Economic Affairs, Vol. **70**(01), pp. 107-112, March 2025
DOI: 10.46852/0424-2513.1.2025.14

AESSRA

RESEARCH PAPER

Malmquist Productivity and Efficiency Analysis for SHG Linked Banks in Puducherry - A Comparative Study

Saranya, C.* and K. Sita Devi

Department of Agricultural Economics, Faculty of Agriculture, Annamalai University, Tamil Nadu, India

*Corresponding author: c.saranya1999@gmail.com (**ORCID ID:** 0009-0006-6897-6909)

Received: 29-11-2024 **Revised:** 21-02-2025 **Accepted:** 04-03-2025

ABSTRACT

Many SHGs and its members account has been linked with the bank for promoting financial inclusion and financial literacy for the rural women. Through bank linkage programme, self-help groups can easily access for bank credit to meet their requirements. This present study has been carried out with the specific objective of analysing the banking in the study area. The annual data for the period from 2015-16 to 2023-24 has been used to analyse the productivity improvement of the SHG linked banks with number of staffs, capital, deposits and operating expenditure as input variables and income and loan disbursement amount to SHGs as output variable using DEA model. The application of Malmquist DEA methods to panel data to estimate total factor productivity change, technology change, technical efficiency change, pure efficiency and scale efficiency change. The Self Help Group – Bank Linkage Programme has an ample of scope to develop and enhance the financial literacy of the rural women. The efficiency of the bank will ensure the outreach of the microcredit, managerial aspects, input-output proportionality and profitability of the institution.

HIGHLIGHTS

- There is an increasing retur to scale for total factor productivity in overall period.
- No change in improvement has been revealed in the pure efficiency change for both the banks.
- The productivity of co-operative bank was higher than that of regional rural bank in Puducherry.
- Regional rural bank has constant returns to scale in technical efficiency, pure and scale efficiencies.

Keywords: Malmquist DEA, banking efficiency, SHG linked banks, total factor productivity change, technology change and technical efficiency change

Self Help Group – Bank Linkage Programme was an essential milestone on the progress of microfinance in India. Under this programme, many SHGs and its members account has been linked with the bank for promoting financial inclusion and financial literacy for the rural women. Through bank linkage programme, self-help groups can easily access for bank credit to meet their requirements. The growth of bank linked SHGs has revealed that there is a significant expansion from initial stage in 1992-93 with 255 SHGs to the current scenario in 2023-24 with 144.22 lakh SHGs. Similarly, the credit disbursement to SHGs was increased suddenly from ₹ 29 lakhs in 1992-93 to ₹ 2,09,286 crores in 2023-24. Any financial assistant can be properly utilized, only when the institution has an organised and systematic functions. With this background, this present study has been carried out with the specific objective of analysing the banking in the study area. There are three bank agencies in Puducherry *viz.*, commercial bank, co-operative bank and regional rural bank. Out of them, co-operative bank and regional rural bank has been specifically

How to cite this article: Saranya, C. and Sita Devi, K. (2025). Malmquist Productivity and Efficiency Analysis for SHG Linked Banks in Puducherry - A Comparative Study. *Econ. Aff.*, **70**(01): 107-112.

Source of Support: None; **Conflict of Interest:** None

selected to study the banking efficiency. Since, the State co-operative bank and regional rural bank is functioning especially at Puducherry region. Whereas, the commercial banks are working as zonal level at Puducherry by covering some regions of Tamil Nadu.

Puduvai Bharathiyar Grama Bank is the regional rural bank in Puducherry with 46 branches in four districts. There are 145 employees and their sponsor bank was Indian bank. The gross non-performing asset was 1.98 per cent with ₹ 2,198.37 lakhs. The net profit/loss was ₹ 1,433.24 lakh with per branch productivity of ₹ 4,893.48 lakh and per employee productivity of ₹ 1,552.41 lakh.

Puducherry State Co-operative Bank Ltd is the co-operative bank in Puducherry region, which was established in the year 1958. At present, it has 25 branches with 201 employees, it receives funding support from State government and NABARD. The total number of affiliated co-operative societies are 280. It functions under two tier structure with Puducherry SCB, Primary Agricultural Cooperative Credit Societies (PACCS) and individual direct. The gross non-performing asset was 15.58 per cent with ₹ 8,648.32 lakhs. The net profit/loss was – ₹ 85.37 lakh with per branch productivity of ₹ 5,416.44 lakh and per employee productivity of ₹ 673.69 lakh.

