CENTRAL EUROPEAN REVIEW
OF ECONOMICS AND MANAGEMENT

ISSN 2543-9472; eISSN 2544-0365

Vol. 2, No. 1, 11-42, March 2018

www.cerem-review.eu
www.ojs.wsb.wroclaw.pl

Assessing the efficiency of urban co-operative banks in India

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Abstract:

Aim: Urban Co-operative Banks are a small albeit significant constituent in the multi-stage credit delivery mechanism of the banking sector in India. These banks have an organisational, managerial and regulatory structure different from commercial banks. It is, therefore, of interest to study the efficiency with which these banks perform their core banking and off balance sheet activities. This paper focuses on the measurement of efficiency in the conduct of core banking and off balance sheet activities for the period 2013-14 to 2015-16.

Design / Research methods: The main idea is to employ the parametric Stochastic Frontier Analysis and the non-parametric Data Envelopment Analysis to measure the efficiency of Urban Co-operative Banks. We estimate two models for both the frontier methods, Model A examines the efficiency in core banking activity and Model B for the off balance sheet activities. The analysis of super efficiency undertaken helps identify the most efficient bank while the quartile analysis provides an insight into the distribution of efficiency (for both Models A and B). A Tobit model (for both Models A and B) has also been estimated to identify the determinants of efficiency.

Conclusions / findings: We find that Urban Co-operative banks display a higher mean efficiency in core banking activities (Model A) as compared to the off-balance sheet activities (Model B) and this finding has been reiterated by the frequency distribution of efficiency for both the frontier methods. The difference in the mean efficiency obtained for Models A and B is much wider under the stochastic frontier analysis. The analysis of super efficiency points out that of the three banks efficient under Model A and five efficient banks under Model only one bank is common to both the models. The quartile analysis highlights that 38.9 percent of the UCBs are ranked in the lower two quartiles of efficiency. The Tobit regression model has identified deposits and loans disbursed as significant determinants of efficiency for both models.

Originality / value of the article: This study contributes significantly to the existent gap in the literature on efficiency measurement of banks in India by focusing on efficiency measurement among urban co-operative banks who play an important role in urban financial inclusion.

Implications of the research: This study is the only study that has measured the efficiency in operations of Urban Co-operative Banks and can hence provide an insight into the operations of these banks. It can also help individual banks in taking appropriate measures to improve efficiency.

Key words: urban co-operative banks; efficiency, super efficiency
JEL: E5, C6.

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Received: 15-09-2017, Revised: 19-12-2017, Revised: 12-01-2018, Accepted: 17-01-2018
doi: http://dx.doi.org/10.29015/cerem.550

1. Introduction

Banks in India can be broadly classified into commercial and co-operative banks. Both these groups of banks are also known as scheduled banks as they are included in the Second Schedule of the Banking Regulation Act, 1965. Co-operative banks are organized in the co-operative sector and operate in urban and rural areas. There is no formal definition of Urban Co-operative Banks (UCBs) and the reference is to primary co-operative banks located in urban and semi-urban areas. These banks have traditionally focused on communities, localities, and workplace groups, and play a crucial role in mobilising resources from lower and middle income groups in urban areas. They essentially lend to small borrowers and businesses. A benefit that UCBs possess is the low cost structure and the flexibility they can provide to the local community by being more responsive to their needs. UCBs in India are registered as co-operative societies under the provisions of State (Provincial) Co-operative Societies Acts or Multi State (Province) Co-operative Societies Acts and are licensed to undertake the business of banking under provisions of the Banking Regulation Act, 1949. UCBs, in turn, are further classified into scheduled and non-scheduled. Scheduled UCBs are those which have a deposit base exceeding INR 1,000 million and can avail of a borrowing/loan facility from the Reserve Bank of India. This facility is not available to non-scheduled UCBs.

The beginnings of co-operative banking in India goes back to the end-nineteenth century and was consequent to the successful co-operative experiments in Britain and Germany. The problems of rural indebtedness towards the end of the 19th century also created an environment conducive to the growth of chit funds and co-operative societies. Co-operatives are based on the tenets of mutual help, democratic decision making, and open membership. The first known co-operative bank or mutual aid society in the country was the "Anyonya Sahakari Mandali" established in the princely State of Baroda in 1889. As the movement gained strength, it led to the enactment of the Co-operative Credit Societies Act, 1904, and later to a more comprehensive Co-operative Societies Act, 1912. The Government of India Act in 1919 transferred the subject of "Co-operation" from itself to the Provincial Governments. The Government of Bombay passed the first State Co-operative

Societies Act in 1925 which led to an important phase in the evolution of co-operative credit institutions in the country. The Multi-Unit Co-operative Societies Act, 1942, was enacted to cover societies with membership from more than one province. The emergence of several national federations of co-operative societies in various functional areas along with several different laws governing the same type of societies led to the consolidation of the laws governing co-operative societies under a comprehensive Central legislation - the Multi-State Co-operative Societies Act, 1984, which covered banks with a presence in several States (provinces). From March 1, 1966, co-operative banks that had a paid-up share capital and reserves of Rs. 1 Lakh and more were brought under the purview of the Banking Regulation Act, 1949, and hence under the supervisory control of the Reserve Bank of India. The deposits of UCBs are covered under Deposit Insurance from 1968 up to Rs. 1 Lakh only.

It is pertinent to note that although commercial banks form the mainstay of the banking system in India, the role played by co-operative banks cannot be underestimated and these banks constitute a vital component in the multi-stage credit delivery mechanism in rural as well as urban areas (Chakrabarty 2003). There has been a tremendous increase in the total number of UCBs in the country from 1,307 in 1991 to 1,574 as of end-March 2016 accompanied by a humungous increase in the deposits and advances of UCBs. Of the 1,574 UCBs, 52 are categorised as Scheduled UCBs and 1,522 as Non-Scheduled UCBs. Deposits increased by 38.61 times from INR 101570 million in end March 1991 to INR 3,92,1794 million as of end March 2016. Advances given by UCBs also increased by 30.61 times from INR 80030 million to INR 24,50,125 million in March 2016. Although the deposits and advances of UCBs have seen a manifold increase over time, their share in the overall deposits and advances of the banking system in India as of end-March 2016 is at a mere 3.5 percent and 3.1 percent respectively (Appendix Table 1). Further, UCB presence is geographically skewed with concentration in a few regions and States (provinces). The regional distribution of UCBs as of end March 2016 indicates a concentration of UCBs in the Western and Southern regions which together account for 81.8 percent of the total UCBs in the country (Appendix Table 2). Within the dominant regions, States (provinces) such

as Maharashtra, Gujarat, Karnataka, Andhra Pradesh, and Tamil Nadu account for more than 80 percent of the UCBs (Appendix Table 3). The concentration in these States can be attributed to the prevalence of a strong co-operative movement and emergence of a strong co-operative leadership (Chakrabarty 2009).

