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Financial Performance Analysis of Dccb's of Haryana Using Data Envelopment Analysis

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ABSTRACT

The purpose of this paper is to evaluate and discuss the technical efficiencies of the 19 District Central Cooperative Banks(DCCBs) of Haryana during the period 2016-17 to 2020-21 and to study the inter-temporal variations in the technical and technological efficiencies of the DCCBs (individually and collectively) over the period of study. The CCR and the BCC models have been employed to obtain the overall technical, pure technical and the scale efficiencies. To study the inter-temporal variations Malmquist Index approach is utilized. The results reveal that the DCCBs in Haryana, from 2016-17 to 2020-21 have experienced on an average 2.1%(mean MI) annual productivity decline rate. The DCCBs Jind, Hisar, Fatehabad and Yamunanagar are the only banks that have reported positive productivity change ranging from .05% to 4.6%.

Key Words*: *Technical Efficiency, Technological Efficiency, Data Envelopment Analysis, Malmquist Index

INTRODUCTION

The yester decades before 1951-52 speak about theanti social elements(private moneylenders/Sahukaars) who used to charge exorbitant rates of interest from innocent farmers and other residents of the villagers in particular. Beyond the interest rates, the moneylenders used to dictate their terms and exploit the farmers in many ways(viz. manipulation of accounts of credit to sell the agricultural produce to moneylenders at lower price, seizure of land and otherwise).After 1950 ,the government undertook various steps to regulate the system and to institutionalize the mechanism by establishing the primary Agricultural Credit Societies(PACS) at village level , District central Cooperative Banks at district level and the State Cooperative Banks at State Level.

The basic purpose of the Cooperative Design(at any level) was to advance loans to the rural people for productive endeavors.The Central Cooperative banks now are dealing in almost every kind of Commercial Banking Operations directly as well as through PACS in rural sectors. The State Cooperative Bank(in a State) provides links between the Apex Bank of the nation(i.e. RBI) and money market. The Cooperative Banks and Societies work discretionary for rural farmers by rendering the services of short term and long termcredits. Almost every state of the country have SCBs(29 in number).

The historical background of Cooperatives is almost a century old. It was 1904 from where the threads of Cooperatives came into fabric .However, this movement came on the rapid path of progress after 1951. Many committees and working groups have contributed in the development of this realm of retail and rural banking.The Cooperative units at all levels have not been as successful as were expected because of certain non-positive features thereof .Curtly writing,these features were ; non saving orientation of rural people, heavy dependence on grants from higher level and governing bodies, external interference, non vigilant approach of stakeholders and increasing over dues(which results in clogging the process of credit recycling etc.These reasons always leave the scope for research and analysis.

RELEVANCE OF THE STUDY

Many cooperative banks became insolvent, and others are at the brink of mergers or acquisition (Chander and Chandel,2010). The Centre and the State should brace themselves up to institute reforms and pursue them vigorously, in order to prevent the cooperative banks slowly become extinct due to their weakening performance. The misdirection of cooperative bank resources could be one of the reasons for this weak performance. Such a situation of DCCBs in Haryana Cooperative banks makes it viable to study and implement measures of improvement in the optimized use of resources(human, financial and physical) apart from governance. So,

i) There is a dire need to recognize a benchmark , that will be a guiding light for other DCCBs. A benchmark is desired to act as a standard or a figure of reference against which the performance of other DCCBs can be assessed and compared, which in turn ,will throw light on the scope of improvements.
ii) The task of recognizing a benchmark and to explore the areas of improvements can be very well accomplished by the technique Data Envelopment Analysis as the DMUs (Decision Making Units) under scrutiny i.e, the DCCBs of Haryana fulfill the conditions and assumptions for the selection of DMUs to be compared.
iii) As it has already been discussed that all the DCCBs in the state are operating under the same governing bodies , with similar goals and are acting intermediaries in the demand and supply of financial needs of agriculturists and artisans in rural areas by utilizing identical resources(inputs) and producing identical services(outputs),except for differences in intensity and magnitude.
iv) The suitability of the technique can further be supported by the number of DMUs in the data set i.e. nineteen and the number of inputs and outputs (three and two respectively), which satisfy various theories about the relation between number of DMUs and the number of inputs and outputs. To mention one of such theories ,*Boussofiane et al. (1991)stipulate that to get good discriminatory power out of the CCR and BCC models the lower bound on the number of DMUs should be the multiple of the number of inputs and the number of outputs.*

Before the technique is applied for the performance measurement of DCCBs in Haryana ,a thorough review of the use of DEA has been done to have a better insight of the application of DEA in commercial as well as cooperative banking sectors .

