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Performance Appraisal and Ranking of DCCBs through Malmquist Index and Super-Efficiency

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Abstract: *In this paper, performance evaluation of District Central Co-operative Banks (DCCBs) of Andhra Pradesh state in India during the years 2006-2011 is carried out through Data Envelopment Analysis (DEA). Further the banks were ranked based on their technical efficiencies and super-efficiency model is used to resolve the rank tie-breaking among the DCCBs. Total Factor Productivity (TFP), technical change and technological change are also obtained with the help of Malmquist Index.*

Keywords: *Data Envelopment Analysis, District Central Co-operative Banks, Malmquist Index, Super-efficiency, Total Factor Productivity*

I. Introduction

Economy of the Country is mainly dependent on agriculture as more than 65% of the total population is engaged in this sector. Credit is an essential sinew for the progress of economic development. In a developing economy like ours, Agriculture Credit assumes greater significance on account of the fact that it is a critical input to support and sustain crop production. Co-operatives play an important role in socio-economic development of rural masses. The Co-operative Movement was introduced into India by the Government as the only method by which the farmers could overcome their burden of debt and keep them away from the clutches of the money-lenders. The Co-operative Credit Societies Act, 1904 was passed by the Government of India and rural credit societies were formed. Through the appointment of registrars and through vigorous propaganda, the Government attempted to popularize the Movement in the rural areas. Within a short period, the Government realized some of the shortcomings of the 1904 Act and, therefore, passed a more comprehensive Act, known as the Co-operative Societies Act of 1912. This Act recognized non-credit societies also, but the rural credit societies have continued to be predominant till now.

A co-operative bank is a financial entity which belongs to its members, who are at the same time the owners and the customers of their bank. Co-operative banking is retail and commercial banking organized on a co-operation, self-help and mutual help basis. Co-operative banks are often created by persons belonging to the same local or professional community or sharing a common interest. Co-operative banks generally provide their members with a wide range of banking and financial services (loans, deposits, banking accounts etc.). Co-operative banks differ from stockholder banks by their organization, their goals, their values, and their governance. The Co-operative Credit system consists of short term credit, medium term credit and long term credit structure. Short Term structure is a three tire structure with Primary Agricultural Credit Societies (PACS) in rural areas, Co-operative Central Banks at the district level and the Apex Bank (State Cooperative Banks (SCBs)) at the state level. The Short Term credit structure provides Short Term credit for crop production and Medium Term credit for small developments through PACS. Totally, in India 93413 PACS with 121225 members are functioning and are affiliated to 372 District Central Cooperative Banks (DCCB) with 13327 branches representing 20 states upto March, 2011. In Andhra Pradesh (A.P.), there are 22 DCCBs with 575 branches. The Central Co-operative Banks secure refinance facilities from NABARD through all state Co-operative Apex Banks. The main functions of DCCBs are to provide finance to the PACS, acceptance of deposits, granting of loans/advances, fixed deposit receipts, collection of bills, safe custody of valuables, agency services and work as balancing center for PACS. Co-operative banks have made a commendable progress in extending its geographical spread and functional reach, but very less work had been done in these banks which have been dismal with huge decline in productivity and efficiency, erosion of profitability, unrealizable debts and many unviable branches. Today, the co-operative credit institutions are facing a tough challenge to deliver on the high expectations in a fiercely competitive credit environment. Apprehension and cynicism are expressed on their creditworthiness and financial viability. In this background, an attempt is made in this paper to evaluate the performance appraisal of 22 DCCBs in the state of Andhra Pradesh (A.P.) using a non-parametric method, Data Envelopment Analysis (DEA) with the following objectives: (a). to study whether the intermediation factors contribute to performance appraisal of DCCBs and (b). to analyze the efficiency trends of DCCBs.

Malmquist Index is utilized to find the Total Factor Productivity (TFP) and technological change. Super-efficiency DEA model is also applied to resolve the tie-breaking of ranks among the DCCBs which are efficient.

II. Methodology

For analyzing the efficiency of DCCBs of AP state in India has been purposefully selected, as the investigators hail from this state. DEA model was used to assess the technical efficiency of DCCBs of AP state in India. DEA is one of the most popular approaches used in the literature to appraise the performance of Decision Making Units (DMUs). It permits the selection of efficient DCCBs with in the AP state. DEA was used in prior studies on the efficiency of financial institutions to examine the impact of some specific changes such as financial reforms, the impact of financial practices and the impact of different ownership groups. DEA assesses the efficiency frontier on the basis of all input and output information from the region (Rogers, 1998). Thus, the relative efficiency of DCCBs operating in the same region can be estimated (Fried et al. 2002). Hence, identification of performance indicators in DCCBs is useful for identifying a benchmark for the whole region. Moreover, the DEA methodology has the capacity to analyze multi-inputs and multi-outputs to assess the efficiency of institutions (Coelli, Rao & Battese 1998).