Despite being a small segment of the banking system, UCBs play a vital role in urban financial inclusion. The Census of India 2011 has highlighted the fast pace of urbanization in the country which has increased from 27.81 percent in 2001 to 31.16 percent in 2011. The Census 2011 has also noted that for the first time since Independence, the absolute increase in population in urban areas has been greater than the increase in rural areas. UCBs, with their well-established connections with specific communities, enjoy the trust of small savers and borrowers. The local nature of their operations and the intermingling with the local community provide a natural advantage in achieving wider urban financial inclusion. The High Power Committee on Urban Co-operative Banks constituted by the RBI in 1999 recognized the critical role played by UCBs in urban financial inclusion -'the co-operative credit endeavour was the first ever attempt at micro credit dispensation in India' (Chakrabarty 2009). UCBs predominantly offer banking services to businessmen, small traders, artisans, factory workers, and salaried people in urban and semi-urban areas. Several artisans and small businessmen are under-banked and often find it difficult to access large commercial banks. UCBs cater to the needs of this population and hence can emerge as major players in urban financial inclusion through their outreach and provision of customized services (Reserve Bank of India 2005).

Efficiency studies relating to banks in India have focused mainly on the performance of scheduled commercial banks along with a comparison of the performance of private and foreign banks. Studies that measure the efficiency of co-operative banks and particularly UCBs are few and this paper seeks to contribute to the literature on efficiency measurement of scheduled UCBs in India. Section II of the paper presents a brief discussion on the different approaches to measure bank efficiency. Section III presents a brief review of efficiency studies with reference to Indian banks including the literature concerning co-operative banks in India. Section IV discusses the methodology, and the empirical evidence is presented in Section V. Section VI concludes the paper.

2. Approaches to measure banking efficiency

The literature on banking efficiency identifies two approaches to study and measure efficiency, namely the production approach and the intermediation approach (Humphrey 1985; Hjalmarsson et al. 2000). The production approach, first discussed by Benston (1965), views banks as entities that provide services to customers such as loans and other financial services. The focus is the number and type of transactions and/or services provided by a bank over a given period of time. Data on such details is often difficult to obtain in the public domain and a common proxy often used is the number of deposits and loan accounts. This approach centres on operating costs and includes physical variables and their costs. The intermediation approach discussed by Sealey and Lindley (1977) views banks as financial intermediaries who transfer funds from one set of agents (depositors) to another set of agents (creditors). Assets created by the bank through loans and advances, securities, and investments generate income while deposits of the bank are liabilities and interest has to be paid by the bank. This approach considers interest as well as operating costs.

Berger and Humphrey (1977) have pointed out that the intermediation approach is better suited to examine bank-level efficiency as at the bank level the focus is often on being cost efficient whereas the production approach is apt for studying branch-level efficiency. Processing of transactions normally takes place at the branch level and hence efficiency measurement in processing transactions and services, the focus of the production approach, is best studied at the branch level.

3. Review of efficiency studies relating to banks in India

The literature on efficiency measurement of banks, internationally and in India, is extensive. The review, consequently, concentrates on major studies that have used frontier methods to examine the efficiency of banks in India including a few studies on co-operative banks in the country. Table 1 presents the details of these studies. The focus of these studies has been a comparative assessment of different types of

efficiency among commercial banks in India viz. technical, cost, revenue, and profit efficiency. Table 1, thus, highlights the paucity of work on efficiency measurement of co-operative banks and more so of urban co-operative banks. This study seeks to fill this gap in the measurement of efficiency of urban co-operative banks in India by analysing technical efficiency for the period 2013-14 to 2015-16.

Table 1. Major studies on banking efficiency in India

Author(s)	Method Used	Focus of the Study	Period of Study	Findings
Bhattacharya et al. (1997)	DEA and SFA	Productive/Technical efficiency of commercial banks	1986-1991	Public sector banks were most efficient followed by foreign banks and private banks.
Sathye (2003)	DEA	Productive efficiency of commercial banks	1997-1998	Efficiency of public and private sector banks was comparable to the efficiency of foreign banks in India. Public sector banks were found to be more efficient than private sector banks.
Shanmugam, Das (2004)	SFA	Technical efficiency of commercial banks	1992-1999	Wide variations observed across bank groups in raising interest margins and non-interest income. Efficiency in raising interest margins was time invariant while that of non-interest income was time varying. The State Bank group and foreign banks performed better than the nationalized banks and private sector banks.
Das, Ghosh (2006)	DEA	Technical efficiency of commercial banks	1992-2002	Wide variation in the technical efficiency of banks and medium-sized public sector banks operated at higher levels of efficiency. More efficient banks were seen to have lower non-performing assets.
Bhattacharya, Pal (2013)	SFA	Impact of financial sector reforms on technical efficiency of commercial banks	1989-2009	Impact of financial sector reforms on technical efficiency was mixed. Decline in efficiency observed for public sector and private sector banks for a large part of the post reform period. Public sector banks displayed higher efficiency as compared to private sector banks and foreign banks.

Table 1. Cont.

Author(s)	Method Used	Focus of the Study	Period of Study	Findings
Kumbhakar, Sarkar (2003)	SFA	Cost efficiency of commercial banks	1986-2000	Improvement in cost efficiency over the time period. Cost efficiency in private sector banks was higher than public sector banks. Decline in inefficiency was slower in the post deregulation period compared to the pre-deregulation period.
Das et al. (2005)	DEA	Technical efficiency, cost efficiency, revenue efficiency, and profit efficiency of commercial banks	1997-2003	Improvement in the median efficiency scores of Indian banks, in general, and particularly of bigger banks. No major difference observed for technical and cost efficiency whereas sharp differences were observed for revenue and profit efficiency.
Sensarma (2005)	SFA	Cost and profit efficiency of commercial banks	1986-2003	Improvement in cost efficiency and a decline in profit efficiency observed during the period. Domestic banks (public sector and private sector) were found to be more efficient than foreign banks. Public sector banks showed greater cost efficiency while private sector banks showed higher profit efficiency.
Kumar, Gulati (2010)	DEA	Cost, technical, and allocative efficiency of public sector banks in India	1993-2008	Deregulation had a positive impact on the cost efficiency of banks. An upward trend observed for technical efficiency whereas a declining trend seen for allocative efficiency. Cost inefficiency of banks was largely due to technical inefficiency rather than allocative inefficiency. Alpha and beta convergence was observed for cost efficiency.
Mahesh, Bhide (2008)	SFA	Impact of financial sector reforms on cost, profit, and loan efficiency of commercial banks	1985-2004	Competition in the post de-regulation period had a significant impact on cost and profit efficiencies while loan efficiency did not display significant improvement. Wide variations seen across different bank groups.