LITERATURE RVIEW

The non parametric technique Data envelopment analysis has been widely used in the performance evaluation of banking sector especially in North American countries like US, Canada, European countries like Italy, Spain. The use of DEA as a performance measuring tool is still in its infancy in India. While other Asian countries like China, Malaysia etc. are exploiting it to find the best out of their banking industry.

Berg, Førsund, and Jansen (1992)examined the productivity of Norwegian banks before and after deregulation based on the value-added approach. Their analysis revealed that productivity regressed in the pre-deregulation years, mainly due to the emergence of idle capacity in anticipation of increased competition with the introduction of deregulation process initiated in 1984. Productivity growth was, however, rapid post 1987, with significant convergence in productivity levels, implying increased competition in the deregulated period.

Yue(1992)demonstrated the use of DEA to find out the relative efficiencies of 60 Missouri commercial banks for the period from 1984 to 1990.Two alternative DEA models have been used for the evaluation : the CCR model and the additive DEA model followed by window analysis of the efficiencies obtained.

Elyasiani and Mehdian (1995)investigated the trends in technical efficiency and technological change for small and large US commercial banks during 1979–86 based on the intermediation approach. Although the efficiency measures declined over this period, small banks emerged as more efficient in the deregulated regime. The gap, however, narrowed considerably in the post-deregulation period.

Berger and Humphrey (1997) envisaging the impact of globalization on the financial market carried out an extensive survey of 130 financial institutions across 21 countries to study their efficiencies. They discourse five different approaches to determine the efficiency frontier. The five approaches discussed in their iconic paper were Stochastic Frontier Analysis(SFA), Distribution Free Approach(DFA), Thick Frontier Analysis(TFA),the free disposal hull method(FDH) and Data Envelopment Analysis, out of which , the first three approaches are parametric and the latter two are non-parametric techniques. They put forth the importance to provide a statistical and a stochastic foundation to DEA by introducing a degree of random error.

Paxton(2003) tested technical efficiency in a semi-formal sector in a developing country. He used stochastic frontier analysis and DEA to evaluate the technical efficiencies of Mexican popular savings and credit sector.It has been observed thatthe X-inefficiency levels for the average Mexican PSCIs are much lower than those found in other efficiency studies.

Favero and Papi(1995) carried out a cross sectional study of technical and scale efficiencies of 174 Italian banks in 1991 using DEA. They concluded that efficiency was best explained by productivity specialization and by size and to a lesser extent by location(as North Italian banks were found to be more efficient than the South-Italian banks).
Mistry and Zhu(2003) identified methodological problem in research examining the relationship between the use of transactional IT and firm performance. They remarkably endorsed the use of DEA for assessing the relative use of differentiated IT as it enables the assessment of multiple inputs and outputs like transactional and strategic IT,

together, in contrast with linear regression based models of analysis which are limited to using only a single dependent variable. The data set consisted of a cross sectional sample of 59 banks from the Functional Cost and Profit Analysis dataset collected by Federal Reserve Banks. The results show that strategic IT is used more efficiently than transactional IT to generate revenues, equity capital and general productivity.

Angelis and Lyroudi (2006) examined the productivity of 100 large Italian banks for the period 2001-2002 by using DEA. The employed DEA to find Malmquist indices of total productivity change which is then put to use in examining the productivity change of the financial institutions of the most recent European Union member countries.Das and Gosh(2006) investigated the performance of Indian commercial banking sector during the post reform period 1992–2002.Medium sized public sector banks were found to be performing at higher level of technically efficiency. To arrive at this, they chose inputs and output variables based on three approaches namely intermediation approach, value added approach and production approach. The variation in technical efficiencies were then observed in relation withownership , bank size, capital adequacy ratio ,non-performing loans and management quality.

Sunil Kumar and Rachita Gulati (2008) have estimated technical, pure technical and scale efficiencies in Indian public sector banks using data envelopment analysis. They found that public sector banks in India (PSBs) have an overall technical efficiency of 88.5 per cent in the . This would mean that PSBs can reduce inputs by 11.5 percent without sacrificing output.

Moffat and Valadkhani(2009) technical and pure technical efficiencies of ten major financial institutions in Botswana for each year during the period 2001-2006 using data envelopment analysis. In order to obtain more robust and reliable results, the sensitivity of our efficiency indices were put into test by choosing three alternative approaches in specifying the mix of inputs and outputs.The empirical results indicate that: (a) no matter which approach and year are taken into consideration, Bank of Baroda and First National Bank (which are both foreign banks) and Botswana Savings Bank (which is a publicly owned institution) are consistently among the most efficient institutions and Botswana Development Corporation, African Bank Corporation and National Development Bank are the least efficient ones; (b) the most efficient banks are either small or large institutions in terms of their asset sizes; (c) due to the small sample size, the evidence of a relationship between the age of institutions and their technical efficiencies remains inconclusive. One can conclude that financial institutions can further enhance efficiency by adopting self-service technologies such as telephone and internet banking which can substantially reduce their service delivery costs.