1.DEA model

Several DEA models have been presented in the literature. The basic DEA model evaluates efficiency based on the productivity ratio which is the ratio of outputs to inputs. This study applied Charnes, Cooper and Rhode's (CCR) (1978) model and Banker, Charnes and Cooper (BCC) (1984) model. The production frontier has constant returns to scale in CCR model. The basic CCR model formulation (dual problem/ envelopment form) is given by :

The basic CCR model formulation (dual problem/ envelopment form)

$$\text{Min}\theta - \varepsilon\left(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+\right)$$

Subject to :

$$\sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = \theta x_{i0} \quad (i=1, \dots\dots\dots\dots, m)$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} - s_r^+ = y_{r0} \quad (r=1, \dots\dots\dots\dots, s)$$

$$\lambda_j \geq 0 \qquad (j=1, \dots\dots\dots\dots, n)$$

Source : Zhu (2003, p.13)

where, $\boldsymbol{\theta}$ denotes the efficiency of DMUj , while y_{rj} is the amount of r^{th} output produced by DMUj using x_{ij} amount of i^{th} input. Both y_{rj} and x_{ij} are exogenous variables and λ_j represents the benchmarks for a specific DMU under evaluation (Zhu 2003). Slack variables are represented by s_i and s_r. According to Cooper, Seiford and Tone (2004) the constraints of this model are:

i. the combination of the input of firm j is less than or equal to the linear combination of inputs for the firm on the frontier;

ii. the output of firm j is less than or equal to the linear combination of inputs for the firm on the frontier; and

iii. the main decision variable $\boldsymbol{\theta_j}$ lies between one and zero.

Further, the model assumes that all DMUs are operating at an optimal scale. However, imperfect competition and constraints to finance may cause DMUs to operate at some level different to the optimal scale (Coelli, Rao & Battese 1998). Hence, the Banker, Charnes and Cooper (1984) BCC model is developed with a production frontier that has variable returns to scale. The BCC model forms a convex combination of DMUs (Coelli, Rao & Battese 1998). Then the constant returns to scale linear programming problem can be modified to one with variable returns to scale by adding the convexity constraint $\Sigma\lambda j = \mathbf{1}$. The model given below illustrates the basic BCC formulation (dual problem/envelopment form) :

The basic BCC model formulation (dual problem/envelopment form)

$$\text{Min}\theta - \varepsilon\left(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+\right)$$

Subject to :

$$\sum_{j=1}^{n}\lambda_j x_{ij} + s_i^- = \theta x_{i0} \qquad (i=1, \ldots\ldots\ldots , m)$$

$$\sum_{j=1}^{n}\lambda_j y_{rj} - s_r^+ = y_{r0} \qquad (r=1, \ldots\ldots\ldots , s)$$

$$\lambda_j \geq 0 \qquad (j=1, \ldots\ldots\ldots ,n)$$

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

Source :Zhu (2003, p.13)

This approach forms a convex hull of intersecting planes (Coelli, Rao & Battese (1998)). These planes envelop the data points more tightly than the constant returns to scale (CRS) conical hull. As a result, the variable returns to scale (VRS) approach provides technical efficiency (TE) scores that are greater than or equal to scores obtained from the CRS approach (Coelli, Rao & Battese 1998). Moreover, VRS specifications will permit the calculation of TE decomposed into two components: scale efficiency (SE) and pure technical efficiency (PTE). Hence, this study first uses the CCR model to assess TE then applies the BCC model to identify PTE and SE for each DMU. The relationship of these concepts is given below :

Relationship between TE, PTE and SE

$TE_{CRS} = PTE_{VRS}*SE$

where TE_{CRS} = Technical efficiency of constant return to scale

PTE_{VRS} = Technical efficiency of variable return to scale

SE = Scale efficiency

Source : Coelli, et al., (1998).

The above relationship, which is unique, depicts the sources of inefficiency, i.e., whether it is caused by inefficient operation (PTE) or by disadvantageous conditions displayed by the scale efficiency (SE) or by both. If the scale efficiency is less than 1, the DMU will be operating either at decreasing return to scale (DRS) if a proportional increase of all input levels produces a less-than-proportional increase in output levels or increasing return to scale (IRS) at the converse case. This implies that resources may be transferred from DMUs operating at DRS to those operating at IRS to increase average productivity at both sets of DMUs (Boussofiane et al.,1992).

