APAEA

Zaman, A. U., Zaman, M. S., & Khan, N. A. (2022). Analysing the Technical Efficiency of Rural Cooperative Banks in India. *Asian Economics Letters*, *3*(4).
https://doi.org/10.46557/001c.37048

Peer-reviewed research

Analysing the Technical Efficiency of Rural Cooperative Banks in India

Aadil Ummar Zaman[1] [a], Mohammad Shahid Zaman[2], Nisar Ahmad Khan[1]

[1] Department of Economics, Aligarh Muslim University, India, [2] VIT Business School, Vellore Institute of Technology, India

Keywords: Technical efficiency, Data envelopment analysis, Rural cooperative banks, JEL: G15 G21 G34

https://doi.org/10.46557/001c.37048

Asian Economics Letters

Vol. 3, Issue 4, 2022

Using data envelopment analysis, this paper investigates the technical efficiency of rural cooperative banks in India from 2013 to 2019. The results indicate a continuous deterioration in efficiency as well as a large asymmetry between states regarding the technical efficiency estimates. Our results highlight the need for improving risk management and lending operations of banks for sustainable increase in the performance of the cooperative banking sector in India.

I. Introduction

Cooperatives in India have been established primarily to supply farmers with low-cost financing and to solve the twin challenges of rural indebtedness and poverty (Raju, 2018). Due to their phenomenal growth in outreach, cooperatives enjoy a unique position in the rural credit delivery system (Vaidyanathan, 2013). In India, rural cooperatives are organised in a three-tiered system, with StCBs (*State Co-operative Banks)* at the apex, DCCBs *(District Central Co-operative Banks)* in the centre, and PACS (*Primary Agricultural Credit Societies)* at the bottom. While StCBs account for 21.2% of the rural cooperatives' assets, DCCBs and PACS account for 48.6% and 25.3% respectively. Together, these institutions account for 65% of the total asset size of all co-operative banks (RBI, 2019-20). Rural cooperatives in India have widespread outreach, with a customer base of over 120 million (Muley, 2007).

However, in recent years, the cooperative sector has faced various financial challenges. Low capital foundations, liquidity issues, weak governance, slower adoption technology, and insufficient check-and-balances are major factors which have adversely affected the functioning of these institutions. The recent revelation of fraud at the Panjab and Maharashtra Cooperative Bank (PMC) has impacted asset quality of cooperative banks in general. As a result, the government has taken several steps to strengthen the governance and oversight of the cooperative banking system, including amending the Banking Regulation Act in 2021 to give the Reserve Bank of India (RBI) more regulatory control over UCBs, StCBs, and DCCBs. Given their overwhelming contribution to financial inclusion, there is immense need to examine the performance of cooperative banks in India.

This paper augments the scanty literature on cooperative banks by evaluating the technical efficiency of the rural cooperative banks in India. Bhatt and Bhat (2013) investigated the performance of cooperative banks in Jammu and Kashmir and found that the low performance of these institutions is associated with their high transaction costs and non-performing assets. Also, Gaurav and Krishnan (2017) evaluated the efficiency of DCCBs and suggested that the performance of such institutions can be increased by adoption of new technology and improvement in management practices. Recently, while evaluating the efficiency of scheduled urban cooperative banks, Raju (2018) found that there is a relatively larger mean efficiency in traditional banking activities such as loans and advances compared to non-traditional off-balance sheet activities. This paper examines the performance of rural cooperative banks in India using data envelopment analysis.

This study contributes to the existing literature in three ways. First, instead of using a grand frontier, we use more flexible separate annual frontiers for estimating the technical efficiency of banks. Second, unlike Gaurav and Krishnan (2017), where they consider only DCCBs, our study includes both DCCBs and StCBs. Third, we use a sample period, which is relevant to the period of the recent major crisis in the cooperative banking sector in India.

The rest of the paper is organised as follows. Section II provides a brief discussion on data and methodology used in this study. Section III summarises our results and findings and Section IV concludes.