Performance evaluation of Cooperative Banking Sector has been a favorite area of research among Indian researchers.Various studies conducted and numerous suggestions were sought to bring effectiveness in the working and operations of financial institutions. Narsimham Committee (1991) punctuated capital adequacy and liquidity as measure of performance whereas the Padamanabhan Committee (1995) suggested CAMEL rating (in the form of ratios) to evaluate financial and operational efficiency, Tarapore Committee (1997) talked about Non-performing assets and asset quality, Kannan Committee (1998) opined about working capital and lending methods, Basel committee (1998 and revised in 2001) recommended capital adequacy norms and risk management measures. Kapoor Committee (1998) recommended for credit delivery system and credit guarantee and Verma Committee (1999) recommended seven parameters (ratios) to judge financial performance and several other committees constituted by Reserve Bank of India to bring reforms in the banking sector by emphasizing on the improvement in the financial health of the banks. Experts suggested various tools and techniques for effective analysis and interpretation of the financial and operational aspects of the financial institutions specifically banks. These have focus on the analysis of financial viability and credit worthiness of money lending institutions with a view to predict corporate failures and incipient incidence of bankruptcy among these institutions.

Bhaskaran and Josh (2000)concluded that the recovery performance of co-operative credit institutions continues to unsatisfactory which contributes to the growth of NPA even after the introduction of prudential regulations. They suggested legislative and policy prescriptions to make co-operative credit institutions more efficient, productive and profitable organization in tune with competitive commercial banking. Jain (2001)has done a comparative performance analysis of District Central Co-operative Banks (DCCBs) of Western India, namely Maharashtra, Gujarat and Rajasthan and found that DCCBs of Rajasthan have performed better in profitability and liquidity as compared to Gujarat and Maharashtra. Singh and Singh (2006)studied the funds management in the District Central Co-operative Banks (DCCBs) of Punjab with specific reference to the analysis of financial margin. It noted that a higher proportion of own funds and the recovery concerns have resulted in the increased margin of the Central Co-operative Banks and thus had a larger provision for non-performing assets. Mavaluri, Boppana and Nagarjuna (2006)suggested that performance of banking in terms of profitability, productivity, asset quality and financial management has become important to stabilize the economy. They found that public sector banks have been more efficient than other banks operating in India. Pal and Malik (2007)investigated the differences in the financial characteristics of 74 (public, private and foreign) banks in India based on factors, such as profitability, liquidity,

risk and efficiency. It is suggested that foreign banks were better performers, as compared to other two categories of banks, in general and in terms of utilization of resources in particular. Singla(2008)emphasized on financial management and examined the financial position of sixteen banks by considering profitability, capital adequacy, debt-equity and NPA. Dutta and Basak (2008)suggested that Co-operative banks should improve their recovery performance, adopt new system of computerized monitoring of loans, implement proper prudential norms and organize regular workshops to sustain in the competitive banking environment. Chander and Chandel (2010)analyzed the financial efficiency and viability of HARCO Bank and found poor performance of the bank on capital adequacy, liquidity, earning quality and the management efficiency parameters.

Nagaraja and Madegowda (2010) in their study of district central co-operative banks over a period of six years from fiscal year 2003-04 to 2008-09. Concluded their performance as unsatisfactory despite playing a major role in providing banking service to a larger portion of agriculturists, small and cottage industrial units, private households etc. Ratio analysis was carried out for the purpose of evaluating profitability, liquidity, solvency, efficiency and risk factor of DCCBs. Chander and Chandel (2011) attempted to analyze the financial performance and viability of four District central cooperative Banks(DCCBs) operating in Hisar division in Haryana for a period of twelve years (1997-98 to 2008-09) by financial analysis with different parameters and z-score analysis. The financial parameters here taken are bankruptcy. His findings revealed that the z-score analysis straightened out all banks in the part of bankruptcy zone (weak performance zone) throughout the study period. DCCB Sirsa and Fatehabad and Sirsa scored first and second position respectively by performing well on profitability, solvency, efficiency and risk parameters but critical on liquidity . It was also discovered that Bhiwani performed best on liquidity, average on performance on solvency and effiency but critical on profitability and risk parameters. Hisar was designated the lowest position w.r.t. all the parameters except solvency.