2.The Malmquist Productivity Index

The Malmquist productivity index can be used to identify productivity differences between two firms or one firm over two-time periods. In this section we have concentrated on one firm over two period's output-oriented Malmquist productivity index. The output-orientated productivity change measures will use an output distance function, which addresses the maximal proportional expansion feasible without altering the input quantities (Coelli, Rao, and Battese (1998)). To estimate technical efficiency changes and technical changes over the period in question, the decomposed Malmquist productivity index was used.

Caves et al. (1982) proposed that output-based Malmquist productivity index between time period's t and (t + 1) can be defined as:

$$M_{t,t+1}\left(y^t, y^{t+1}, x^t, x^{t+1}\right) = \left[\frac{D^t\left(y^{t+1}, x^{t+1}\right)}{D^t\left(y^t, x^t\right)} * \frac{D^{t+1}\left(y^{t+1}, x^{t+1}\right)}{D^{t+1}\left(y^t, x^t\right)}\right]^{1/2} \qquad (1)$$

where the notation D represents the distance function and the value of M is the Malmquist productivity index. The first ratio represents the period t Malmquist index. It measures productivity change from period t to period (t+1) using period t technology as a benchmark. The second ratio is the period (t + 1) Malmquist index and measures productivity change from period t to period (t + 1) using period (t + 1) technology as a benchmark. A value of M greater than one (i.e. M >1) denotes productivity growth, while a value less than one (M<1) indicates productivity decline, and M=1 corresponds to stagnation.

According to Färe et al. (1994) the output-based Malmquist productivity index between time periods t and (t + 1) can be decomposed into two components, which is an equivalent of index (1), as (Färe et al. (1995), Grifell-Tatjé and Lovell (1996)):

$$M_{t,t+1}\left(y^t, y^{t+1}, x^t, x^{t+1}\right) = \frac{D^{t+1}\left(y^{t+1}, x^{t+1}\right)}{D^t\left(y^t, x^t\right)} \left[\frac{D^t\left(y^t, x^t\right)}{D^{t+1}\left(y^t, x^t\right)} * \frac{D^t\left(y^{t+1}, x^{t+1}\right)}{D^{t+1}\left(y^{t+1}, x^{t+1}\right)} \right]^{1/2} \qquad (2)$$

In equation (2) the term outside the brackets (EFFCH) is a ratio of two distance functions, which measures the change in the output-oriented measure of the Farell technical efficiency between period t and t+1. The square root term (TECHCH) is a measure of the technical change in the production technology. It is an indicator of the distance covered by the efficient frontier from one period to another and thus a measure of technological improvements between the periods. The term (EFFCH) is greater than, equal to or less than one if the producer is moving closer to, unchanging or diverging from the production frontier, respectively. The square root term (TECHCH) is greater than, equal to or less than one when the technological best practice is improving, unchanged, or deteriorating, respectively.

3. Super-efficiency DEA model:

The main purpose of super-efficiency is to provide tie-breaking procedure for ranking DMUs which are efficient in traditional DEA models. When a DMU under evaluation is not included in the reference set of the original DEA models, then these models are called super-efficiency DEA models. Then super-efficiency DEA models can be obtained in two categories namely CRS and VRS. The CCR super-efficiency DEA model was developed under CRS by Andersen and Petersen (1993) (Called AP model). Thrall (1996) pointed out that the AP model may result in infeasibility and instability when some inputs are close to zero. Similarly Zhu (2001) showed that super-efficiency DEA models with CRS could occur with infeasibility if and only if there is a zero in data.

The infeasibility of the related linear program is very likely to occur (see Banker et. al (1984) and Seiford and Zhu (1998)) when super-efficiency DEA model based on the BCC model (VRS super-efficiency model) is considered. Seiford and Zhu (1998) showed the necessary and sufficient conditions of infeasibility in VRS super-efficiency model. Yao (2003) stated that super-efficiency can be interpreted as input saving and output surplus achieved by an efficient DMU. By utilizing the Yao's interpretation, Said Ebadi (2012) proposed a VRS super-efficiency model which is known as input-output orientation super-efficiency model which is always feasible.