II. Data and Methodology

The bank wise data for inputs and outputs was collected from the database of the National Federation of State Co-

a Corresponding author email: zamanamu13@gmail.com

Table 1. Descriptive Statistics

Variables	Mean	Median	Std. Dev.	Minimum	Maximum
Outputs					
Advances	805558.3	605698.0	879426.0	905.0	4600000.0
Investments	439427.9	297659.5	576748.3	6512.0	3900000.0
Inputs					
Loanable Funds	1199755.0	961574.0	1398229.0	25426.0	8900000.0
Operating Expenses	14716.4	4739.0	24588.2	1.0	185663.0

This table reports descriptive statistics of all variables used in this study. Values are represented in Indian rupees [(₹) lakhs].

operative Banks (NAFSCOB). Our sample consists of a panel of 331 DDCBs and 26 StCBs operating in India over the period of 2013 to 2019. However, for the sake of comparability, we have aggregated the inputs and outputs of DDCBs at the state level. Majority of the studies on banking efficiency follow the *intermediation approach* or the *production approach* for selecting inputs and outputs. The *intermediation approach* treats banks as an intermediating entity while the *production approach* considers banks as service providers to their customers.[1] We use a variant of the *intermediation approach* in our analysis. *Investments* and *advances* are treated as outputs while *loanable funds* (the sum of deposits and borrowings) and *operating expenses* (the sum of labour and capital expenses) are our input variables. All of our input and output variables are well supported in the literature (see, among others, Das & Ghosh, 2009; Ray & Das, 2010; Zaman & Bhandari, 2020). The descriptive statistics of our input and output specification is shown in Table 1.

While evaluating the performance of banking institutions, studies mainly use two competing approaches, the parametric and non-parametric approaches. In parametric models, stochastic frontier analysis (SFA) has been widely used, whereas in the non-parametric framework, data envelopment analysis (DEA) is quite popular. We use DEA in this study to measure input-oriented efficiency of rural cooperative banks. In DEA, a benchmark technology is created by combining the observable input-output bundles of the DMUs without specifying any functional form about production technology.[2] The *frontier*, which is established by linking the best practice banks within the sample, is used to determine the potential degree of performance. We use input-orientation since bank managers have more control over inputs than outputs. The input-oriented models aim at minimising the inputs while producing the given level of output. The input-oriented technical efficiency (*TE*) of the g^{th} bank with variable returns to scale (VRS) technology is calculated by solving the following mathematical programming problem:

$$
\begin{aligned}
&\textbf{Minimize } \theta_{\mathrm{g}} \\
&\quad subject\ to \\
&\qquad \sum_{k=1}^{N} \lambda_k x_{rk} \leq \theta_g x_{rg}, \\
&\qquad\quad for\ all\ \ r = 1, 2, \ldots, q \\
&\qquad \sum_{k=1}^{N} \lambda_k y_{sk} \geq y_{sg}, \\
&\qquad\quad for\ all\ \ s = 1, 2, \ldots, \mathrm{p} \\
&\qquad \sum_{k=1}^{N} \lambda_k = 1, \quad \lambda_k \geq 0, \\
&\qquad\quad for\ all\ \ k = 1, 2, \ldots, \mathrm{N}.
\end{aligned}
\tag{1}
$$

Equation (1) is solved *N* times, once for each bank. The indicator *TE* of the g^{th} bank in the above model is given by $TE_{io}^{vrs} = \theta^*$, and takes a value between 0 and 1. A *TE* score of $\hat{\theta}_k = 1$ indicates that the bank is fully efficient, whereas $\hat{\theta}_k < 1$ stands for an inefficient bank. Furthermore, instead of using a grand frontier (Ataullah & Le, 2006), we use more flexible separate annual frontiers (Zaman & Bhandari, 2021) for calculating efficiency of banks.

III. Results and Discussion

The average technical efficiency for rural cooperative banks in India as well as among DCCBs and StCBs are shown in Table 2. For estimating our model, we use "teradial" command in Stata software.[3] The average input-oriented *TE* of rural cooperative banks for the entire period is 78.7%, this means based on only 78.7% of inputs used currently, average rural banks could produce the same output level if the banks were operating on frontier. A closer look at the table shows that there has been a continuous deterioration in the technical efficiency of rural cooperative banks over the years. The main reason for the dismal performance of rural cooperatives is that they have higher nonperforming assets, and they experience weaker recovery. Secondly, rural cooperatives have a larger proportion of agricultural loans in their loan portfolios, which makes them more vul-

1 For a detailed description of the appropriateness of various approaches used in banking performance literature for selecting inputs and outputs, see Kumar and Gulati (2014).

2 For an extended discussion on non-parametric and parametric methodologies, see Ray (2004) and Kumbhakar and Lovell (2003).