Chandel (2012) made an attempt to make a profound comparative financial analysis of eleven DCCBs operating in Ambala and Rohtak divisions in Haryana, for the period (1997-98 to 2008-09) based on profitability, liquidity, efficiency, solvency, risk and efficiency. The DCCBs Jhajjar and Karnal were the best performers in their respective divisions. Panchkula and Jind on the other hand were found to be worst performer in their respective division. On a whole, DCCBs in Rohtak division were found to be performing better than those in Ambala division on parameters profitability, solvency and risk.

Kanchu(2012), in hispaper attempted to examine the growth of DCCBs in India through selective indicators, it analyzes the Deposits, Credits and C/D Ratios of DCCBs. This paper also studies the growth of investment, working Capital and Cost of Management position in DCCBs. To achieve the objectives of the paper data has been collected from various secondary sources and analyzed by using various statistical tools.

Use of the Data Envelopment Analysis technique is not rare in performance measurement literature of DCCBS, though it is not prevalent too.Sharma and Kawadia(2006) investigated the relationship between the ‘size’ and ‘efficiency’ of the Indian urban cooperative Banking sector to answer for their better survival in the presence of current challenges and changes.They employed BCC model of DEA to categorize banks as efficient and inefficient and gave away recommendations based on that..

Ganeshan(2009) measure the efficiency of 30 State Cooperative Banks (SCBs) and 20 District Central Cooperative Banks (DCCBs) in India are examined during the period 2002-06. By using direct empirical method, the performance of SCBs and DCCBs is discussed. The self-efficiency of each SCB and DCCB in each state is measured using Data Envelopment Analysis (DEA). The SCBs and DCCBs are peered into region-wise and then, the efficiency score is obtained for each SCB and DCCB within the peer group. The efficiency score among the regions is also measured. The objective of the study is not to compare the performance of SCBs and DCCBs as they are incomparable with the present data. This study emphasizes on the performance of SCBs and DCCBs in terms of its technical efficient score. However, the scope of efficiency is limited to technical efficiency only.

Feroze(2012) employed Data Envelopment Analysis (DEA) to measure the efficiency of District Co-operative Banks in Kerala during 2005-2009. The empirical results of the study reveal that the level of efficiency in DCBs is 74 per cent and the magnitude of inefficiency is 26 per cent. 6 DCBs obtain efficiency score equal to 1 and formed the efficiency frontier. The sources of inefficiency in DCBs stem from both managerial inefficiency and inappropriate size. The study suggests potential improvements in the efficiency of inefficient DCBs in terms of potential reduction in inputs and potential addition to outputs.

DATA AND METHODOLOGY

The data has been taken from the annual reports containing the balance sheets and profit and loss statements of District Central Cooperative Banks issued by NAFSCOB(National Federation of State Cooperative Banks),India.

To evaluate the performance of nineteen DCCBs of Haryana ,the data has been cross sectioned into a period of five years viz from financial year 2016-17 to financial year 2020-21.

The non parametric technique of Data envelopment analysis has been used to evaluate the year-wise overall technical efficiency scores. To achieve this, we have utilized the CCR (Charnes, Cooper and Rhodes) model to reduce the multiple input, multiple output situation for each DMU(i.e. DCCBs in our case) to a scalar measure of technical efficiency.

To elaborate CCR model, consider a set of decision making units(DMUs) j=1,2,…,n utilizing quantities of inputs

$$X = (x_{ij}), i = 1,2,...,m \ ,$$

to produce quantities of outputs

$$Y = (y_{rj}), r = 1,2,...,s$$

Here, x_{ij} denotes the amount of the *ith*input used by the DMU j and y_{rj} the amount of the r[th]output produced by the DMU j.Assuming constant returns to scale (CRS), strong disposability of inputs and outputs and convexity of the production possibility set, the overall technical efficiency score for the DMU k (denoted by θ^*) can be obtained by solving the following model (Charnes et al.)

$$\min_{\theta,\lambda,s^-,s^+} \theta = \theta^* - \varepsilon\left(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+\right)$$