The super efficiency model with input-output orientation:

The model is as:

$$\begin{aligned}
&Min(1+\beta_0)\\
&s.t \sum_{j=1,\, j\neq o}^{n} \lambda_j x_{ij} - (1+\beta_0)x_{io} \leq 0 \qquad i = 1,2,\ldots.,m\\
&\quad \sum_{j=1,\, j\neq o}^{n} \lambda_j y_{rj} - (1-\beta_0)y_{ro} \geq 0 \qquad r = 1,2,\ldots.,s\\
&\quad \sum_{j=1,\, j\neq o}^{n} \lambda_j = 1\\
&\quad \lambda_j \geq 0 \qquad\qquad j = 1,2,\ldots.,n,\ j\neq o
\end{aligned}$$

III. Data and variables for the study

The establishment of DCCBs at the district level was to serve as a link between the ultimate credit disbursing outlets, viz., PACS at the base level, DCCBs at the intermediate level and SCBs at the apex level. In general, commercial banks discharge the duties of intermediation and asset management. But the primary duty of a DCCB is intermediation. DEA assumes that, the inputs and outputs have been correctly identified. Usually as the number of inputs and outputs increase, more DMUs tend to get an efficiency rating of 1 as they become too specialized to be evaluated with respect to other units. On the other hand, if there are too few inputs and outputs, more DMUs tend to be comparable. In any study, it is important to focus on correctly specifying inputs and outputs. DEA is commonly used to evaluate the efficiency of a number of DMUs and it is a multi-factor productivity analysis model for measuring the relative efficiency of a homogeneous set of DMUs. For every inefficient DMU, DEA identifies a set of corresponding efficient DMU that can be utilized as benchmarks for improvement of performance and productivity. DEA is developed based on two scale of assumptions viz., Constant Return to Scale (CRS) model and Variable Return to Scale (VRS) model. CRS means that the producers are able to linearly scale the inputs and outputs without increasing or decreasing efficiency. This is a significant assumption. The assumption of CRS may be valid over limited ranges but its use must be justified. As an aside, CRS tends to lower the efficiency scores while VRS tends to raise efficiency scores.

For enabling the study of evaluation of DCCBs in intermediation approach, we have the following resources(inputs) and productivity indicators or outputs :

Inputs :	X_1 – Total membership(in No.),	X_2 **-** Paid up Capital(Rs. in Lakhs),
	X_3 – Total deposits(Rs. in Lakhs),	X_4 – Total borrowings(Rs. in Lakhs),
	X_5 – Cost of management(Rs. in Lakhs).	
Outputs:	Y_1 – Total loans issued(Rs. in Lakhs),	Y_2 – Total demand(Rs. in Lakhs).

The study involves the application DEA to assess the efficiency of 22 DCCBs in AP State in India during the years 2006-07, 2007-08, 2008-09, 2009-10, 2010-11. The data used for assessment was obtained from the annual reports published by DCCBs and from website <www.nafscob.org.in>. DEA model is executed separately for each year using input-orientation with radial distances to the efficient frontier. By running these programmes with the same data under CRS and VRS assumptions, measures of overall technical efficiency (TE) and 'pure' technical efficiency (PTE) are obtained.

IV. Results and discussion

The main theme of the present study is to assess the performance of 22 DCCBs of AP state in India. The study intends to assess the efficiency of DCCBs and thereby improving intermediation factors to provide appropriate credit facilities for farming community.

The findings of DEA portrayed through Table 1 revealed the following salient information :

- Only one DCCB among 22 DCCBs in Andhra Pradesh state is operated at Constant Return to Scale (CRS) in the entire period of study, which is 2006-07 to 2010-11. This indicates that the DCCB, Cuddapah in A.P. state is operated with stability, balancing the inputs (resources contained in this) to satisfy the outputs i.e. the purpose of DCCBs. This is :

Table 1: DCCBs with Constant Return to Scale(CRS) :

S.No.	Name of DCCB	RETURN TO SCALE				
		2006-07	2007-08	2008-09	2009-10	2010-11
1	CUDDAPAH	crs	crs	crs	crs	crs

- About 32 percent i.e. 7 out of 22 total DCCBs in A.P. state are operating with Increasing Return to Scale (IRS) throughout the study period which reveals that these are showing encouraging trend to promote the purpose of DCCB subject to additional inputs or resources and support. Infact these DCCBs do need encouragement to promote the goal or purpose of DCCBs. These are :

Table 2 : DCCBs with Increasing Return to Scale(IRS) :

S.No.	Name of DCCB	RETURN TO SCALE				
		2006-07	2007-08	2008-09	2009-10	2010-11
1	CHITTOOR	**irs**	**irs**	**irs**	**irs**	**irs**
2	GUNTUR	**irs**	**irs**	**irs**	**irs**	**irs**
3	KURNOOL	**irs**	**irs**	**irs**	**irs**	**irs**
4	MAHABUBNAGAR	**irs**	**irs**	**irs**	**irs**	**irs**
5	MEDAK	**irs**	**irs**	**irs**	**irs**	**irs**
6	NALGONDA	**irs**	**irs**	**irs**	**irs**	**irs**
7	WARANGAL	**irs**	**irs**	**irs**	**irs**	**irs**