Table 1. Cont.

Author(s)	Method Used	Focus of the Study	Period of Study	Findings
Studies pertaining to Co-operative Banks in India				
Ramesh, Patel (1999)		Growth performance of urban co-operative banks	1975-1994	A phenomenal growth seen in the number of bank branches, membership, share capital, reserves, deposits and advances. This growth was, however, accompanied by a huge increase in borrowings by UCBs.
Shah (2001, 2007)		Performance of rural co-operative credit institutions in Maharashtra	1981-2003	A slowdown in growth of membership and institutional financing, rapid increase in outstanding against loan advances. Major challenges include high transactions costs, poor repayment record, growing non-performing assets and wilful default.
Chander, Chandel (2010)	Financial ratio analysis	Evaluate performance of four District Central Co-operative Banks in Haryana	1998-2009.	All four banks in the bankruptcy zone which could be attributed to financial mismanagement and underutilization of resources.
Bhatt, Bhat (2013)	DEA	Technical efficiency of eight co-operative banks in Jammu & Kashmir and identify factors which influence efficiency	2001-07	3 of the 8 banks were found to be efficient under CRS-DEA model while 5 of 8 banks were efficient under the VRS-DEA model. Better management of deposits, loan recovery, investment and improving skill of staff could improve efficiency.
Gaurav, Krishnan (2017)	DEA and SFA	Technical efficiency of District Central Co-operative Banks in India	2002-14	Substantial variation in the efficiency of District Central Co-operative Banks across States. Adoption of better technology and improvement in management can help improve efficiency.
Note: Commercial banks refers to public sector, private sector, and foreign banks in India.				

4. Methodology

Bank performance has been traditionally measured using financial ratio analysis. The drawback of this approach is that it tends to aggregate several aspects of performance and can be misleading as it depends on an arbitrary benchmark ratio both of which may not help assess the long term performance of banks (Sherman, Gold 1985; Yeh 1986). Sherman and Gold (1985) were the first study to apply frontier methods to measure banking efficiency. The non-parametric Data Envelopment Analysis (DEA) and the parametric Stochastic Frontier Analysis (SFA) have been extensively employed in efficiency measurement in recent times. Other frontier methods used are the free disposal hull, thick frontier, and the distribution free approaches (Sathye 2003). The parametric SFA requires the specification of a functional form whereas the nonparametric DEA uses mathematical programming. Seiford and Thrall (1990) write 'that the kind of mathematical programming procedure used by DEA for efficient frontier estimation is comparatively robust'. The mathematical formulations of the DEA models can be converted to simpler formulations which are easier to estimate using the linear programming (LP) procedure to estimate relative efficiency in decision making units (DMUs) and can be used to calculate the best practice production frontier for firms (Ali, Seiford 1993). A main property of DEA is that it does not require any a priori assumptions about the functional form and the distribution of the error term (Coelli 1995).

Efficiency of a DMU, in this case a bank, can be defined as the ability with which it can convert inputs to outputs and is calculated as the ratio of outputs to inputs. Efficiency can also be defined as the ratio of minimum costs that would have to be incurred to the actual costs incurred to produce a given level of output and efficiency measures always lie between 0 and 1.

4.1. Stochastic frontier analysis

Stochastic Frontier Analysis (SFA) was developed by Aigner et al. (1977) and Meeusen and Van den Broeck (1977). The approach requires that a functional form be specified for the frontier production function. An advantage of SFA over DEA is

that it takes into account measurement errors and other noise in the data (Latruffe et al. 2004).

Suppose a producer has a production function $f(\boldsymbol{x}_i, a)$. In a world with no inefficiency, the firm i would produce

$$y_i = f(\boldsymbol{x}_i, \boldsymbol{\alpha}) \quad (1)$$

where, y_i = output; $\boldsymbol{x}_i$ = vector of inputs ; $\boldsymbol{\alpha}$ = vector of parameters to be estimated.

A fundamental element of SFA is that each firm can potentially produce less than its maximum capacity due to inefficiency which renders the production function as:

$$y_i = f(\boldsymbol{x}_i, \boldsymbol{\alpha}) + e_i \; i = 1.....N \quad (2)$$

where, $e_i = v_i - u_i$, is a composite of two error terms:

(i) v_i is a normally distributed error term representing measurement and specification error or noise and represents factors beyond the control of the firm; $v_i \sim N(0, \sigma_v^2)$

(ii) u_i is a one sided error term which represents inefficiency i.e. the inability to produce the maximum level of output given the inputs used. The component u_i is assumed to be distributed independently of v_i and to satisfy $u_i \geq 0$. The non-negativity of the technical inefficiency term reflects the fact that if $u_i \geq 0$ the unit (firm or country or state) will not produce at the maximum attainable level. The generalization of the specification of u_i by Battese and Coelli (1988) is given by $u_i \sim N^+(0, \sigma_u^2)$ or $u_i \sim N^+(\mu, \sigma_u^2)$.

A measure of inefficiency can be obtained by means of the parameter γ which is defined as

$$\gamma = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2} \quad (3)$$

where, σ_v^2 and σ_u^2 are the variances of the noise and inefficiency effects respectively.

The value of γ lies between 0 and 1. If it is close to zero then deviations from the frontier can be attributed to noise, while if the value of γ is close to 1, then deviations from the frontier can be attributed to technical inefficiency (Battese, Corra 1977; Tran et al. 2008; Coelli et al. 2005).

Another measure of inefficiency can be obtained from the parameter λ (Aigner et al. 1977) which is computed as:

$$\lambda^2 = \frac{\sigma_u^2}{\sigma_v^2} \geq 0 \qquad (4)$$

4.2. Data Envelopment Analysis

The Data Envelopment Analysis (DEA) method allows the generalization of the single output/input technical efficiency measure to multiple outputs/inputs by constructing a relative efficiency measure. DEA models can be estimated either under constant returns to scale or variable returns to scale. The Constant Returns to Scale (CRS) efficiency is obtained by solving the Charnes, Cooper and Rhodes (CCR) model. The CRS model estimates the gross efficiency of a DMU which reflects technical and scale efficiency. The efficiency of transforming inputs into output denotes technical efficiency while scale efficiency estimates that most productive scale size which is the scale at which efficiency is 100 percent. The Banker, Charnes and Cooper (BCC) model measures the Variable Returns to Scale (VRS) efficiency. This model takes into consideration the variation in efficiency with respect to the scale of operation and therefore measures pure technical efficiency. The scale efficiency of a DMU can be calculated as the ratio of its CRS to VRS efficiency. The CRS efficiency of a firm is always less than or equal to its VRS efficiency. Thus, other things being equal, the VRS model gives the highest efficiency score while the CRS model gives the lowest score. The focus in DEA models on variable returns is mainly to ascertain whether a DMU exhibits decreasing, increasing, or constant returns to scale rather than to quantify the degree of returns to scale (Fukuyama 2000).