METHODOLOGY

Data Collection

This entire study is based only on secondary data which were collected from Statistical book of Puducherry, a key statistic of co-operative bank and regional rural bank, annual report of co-operative bank and balance sheet of regional rural bank. The annual data for the period from 2015-16 to 2023-24 has been used to analyse the productivity improvement of the SHG linked banks with number of staffs, capital, deposits and operating expenditure as input variables and income and loan disbursement amount to SHGs as output variable using DEA model.

Tools of Analysis

Data Envelopment Analyses (DEA) has been used to analyse the efficiencies in production. There are three models under DEA. First CRS (constant returns to scale) and VRS (variable returns to scale) model, it is used to estimate the technical and scale efficiencies (Fare, Grosskopf and Lovell, 1994). Second, this is the modified method of first model, which is used to estimate cost and allocative efficiencies (Fare *et al.* 1994). Third, the application of Malmquist DEA methods to panel data to estimate total factor productivity change, technology change, technical efficiency change, pure efficiency and scale efficiency change (Fare, Grosskopf, Norris and Zhang, 1994). Using the panel data of the bank, the data envelopment analysis has been carried out to study the efficiency. Malmquist index is defined as the measurement to calculate the productivity change and it is decomposed into technical change and technology efficiency change. Fare *et al.* (1994) formulated an output-based Malmquist index for productivity change in the firm.

$$m_0(y_{t+1},\ x_{t+1}, y_t,\ x_t) = \left[\frac{d_0^t(x_{t+1}, y_{t+1})}{d_0^t(x_t, y_t)} \times \frac{d_o^{t+1}(x_{t+1}, y_{t+1})}{d_o^{t+1}(x_t, y_t)}\right]^{1/2}$$

It represents the efficiency of the production point (x_{t+1}, y_{t+1}) relative to the production point (x_t, y_t). If the result is greater than one, it indicates a positive total factor productivity growth from period t to period $t + 1$. This index is a geometric mean of two output-based Malmquist index. Output oriented measures is an alternative approach for input-oriented measures. It deals with how much can output quantities be proportionally expanded without altering the input quantities used.

RESULTS AND DISCUSSION

By considering the objective, output oriented Malmquist index has been estimated using the variables from similar past studies. Assume the input variables namely number of staff and capital from Sherman and Gold (1985), Ferrier and Lovell (1990) and Berg *et al*. (1993), deposit from Berger and Humphrey (1997) and operating expenditure from Babu (2014) and Sharma (2010) and output variable as loan (Babu, 2014) and Income (Sharma, 2010). Hence, this index has been widely used in various fields such as banking (Arjomandi *et al.* 2010; Sharma and Gupta, 2010; Babu and Kulshreshtra, 2014; Ibrahim and Sasikala, 2014; Galab and Vedam, 2018; Ravi and Ghosh, 2021) and agriculture (Pawan

and Sudhakar, 2018; Rede and Bhattachary, 2020; Sahu *et al.* 2022).

Change in Technical Efficiency for SHG linked Banks

The annual technical efficiency has been analysed for SHG linked Co-operative bank and Regional rural bank during the period 2015-16 to 2023-24 and returns to economies is presented in Table 1.

Table 1: Estimates of Change in Technical Efficiency for SHG linked banks in Puducherry

Year	Cooperative Bank	RRB	Both	Return to Scale
2015-16	1.236	1.000	1.112	Increasing
2016-17	1.125	1.000	1.061	Increasing
2017-18	1.175	1.000	1.084	Increasing
2018-19	0.972	1.000	0.986	Decreasing
2019-20	1.044	1.000	1.022	Increasing
2020-21	1.000	1.000	1.000	Constant
2021-22	1.000	1.000	1.000	Constant
2022-23	1.000	1.000	1.000	Constant
2023-24	1.000	1.000	1.000	Constant
Mean	1.061	1.000	1.029	Increasing

From Table 1, it could be inferred that the mean technical efficiency of co-operative bank has increased its productivity during the period from 2015-16 to 2023-24 in Puducherry union territory. Since, the Malmquist index for change in technical efficiency was greater than one i.e., 1.061. However, the mean technical efficiency for regional rural bank has indicated that it was no change in productivity. There was a constant efficiency without any decline in trend over a period of time. As a result, the technical efficiency for both the banks have shown its improvement by increasing their productivity during 2015-16 to 2017- 18, 2019-20 and also in the overall period of last ten years. From the year 2020-21 onwards, there was a constant productivity in its technical efficiency.

