

# Total Factor Productivity of Regional Rural Banks in India: A Malmquist Approach

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## ABSTRACT

*The present study attempts to empirically examine the total factor productivity changes of regional rural banks using a balanced panel dataset of 50 observations during the post reform period spanning from 1991-92 to 2006-07. A non parametric Malmquist productivity Index was applied to calculate productivity. Total factor productivity was decomposed into technical efficiency and technological change and technical efficiency change was further decomposed into pure efficiency change and scale efficiency change. Total factor productivity change (TFPCH) in performance of Regional Rural Banks averaged at 1.3 percent during 1991-92 to 2006-0. The decomposition of TFPCH showed that the mean technical progress increased at .9 percent whereas mean technical efficiency has shown a marginal increase 0.1 percent during that period. The highest growth rate has been observed in case of Malwa Grameen Bank and Kshetriya Kisan Grameen Bank which was 5.7 percent and 3.8 percent respectively. The change in scale efficiency has shown increasing trend of 0.3 percent.*

**Keywords:** Malmquist productivity Index, Regional Rural Banks, Total factor productivity.

## INTRODUCTION

Rural finance is a matter of great concern in an agrarian economy like India (Valasamma, January, 2005). The institutional credit accounts for 60 percent of the total credit needs and rest of the 40 percent is provided by non-institutional sector (informal sector). The informal sector for rural finance is age old. It consists primarily of rural money lenders, traders, merchants etc. It proved to be avaricious and ruinous for rural India. Realizing the fleeing of rural masses, government of India took several initiatives to promote the growth of rural and agriculture sector. Amongst these initiatives, major were the establishment of Regional Rural Banks (RRBs), Co-operative Banks and nationalization of commercial banks. Moreover, it was made mandatory on the part of the commercial banks to provide credit to agriculture sector on priority basis.

In the early 1970s, the government observed that despite a wide banking network and development initiatives in the first 25 years, since independence, a critical gap still existed in meeting the credit needs of the rural poor. To find a solution, the government appointed a working group on rural credit, the Narasimham Committee, in July, 1975. The committee observed that the cost structure of commercial banks, the attitude of bank employees and the lack of a professional approach in the co-operative credit system were the main stumbling blocks to rural credit. The committee also observed that the deposits collected by banks from rural areas were not totally deployed there. The panel, therefore, recommended the creation of a new set of regionally oriented rural banks which would combine a co-operatives local feel and a commercial bank's business acumen. The government accepted these recommendations and, accordingly, the ordinance of RRBs, 1975 was promulgated on September 26, 1975. This was replaced by the RRBs Act, 1976 on February 9, 1976. The mandate of these rural financial institutions was to:

- take banking to the doorsteps of the rural masses, particularly in areas without banking facilities;
- make available cheaper institutional credit to the weaker section of society, who were to be the only clients of these banks;
- mobilize rural savings and channelize them for supporting productive activities in rural areas;
- generate employment opportunities in the rural areas; and
- bring down the cost of providing credit in rural areas

These banks were sponsored by Public Sector Banks (PSBs) which having 35 percent of the share capital, and also provided technical and managerial support. The government of India owns 50 percent of share capital and the state government owns 15 percent (Reddy, 2006). Along with commercial banks, RRBs participated enthusiastically in poverty alleviation schemes and disadvantaged area (drought-prone regions and deserts) development programmes. They quickly became an important and integral part of the rural credit system. However, their financial viability was initially overstretched by policy rigidities coupled with a low capital base in an environment of inadequate infrastructure and deeper social and economic disparities. RRBs were established with initial issued capital of Rs. 25 lakh, with Rs. 1 crore as authorized share capital which was further enhanced to Rs. 5 crore with the paid up capital of Rs. 1 crore in 1987.

In order to have knowledge about the growth of RRBs, we have to analyze their expansion in terms of number of branches, increase in the volume of loans and deposits with the objective of banking for the rural masses. Expansion scenario of RRBs is elaborated in Table 1.

