries to all employees
Output Variables	Spread	Interest Earned minus Interest Expended
	Other Income	Commission, exchange & brokerage

For the purpose of present study the MPI as developed by Fare et al. (1992, 1994) has been used. The MPI between periods t_1 and t_2 ; $t_1 < t_2$, has been defined as the geometric mean of M^{t_1} and M^{t_2} ,

$$M(x^{t_2}, y^{t_2}, x^{t_1}, y^{t_1}) = \left(\frac{D^{t_1}(x^{t_2}, y^{t_2})}{D^{t_1}(x^{t_1}, y^{t_1})} \frac{D^{t_2}(x^{t_2}, y^{t_2})}{D^{t_2}(x^{t_1}, y^{t_1})} \right)^{\frac{1}{2}} \dots \dots (i)$$

Equation (i) can also be written as

$$M(x^{t_2}, y^{t_2}, x^{t_1}, y^{t_1}) = \frac{D^{t_2}(x^{t_2}, y^{t_2})}{D^{t_1}(x^{t_1}, y^{t_1})} \left(\frac{D^{t_1}(x^{t_2}, y^{t_2})}{D^{t_2}(x^{t_2}, y^{t_2})} \frac{D^{t_1}(x^{t_1}, y^{t_1})}{D^{t_2}(x^{t_1}, y^{t_1})} \right)^{\frac{1}{2}} \dots \dots (ii)$$

Equation (ii) decomposed Malmquist productivity index into two factors i.e. the efficiency change and the technological change. Thus, for constant returns to scale,

$$\text{TFP change } = \text{ Change in Efficiency } \times \text{ Change in Technology } \dots (iii)$$

If the level of inputs and outputs remains same from time period t_1 to t_2 i.e. $x^{t_1} = x^{t_2}$ and $y^{t_1} = y^{t_2}$ then Malmquist index given by eq. (ii) indicates no change in productivity. The value greater than 1 indicates improvement and the value less than one indicates deterioration.

FINDINGS AND DISCUSSION:

The results of productivity change is shown as Malmquist Productivity Index (MPI) and it is further decomposed into technological change (TC) and efficiency change (EC). If the value is one (1) it means that the productivity change improves in time period 't+1' as compared to period 't'. Similarly, if the value of technological change is more than 1, it means that there is improvement in adoption in technology leading to productivity growth. In case of efficiency change, if the value is greater than 1, it means there is improvement in ability of management to handle operational activity. In case value is less than one in MPI, TC, EC than it means productivity reduces, there is lack of adoption of technology, managerial staff is incapable of coping up with the operational system respectively. Values equal to one means no change in productivity.

Table 3 presents the results of Malmquist Productivity Index (MPI), technological efficiency and efficiency change. The mean Malmquist productivity score is less than 1. It means that the productivity growth has been deteriorated after second generation reforms. Only 6 banks have shown MPI value and efficiency change more than average MPI and average efficiency change and 8 banks have shown improvement in technological change. Overall mean score shows a lack of bank's ability to cope up with technology. But the average managerial productivity has shown an improvement of 3.63 percent. It means that the banks are low in technology adoption ability but possess better managerial ability.

Further the table shows that six banks out of 19 banks under study have shown positive change in productivity after the second generation reforms. Malmquist Productivity Analysis for the Indian Bank depicts that its productivity has been increased by 64.92% which is due to improved technological change (25.21%) and as well as efficiency change (31.72%). Due to change in productivity it stood at number 1 position as compared to 19 nationalised banks under study. Second position is occupied by the Vijaya Bank. The bank showed the relative productivity change of 46 percent. There is improvement in both technical change and efficiency change. Third rank is occupied by the Andhra Bank which showed relative productivity change by 39 percent. The improvement is mainly due to improved technical change (30%) as well as efficiency change (7%). The Bank of Baroda stood at rank 4 due to positive relative productivity change by 37 percent. This change has been due to improved technical change as well as efficiency change. It means that the bank has been able to improve managerial efficiency and had adopted technology as well. 5th rank has been occupied by the Indian Overseas Bank with the relative productivity change of 14%. The bank has shown a small positive improvement in technical change (7%) as well as efficiency change (6%). The Bank of India has also shown a small positive productivity change of 3 percent. Further decomposition shows that the bank has adopted technology very well due to which technical change has shown an improvement of 17 percent. Technological change characterised innovation. But the managerial performance has deteriorated as the efficiency change is less than 1.