Depending on the orientation, DEA models can be expressed either as output-oriented (maximization) or input-oriented (minimization) models. The output-oriented DEA model seeks to maximize output production for a given level of resources whereas the input-oriented envelopment model aims to produce the observed output with minimum inputs. Thus, the dual of the output-maximizing DEA model is the input-oriented envelopment model and vice versa (Ramanathan 2003).

An input-oriented CRS-DEA model of cost efficiency for a bank can be expressed as (Färe, Grosskopf 1985):

$$\begin{aligned} & Min\ w_i x_i \\ subject\ to \quad & \\ & Y\lambda_i \geq y_i \\ & X\lambda_i \leq x_i \\ & \lambda_i \geq 0 \end{aligned} \qquad (5)$$

where, w_i denotes the vector of input prices for bank *i*; the first condition states that the output of bank *i* cannot be less than a linear combination λ_i of the output of all banks *Y*; the second inequality states that the input vector of bank *i* cannot be greater than a linear combination λ_i of the input vectors of all banks *X*. Solving the above equation gives the minimum costs and a comparison of minimum costs to actual costs gives an estimate of cost efficiency.

The measure of technical inefficiency obtained from the input-oriented DEA models corresponds to Farell's input-based measure of technical inefficiency. The estimates of efficiency obtained from the input-oriented and output-oriented measures would be similar under the CRS model but are unequal for the VRS model as the CRS-DEA model is only appropriate when all firms are operating at optimal scale. However, due to imperfect competition or constraints on finance, firms may not operate at the optimal scale and hence an input-oriented variable return to scale may be used to calculate technical efficiency. Further, the choice of orientation (input or output) is dependent on which quantities (inputs or outputs) the DMU has most control over and are the unit's primary decision variables (Coelli et al. 2005). Coelli and Perelman (1999) point out that the choice of orientation has only a minor influence on the scores obtained. Coelli et al. (2005: 181) also note that 'the output and input oriented DEA models will estimate exactly the same frontier and therefore, by definition, identify the same set of firms as being efficient. It is only the inefficiency measures associated with the inefficient firms that may differ between the two methods'.

5. Empirical evidence

This paper seeks to measure the efficiency of UCBs in India in the framework of the intermediation approach for the period 2013-14 to 2015-16. Efficiency has been measured using both the frontier methods, namely stochastic frontier and data envelopment analysis. There were 1,574 UCBs in India as of end-March 2016. Of these, 52 banks are categorised as scheduled UCBs and 1,522 as non-scheduled UCBs. The focus of the paper is on the efficiency of scheduled UCBs and data has been obtained from Primary (Urban) Co-operative Bank Outlook, Reserve Bank of India. Sathye (2003) writes, 'the choice of inputs and outputs in DEA is a matter of long standing debate'. The total income of a bank comprises of net interest income and non-interest income. Although the average non-interest income of all UCBs taken together during the period under consideration (2013-14 to 2015-16) constituted only 10 percent of its total income, there exist huge variations among individual banks and it contributes 16 to 20 percent of total income in some scheduled UCBs. Besides, in recent times UCBs have expanded their off-balance sheet activities and not taking into consideration non-interest income may not provide a correct estimate of efficiency. This paper, therefore, considers two separate models for the two output variables – net interest income (Model A) and non-interest income (Model B). Model A has a single output variable - net interest income and three input variables have been considered which reflect physical capital, labour, and loanable funds which are proxied by the expenditure incurred on fixed assets, labour. Interest paid is a critical variable especially for UCBs as most co-operative banks offer a higher interest rate on deposits as compared to their counterparts such as scheduled commercial banks. Model B concerns the non-interest income that accrues to a bank from off-balance sheet activities. Most of these activities are in the nature of provision of services for which the bank charges a fee or commission and hence the input variables included are the expenditure incurred on fixed assets and labour. All variables are values in logs.

Three of the 52 scheduled UCBs were not considered for efficiency estimation as data for two banks – Vasai Vikas Sahakari Bank Limited and Vasavi Co-operative Urban Bank Limited was not reported for all the years under consideration

while the net interest income of Rupee Co-operative Bank Limited was negative during the period under consideration. Since no major year to year variations were seen in either the output or input variables for the time period under consideration, it was decided to measure efficiency by taking the average value of the output and input variables. A brief description of the variables used in the estimation is in Table 2.

Table 2. Description of variables used in the empirical analysis

Variable	Description
Output Variables	
Net Interest Income (LNETINTINC)	Interest Earned–Interest Expended (Paid) refers to the income earned from traditional/core banking activities such as accepting deposits, lending and investment in government and other securities; interest paid by banks on deposits and interest paid on borrowings from the RBI and other agencies
Non-Interest Income (LNONINTINC)	Income from off–balance sheet activities and includes fees, commissions, exchange and brokerage; profit & loss from foreign exchange operations; trading and sale of securities; sale of fixed and other assets and dividend income
Input Variables	
Price of Physical Capital or Fixed Assets (LFXDASSET)	Rent, taxes and lighting, printing and stationery, depreciation on bank's property, repairs and maintenance and insurance
Price of labour (LSAL)	Payments and provisions for employees
Price of loanable funds (LINTPD)	Interest paid on deposits and borrowings from the Reserve Bank of India and other agencies
Note: All variables are expressed in INR million and expressed as natural logs in estimation.	

Source: Author's own elaboration.

Table 3 presents the descriptive statistics of the variables used in the estimation of the DEA and SFA models and in the Tobit regression model. It can be seen that the least average input cost/expenditure is on fixed assets followed by salary and payments to staff. Among output variables, the average for non-interest income is much higher than that of net interest income. A comparison of the standard deviation of both these output variables indicates that the variations in non-interest income among UCBs is much higher than for net interest income given that there exists a

huge peer pressure among UCBs to maintain a similarity in interest rates offered on deposits. The wide range observed in share capital, deposits, investments, and loans also points to the vast heterogeneity in the operations of scheduled UCBs.

Table 3. Descriptive statistics of variables (INR Million)

Statistic	Mean	Minimum	Maximum	Standard Deviation
Net Interest Income	1020	82	6179	1168
Non- Interest Income	3484	204	26460	4763
Interest Paid	2464	122	20280	3614
Expenditure Incurred on Fixed Assets	206	13	1292	280
Expenditure Incurred on Salary and Payments to Staff	385	36	2997	478
Share Capital	620	74	3351	598
Deposits	33013	1452	275354	47462
Investments	10580	865	83105	14865
Loans	21350	689.9	178781	31381

Source: Author's own elaboration.