**Table 1.** Expansion of RRBs during 1975-2009

<b>Period Ending</b>	<b>Banks</b>	<b>Branches</b>	<b>Loans (Rs. in Crore)</b>	<b>Deposits (Rs. in Crore)</b>
December 1975	6	17	0.10	0.20
December 1980	85	3279	243.38	199.83
December 1985	188	12606	1407.67	1286.82
March 1990	196	14449	3554.04	4150.52
March 1995	196	14509	6290.97	11150.01
March 1997	196	14508	7852.66	15423.42
March 1998	196	14508	8486.62	19325.65
March 1999	196	14508	9367.21	23597.61
March 2000	196	14311	13814.89	32204.94
March 2001	196	14311	15816.30	38271.87
March 2002	196	14390	18629.22	44539.15
March 2003	196	14433	22157.85	50098.34
March 2004	196	14446	26113.86	56350.08
March 2005	196	14484	32870.03	62143.40
March 2006	133	14494	39125.57	71329.00
September 2008	86	15485	57531	99095
September 2009	82	15723	65604	120187

**Source:** Statistics on RRBs, NABARD, Mumbai.

Perusal of Table 1 depicts that initially there were 6 RRBs having loans and deposits of worth Rs. 0.10 and 0.20 crores respectively. Further number of banks and branches increased to 188 and 12606 at the end of December, 1985. As compared to 1975 loans and deposits grew tremendously. Further in 1990, number of RRBs rose to 196 having branches 14449 with loans and deposits of Rs. 3554.04 crore and Rs. 4150.52 crore respectively. The number of banks remained 196 till March, 2005 and further reduced to 82 in September, 2009. But during March, 1990 to March, 2009 number of branches increased as well decreased marginally and finally in March, 2009 number of branches increased to 15723. On the other hand, loans and deposits increased continuously during the same period. And finally in March, 2009 although number of banks reduced but loans and deposits increased to Rs 65604 crore and Rs. 120187 crore respectively. Overall scenario depicted that instead of number of decrease of RRBs, but branches, loans and deposits showed the positive and remarkable growth.

This research paper is organized into five sections. Section 2 presents a brief review of literature on the related work done in the same field along with the objectives of the present study and also discusses research methodology. Section 3 presents database and measurement of variables. Section 4 discusses the empirical results of the study. Finally, Section 5 sums up the main points emerging from the analysis.

**REVIEW OF LITERATURE**

A scan of the existing literature on the efficiency of RRBS provides that there exists various studies that used financial ratio approach. Most of the studies on the performance evaluation of RRBs concentrated on the banks in particular state/region. Some of the studies are: Singh (1992) analyzed the performance of RRBs banks in Punjab. Prasad (2003) evaluated the performance of RRBs in India. Moreover, Pati (2005) developed the performance of RRBs in the north-east region. The study of Bagchi and Hadi (2006) concentrated on the performance of regional rural banks in West Bengal. Few studies also exist in the literature which concentrated on the efficiency of a single regional rural bank. Some of the studies conducted so far are as: Sudhaker, et al. (1984) evaluated the performance of Cauvery Grameen Bank in Mysore district. Parmar (1986) assessed the performance of Banaskantha Mehsane Grameen Bank in Gujarat. Sangwan (1988) analyzed the performance of Chattanja Grameen Bank in Andhra Pradesh. Jagadeesha et. al (1990) evaluated the performance of Tungabhadra Grameen Bank in Karnataka. Further, Hosamani (2002) explored the performance of Malaprabha Grameen Bank in Karnataka and Yadappanvar and Nath (2003) assessed the performance of Aurangabad and Jalna Grameen Bank in Maharashtra. Even there exist few studies that analyzed the efficiency of RRBS using most popularly used parametric technique of Stochastic Frontier Analysis (SFA) and non-parametric technique of Data Envelopment Analysis. The notable studies belongs to this group are: Khankhoje and Sathye (2008) and Mohindra V and G Devgan (2011).