$s.t.$

$$\sum_{i=1}^{n} \lambda_j x_{ij} + s_i^- = \theta^* x_{io}, i = 1,2,...,m$$

$$\sum_{i=1}^{n} \lambda_j y_{rj} - s_r^+ = \theta^* y_{ro}, j = 1,2,...,r$$

$$s_i^-, s_r^+ \geq 0$$
$$\lambda_j \geq 0, j = 1,2,...,n$$

Since the model measures the efficiency of single DMU (DMU_o) ,it needs to be solved n times to obtain efficiency score of each DMU. This efficiency score is within the range from zero to one , $0 < \theta^* \leq 1$.If θ^*=1 and $s_i^- = s_r^+$ =0 the the DMU_o is Pareto efficient. For DMU_o we define the technical inefficiency score as $1-\theta^*$.In fact, $1-\theta^*$ gives the necessary reduction in all inputs of DMU_o to be rated as fully efficient. It is worth mentioning here that the above given model is an input-oriented model since the objective is to utilize minimum level of inputs with the same level of production. To decompose the technical efficiency into pure technical efficiency and scale efficiency, another model of DEA has been employed namely the BCC (Banker, Charnes and Cooper).It can be formulated as follows:

$$\min_{\theta,\lambda,s^-,s^+} \theta = \theta^* - \varepsilon\left(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+\right)$$

$s.t.$

$$\sum_{i=1}^{n} \lambda_j x_{ij} + s_i^- = \theta^* x_{io}, i = 1,2,...,m$$

$$\sum_{i=1}^{n} \lambda_j y_{rj} - s_r^+ = \theta^* y_{ro}, j = 1,2,...,r$$

$$\sum_{i=1}^{n} \lambda_j = 1$$

$$s_i^-, s_r^+ \geq 0$$
$$\lambda_j \geq 0, j = 1,2,...,n$$

The two models, namely the CCR model and the BCC model can be differentiated by the convexity constraint $\sum_{i=1}^{n} \lambda_j = 1$ added to the later model which gives away the pure technical efficiencies.The scale efficiencies can thus be obtained by dividing Overall technical efficiencies by pure technical efficiency.

Selection of Inputs and Outputs for the Analysis

The selection of inputs and outputs for the performance evaluation of a process with the help of Data Envelopment Analysis needs a careful consideration. Because only the right selection of inputs and outputs will able to bring out the special characteristics of the process. In the conventional application of DEA, it is assumed that one can, given a collection of available measures, clearly specify which will constitute inputs and which outputs(Cook and Zhu,2006). But in some cases, the performance model is not well defined, so it is critical to select the appropriate inputs and outputs by other means. When we have many potential variables for evaluation, it is difficult to select inputs and outputs from a large number of possible combinations. The objectives of the analysis crucially rely upon the choice of inputs and outputs. The context of assessment is a key issue in selecting the inputs and outputs.

Here ,in our area of interest a number of combinations of inputs and outputs are possible. A review of literature has been very helpful and justifying in our selection of our choice of inputs and outputs. There is a considerable disagreement among researchers about what constitute inputs and outputs of banking industry (Casu, 2002; Sathye, 2003).In baking performance evaluation literature, two approaches have been found to be prevailing.

- The production approach
- The Intermediation approach

The production approach considers banks as producers of services for customers, accepting deposits and converting them into loans. Therefore, the number of employees and the physical capitalis considered as inputs and the number of accounts or its related transactions are taken as outputs.

Sherman and gold(1985),Ferrier and Lovell(1990) and Fried et al.(1993) based their analysis on production approach.The intermediation approach,on the other hand, perceives banks acting as intermediaries between savers and borrowers.So, physical capital, labor and deposits were assumed to comprise the resources utilized to execute this intermediation to yield loans and investments. Charnes et al., Bhattacharyya et al. (1997),Kumar et al.(2008) were among those who selected this approach for their analysis.

For the purpose of our study, we should keep the objective of District central Cooperative Banks in mind before making any such selection. It is known that these DCCBs have been set to serve the financial requirements of the rural people in prior to generating profits. They are based on the concept of Cooperation. A thorough investigation of the objectives and motives of the working of DCCBs endorses the selection of intermediation approach for the selection of inputs and outputs.

So, we have arrived at three inputs viz. physical capital, expenses and loan able funds. The physical capital represents the book value of premises and fixed assets net of depreciation. Expenses comprise interest expenses, salaries, director's fees, rent, legal charges, postage and telephone, audit fee, depreciation, stationary and printing and other expenses. The input variable loan able funds is obtained by adding both deposits and borrowings.

Two outputs have been selected as Total income and Loans.The total income is the sum of interest and non-interest income.The input variable loans account for the amount of loans outstanding.Here, we would like to assert that The choice of the variables followed two criteria: relevance and data availability.