5.1 Results of stochastic frontier analysis

The variables considered in the stochastic frontier model are similar to the output and input variables considered for DEA (described in Table 2). The results of the SFA models are given in Table 4. The dependent variable in Model A is log of net interest income while expenditure incurred on fixed assets, salary and other payments, and interest paid are the explanatory variables. It can be observed that interest paid by a bank has a statistically significant impact (at 1 percent level of significance) on the net interest income earned by the bank. The relationship between the expenditure incurred on fixed assets such a rent etc. although positive is not statistically significant while a negative albeit not significant relationship is seen between the expenditure incurred on labour and the net interest income of a bank. The lambda (λ) parameter is 0.64 and statistically significant at 5 percent clearly indicating that the existence of technical inefficiency and deviations from the frontier are not entirely due to noise. Inefficiency contributes on average almost 64 percent to the value of λ over this period.

Table 4. Results of stochastic frontier analysis

	Model A	**Model B**
constant	0.22 (0.52)	2.25*** (6.9)
LFXDASSET	0.04 (0.48)	0.48*** (5.61)
LSAL	-0.07 (-0.54)	0.61*** (5.32)
LINTPD	0.91*** (6.96)	--
λ	0.64** (1.64)	1.70** (2.09)
p- values are in parentheses. *** = p < 0.01; ** = p < 0.05; * = p < 0.10 λ is the estimate of the term in equation (4)		

Source: Author's own elaboration.

Model B seeks to capture the efficiency of scheduled UCBs in off-balance sheet activities and the explanatory variables considered are the expenditure incurred on fixed assets and salary and other payments. Both these explanatory variables are positive and statistically significant at 1 percent level. Further, the statistically significant λ (lambda) statistic reveals high inefficiency in off-balance sheet activities undertaken by the scheduled UCBs. A comparison of the λ statistic for Models A and B indicates that scheduled UCBs display inefficiency in both core banking activity as well as in their expanded non-core off-balance sheet activities. Further, the inefficiency is much higher (170 percent) in the non-core operations. A frequency distribution of efficiency for Models A and B along with the respective mean efficiency is presented in Table 5 which shows that the mean efficiency of Model A is higher than that of Model B implying thereby that scheduled UCBs are generally more efficient in traditional/core banking activities as compared to off-balance sheet activities. A comparison of the frequency distribution of banks across the efficiency range for Models A and B reiterates the finding. It can be observed that all the 49 banks were in the efficiency range of 0.7 and above for Model A. Further, 48 banks (98 percent) were in the efficiency range of 0.8 to 1 while only 1 bank was in the low efficiency range of 0.7 to 0.8.

Table 5. Frequency distribution of efficiency scores – SFA Model

Model A			Model B		
Efficiency Range	No. of Banks	Percent of Banks	Efficiency Range	No. of Banks	Percent of Banks
$0.4 \leq E < 0.5$	--	--	$0.4 \leq E < 0.5$	2	4.08
$0.5 \leq E < 0.6$	--	--	$0.5 \leq E < 0.6$	1	2.04
$0.6 \leq E < 0.7$	--	--	$0.6 \leq E < 0.7$	5	10.20
$0.7 \leq E < 0.8$	1	2.04	$0.7 \leq E < 0.8$	18	36.73
$0.8 \leq E < 0.9$	25	51.02	$0.8 \leq E < 0.9$	18	36.73
$0.9 \leq E < 1$	23	46.94	$0.9 \leq E < 1$	5	10.20
Total	49	100.00		49	100.00
Mean Efficiency	0.895			0.778	

Source: Author's own elaboration.

The frequency distribution for Model B shows a higher percentage of banks in the lower ranges of efficiency - 26 banks (53.1 percent) were in the lower efficiency range of 0.4 to 0.8 whereas only 23 banks (46.9 percent) were in the efficiency range 0.8 to 1. Of these, only 5 banks were in the highest efficiency range greater than 0.9.

5.2 Results of Data Envelopment Analysis

A two-stage input-oriented model was estimated to measure the efficiency in banking operations of scheduled UCBs for the period 2013-14 to 2015-16. Given that the time period under consideration is very short, a CRS-DEA model was better suited to capture the overall efficiency. Both Models A and B have a single output and three and two input variables respectively. Like in the case of the SFA model, efficiency was computed for 49 of the 52 scheduled UCBs. Pastor and Ruiz (2007) discuss DEA models such as the translation invariant model, Seiford and Zhu's (2002) posteriori approach, directional distance models, range directional models and weighted additive models that allow for the inclusion of DMUs with negative output (as in the case of Rupee Co-operative Bank which had negative net interest income in all the three years). Most of these studies with negative data are for models with variable returns to scale and it can be inferred that the constant returns to scale (CCR) model cannot be used for negative data. Consequently, as per usual

practice, this paper does not take banks which have a negative output variable into consideration. The efficiency estimates for both models is presented in Table 6.

Table 6. Summary of efficiency estimates: input oriented CRS- DEA Model

Statistic	Model A	Model B
Mean	0.929	0.924
Minimum	0.804	0.800
Maximum	1	1
Standard deviation	0.040	0.050

Source: Author's own elaboration.

The DEA models estimated indicate that the average overall efficiency as given by the CRS-DEA model is quite high for both Model A (0.929) and Model B (0.924). The standard deviation for both models is not very high indicating small variations in performance among scheduled UCBs. Further, the range of efficiency is marginally wider for banks under Model B. Given the high mean efficiency displayed by scheduled UCBs, it would be of interest to study the distribution in efficiency. Table 7 presents the frequency distribution of the efficiency of the CRS-DEA model.

Table 7. Frequency distribution of technical efficiency

	Model A		Model B	
Efficiency Range	No of Banks	Percent of Banks	No of Banks	Percent of Banks
$0.8 \leq E < 0.9$	10	20.4	16	33
$0.9 \leq E < 1$	36	73.5	28	57
$E = 1$	3	6.1	5	10

Source: Author's own elaboration.

It can be observed that a fifth of the scheduled UCBs have an efficiency score that is below 0.9 (90 percent) and only 3 banks (6.1 percent) have an efficiency score of 1 in the traditional and core banking activity (Model A). For Model B, more than one-third of the banks have an efficiency score less than 0.9 and 5 banks (10 percent) have an efficiency score of 1. Besides, the number of banks with an efficiency score between 0.9 and 1 is higher under Model A.