- However it is important to note that none of the other DCCBs are operating with Decreasing Return to Scale (DRS) throughout the study period in the entire A.P. state which is a encouraging factor with respect to the efficiency of DCCBs. But the DCCBs Eluru (2009-10) and Krishna (2008-09) are operated with Decreasing Return to Scale (DRS) for one year of study period.
- It is also noticed that some of the DCCBs have shown a shift in the return to scale pattern that is, either from IRS to CRS or vice-versa implying that, there is increased resource use efficiency with reference to

the exploitation of resources usage. Hence, these DCCBs have shown an increased pace of return to scale. These DCCBs are :

Table 3: DCCBs with trend of Scale during 2006-2011

S.No.	**Name of DCCB**	**RETURN TO SCALE**				
		2006-07	2007-08	2008-09	2009-10	2010-11
1	ADILABAD	crs	crs	crs	**irs**	**irs**
2	ANANTAPUR	crs	crs	crs	crs	**irs**
3	ELURU	crs	crs	crs	**DRS**	**irs**
4	HYDERABAD	**irs**	**irs**	crs	crs	**irs**
5	KAKINADA	**irs**	**irs**	crs	crs	crs
6	KARIMNAGAR	crs	**irs**	crs	crs	crs
7	KHAMMAM	**irs**	**irs**	**irs**	crs	crs
8	KRISHNA	crs	crs	**DRS**	crs	**irs**
9	NIZAMABAD	**irs**	crs	crs	**irs**	crs
10	PRAKASAM	**irs**	**irs**	crs	crs	**irs**
11	SPS NELLORE	**irs**	crs	**irs**	**irs**	**irs**
12	SRIKAKULAM	crs	crs	crs	crs	**irs**
13	VISHAKAPATNAM	crs	crs	crs	crs	**irs**
14	VIZIANAGARAM	**irs**	crs	crs	crs	crs

Table 4: DCCBs with Malmquist Index Annual Averages during 2006-2011

S.No.	Name of DCCB	technical efficiency change	technological change	pure efficiency change	scale efficiency change	total factor productivity change
1	ADILABAD	0.926	1.048	1	0.926	0.971
2	ANANTAPUR	0.958	1.115	0.981	0.977	1.069
3	CHITTOOR	1.106	1.15	1.036	1.068	1.271
4	CUDDAPAH	1	1	1	1	1
5	ELURU	0.947	1.003	0.947	1	0.949
6	GUNTUR	0.983	1.017	1.03	0.955	1
7	HYDERABAD	1.083	1.063	1	1.083	1.151
8	KAKINADA	1.089	1.039	1.066	1.021	1.131
9	KARIMNAGAR	1	1.225	1	1	1.225
10	KHAMMAM	1.08	1.201	1.011	1.068	1.297
11	KRISHNA	0.954	0.987	0.954	1	0.941
12	KURNOOL	1.182	1.161	1.027	1.15	1.372
13	MAHABUBNAGAR	0.941	0.947	0.954	0.986	0.891
14	MEDAK	0.915	1.016	1.062	0.861	0.93
15	NALGONDA	0.857	1.154	0.922	0.93	0.989
16	SPS NELLORE	0.931	1.225	0.953	0.977	1.14
17	NIZAMABAD	1.032	1.22	1	1.032	1.26
18	PRAKASAM	1	1.179	0.955	1.047	1.178
19	SRIKAKULAM	0.921	1.097	1	0.921	1.011
20	VISHAKAPATNAM	0.999	1.066	1	0.999	1.065
21	VIZIANAGARAM	1.048	1.143	1	1.048	1.198
22	WARANGAL	1.032	1.07	0.981	1.052	1.104
	mean	**0.996**	**1.093**	**0.994**	**1.003**	**1.09**

From the table 4, as per the technical efficiency during the study period, it is revealed that 8 DCCBs out of 22, i.e. 36%, have increased their mean annual technical efficiency change and 14% of DCCBs remained unchanged. Further, 50% of DCCBs experienced decline in technical efficiency change. Among the DCCBs which registered progress in technical efficiency change, Kurnool (18.2%) and Chittoor (10.6%) took the first two positions and the first two DCCBs regressed are Nalgonda (14.3%) and Medak (8.5%).

It is also observed that 9.3% of average annual technological progress change was occurred during the study period 2006-2011. 86% of DCCBs showed progress, 9% of DCCBs experienced technological decline and 5% of DCCBs remained unchanged. Both the Karimnagar (22.5%) and Nizamabad (22.5%) DCCBs got first position with respect to technological progress and Prakasam (22%) and Khammam (20.1%) took the next positions. Only one DCCB i.e. Cuddapah remain unchanged. The DCCBs which faced retrogression are Mahabubnagar (5.3%) and Krishna (1.3%) only.