3 Alternatively, other packages, such as DEAP, R, and MATLAB, among others, can be used to estimate this model.

Table 2. Average Technical Efficiency Scores of Indian Rural Cooperative Banks

Year	*TE*	Std.	Year	*TE*	Std.	Year	*TE*	Std.
	All RCBs			*DCCBs*			*StCBs*	
2013	0.850	0.168	2013	0.835	0.160	2013	0.860	0.175
2014	0.812	0.157	2014	0.830	0.140	2014	0.800	0.169
2015	0.786	0.146	2015	0.818	0.116	2015	0.767	0.172
2016	0.802	0.148	2016	0.834	0.120	2016	0.781	0.164
2017	0.786	0.160	2017	0.821	0.125	2017	0.764	0.180
2018	0.756	0.157	2018	0.799	0.139	2018	0.728	0.166
2019	0.723	0.163	2019	0.778	0.136	2019	0.688	0.175
2013-2019	0.787	0.157	2013-2019	0.816	0.133	2013-2019	0.768	0.171

This table reports mean technical efficiency of rural cooperative banks in India. The annual figures reported in the columns, titled *TE*, are the geometric means of results for individual banks in the respective category. The last row reports the geometric means of the annual geometric means for each category over the full sample period.

nerable to the whims of nature and agricultural performance fluctuations. Thirdly, there has been a continuous rise in operating expenses over the years due to overstaffing (RBI, 2020). All these factors have affected the performance of these financial institutions. These results suggest that there is substantial scope for improvement in technical efficiency by the improvement of lending practices, adaptation of sophisticated technology and the use of better risk management practices. These findings are therefore in line with the findings of Gaurav and Krishnan (2017). Furthermore, the dispersion of input-oriented *TE* estimates given by standard deviation shows some rising tendency.

The average input-oriented *TE* scores of DCCBs and StCBs during the sample period was found to be 0.816 and 0.768 respectively. The dismal performance of StCBs is because of the increase in lost assets owing to technical write-offs and poor recovery, possibly due to state governments' implementation of debt relief programmes. Additionally, because StCBs provide liquidity support to DCCBs and PACS, they are vulnerable to DCCBs' performance swings, which would affect their performance.

Figure 1 presents the state wise time averages of technical efficiency of DCCBs. From the figure, it can be seen that Chhattisgarh and Maharashtra are the top performing states with the highest mean technical efficiency followed by Tamil Nadu and Uttarakhand. Our results corroborate the VRS input-oriented findings of Gaurav and Krishnan (2017). The relative inefficiencies in states like Punjab, Haryana and Jammu and Kashmir stem from the systemic problems of poor capital base, inadequate corporate governance, and delayed adoption of new technologies, whereas states like Maharashtra and Tamil Nadu have a long history of having a strong rural cooperative system and are the frontrunners in providing rural credit (Chavan, 2015).

When considering the state wise time averages of technical efficiency of StCBs, a different picture emerges. Punjab, Uttar Pradesh and Himachal Pradesh were the best performing states, whereas Meghalaya, Karnataka and Goa were the worst performing states. Poor performing states such as Karnataka and Goa have a smaller percentage of owned funds and higher administrative expenses [as a percentage of working capital] as compared to high performing states.

We checked the robustness of our empirical results by running different set of inputs and outputs following the *value-added approach*.[4] We use the two inputs (employee expenses, operating expenses) and five outputs (investments, advances, current deposits, saving deposits and fixed deposits) model. In line with the *intermediation approach*, DCCBs performed better compared to SCBs. Furthermore, the top performing banks remained essentially unchanged in both the *intermediation approach* and *value-added approach*. All this confirms the robustness of our results.[5]

IV. Concluding Remarks

Using data envelopment analysis, this study investigates the input-oriented technical efficiency of rural cooperative banks in India from 2013 to 2019. The results show a continuous deterioration in the technical efficiency of rural cooperative banks over the sample period. Furthermore, DCCBs were found to be performing relatively better as compared to StCBs. A large asymmetry was also found between states regarding their technical efficiency in both DCCBs and StCBs.

Our results have important policy implications. We found that the poor performance of rural cooperatives is due to their higher non-performing assets and weaker recovery. Thus, improving the lending operations of banks on one hand and using proper risk management practices on

4 For a comprehensive description of the *value-added approach* for selecting inputs and outputs, see Das and Ghosh (2006).