A scan of the existing literature on the productivity of banks provides that there are many studies which are based on the productivity of banks. A brief review of some of studies conducted on productivity of banks in foreign and Indian context are given in this section.

Saha and Ravishankar (2000) estimated productivity of the Indian Commercial Banks for the period 1991 to 1994. Berg, Forsund and Jansen (1992) studied the impact of deregulation on the productivity growth of Norwegian banks for the period 1980-89. Grifell-Tatze and Lovell (1997) studied the impact of deregulation on productivity change of saving and commercial banks in Spain for the period 1986-1993. Dogan and Fausten (2002) made DEA based Malmquist index to calculate productive growth and technical change of Malaysian banking sector. The sample period, they took into consideration is 1989-98 divided into two sub-periods of 1989-93 and 1994-98. Nath et. al (2000) employed DEA to measure the productivity of 68 major Indian commercial banks for the year 1999. They took 27 public sector banks, 20 private sector banks and 21 foreign banks for their study. Kumbhakar and Sarkar (2003) analyzed the relationship between deregulation and total factor productivity (TFP) growth of the PSBs in India during the period 1985-1996. Galagedra and Edirisuriya (2004) used DEA based Malmquist productivity index to investigate efficiency and total factor productivity growth of commercial banks in India over the period 1995-2002. Shabbar Jaffry, et al. (2007) studied to measure changes in productivity and technical efficiency levels within banking sectors of the Indian sub-continent: specifically India, Pakistan and Bangladesh, over the period 1993–2001.

A scan of the existing literature on the efficiency of RRBS provides that there exists no study except Reddy (2005) whose studies based on productivity of RRBS. The present study is an attempt in this direction which aims to enrich the already scant literature on the

performance evaluation of RRBs using Malmquist Approach. The present study has two important objectives.

**OBJECTIVES OF THE STUDY**

Specific objectives of the study were

1. To measure total factor productivity of Regional Rural banks in India based on Malmquist Index.
2. To analyze the trend in total factor productivity of Regional Rural banks in India

**RESEARCH METHODOLOGY**

The Malmquist TFP index calculates the change in productivity between two points by estimating the ration of the distances of each point relative to a common technology. The Malmquist input oriented TFP change index between the base period t & the following period t+1 is defined as:

$$M(y_t, x_t, y_{t+1}, x_{t+1}) = \left[ \frac{d_{t+1}(Y_{t+1}, X_{t+1})}{d_t(Y_t, X_t)} \times \frac{d_t(Y_{t+1}, X_{t+1})}{d_{t+1}(Y_{t+1}, X_{t+1})} \right]^{1/2}$$

A value of M greater than unity implies a positive TFP growth from period t to period t+1. Otherwise, a value of M less than one indicates a TFP decline. Equation (1) is geometric mean of two TFP indices. The first index is calculated with respect to period t technology, while the second index is evaluated with respect to period t+1 technology.

The advantage of the Malmquist index is that it allows the researcher to distinguish between shifts in the production frontier (technological change, TC) and movements of firms towards the frontier technical efficiency change, TEC).. The measure of technical efficiency must be between 0 & 1.

Total Factor Productivity Change Index =

$$\frac{D^t(y^t, x^t)}{D^{t+1}(y^{t+1}, x^{t+1})} \times \left[ \frac{D^{t+1}(y_{t+1}, x_{t+1})}{D^t(y^{t+1}, x^{t+1})} \times \frac{D^{t+1}(y^t, x^t)}{D^t(y^t, x^t)} \right]^{1/2}$$

Technological Change Index =  $\left[ \frac{D^{t+1}(y_{t+1}, x_{t+1})}{D^t(y^{t+1}, x^{t+1})} \times \frac{D^{t+1}(y^t, x^t)}{D^t(y^t, x^t)} \right]^{1/2}$

Technical Efficiency Change Index =  $\left[ \frac{D^{t+1}(CRS)(y_{t+1}, x_{t+1})}{D^t(CRS)(y^t, x^t)} \right]$