5.3 Super efficiency and quartile analysis of efficiency

All efficient DMUs need not necessarily have the same performance level and a disaggregation of the efficiency scores (super efficiency) of the efficient DMUs can reveal the extent of efficiency among the efficient units. The Andersen and Petersen (1993) super efficiency approach has been employed to obtain the estimates of super efficiency. Table 8 presents the scores of efficiency and super efficiency for the efficient scheduled UCBs and it can be seen that all efficient banks had feasible solutions for Models A and B.

Table 8. Super efficiency scores of efficient banks

	Model A			Model B	
Bank	Efficiency Score	Super Efficiency Score	Bank	Efficiency Score	Super Efficiency Score
Gopinath Patil Parsik Janata Sahakari Bank Ltd.	1	1.01	Bharati Sahakari Bank Ltd.	1	1.00
Nasik Merchant's Co-operative Bank Ltd.	1	1.04	Indian Mercantile Co-operative Bank Ltd.	1	1.01
Sardar Bhiladwala Pardi Peoples Co-operative Bank Ltd	1	1.15	Janalaxmi Co-operative Bank Ltd.,	1	1.00
			Mehsana Urban Co-operative Bank Ltd.	1	1.00
			Sardar Bhiladwala Pardi Peoples Co-operative Bank Ltd.	1	1.05

Source: Author's own elaboration.

The super efficiency scores revealed that in the case of Model A the efficiency score of 1 actually ranged between 1.15 and 1.01 while for Model B, 3 of the 5 efficient banks had a super efficiency score of 1 itself and the highest super

efficiency score was 1.05 for Sardar Bhiladwala Pardi Peoples Co-operative Bank Ltd. This bank is the only scheduled UCB that features as an efficient bank both for Models A and B.

A quartile analysis of efficiency performance by banks revealed that all the three efficient banks under Model A are in the best-performing fourth quartile whereas for Model B only two banks - Mehsana Urban Co-operative Bank Ltd. and Sardar Bhiladwala Pardi Peoples Co-operative Bank Ltd are in the fourth quartile for both the SFA and DEA models. Using DEA analysis for Model B, the other 3 efficient banks, however, showed huge variations in efficiency under the SFA model and were not necessarily in the highest fourth quartile. The details of individual bank efficiency (DEA and SFA) along with the quartile analysis is in Appendix Table 4.

Table 9. Banks with lower efficiency in model A and model B

Abhyudaya Co-operative Bank Ltd., Mumbai	Nagpur Nagrik Sahakari Bank Ltd.
Amanath Co-operative Bank Ltd. Bangalore	NKGSB Co-operative Bank Ltd., Mumbai
Bharat Co-operative Bank (Mumbai) Ltd., Mumbai	Nutan Nagarik Sahakari Bank Ltd., Ahmedabad
Cosmos Co-operative Urban Bank Ltd.	Pravara Sahakari Bank Ltd.
Greater Bombay Co-operative Bank Limited	Saraswat Co-operative Bank Ltd., Bombay
Janakalyan Sahakari Bank Ltd., Mumbai	Shamrao Vithal Co-operative Bank Ltd.
Janata Sahakari Bank Ltd., Pune.	Shikshak Sahakari Bank Ltd., Nagpur.
Kalyan Janata Sahakari Bank Ltd., Kalyan	The Akola Urban Co-operative Bank Ltd., Akola.
Karad Urban Co-operative Bank Ltd.	The Kapol Co-operative Bank Ltd., Mumbai
Mapusa Urban Co-operative Bank of Goa Ltd.,	**Total = 19 Scheduled UCBs**

Source: Author's own elaboration.

From a policy perspective, it is imperative to identify banks that display low levels of efficiency in both core banking activity as well as in off-balance sheet activities. Table 9 records 19 (38.9 percent) scheduled UCBs in the lower first two quartiles of efficiency by either the DEA or the SFA analysis for both Models A and

B. It is pertinent to note that there are other banks in quartiles 1 and 2 but not included in Table 9 as they are not common to both Models A and B.

5.4 Input slacks

Input slacks are indicators of the potential areas of improvement. Table 12 presents the mean input slack for each of the input variables. The mean input slack was almost similar for salary payments and interest paid by banks and marginally higher on expenditure incurred by banks on fixed assets for Model A. Further, an almost equal number of banks had a slack on each of these inputs. The analysis on slacks also indicated that 3 banks – Goa Urban Co-operative Bank Limited, Nagpur Nagrik Sahakari Bank Limited, and Saraswat Co-operative Bank Limited, Bombay – had no input slacks while 46 of the 49 scheduled UCBs face a slack on at least one input variable.

Table 10. Mean input slack values and percentage of banks having input slacks

	Model A		Model B	
	Mean Slack Value	No. of Banks With Slack	Mean Slack Value	No. of Banks With Slack
LSAL	0.09	19 (38.8)	0.004	1 (2.0)
LFXDASSET	0.14	20 (40.8)	0.08	11 (22.5)
LINTPD	0.08	19 (38.8)	--	--
No. of Banks with Zero Slack	3 banks	6.12 percent	37 banks	75.5 percent
No. of Banks with at least 1 Slack	46 banks	93.88 percent	12 banks	24.5 percent
Figures in parentheses indicate percentage of banks with slack				

Source: Author's own elaboration.

As concerns Model B, the average input slack on fixed assets was higher than on salary payments. Further, 11 banks (22.5 percent) witnessed a slack on fixed assets whereas only 1 bank (Mapusa Urban Co-operation Bank of Goa, Limited) showed a slack on salary. Also, 75.5 percent banks had zero slack and only 24.5 percent banks saw just one input slack.

5.5 Results of the Tobit Model

The second step of the two stage DEA was the Tobit model to identify the determinants of efficiency. Variables that can influence efficiency like amount of share capital, deposits, investments, and loans have been considered. Here too, the explanatory variables were considered as average values of the period and transformed to natural logs. The choice of explanatory variables took into consideration the impact these variables had on core banking activity (Model A) as well as the off-balance sheet activities (Model B). Share capital and reserve funds represent the funds owned by a bank and together constitute a major component of the working capital. These variables also determine the borrowing capacity of co-operative banks. While share capital impacted the lending capacity of an UCB, reserve funds formed the buffer for contingencies, if any. Other important constituents of working capital are deposits and borrowings and reflect borrowed or not–owned funds of a bank. A large deposit base or an increase in the deposit base and reserves funds would point to a greater reliance of a bank on its own funds. Although reserve funds and borrowings are important in lending activity, the Tobit model estimated does not include reserve funds as 4 of the 49 banks (Amanath Co-operative Bank Limited, Bangalore; Indian Mercantile Co-operative Bank Ltd., Lucknow; Mapusa Urban Co-operative Bank of Goa Limited and The Kapol Co-operative Bank Limited, Mumbai) considered in the sample showed negative reserves in all the three years. Borrowings of banks was also not included as almost 50 percent of the banks considered in the sample show zero borrowings.