Change in Technology for SHG linked Banks

The annual change in technology has been analysed for SHG linked Co-operative bank and Regional rural bank during the period 2015-16 to 2023-24 and returns to economies is presented in Table 2.

Table 2: Estimates of Change in Technology for SHG linked banks in Puducherry

Year	Cooperative Bank	RRB	Both	Return to Scale
2015-16	1.595	1.135	1.345	Increasing
2016-17	1.248	1.115	1.180	Increasing
2017-18	1.094	0.955	1.022	Increasing
2018-19	1.225	1.046	1.132	Increasing
2019-20	1.111	0.971	1.038	Increasing
2020-21	1.235	1.020	1.122	Increasing
2021-22	0.993	0.980	0.986	Decreasing
2022-23	1.068	0.937	1.000	Constant
2023-24	0.955	0.909	0.932	Decreasing
Mean	1.169	1.007	1.084	Increasing

From Table 2, it could be inferred that the change in technology for co-operative bank had shown improvement during the period from 2015-16 to 2020-21 and 2022-23 with Malmquist index greater than one. There was an increase in productivity in these years. Whereas, the change in technology for regional rural bank has increased productivity randomly during the year 2015-16, 2016-17, 2018-19 and 2020-21. The impact of pandemic period had a serious back lock in banking sector also, by affecting capital mobilisation and investment opportunity. Because of this effect, there might be decreasing trend in their productivity. Even though, the mean value of change in technology was 1.169 and 1.007 for co-operative bank and regional rural bank, respectively during the period from 2015-16 to 2023-24, there exists an increasing productivity in technology for both institutions.

Change in Pure Efficiency for SHG linked Banks

The annual pure efficiency has been analysed for SHG linked Co-operative bank and Regional rural bank during the period 2015-16 to 2023-24 and returns to economies is presented in Table 3.

Table 3: Estimates of change in Pure Efficiency for SHG linked banks in Puducherry

Year	Cooperative Bank	RRB	Both	Return to Scale
2015-16	1.000	1.000	1.000	Constant
2016-17	1.000	1.000	1.000	Constant
2017-18	1.000	1.000	1.000	Constant

2018-19	1.000	1.000	1.000	Constant
2019-20	1.000	1.000	1.000	Constant
2020-21	1.000	1.000	1.000	Constant
2021-22	1.000	1.000	1.000	Constant
2022-23	1.000	1.000	1.000	Constant
2023-24	1.000	1.000	1.000	Constant
Mean	1.000	1.000	1.000	Constant

Table 3 indicates that the change in pure efficiency for SHG linked banks namely co-operative bank and regional rural bank has no change in productivity during the overall period. Moreover, both the banks have maintained a constant level of managerial skill for betterment purpose over the years.

Change in Scale Efficiency for SHG linked Banks

The annual scale efficiency has been analysed for SHG linked Co-operative bank and Regional rural bank during the period 2015-16 to 2023-24 and returns to economies is presented in Table 4.

Table 4: Estimates of change in Scale Efficiency for SHG linked banks in Puducherry

Year	Cooperative Bank	RRB	Both	Return to Scale
2015-16	1.236	1.000	1.112	Increasing
2016-17	1.125	1.000	1.061	Increasing
2017-18	1.175	1.000	1.084	Increasing
2018-19	0.972	1.000	0.986	Decreasing
2019-20	1.044	1.000	1.022	Increasing
2020-21	1.000	1.000	1.000	Constant
2021-22	1.000	1.000	1.000	Constant
2022-23	1.000	1.000	1.000	Constant
2023-24	1.000	1.000	1.000	Constant
Mean	1.061	1.000	1.029	Increasing

Table 4 inferred that the change in scale efficiency for co-operative bank had increasing productivity during the period from 2014-15 to 2017-18 and 2019-20. Moreover, the highest productivity was 1.236 in the year 2015-16, followed by 2017-18, 2016-17 and 2019-20. From 2020-21 onwards, there was a constant productivity in co-operative bank. Whereas, the change in scale efficiency for regional rural bank has no change in productivity, without any declining trend.

Change in Total Factor Productivity for SHG linked Banks

The annual total factor productivity had been analysed for SHG linked Co-operative bank and Regional rural bank during the period 2015-16 to 2023-24 and returns to economies is presented in Table 5.