Pure Technical Efficiency Change Index =  $\left[ \frac{D^{t+1}(VRS)(y_{t+1}, x_{t+1})}{D^t(VRS)(y^t, x^t)} \right]$

$$\text{Scale Efficiency Change Index} = \left[ \frac{D^{t+1}(CRS)(y_{t+1}, x_{t+1})}{D^t(CRS)(y^t, x^t)} \right] / \left[ \frac{D^{t+1}(VRS)(y_{t+1}, x_{t+1})}{D^t(VRS)(y^t, x^t)} \right]$$

SECH is actually the geometric mean of two scale efficiency change measures, the First relative to the period  $t$  technology, the latter relative to the period  $s$  technology.

The subscripts,  $v$  and  $c$ , refer to the VRS and CRS technologies, respectively.

Hence, we have

$$\text{EFCH} = \text{PTECH} \times \text{SECH}$$

Which results being rewritten as  $\text{TFPCH} = \text{PTECH} \times \text{SECH} \times \text{TCH}$

### Measurement of input and output variable in Banking

The first step in measuring the efficiency is to specify inputs and outputs of the firms under consideration. The present study followed an intermediation approach to select input and output variables. The major advantage of intermediation approach over the production cost approach and user- cost approach; method is the inclusion of interest costs in total costs and it assigns monetary value to specific input and output variable.

For the calculation of efficiency measures, the inputs are loanable funds (X1), fixed assets (X2) and labor (X3). Loan able funds measure as the sum of deposits and borrowings at the end of the financial year. Deposits include demand deposit, saving bank deposit and term deposit. Borrowings include borrowing/ refinance obtained from the Reserve Bank of India, commercial banks (including co-operative banks) and other institutions and agencies like Industrial Development Bank of India (IDBI) Export Import (EXIM) Bank of India, National Agriculture Bank of India (NABARD) etc. The input variable of fixed assets comprises premises and other fixed assets, include furniture and fixtures. In addition to this, we have incorporated wages as a proxy variable which consists in the form of the staff salaries/wages, allowances, bonus, other staff benefits like provident fund, pension fund, gratuity, liveries to staff, leave fare concessions, staff welfare, medical and house rent allowances to staff etc.

For the present study, we have considered two measures of outputs which are proxies in terms of advances (Y1) and spread (Y2). Advances include bills purchased and discounted, cash credits, overdrafts and loans repayable on demand and term loans. Spread reflects the net interest income, measured as the difference between interest earned and interest expended for a given period of time. Interest earned includes interest and discount on all types of loans and advances like cash credit, demand loans, overdrafts export loans, term loans, domestic and foreign bills purchased and discounted/rediscounted, interest on balances with RBI and other inter-bank funds, income on investments and others. The interest expended on deposits and borrowings results in the rise of major expenses. Further, all the output and input have been measured in millions. For calculating the efficiencies scores, the analysis has been carried out with real values of the variables (except labor) which have been obtained by deflating the nominal values by the implicit price deflator base (1999-2000 = 100). Further, the input and output variables have been normalized by dividing them by the total assets of individual banks to reduce the effects of random noise due to measurement error in the inputs and outputs.

**Data Base**

The study has considered 50 Regional Rural Banks operating in India during the sample period from 1992 to 2007. All the 50 RRBs are being referred to as B1, B2....B50 respectively in this article. The sample period selected is constrained to the availability of data on the input and output variables considered for the present study.

As far as, sample banks are concerned, this study has considered balanced panel data set of 50 RRBs during the period spanning from 1991-1992 to 2006-2007. Only those banks have been considered in the studies which have been continuously operating since 1991-1992 to 2006-2007 so as to make a balanced panel data set. The list of banks included in the sample along with sponsors banks and states has been shown in Appendix 1.

The data on the input and output variables has been taken from Compact disc available on “Statistical Tables relating to Banks in India (including RRBs) 1979 to 2007” available from Reserve Bank of India, Mumbai. Further for the Annual Accounts of Banks, Report on Trend & Progress in Banking, Annual Publications of Reserve Bank of India has been used.