The results of the Tobit model (Table 11) indicated deposits and loans disbursed by a bank to be significant determinants of efficiency for both Models A and B. Shanmugan and Das (2004) also reported deposits to be a major determinant of efficiency. A negative and statistically significant co-efficient on deposits, however, points to an inverse relationship between the increase in deposits and the efficiency achieved as regards net interest income earned by the bank. The positive and significant co-efficient of loans would imply that an increase in loans can positively influence the efficiency obtained on net interest income. The significance of the loans variable for Model B may be interpreted as customers of a bank who have obtained a loan from the bank may also approach it for the services of non-core

activities, given that customers of UCBs are often under banked. Further, investments made by the bank would generate revenue for the bank and hence the positive and significant relationship observed between efficiency and investments. Share capital has a positive impact on non-interest income efficiency. These results of the Tobit model, however, need to be considered with care given that the reserve funds and borrowings were not included in the Tobit estimation.

Table 11. Results of the Tobit Model

	Model A	Model B
Variable	Co-efficient	Co-efficient
Constant	1.07*** (14.67)	1.32 *** (13.90)
lshare	-0.003 (-0.24)	0.02@ (1.78)
ldep	-0.13* (-2.35)	-0.24** (-3.26)
linvst	0.06* (2.01)	0.06 (1.47)
lloans	0.07@ (1.87)	0.14** (3.02)
t- values are in parentheses. *** -- p < 0.001; ** -- p < 0.01; * -- p < 0.05 @ -- p=0.1		

Source: Author's own elaboration.

5. Conclusion

UCBs, thus, constitute a heterogeneous group in terms of geographical spread, area of operation, size and in terms of individual performance. The regional distribution of UCBs pointed to a concentration in the Western and Southern regions of the country. The States of Maharashtra, Gujarat, Karnataka, Andhra Pradesh, and Tamil Nadu account for more than 80 percent of the UCBs in the country as of end March 2016. There has been an impressive increase in deposits and advances of UCBs since 1991. UCBs form a miniscule albeit important segment of the banking sector in the country particularly with regard to urban financial inclusion. The paper has examined the efficiency for 49 of the 52 scheduled UCBs in both the

traditional/core banking activities as well as in off-balance sheet activities using both stochastic frontier and data envelopment analysis for the period 2013-14 to 2015-16. The results point to a high mean efficiency in core banking activities as compared to the non-core/off-balance sheet activities. This finding has been reiterated by the frequency distribution of efficiency for banks. An analysis of super efficiency indicated only one Scheduled UCB - Sardar Bhiladwala Pardi Peoples Co-operative Bank Ltd.- common to both Models A and B for both the frontier methods. The quartile analysis highlights that 38.9 percent of the UCBs were ranked in the lower two quartiles of efficiency and the Tobit regression model has identified deposits and loans disbursed as significant determinants of efficiency.

The high efficiency displayed by UCBs in core banking as well as off-balance sheet activities during the three year period must be interpreted with caution as they may not hold if efficiency is estimated for a longer period of time. Further, UCBs are faced with several challenges that range from poor financial health to governance issues. UCBs, in general, tend to borrow from each other and the collapse of a UCB has the potential to destabilise the UCB sector. Such UCB failures have led to serious concerns about the systemic risk posed by these banks. Another major concern is the financial health of UCBs. The gross non-performing assets as a percent of gross advances of UCBs increased from 5.7 percent in 2013-14 to 6.6 percent in 2015-16. The percentage of UCBs under the highest rated category 'A' under the CAMELS model declined from 28.4 per cent in 2014-15 to 25.8 per cent in 2015-16. The Capital to Risk Weighted Assets Ratio (CRAR) of scheduled UCBs was 5.85 percent as of end March 2015. The Reserve Bank of India's requirement of strict compliance with capital adequacy norms also creates problems for UCBs as these banks cannot raise share capital from the public. The other challenges faced by UCBs are duality of control between the Reserve Bank of India and respective State governments, the low level of professionalism, apprehensions about the credentials of promoters of some new UCBs, and lack of training among both lower staff and top management which has led to serious problems of governance. Several measures have been taken by the Reserve Bank of India to ensure their financial health and better corporate governance.

APPENDIX

Table 1. Urban co-operative banks: some statistics (End March, INR Million)

Year	No of Banks	Deposits	Advances
1991	1,307	101,570	80,030
2001	1,618	808,400	543,890
2011	1,645	2119000	1365000
2015	1,579	3,551,359	2,243,286
2016	1,574	3,921,794	2,450,125

Source: Reserve Bank of India. (several publications)

Table 2. Regional distribution of UCBs (end March 2016)

Region	No. of UCBs	Region Percent to Total
Northern	72	4.6
North Eastern	16	1.0
Eastern	58	3.7
Central	135	8.5
Western	738	46.7
Southern	555	35.1
Total	1574	100

Source: Reserve Bank of India, Primary (Urban) Co-operative Bank Outlook, 2015-16.

Table 3. State-wise distribution of UCBs in major regions (end March 2016)

Western Region		Southern Region	
States	No. of UCBs	States	No. of UCBs
Goa	6	Andhra Pradesh	48
Gujarat	224	Karnataka	265
Maharashtra	508	Kerala	60
Region Total	738	Tamil Nadu	129
		Telangana	52
		Puducherry	1
		Region Total	555

Source: Reserve Bank of India, Primary (Urban) Co-operative Bank Outlook, 2015-16.

Table 4. Individual bank efficiency score – DEA and SFA models with quartiles

		Model A Net Interest Income				Model B Non-Interest Income			
Sr. No	Bank Name	DEA	Quartile	SFA	Quartile	DEA	Quartile	SFA	Quartile
1	Abhyudaya Co-operative Bank Ltd., Mumbai	0.8965	1	0.88445	2	0.8643	1	0.72603	1
2	Ahmedabad Mercantile Co-Op Bank Ltd.	47	4	0.92953	4	0.9241	3	0.82434	3
3	Amanath Co-operative Bank Ltd. Bangalore	0.9052	1	0.89451	2	0.8268	1	0.46812	1
4	Andhra Pradesh Mahesh Co-Operative Urban Bank Ltd.	0.9405	3	0.91325	4	0.94	3	0.81311	3
5	Bassein Catholic Co-operative Bank Ltd.	0.9845	4	0.92352	4	0.9688	4	0.91633	4
6	Bharat Co-operative Bank (Mumbai) Ltd., Mumbai	0.9223	2	0.90711	3	0.8923	1	0.81773	3
7	Bharati Sahakari Bank Limited.	0.9659	4	0.88604	2	1	4	0.8492	3
8	Bombay Mercantile Co-operative Bank Limited	0.9371	3	0.92112	4	0.8007	1	0.51437	1
9	Citizen Credit Co-operative Bank Ltd., Mumbai	0.9364	3	0.91519	4	0.8928	1	0.78641	2
10	Cosmos Co-operative Urban Bank Ltd.	0.9052	1	0.87444	1	0.9178	2	0.86661	4
11	Dombivli Nagari Sahakari Bank Ltd.	0.9605	3	0.90232	3	0.964	3	0.87826	4

Table 4. Cont.