The average annual growth in Total Factor Productivity (TFP) during the study period is 9%. Further, 64% of DCCBs were observed to have made progress while 27% experienced a decline and 2 DCCBs namely Cuddapah and Guntur remained unchanged. In terms of increase in TFP during study period; Kurnool (37.2%), Khammam (29.7%) and Chittoor (27.1%) are the first three. The growth in TFP of these DCCBs is due to improvement in technical efficiency and implementation of innovative ideas. The DCCBs Mahabubnagar

(10.9%) and Madak (7%) are the first two which experienced the highest decline in TFP. The decrease in technological and technical efficiency decline of the DCCBs caused the decrease in TFP.

Table 5: Yearwise Average Malmquist Index Summary of Annual Means

S.No.	year	technical efficiency change	technological change	pure efficiency change	scale efficiency change	total factor productivity change
1	2007-08	1.069	0.899	1	1.069	0.961
2	2008-09	0.966	0.975	1.013	0.953	0.942
3	2009-10	0.949	1.227	1.009	0.94	1.164
4	2010-11	1.007	1.329	0.954	1.055	1.338
	mean	**0.996**	**1.093**	**0.994**	**1.003**	**1.09**

Table 5 shows that the average annual technical efficiency change is decreased during the study period 2006-2011. In addition, the average technological change and TFP is increased. In the year 2007-08, the technical efficiency change is recorded as highest and the least is in the year 2009-10. The highest and least technological changes are occurred in the years 2010-11 and 2007-08 respectively. Similar terms with respect to TFP are 2010-11 and 2008-09.

In this paper as a last step, we tried to rank the DCCBs under study, then it is observed that there are some efficient DCCBs which demanded for the rank to be shared among them. So for resolving the tie-breaking we preferred super-efficiency DEA model. For executing the super-efficiency DEA model we have considered different efficient DCCBs in different study years. The DCCB of Cuddapah stood first in all the years of study period except in the year 2011 and Karimnagar took the first position in the year 2011(from Table No.7). The DCCB Kurnool has remained in last position in all years of study period except in the year 2011 and it bagged ninth position in the year 2011 whereas the DCCB Nalgonda stood last in the same year.

V. Conclusion

The informal discussions held with DCCB Officials and farmers revealed the following interesting points for the heartening performance of DCCBs:

- Farmers are showing positive attitude for obtaining their credit in the DCCBs compared to local lenders on account of the reduced rate of interests being available in the DCCBs.
- Loan waiving facility during natural calamities like flood, drought, sudden pest or disease attacks etc.
- More encouragement by the Government in the form of implementing pledge loan schemes, Rythu Bandhu Padhakam etc.
- The co-operative system consists of different structures of credit facility to cater the needs of different groups of farmers.

The analyses reveal that only one DCCB in A.P. state is performing optimally (efficiently fulfilling the purpose) balancing the resources throughout the study period. However 32 percent of overall 22 DCCBs in A.P. state are showing increasing trend which needs more funds to make themselves optimal. The remaining 64 percent of DCCBs in A.P. state are showing the mixed trend i.e. increasing and optimal which results that these DCCBs also need more funds at certain stages to be optimal. In terms of technological change, majority of DCCBs are having progress during the study period. At the same time many DCCBs improved their TFP and technical efficiency change. Tie-breaking of ranks among the DCCBs was also resolved with the help of super-efficiency DEA model.

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Table: No. of DCCBs showing RTS frome 2006-07 to 2010-11 :

RETURN TO SCALE	NUMBER OF DCCBs				
	2006-07	2007-08	2008-09	2009-10	2010-11
Increasing	14	12	9	10	16
Constant	8	10	12	11	6
Decreasing	Nil	Nil	1	1	Nil
Total	22	22	22	22	22

Table: DCCBs along with efficiencies and Statistical analysis in A.P. during 2006-2011 :

Description	2006-07			2007-08			2008-09			2009-10			2010-11		
	CRS	VRS	Scale	CRS	VRS	Scale	CRS	VRS	Scale	CRS	VRS	Scale	CRS	VRS	Scale
MEAN	0.804	0.9455	0.8464	0.8539	0.9454	0.8979	0.8348	0.9572	0.8631	0.8107	0.9665	0.8344	0.7927	0.9241	0.853
S.D.	**0.1897**	**0.0863**	**0.1655**	**0.1766**	**0.0843**	**0.1409**	**0.2095**	**0.0775**	**0.1727**	**0.2506**	**0.0812**	**0.232**	**0.1886**	**0.1007**	**0.159**
Minimum	0.4463	0.7412	0.5179	0.5159	0.7693	0.5986	0.4802	0.7358	0.5395	0.3401	0.6531	0.3401	0.4494	0.7234	0.5108
Maximum	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DCCBs Evaluated	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Efficient DCCBs	8	14	8	10	14	10	12	16	12	11	15	11	6	12	6
Inefficient DCCBs	14	8	14	12	8	12	10	6	10	11	7	11	16	10	16