5 Due to space limitation, we have not reported the results. However, the results are available upon request.

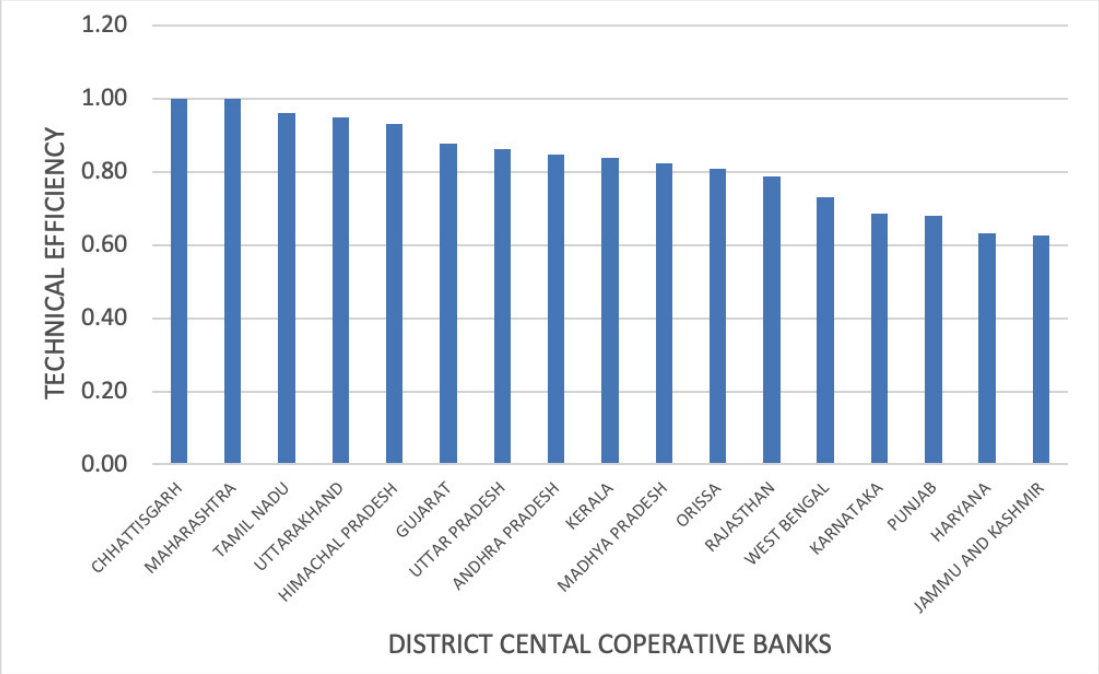

Figure 1. State Wise Input Oriented Technical Efficiency of DCCBs

Note: The horizontal axis shows the state wise DCCBs and the vertical axis represents time average input oriented technical efficiency of DCCBs for the respective state.