		Model A Net Interest Income				Model B Non-Interest Income			
Sr. No	Bank Name	DEA	Quartile	SFA	Quartile	DEA	Quartile	SFA	Quartile
12	Goa Urban Co-operative Bank Limited.	0.9241	2	0.8941	2	0.95	3	0.85799	4
13	Gopinath Patil Parsik Janata Sahakari Bank Ltd., Thane	1	4	0.94564	4	0.8803	1	0.6847	1
14	Greater Bombay Co-operative Bank Limited	0.8818	1	0.87228	1	0.8751	1	0.66452	1
15	Indian Mercantile Co-operative Bank Ltd.,Lucknow	0.9271	2	0.86918	1	1	4	0.80211	3
16	Jalgaon Janata Sahakari Bank Ltd.	0.9062	2	0.88676	2	0.9415	3	0.79513	3
17	Janakalyan Sahakari Bank Ltd., Mumbai	0.8919	1	0.87766	1	0.8937	2	0.78782	2
18	Janalaxmi Co-operative Bank Ltd., Nashik	0.9611	4	0.90573	3	1	4	0.70755	1
19	Janata Sahakari Bank Ltd., Pune.	0.9088	2	0.89461	2	0.9067	2	0.87963	4
20	Kallappanna Awade Ichalkaranji Janata Sahakari Bank Ltd.	0.9449	3	0.87611	1	0.9799	4	0.84345	3
21	Kalupur Commercial Coop.Bank Ltd.	0.9554	3	0.91549	4	0.9493	3	0.90326	4
22	Kalyan Janata Sahakari Bank Ltd., Kalyan	0.9188	2	0.9006	3	0.9109	2	0.72819	1

Table 4. Cont.

		Model A Net Interest Income				Model B Non-Interest Income			
Sr. No	Bank Name	DEA	Quartile	SFA	Quartile	DEA	Quartile	SFA	Quartile
23	Karad Urban Co-operative Bank Ltd.	0.8933	1	0.88007	1	0.9074	2	0.78777	2
24	Mahanagar Co-operative Bank Ltd., Mumbai	0.9295	3	0.91017	3	0.9052	2	0.76391	2
25	Mapusa Urban Co-operative Bank of Goa Ltd., Mapusa	0.8777	1	0.86097	1	0.9562	3	0.7594	2
26	Mehsana Urban Co-Op Bank Ltd.	0.9802	4	0.89288	2	1	4	0.92206	4
27	Nagar Urban Co-operative Bank Ltd., Ahmednagar	0.9785	4	0.91324	3	0.9809	4	0.8895	4
28	Nagpur Nagrik Sahakari Bank Ltd.	0.9186	2	0.90259	3	0.8774	1	0.63465	1
29	Nasik Merchant's Co-operative Bank Ltd.	1	4	0.94178	4	0.9673	3	0.87865	4
30	New India Co-operative Bank Ltd., Mumbai	0.9635	4	0.88361	1	0.9846	4	0.75547	2
31	NKGSB Co-operative Bank Ltd., Mumbai	0.9082	2	0.89288	2	0.9002	2	0.79306	2
32	Nutan Nagarik Sahakari Bank Ltd., Ahmedabad	0.8917	1	0.87593	1	0.9243	3	0.78284	2
33	Pravara Sahakari Bank Ltd.	0.9204	2	0.88529	2	0.9723	4	0.73772	2
34	Punjab & Maharashtra Co-operative Bank Ltd.	0.9374	3	0.91275	3	0.9232	2	0.73524	2
35	Rajkot Nagrik Sahakari Bank Ltd.	0.9466	3	0.87935	1	0.974	4	0.90844	4

Table 4. Cont.

		Model A Net Interest Income				Model B Non-Interest Income			
Sr. No	Bank Name	DEA	Quartile	SFA	Quartile	DEA	Quartile	SFA	Quartile
36	Sangli Urban Co-operative Bank Ltd., Sangli	0.8898	1	0.86952	1	0.935	3	0.83842	3
37	Saraswat Co-operative Bank Ltd., Bombay	0.8945	1	0.88513	2	0.8456	1	0.77294	2
38	Sardar Bhiladwala Pardi Peoples Coop Bank Ltd.	1	4	0.9307	4	1	4	0.87232	4
39	Shamrao Vithal Co-operative Bank Ltd.	0.9017	1	0.88759	2	0.8756	1	0.74782	2
40	Shikshak Sahakari Bank Ltd., Nagpur.	0.9089	2	0.89406	2	0.8992	2	0.69989	1
41	Solapur Janata Sahakari Bank Ltd.	0.9366	3	0.91228	3	0.9103	2	0.81069	3
42	Surat Peoples Coop Bank Ltd.	0.9672	4	0.92499	4	0.9486	3	0.91403	4
43	Thane Bharat Sahakari Bank Ltd.	0.9101	2	0.89679	3	0.8878	1	0.64328	1
44	The Akola Janata Commercial Co-operative Bank Ltd., Akola.	0.9238	2	0.90447	3	0.8986	2	0.74928	2
45	The Akola Urban Co-operative Bank Ltd., Akola.	0.8292	1	0.80586	1	0.8888	1	0.73044	1
46	The Kapol Co-operative Bank Ltd., Mumbai	0.8044	1	0.79567	1	0.8083	1	0.45184	1
47	The Khamgaon Urban Co-operative Bank Ltd., Khamgaon.	0.9659	4	0.92086	4	0.9578	3	0.81484	3

Table 4. Cont.

		Model A Net Interest Income				Model B Non-Interest Income			
Sr. No	Bank Name	DEA	Quartile	SFA	Quartile	DEA	Quartile	SFA	Quartile
48	TJSB Sahakari Bank	0.9329	3	0.91037	3	0.9231	2	0.80631	3
49	Zoroastrian Co-operative Bank Ltd., Bombay	0.9601	3	0.91513	4	0.9684	4	0.82414	3
	Quartile 1	0.9052		0.88361		0.8928			0.73524
	Quartile 2	0.9271		0.89461		0.9232			0.79306
	Quartile 3	0.9605		0.91324		0.9673			0.8492
	Quartile 4	1		0.94564		1			0.92206

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