Table 6 : CRS, VRS, Scale efficiencies and RTS of selected DCCBs in Andhra Pradesh from 2006-07 to 2010-11 :

S.No.	Name of DCCB	2006-07				2007-08				2008-09				2009-10				2010-11			
		CRS	VRS	Scale	RTS	CRS	VRS	Scale	RTS	CRS	VRS	Scale	RTS	CRS	VRS	Scale	RTS	CRS	VRS	Scale	RTS
1	ADILABAD	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.9993	1	0.9993	irs	0.7344	1	0.7344	irs
2	ANANTAPUR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.8439	0.9253	0.912	irs
3	CHITTOOR	0.4745	0.8694	0.5458	irs	0.5253	0.8694	0.6042	irs	0.5068	0.8811	0.5752	irs	0.4378	0.9581	0.4569	irs	0.7088	1	0.7088	irs
4	CUDDAPAH	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
5	ELURU	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.9401	0.9765	0.9628	**DRS**	0.8044	0.806	0.9981	irs
6	GUNTUR	0.6356	0.7412	0.8575	irs	0.7134	0.7693	0.9274	irs	0.66	0.8058	0.8191	irs	0.6134	0.8221	0.7462	irs	0.5941	0.8346	0.7119	irs
7	HYDERABAD	0.6855	1	0.6855	irs	0.8177	1	0.8177	irs	1	1	1	crs	1	1	1	crs	0.9421	1	0.9421	irs
8	KAKINADA	0.7122	0.7753	0.9186	irs	0.9621	0.9623	0.9998	irs	1	1	1	crs	1	1	1	crs	1	1	1	crs
9	KARIMNAGAR	1	1	1	crs	0.7501	0.9308	0.8059	irs	1	1	1	crs	1	1	1	crs	1	1	1	crs
10	KHAMMAM	0.7355	0.9565	0.7689	irs	0.9856	1	0.9856	irs	0.8692	1	0.8692	irs	1	1	1	crs	1	1	1	crs
11	KRISHNA	1	1	1	crs	1	1	1	crs	0.7805	1	0.7805	**DRS**	1	1	1	crs	0.8279	0.8282	0.9997	irs
12	KURNOOL	0.4463	0.8618	0.5179	irs	0.5159	0.8618	0.5986	irs	0.4802	0.8902	0.5395	irs	0.3653	1	0.3653	irs	0.8709	0.96	0.9072	irs
13	MAHABUBNAGAR	0.5725	0.8729	0.6559	irs	0.5504	0.7911	0.6957	irs	0.4933	0.7358	0.6704	irs	0.4555	0.6531	0.6974	irs	0.4494	0.7238	0.621	irs
14	MEDAK	0.7296	0.7851	0.9293	irs	0.7235	0.7843	0.9225	irs	0.4992	0.8873	0.5626	irs	0.5014	0.9653	0.5194	irs	0.5108	1	0.5108	irs
15	NALGONDA	0.8795	1	0.8795	irs	0.8325	1	0.8325	irs	0.8369	1	0.8369	irs	0.6446	1	0.6446	irs	0.475	0.7234	0.6566	irs
16	NIZAMABAD	0.8809	1	0.8809	irs	1	1	1	crs	1	1	1	crs	0.8719	0.9702	0.8987	irs	1	1	1	crs
17	PRAKASAM	0.6988	0.9392	0.744	irs	0.7518	0.8299	0.9059	irs	1	1	1	crs	1	1	1	crs	0.6977	0.7797	0.8949	irs
18	SPS NELLORE	0.8661	1	0.8661	irs	1	1	1	crs	0.5709	0.8579	0.6655	irs	0.3401	1	0.3401	irs	0.6499	0.8236	0.7891	irs
19	SRIKAKULAM	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.7207	1	0.7207	irs
20	VISHAKAPATNAM	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.9959	1	0.9959	irs
21	VIZIANAGARAM	0.8302	1	0.8302	irs	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
22	WARANGAL	0.5397	1	0.5397	irs	0.6585	1	0.6585	irs	0.6688	1	0.6688	irs	0.6665	0.9182	0.7259	irs	0.6124	0.9252	0.6619	irs
MEAN		**0.804**	**0.9455**	**0.8464**		**0.8539**	**0.9454**	**0.8979**		**0.8348**	**0.9572**	**0.8631**		**0.8107**	**0.9666**	**0.8344**		**0.7927**	**0.9241**	**0.853**	
S. D.		**0.1897**	**0.0863**	**0.1655**		**0.1766**	**0.0843**	**0.1409**		**0.2095**	**0.0775**	**0.1727**		**0.2506**	**0.0812**	**0.232**		**0.1886**	**0.1007**	**0.159**	