Other than these six banks, rest all 13 banks namely, the Corporation Bank, the Canara Bank, the Punjab National Bank, the Oriental Bank of Commerce, the United Bank of India, the Union Bank of India, the Bank of Maharashtra, the Syndicate Bank, the Punjab and Sind Bank, the Dena Bank, the UCO Bank, the Allahabad Bank and the Central Bank of India have shown negative relative productivity change. Technical change in all these 13 banks has been deteriorated. Though out of 13, only 5 banks have shown downtrend in their managerial capability. Majority of the banks i.e. 8 banks have shown improved efficiency change. Here, it can be concluded that the productivity growth exhibit technology change and hence productivity growth, characterised innovations.

CONCLUSIONS:

It was found that 6 banks namely, the Indian Bank, the Vijaya Bank, the Andhra Bank, the Bank of Baroda, the Indian Overseas Bank and the Bank of India showed positive productivity change as compared to all other 13

nationalised banks under study. Further this improvement is due to improvement in operations as 14 banks have shown the same. On an average efficiency change is just 3.63%, which is very meagre. In terms of adoption of technology only 6 banks have shown improvement. The mean results show that productivity change deteriorated after second generation of financial sector reforms. This may be due to cleaning up of balance sheets, stringent norms, provisioning requirements etc. Further decomposition of MPI shows that the Indian nationalised banks are not successful in harnessing the benefits of adoption of technology. Overall, it can be concluded that Indian nationalised banks are lacking in production technology improvement but relatively these banks are able to achieve high level of efficiency improvement. Thus, it is strongly recommended that nationalised banks operating in India should adopt proper use of technology and should invest more in technology. This will help banks in increasing outputs even by using the same level of input resources. The improved managerial productivity of majority of the banks can be harnessed further by launching some innovative banking practices based on latest technology.

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TABLES

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Table 3: Malmquist Productivity Index

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Name of Bank	Malmquist Productivity Index	Technological Change	Efficiency Change
Allahabad Bank	0.5620	0.6423	0.8750
Andhra Bank	1.3930	1.2964	1.0745
Bank of Baroda	1.3727	1.1630	1.1803
Bank of India	1.0333	1.1698	0.8833
Bank of Maharashtra	0.8002	0.7776	1.0290
Canara Bank	0.8495	0.9377	0.9060
Central Bank of India	0.4151	0.4151	1.0000
Corporation Bank	0.9218	0.9218	1.0000
Dena Bank	0.7547	0.8074	0.9347
Indian Bank	1.6492	1.2521	1.3172
Indian Overseas Bank	1.1370	1.0724	1.0602
Oriental Bank of Commerce	0.8030	0.7788	1.0311
Punjab and Sind Bank	0.7876	0.7729	1.0190
Punjab National Bank	0.8204	0.8204	1.0000
Syndicate Bank	0.7931	0.7931	1.0000
UCO Bank	0.7164	0.8940	0.8014
Union Bank of India	0.8002	0.8002	1.0000
United Bank of India	0.8023	0.6371	1.2593
Vijaya Bank	1.4586	1.0971	1.3294
Mean	.9400	.8973	1.0363
Number of banks above mean score	6	8	6
Minimum	.4200	.4200	.8000
Maximum	1.65	1.30	1.33
Std. Dev.	.3210	.2287	.1455

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