RESULTS AND INTERPRETATION

Table 1 Descriptive Statistics of Inputs and Outputs of the Analysis of DCCBs

	Physical assets				Expenses				Loanable funds				Total income				Loans			
	Max	Min	Avg	SD	Max	Min	Avg	SD	Max	Min	Avg	SD	Max	Min	Avg	SD	Max	Min	Avg	SD
2006-07	9.74	0.8	3.594	2.18	35.81	9.12	19.08	6.343	483.1	189	302.6	86.42	31.64	12.02	18.8	5.395	445.2	165	273	71
2007-08	9.72	1.17	4.424	2.353	41.7	12.69	23.16	6.959	550.4	165.6	340.5	106.9	44.06	13.22	23.7	7.833	504	140	299	88.8
2008-09	12.86	0.92	4.911	3.07	44.05	12	26.17	7.406	613.2	161.7	343.9	114.4	45.27	12.35	30.5	8.347	516.9	136	292	91.5
2009-10	47.97	1.77	7.941	10.03	53.34	13.09	28.47	9.82	638.7	173.8	373	121.2	49.89	11.76	29.2	9.458	532.1	142	299	93.3
2010-11	18.91	1.5	6.478	4.46	52.49	13.71	30.82	9.596	818.4	212.9	436.9	152.3	55.75	14.36	31.6	10.94	591.3	168	347	106

Slack Analysis: One of the advantages of using DEA as a performance evaluation tool is that not only it gives away the level of efficiencies of DMUs by assigning them numerical values but also it unwraps the amount of slacks present in inputs and output by executing the two-phase linear program. Therefore, after minimizing the input efficiency,the next stage involves calculating the optimal set of slack values with an assurance that input efficiency will not decrease at the expense of slack values of the inputs and outputs. Once efficiency has been minimized, the linear program does seek the maximum of inputs and outputs. Any positive value in inputs or output slacks implies that the DMU under scrutiny can improve beyond the level implied by the estimate of efficiency value obtained. If the efficiency is unity and the slacks are zero,then the output levels can not be expanded jointly or individually without raising its input levels. Further, its input level cannot be lowered given its output levels and we say that the DMU is Pareto-Efficient with OE 1.

Table1 Slack Analysis (Appendix) accounts the DCCBs with non-zero inputs and output slacks excluding the fully efficient units as they have nil slack value manifesting there best performance. To elaborate the situation, let us take the case of Gurgaon DCCB (Table 2.4), which one of the worst performing banks, reporting 48.598 crores of an average slacks in loanable funds , which is 8.1 % of the total loanable funds invested by the bank in the period

Table 2 Slack Analysis of Gurgaon and Kurukshetra DCCBs

GURGAON			KURUKSHETRA		
Loanable Funds (Input) in crores	Avg.	599.656	Physical assets (Input) in crores	Avg.	6.244
	Avg Slack	48.6		Avg Slack	1.5
	%	8.105		%	24.019
Loans (Output) in crores	Avg.	328.864	Total Income (Output) in crores	Avg.	24.592
	Avg Slack	96.453		Avg Slack	1.596
	%	29.329		%	6.488

Source: Authors' Calculations

of study. This implies that if Gurgaon would have been able to cut down its input by 8.1% and augment its loans by 29.32 %,it would have joined the group of best performing banks by reaching to the efficient frontier. The presence of large amount of slacks in inputs or outputs or both is reflected in the form of low efficiency scores. Gurgaon DCCB typifies this fact by exhibiting large amount of slacks in one or more of its inputs and outputs. Similarly, if we take up the case of Kurukshetra DCCB, it has used 24.019 % excess physical assets and yielded 6.488 % less of total income. A bird's eye survey of the slack data tells that no DCCB has shown up slacks in their input expenses during the period of study except for the year 2017 where some of the banks like Hisar, Jind and Sirsa DCCBs have slacks in expenses too. At the same time, physical assets in inputs and loans in the outputs accounted for the large amount of slacks. So, the supervisors and policy makers should advertently consider this observation so that the physical assets can be preserved and maintained regularly and such policies should be designed so as to attract more and more individuals and members for issuing loans. Slacks reduction and management is a sensitive process and needs a careful probe of issues and solutions.

Projections Analysis: DEA assigns reference set for an inefficient DMU. The DMUs in the reference set play as role models in accordance with the assigned weights. Another important DEA result is the target values or projections for the input and output variables of an inefficient DMU to achieve full efficiency.DEA thus provides significant amount of information from which analysts and managers derive insights and guidelines to enhance their existing performance. These target values represent upto which value an input should be decreased while keeping the outputs at the same levels (i.e. input orientation) or how much an output should be increased while the input level remains unincreased (i.e. output orientation) respectively so that the DMU becomes efficient.