Table 5: Estimates of change in Total Factor Productivity for SHG linked banks in Puducherry

Year	Cooperative Bank	RRB	Both	Return to Scale
2015-16	1.970	1.135	1.495	Increasing
2016-17	1.403	1.115	1.251	Increasing
2017-18	1.286	0.955	1.108	Increasing
2018-19	1.191	1.046	1.116	Increasing
2019-20	1.160	0.971	1.061	Increasing
2020-21	1.235	1.020	1.122	Increasing
2021-22	0.993	0.980	0.986	Decreasing
2022-23	1.068	0.937	1.000	Constant
2023-24	0.955	0.909	0.932	Decreasing
Mean	1.251	1.008	1.119	Increasing

From Table 5, it could be inferred that the change in total factor productivity for co-operative bank and regional rural bank had increasing improvement in productivity. Since, the Malmquist index was greater than one, with 1.251 and 1.008 for co-operative bank and regional rural bank, respectively. From the year 2021-22 onwards, the total factor productivity has faced decline in productivity. This might be due to the consequences of COVID-19 on the banking sector and recovery phase of economy.

Estimates of Malmquist Index for SHG linked Banks

The annual means of Malmquist index has been analysed for SHG linked bank during the period 2015-16 to 2023-24 and the overall result is presented in Table 6.

From Table 6, it could be revealed that the malmquist index for overall change in technology for SHG linked banks was 1.084, which infers increasing productivity. The digitalization of bank has made transaction to be very simple and easy access to everyone. The value of pure efficiency shows that there is constant productivity over the years. The malmquist index for overall scale efficiency was 1.028, it shows improved productivity. However,

Table 6: Result of Malmquist Index for SHG linked Banks in Puducherry - Year wise

Year	Technical Efficiency Change	Technological Change	Pure Efficiency	Scale Efficiency	Total Factor Productivity Change
2015-16	1.112	1.345	1.000	1.112	1.495
2016-17	1.061	1.180	1.000	1.061	1.251
2017-18	1.084	1.022	1.000	1.084	1.108
2018-19	0.986	1.132	1.000	0.986	1.116
2019-20	1.022	1.038	1.000	1.022	1.061
2020-21	1.000	1.122	1.000	1.000	1.122
2021-22	1.000	0.986	1.000	1.000	0.986
2022-23	1.000	1.000	1.000	1.000	1.000
2023-24	1.000	0.932	1.000	1.000	0.932
Mean	1.028	1.084	1.000	1.028	1.119

Table 7: Result of Malmquist Index for SHG linked Banks in Puducherry – Bank wise

Name of the Bank	Technical Efficiency Change	Technological Change	Pure Efficiency	Scale Efficiency	Total Factor Productivity Change
Cooperative Bank	1.058	1.157	1.000	1.058	1.224
RRB	1.000	1.005	1.000	1.000	1.005
Mean	1.028	1.081	1.000	1.028	1.114

this technical efficiency changes or 'catch up effect' is the product of pure efficiency and scale efficiency changes. The malmquist index for overall mean value of change in technical efficiency for SHG linked banks in Puducherry was 1.028. This indicates that there is an acceleration in bank performance, optimization of resources and efficiency in decision making units. The total factor productivity for both banks was 1.119, it accounts for increased productivity during the last ten years (2015-16 to 2023-24).

Estimates of Malmquist Index for SHG linked Banks

The means of Malmquist index has been analysed for Co-operative bank and Regional rural bank during the period 2015-16 to 2023-24 and overall result of total factor productivity change, technology change, technical efficiency change, pure efficiency and scale efficiency change is presented in Table 7.

From Table 7, it could be revealed that technical efficiency, technology change, scale efficiency and total factor productivity for both banks shows improvement in productivity and pure efficiency for both bank shows constant productivity. Therefore, by comparing them co-operative bank has more efficiency and improvement than that of regional rural bank in Puducherry.

CONCLUSION

This study has been attempted to examine the banking efficiency of co-operative bank and regional rural bank in Puducherry during the period from 2015-16 to 2023-24, which are considered as bank linked with SHGs. Using DEA Malmquist index, annual indices of total factor productivity, technical change, technological change, pure efficiency and scale efficiency were estimated for both banks. There is an increasing return to scale for total factor productivity in overall period. No change in improvement has been revealed in the pure efficiency change for both the banks. By comparing them, the productivity of co-operative bank was higher than that of regional rural bank in Puducherry. This might be due to their better performance in decision making units and technology transfer of co-operative bank. However, regional rural bank has constant returns to scale in technical efficiency, pure and scale efficiencies. This consistency over the years might help for better performance of the bank. Therefore, the Self-Help Group – Bank Linkage Programme has an ample of scope to develop and enhance the financial literacy of the rural women. The efficiency of the bank will ensure the outreach of the microcredit, managerial aspects, input-output proportionality and profitability of the institution.