Table 7 : Comparison of the Ranks through Technical Efficiencies(TE-VRS) and Super-efficiencies(SE)

S No.	Name of DCCB	2007				2008				2009				2010				2011			
		TE	Rank	SE	Rank	TE	Rank	SE	Rank	TE	Rank	SE	Rank	TE	Rank	SE	Rank	TE	Rank	SE	Rank
1	ADILABAD	1	1	1.7184	10	1	1	1.7360	12	1	1	1.6029	14	1	1	1.6461	13	1	1	1.6166	15
2	ANANTAPUR	1	1	1.8628	4	1	1	1.8733	4	1	1	1.9297	3	1	1	1.8859	7	0.9161	17	0.9161	17
3	CHITTOOR	0.8389	21	0.8389	21	0.8389	20	0.8389	20	0.8522	19	0.8522	19	0.8596	17	0.8596	17	1	1	1.8345	8
4	CUDDAPAH	1	1	1.9704	1	1	1	1.9723	1	1	1	1.9656	1	1	1	1.9610	1	1	1	1.9626	2
5	ELURU	1	1	1.9399	2	1	1	1.9209	3	1	1	1.9473	2	1	1	1.8980	6	1	1	1.9176	5
6	GUNTUR	0.9216	18	0.9216	18	1	1	1.8687	5	0.8153	20	0.8153	20	0.8414	19	0.8414	19	0.7905	19	0.7905	19
7	HYDERABAD	1	1	1.7656	9	1	1	1.7803	10	1	1	1.7674	10	1	1	1.8403	8	1	1	1.7095	11
8	KAKINADA	0.8535	20	0.8535	20	0.9706	18	0.9706	18	1	1	1.9165	6	1	1	1.9260	4	1	1	1.9307	3
9	KARIMNAGAR	1	1	1.8452	6	0.9441	19	0.9441	19	0.8923	18	0.8923	18	1	1	1.9178	5	1	1	1.9663	1
10	KHAMMAM	0.9498	17	0.9498	17	1	1	1.8189	9	1	1	1.8437	8	1	1	1.9315	3	1	1	1.8712	6
11	KRISHNA	1	1	1.9347	3	1	1	1.9509	2	1	1	1.9297	4	1	1	1.9461	2	1	1	1.9271	4
12	KURNOOL	0.7058	22	0.7058	22	0.721	22	0.7210	22	0.719	22	0.7190	22	0.7136	22	0.7136	22	1	1	1.8150	9
13	MAHABUBNAGAR	0.8613	19	0.8613	19	0.803	21	0.8030	21	1	1	1.8058	9	0.8038	20	0.8038	20	0.7596	21	0.7596	21
14	MEDAK	1	1	1.6581	12	1	1	1.6795	14	0.8104	21	0.8104	21	0.8565	18	0.8565	18	1	1	1.6827	12
15	NALGONDA	1	1	1.6642	11	1	1	1.6948	13	1	1	1.7366	12	1	1	1.5626	15	0.7212	22	0.7212	22
16	NIZAMABAD	1	1	1.5620	5	1	1	1.8382	7	1	1	1.9245	5	0.985	16	1.8316	9	0.7719	20	0.7719	20
17	PRAKASAM	1	1	1.8502	8	1	1	1.8307	8	0.9696	17	0.9696	17	1	1	0.7373	21	0.8629	18	0.8629	18
18	SPS NELLORE	1	1	1.8210	14	1	1	1.7595	11	1	1	1.5103	16	0.7373	21	0.9850	16	1	1	1.7464	10
19	SRIKAKULAM	1	1	1.5327	15	1	1	1.5619	16	1	1	1.6014	15	1	1	1.6303	14	1	1	1.6026	16
20	VISHAKAPATNAM	1	1	1.8337	7	1	1	1.8441	6	1	1	1.8724	7	1	1	1.8104	10	1	1	1.8602	7
21	VIZIANAGARAM	1	1	1.4652	16	1	1	1.4986	17	1	1	1.7672	11	1	1	1.7770	11	1	1	1.6429	13
22	WARANGAL	1	1	1.6208	13	1	1	1.6445	15	1	1	1.6782	13	1	1	1.7318	12	1	1	1.6335	14