**RESULTS & ANALYSIS**

Malmquist Productivity indices have been compared for productivity RRBS. Table 2 depicts the yearly average and decomposed results of productivity of RRBS.

**Table 2.**Malmquist index Annual summary of Means of Regional Rural Banks

Year	EFFCH(1)	TECHCH(2)	PECH(3)	SECH(4)	TFPCH(5)
1992-93	.986	1.065	.966	1.023	1.050
1993-94	.980	.963	.996	.985	.944
1994-95	.969	1.025	.982	.987	.993
1995-96	1.049	0.936	1.019	1.029	.981
1996-97	.993	1.161	1.012	.981	1.153
1997-98	1.009	1.061	.984	1.026	1.071
1998-99	1.055	1.034	1.080	.977	1.091
1999-2000	1.032	.977	1.021	1.011	1.008
2000-2001	.988	1.041	.991	.997	1.029
2001-2002	.996	.975	1.005	.992	.971
2002-2003	.903	1.071	.895	1.009	.967
2003-04	1.113	.863	1.095	1.017	.960
2004-05	.978	.993	.979	.99	.971
2005-06	1.019	.963	1.031	.989	.982
2006-07	1.016	1.037	1.017	.999	1.054
Mean	1.005	1.009	1.004	1.001	1.013

In this study, Malmquist Productivity Index (MPI) was decomposed into the technical change index (TECHCH) and Efficiency change (EFFCH) index. In order to identify the Changes in scale efficiency, EFFCH were further classified into pure efficiency change (PECH) and scale efficiency change (SECH).

Table 2, indicated that that the fifty banks in the panel, experienced total factor productivity change (TFPCH) in performance of banks averaged at 1.3 percent during 1992-93 to 2006-

07. The decomposition of TFPCH showed that the mean technical progress increased at .9 percent whereas mean technical efficiency has shown a marginal increase 0.1 percent during that period. While we observe a decrease in TFPCH in all the years, with 1996-97, 1997-98, 1998-99, 1999-2000 and 2006-07 being the only exception, the change is inconsistent as it concerns EFCH and TCH. More precisely, we observe a positive change of EFCH during 1995-96, 1997-98, 1998-99, 1999-2000, 2003-04, 2005-06 and 2006-07 associated with a negative change of TCH. Decomposition of the EFCH into its two components indicates that pure technical efficiency that measures performance only due to managerial activity increased by 0.4% whereas scale efficiency increased on average by 0.1%. Furthermore, investigation of the results by year indicates a positive SECH during 1995-96, 1997-98, 1998-99, 1999-2000, 2002-03, 2003-04 and 2006-07 Table 3 shows means of total factor productivity change by bank over the period of our analysis.

**Table 3.** Malmquist index Summary of Means of Regional Rural Banks

Sr. No	Code No.	EFFCH(1)	TECHCH(2)	PECH(3)	SECH(4)	TFPCH(5)
1	B1	.970	1.006	.970	1.000	.976
2	B2	.994	1.019	.996	.998	1.012
3	B3	1.025	1.008	1.025	1.000	1.033
4	B4	.977	1.000	.979	.998	.977
5	B5	1.022	1.008	1.021	1.001	1.030
6	B6	1.017	1.005	1.018	.999	1.022
7	B7	1.014	1.051	1.016	.998	1.066
8	B8	.986	.996	.989	.997	.982
9	B9	.976	.966	.963	1.014	.943
10	B10	1.009	1.007	1.010	.999	1.016
11	B11	1.000	1.027	1.000	1.001	1.027
12	B12	.991	1.012	.992	.999	1.003
13	B13	1.023	1.020	1.025	.999	1.044
14	B14	.981	1.005	.984	.997	.986
15	B15	.980	.985	.982	.999	.965
16	B16	1.007	.992	1.009	.999	.999
17	B17	1.001	1.027	1.004	.997	1.028
18	B18	1.019	.993	1.022	.997	1.012
19	B19	1.008	1.014	1.000	1.008	1.021
20	B20	1.025	1.036	1.026	.999	1.062
21	B21	1.000	1.038	1.000	1.000	1.038
22	B22	1.029	.997	1.008	1.020	1.026
23	B23	.991	.981	.988	1.003	.973
24	B24	1.010	1.057	1.010	1.000	1.068
25	B25	1.001	.994	.999	1.002	.996
26	B26	.993	1.011	.994	.999	1.005
27	B27	1.001	1.002	1.006	.995	1.004
28	B28	1.027	1.005	1.018	1.009	1.032
29	B29	.984	.994	1.000	.974	.968