For employing the improvements, CCR projections formulas are applied, which as follows

$$\hat{x}_{i0} = \theta^* x_{i0} - s^{-*} = \sum_{j \in E_0} x_j \lambda_j^* \text{.....(1)}$$

$$\hat{y}_{r0} = y_{r0} + s^{+*} = \sum_{j \in E_0} y_j \lambda_j^* \text{.....(2)}$$

Here , $\hat{x}_{i0}$ represents the improvement in i[th] input of the DMU under scrutiny whereas $\hat{y}_{r0}$ is the suggested improvement in its r[th] output. The expression (1) gives improvement in the corresponding input by radialy decreasing the original input and then subtracting the corresponding slacks out of it or it can also be obtained by

positive combination of observed input values of DMUs in the reference set. Keeping these things in mind, discussing projections for the inefficient DCCBs on the efficient frontier seems worth. Rewari DCCB , in the year 2011,has an efficiency score of 0.889.The DCCB members in its reference set are Fatehabad DCCB, Faridabad and Panipat. The results have been reported in table no 3

Table 3 Suggested Projections for Rewari DCCB for the Year 2021

Rewari(Score:0.885)				
Input/ Output	Data	Projection	Difference	%
Physical assets	6.63	5.274	-1.356	-20.45%
Expenses	22.03	19.506	-2.524	-11.46%
Loanable funds	304.57	269.681	-34.889	-11.46%
Total income	22.06	22.06	0	0.00%
Loans	247.46	247.46	0	0.00%

The improvement its physical assets($\hat{x}_{10}$)utilization can be obtained as follows:

$$\hat{x}_{10} = (0.425545 \times 8.79) + (0.147528 \times 3.78) + (6.4 \times 10^{-2} \times 15.12) = 5.274$$

The improvement in its other inputs and outputs are as follows:

$$\hat{x}_{20} = (0.425545 \times 30.64) + (0.147528 \times 31.99) + (6.4 \times 10^{-2} \times 27.12) = 19.506$$

$$\hat{x}_{30} = (0.425545 \times 452.73) + (0.147528 \times 345.5) + (6.4 \times 10^{-2} \times 404.14) = 269.6808$$

$$\hat{y}_{10} = (0.425545 \times 35.46) + (0.147528 \times 34.05) + (6.4 \times 10^{-2} \times 30.2) = 22.06$$

$$\hat{y}_{20} = (0.425545 \times 406.57) + (0.147528 \times 337.44) + (6.4 \times 10^{-2} \times 382.6) = 247.46$$

where $\hat{x}_{10}$ is the projected value of physical assets for Rewari DCCB

$\hat{x}_{20}$ is the projected value of expenses for Rewari DCCB

$\hat{x}_{30}$ is the projected value of loanable funds for Rewari DCCB

$\hat{y}_{10}$ is the projected value of total income for Rewari DCCB

$\hat{y}_{20}$ is the projected value of loans for Rewari DCCB

It can be clearly seen that the projection point of the outputs are same as the original outputs of Rewari. The similar explanation can be extended for other DCCB.

Categorization Among Inefficient Dccbs: Following Kumar and Gulati(2008) we have categorized inefficient banks on the basis of the quartile values of their technical efficiency scores. Instead of segregating banks in to four categories as done by Kumar and Gulati (2008), we have assigned only three categories to have a deeper insight at the performances of these banks .The bases of such a choice is attributed to the spread of the efficiency scores. The spread of the efficiency scores seems narrow which is evident from the standard deviations (with max. value 0.063) of these scores observed over the period of five years. The three categories are: **Below average** with scores **less than Q_1**, **Average** between Q_1 and Q_3 and **Marginally inefficient** with scores greater than Q_3. The category below average banks comprises of those DCCBs which have not been able to make optimized use of their resources.

They might require a substantial attention and improvements in regard to their resources utilization. The supervisors should pay special heeds during the on-site inspection of these banks to understand the weaknesses in the banks and to develop an action plan to take care of such weaknesses as well as to help the bank to grow. These banks need to cut down their inputs to achieve the same level of outputs. This can be done by setting the banks in their respective reference set as benchmarks and thus deciding the course of action for improvements. Based on this assumption, five banks viz. Ambala, Gurgaon, Rewari, Rohtak and Sirsa were categorized "Below Average'' performing banks. On the other hand , Marginally inefficient

Table 4 Categorization among inefficient DCCBs

Below Average	Average	Marginally Inefficient
Ambala	Jhajjar	Ft/bad
Gurgaon	Jind	Kaithal
Hisar	Karnal	K/shetra
Rohtak	Panipat	M/garh
Sirsa	Sonepat	Rewari
	Y/nager	
	P/kula	
	Bhiwani	
	F/bad	

banks are those which have performed fairly well and which are very close to the efficient frontier ,thus requiring minor improvements in there utilization of resources.Though ,they cannot be set as bench marks,they exhibit a high level of operating efficiency.But this observation doesn't exclude them from getting the attention of the supervisors and regulators,instead ,a little bit special attention can make them the leading banks among the group.