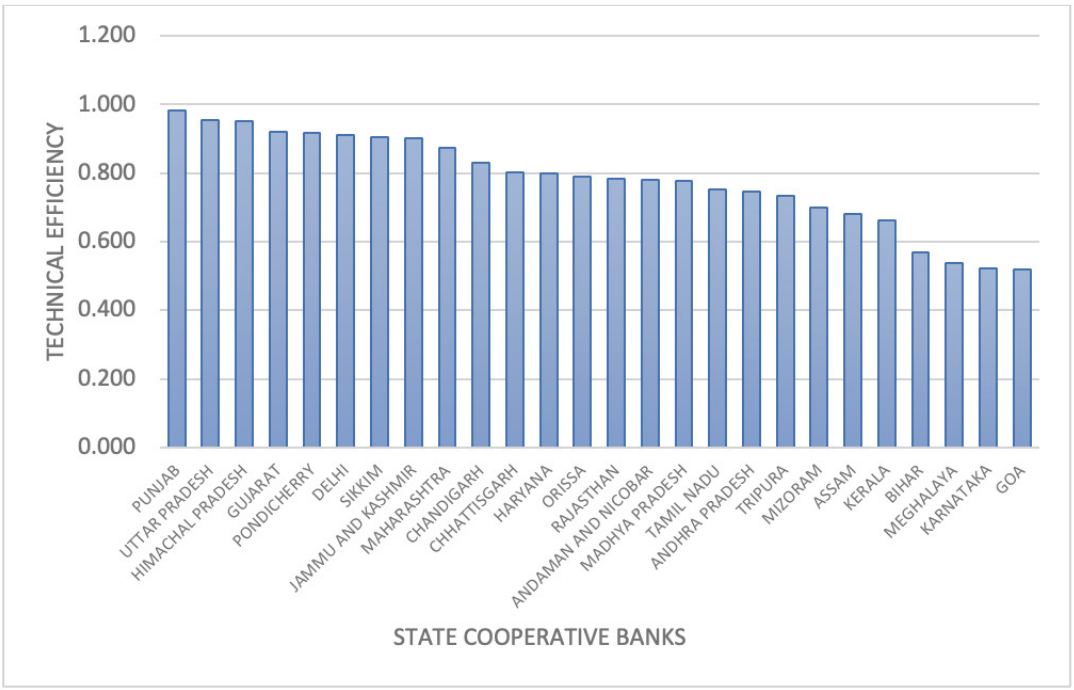

Figure 2. State Wise Input Oriented Technical Efficiency of StCBs

Note: The horizontal axis shows the state wise StCBs and the vertical axis represents the time average input oriented technical efficiency scores for the respective state.

the other hand would help improve the performance and soundness of the cooperative banking sector in India.

Our study has certain limitations as well. We only examine the performance of rural cooperative banks. A potential direction for future research would be to extend this analysis by investigating the nexus between competition and stability of cooperative banks in India.

Acknowledgement

The authors are thankful to the Guest Editor and two anonymous reviewers for their constructive suggestions and comments.

Submitted: January 21, 2022 AEDT, Accepted: May 10, 2022 AEDT

References

Ataullah, A., & Le, H. (2006). Economic reforms and bank efficiency in developing countries: The case of the Indian banking industry. *Applied Financial Economics*, *16*(9), 653–663. https://doi.org/10.1080/09603100500407440

Bhatt, M. S., & Bhat, S. A. (2013). Financial performance and efficiency of cooperative banks in Jammu & Kashmir (India). *Journal of Co-Operative Accounting and Reporting*, *2*(1), 16–36.

Chavan, P. (2015). Rural Credit Cooperatives in Maharashtra: A Tale of Growing Divides. *Economic and Political Weekly*, *50*(38), 52–61.

Das, A., & Ghosh, S. (2006). Financial deregulation and efficiency: An empirical analysis of Indian banks during the post reform period. *Review of Financial Economics*, *15*(3), 193–221. https://doi.org/10.1016/j.rfe.2005.06.002

Das, A., & Ghosh, S. (2009). Financial deregulation and profit efficiency: A nonparametric analysis of Indian banks. *Journal of Economics and Business*, *61*(6), 509–528. https://doi.org/10.1016/j.jeconbus.2009.07.003

Gaurav, S., & Krishnan, J. (2017). How efficient are India's Cooperative Banks? Evidence from DCCBs. *Economic and Political Weekly*, *52*(12), 115–124.

Kumar, S., & Gulati, R. (2014). Deregulation and efficiency of Indian banks. In *India Studies in Business and Economics*. Springer India. https://doi.org/10.1007/978-81-322-1545-5

Kumbhakar, S. C., & Lovell, C. K. (2003). *Stochastic frontier analysis*. Cambridge University Press.

Muley, S. S. (2007). Role of Co-operative Banks in Rural Credit. *Cooperative Perspective*, *42*(1/2), 31–40.

Raju, S. (2018). Assessing the efficiency of urban co-operative banks in India. *Central European Review of Economics and Management*, *2*(1), 11–42. https://doi.org/10.29015/cerem.550

Ray, S. C. (2004). *Data envelopment analysis: Theory and techniques for economics and operations research*. Cambridge University Press. https://doi.org/10.1017/cbo9780511606731

Ray, S. C., & Das, A. (2010). Distribution of cost and profit efficiency: Evidence from Indian banking. *European Journal of Operational Research*, *201*(1), 297–307. https://doi.org/10.1016/j.ejor.2009.02.030

Reserve Bank of India. (2020). Report on trend and progress of banking in India. *Reserve Bank of India*. https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/0RTP2020_F3D078985540A4179B62B7734C7B445C9.PDF

Vaidyanathan, A. (2013). Future of cooperatives in India. *Economic and Political Weekly*, *48*(18), 30–34.

Zaman, M. S., & Bhandari, A. K. (2020). Financial deregulation, competition and cost efficiency of Indian commercial banks: Is there any convergence? *Indian Economic Review*, *55*(2), 283–312. https://doi.org/10.1007/s41775-020-00100-7

Zaman, M. S., & Bhandari, A. K. (2021). Stressed assets, off-balance sheet business activities and performance of Indian banking sector: A DEA double bootstrap approach. *Studies in Economics and Finance*, *39*(44), 572–592.