REFERENCES

Arjomandi, A., Valadkhani, A. and Harvie, C. 2010. An Analysis of Productivity Changes in the Iranian Banking Industry: a Bootstrapped Malmquist Approach, Department of Economics, University of Wollongong, Working Paper 08-10, 2010, 26p.

Berg, S.A., Forsund, F.R., Hjalmarsson, L. and Souminen, M. (1993). Banking efficiency in the Nordic countries. *Journal of Banking and Finance*, **17**(2–3): 371–388.

Berger, A.N. and Humphrey, D.B. 1997. Efficiency of financial institutions: International survey and directions for future research. *European Journal of Operational Research*, **98**(2): 175–212.

Bhat, A., Kachroo, K., Dwivedi, S. and Singh, S.P. 2019. Marketing Cost and Price Spread Analysis of Fruit and Vegetables of Udhampur district of Jammu and Kashmir, India. *Indian Journal of Ecology*, **Special Issue**(7): 77-80.

Fare, Grosskopf and Lovell, 1994. *'Production Frontiers'*, Cambridge University Press.

Fare, R., Grosskopf, S., Lindgren, B. and Roos, P. 1994a. Productivity Developments in Swedish Hospitals: A Malmquist Output Index Approach. *In* Charnes, A., Cooper, W.W., Y., L.A. & M., S.L. (Eds.) Data Envelopment Analysis: Theory, Methodology and Applications, Boston: Kluwer.

Fare, R., Grosskopf, S., Norris, M. and Zhang, Z. 1994b. Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries, *The American Economic Review*, **84**(1): 66-83.

Ferrier, G.D. and Lovell, C.A.K. 1990. Measuring cost efficiency in banking: Econometric and linear programming evidence. *Journal of Econometrics*, **46**(1–2): 229–245.

Galab, S. and Vedam, B. 2018. Analysing Bank Productivity Using Malmquist Approach: A Case of Karnataka and Undivided Andhra Pradesh Regional Rural Banks (RRBs). *Indian Journal of Agricultural Economics*, **73**(4): 515-530.

Ibrahim B.M. and Sasikala, P. 2014. Efficiency and Productivity Analysis of Puducherry Cooperative Banks by Using DEA Approach, *International Journal of Scientific Research*, **3**(5): 375 – 378.

Kaur, M., Bhat, A., Singh, S.P., Sharma, R. and Gupta, L.M. 2020. Marketing Analysis of Marigold in Jammu Subtropics of Jammu and Kashmir. *Economic Affairs*, **65**(1): 69-76.

Kumar, H., Bhat, A., Choudhary, P. and Sharma, M. 2022. Economic Analysis of production of Harad (*Terminalia chebula*) and constraints faced in its cultivation in Jammu. *Indian Forester*, **148**(5): 245-255.

Muneer Babu, M. and Praveen, K. 2014. Productivity Change and Technical Efficiency in Indian Microfinance Institutions, *Studies in Microeconomics*, **2**(2): 165–200.

Ravi, R. and Ghosh, A. 2021. Efficiency Analysis of Scheduled Commercial Banks of Bihar: An Outreach Perspective. *Journal of Rural Development*, pp. 424-441.

Rede, G.D. and Bhattacharyya, K. 2020. Efficiency of pomegranate growers: A data envelopment analysis. *Economic Affairs*, **65**(2): 161-166.

Sahu, A., Kolar, P., Nahatkar, S. and Vani, G.K. 2022. Technical Efficiency of Wheat Production in Major Wheat Producing States of India: A Data Envelopment Analysis (DEA). *Economic Affairs*, **67**(01 Spl.): 107-111.

Sharma, S. and Gupta, S. 2010. 'Malmquist productivity and efficiency analysis for banking industry in India', *Int. J. Business Excellence*, **3**(1): 65–76.

Sharma, P.K. and Dwivedi, S. 2018. Economic Analysis of Pecan Nut Production: An Application of Input Oriented DEA Model. *Economic Affairs*, **63**(1): 223-228.

Sherman, H.D. and Gold, F. 1985. Bank branch operating efficiency: Evaluation with data envelopment analysis. *Journal of Banking and Finance*, **9**(2): 297–315.