**Table 3.** Malmquist index Summary of Means of Regional Rural Banks (Contd...)

Sr. No	Code No.	EFFCH(1)	TECHCH(2)	PECH(3)	SECH(4)	TFPCH(5)
30	B30	1.020	.983	1.018	1.001	1.003
31	B31	.999	1.018	1.000	.999	1.017
32	B32	1.017	1.014	1.014	1.003	1.032
33	B33	1.030	1.011	1.027	1.002	1.041
34	B34	1.005	1.021	1.006	.999	1.26
35	B35	1.028	1.022	1.000	1.028	1.051
36	B36	1.021	.984	1.023	.998	1.005
37	B37	.999	1.005	1.000	.999	1.004
38	B38	1.022	1.000	1.023	.999	1.022
39	B39	1.004	1.019	.981	.999	.998
40	B40	1.004	1.001	1.002	1.002	1.005
41	B41	1.015	1.004	1.015	1.000	1.019
42	B42	1.001	1.008	1.005	.997	1.010
43	B43	1.008	1.008	1.007	1.001	1.016
44	B44	1.002	1.006	1.002	1.000	1.008
45	B45	1.003	1.002	.994	1.010	1.005
46	B46	1.011	.998	1.012	.999	1.008
47	B47	1.004	.989	1.000	1.004	.994
48	B48	1.018	1.013	1.000	1.018	1031
49	B49	1.00	1.026	1.000	1.000	1.026
50	B50	1.020	1.008	1.018	1.002	1.028
	Mean	1.005	1.009	1.004	1.001	1.013

Glance at table 3, the highest growth rate has been observed in case of B24 (5.7 percent), which was followed by B21 (3.8 percent). This growth was entirely due to technical changes in these banks. B1, B4, B8, B9, B14, B15, B16, B23, B25, B29, B39, B47 has shown declining trend in growth of productivity of nationalized banks in India. However, among two components of TFPCH, the change in technical efficiency and PECH was low in all RRBS. Whereas change in technical efficiency was highest incase of B22 (2.9 percent) this was followed by B20 (2.5 percent). B1, B2, B4, B8, B9, B12, B14, B15, B23, B26, B29, B31, B37, and B39 have shown declining trend in EFFCH. B1, B3, B5, B9, B11, B21, B22, B23, B24, B25, B28, B32, B33, B35, B40, B41, B43, B44, B47, B48, B49 and B50 B39 have shown increasing trend in SECH In fact change in TFP was mainly due change in technology. B24 has shown highest TECHCH (5.7 percent), and B21 (3.8 percent) has shown change in technology which would have impact on change in TFP. Whereas B1, B4, B8, B9, B14, B15, B16, B23, B25, B29, B39, B47 have shown declining trend in TECHCH which led to decline in TEPCH of these banks.

### CONCLUSION

From the above analysis it was concluded that total factor productivity change (TFPCH) in performance of nationalized banks Total factor productivity change (TFPCH) in performance of Regional Rural Banks averaged at 1.3 percent during 1991-92 to 2006-07 The

decomposition of TFPCH showed that the mean technical progress increased at .9 percent whereas mean technical efficiency has shown a marginal increase 0.1 percent during that period. The highest growth rate has been observed in case of Malwa Grameen Bank and Kshetriya Kisan Grameen Bank which was 5.7 percent and 3.8 percent respectively. The change in scale efficiency has shown increasing trend of 0.3 percent.

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