ZONE-WISE ANALYSIS OF EFFICIENCIES

As mentioned earlier, DCCBs in Haryana have been divided into four divisions namely Ambala division, Gurgaon division, Hisar division and Rohtak division.The description of DCCBs in all the division is given in Table 5.Their efficiencies are revealed in the following table 2.8which has been averaged out for all five years of study. The average OE scores of all the divisions declares all the divisions to be equally efficient though Rohtak division's overall efficiency shows a marginal difference from the OE scores of other divisions.

Table5 The Four Zones of DCCBs in Haryana

Ambala Division	Gurgaon Division	Hisar Division	Rohtak Division
Ambala	Faridabad	Sirsa	Rohtak
Karnal	Gurgaon	Fatehabad	Sonepat
Kaithal	Mahenderagarh	Bhiwani	Jhajjar
Kurukshetra	Rewari	Hisar	Jind
Yamunanagar			Panipat
Panchkula			

The PTE scores, however, put some light on the actual picture which reveals that the Hisar division to be most technically inefficient followed by Gurgaon division whereas Rohtak and Ambala division reflect the same PTE scores.

Table 6 Zone-wise average Efficiencies

ZONES	*AVG (OE)*	*AVG (PTE)*	*AVG (SE)*
Ambala	0.954	0.971	0.982
Gurgaon	0.954	0.959	0.968
Hisar	0.955	0.822	0.979
Rohtak	0.945	0.972	0.985

Hisar division ,in spite of scoring highest on overall efficiency, shows PTIE (1-PTE) of 17.8 % which suggest that DCCBs in this division have been least successful to yield maximum output out of minimum input which is evident from the average PTE scores(of all five years 2016-17,2017-18,2018-19,2019-20,2020-21) of the individual banks in the division. Their high OE score is thus attributed to the high scale efficiency that they possess.This suggests that proper utilization of inputs is a bigger problem for these banks as compared to working on the optimal scale.Though this state of affairs is applicable to all the divisions in Haryana. Here,in context of scale efficiency Rohtak ,though not ,substantially, outstands other divisions with Gurgaon as the least scale efficient banks. This analysis suggests that no DCCB , irrespective of the divisions in which it falls ,is fully efficient (which is more of technical inefficiency rather than scale inefficiency) .There is dire need to work on resource utilization and allocation to remove out inefficiencies.

CONCLUSIONS AND FINDINGS:

The Overall technical efficiencies have been divided into its non-additive mutually exclusive components:

- Pure technical efficiency
- Scale efficiency

The analysis exhaustively considered 19 District Central Cooperative Banks operating in Haryana for the time period 2017-2021. The results show that average OTE scores range from *0.847* to 0.998. This suggests that none of DCCB has been able to outperform other DCCBs consistently over the period of study .However, the overall level of technical inefficiency has acknowledged a decreasing trend ranging from 0.625 in 2016-17 to 0.451 in 2020-21.

The analysis enables us to make the following inferences about the performance of DCCBs in Haryana:

- The DCCBs Mohindergarh and Karnal are found to be most consistent performer through the period of study reporting average OTE scores of 0.998 and0.997 respectively,both emerging out as fully efficient banks in at least three out of five period of study. Therefore, these banks can be set as benchmark as far as optimized utilization of resources are concerned.
- Gurgaon, Rewari and Hisar DCCBs have never been able to play a benchmark for even once during the period of study. Gurgaon ,the most inefficient DCCB among peers , has used an average of Rs. 48 crores excess of loanable fund and at the same time reports Rs. 96.453 crores of a shortfall in yielding the output Loans.
- No DCCB has shown slacks in their input expenses during the period of study except for the year 2017 where some of the DCCBs have slacks in expenses too.
- The categorization on the bases of efficiencies of DCCBs declares Ambala, Gurgaon , Rewari, Rohtak and Sirsa as “Below Average” DCCBs.
- The Zone wise efficiency Analysis, however reveals no significant differences in average overall efficiency of DCCBs. Though, the figures suggests that proper utilization of inputs ia a bigger problem for these banks as compared to working on optimal scale.

However, this entire analysis leaves the scope to study the inter-temporal variations in technical and scale efficiencies of the DCCBs using a robust time series analysis technique.

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