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MULTIVARIATE TECHNIQUES IN RANKING PERFORMANCE : AN APPLICATION TO THE WORKING OF PCARDBS IN KARNATAKA*

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ABSTRACT

The performance of PCARDB's in the districts of Karnataka were ranked by applying the principal component analysis on selected performance indicators. Further, using discriminant analysis the factors contributing to the disparity between the districts where the PCARDB's were performing well from those where they were not, was quantified. The discriminant function revealed that growth in working capital, deposits and overdue loans distinguished high performing banks from low performing banks.

Introduction

The modernisation and improvement of agriculture needs considerable capital for investment. Unfortunately, "agriculture in our country is mostly a poor man's occupation and hence the need for depending on external financia resources becomes inevitable" (Obul Reddy, 1986). According to Dantwala (1988), in Indian agriculture with 74.5 per cent of operational holdings falling in the category of small and marginal, the primary responsibility of developmen rests with the Government because it needs colossal public expenditure and strong policy intervention. Based on their knowledge and experience, credi institutions should advise and assist the concerned authorities on the developmen potential in their "Service Area" but should not assume the role of an alternate planning agency.

Due to the technological innovations and the consequent commercialization of agriculture, capital intensive strategies are gaining primacy. In spite of the rapid strides, the Indian peasant is still critically short of capital. India has been fairly successful in institutionalizing rural credit, especially after independence and, as a result, bulk of the production credit needs of the farmers and rura

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people are met through institutional sources. Over the period 1969-87 the institutional credit for agriculture increased from Rs. 1272 crores to Rs. 17602 crores (Vishwanathan, 1989). Ever since the enactment of the first Co-operative Credit Societies Act in 1904, co-operatives have been accepted as an important agency for rural finance. The agricultural credit disbursed by the co-operatives increased from a meagre Rs. 23 crores in 1951-52 to over Rs. 1497 crores as short and medium term credit in 1988-89. The long term lending by the land development banks touched the mark of Rs. 719 crores in 1989-90 (Shah, 1992).

The term loans for agriculture and rural development are provided by the co-operative agriculture and rural development banks which are generally known as co-operative land development banks under a two tier structure. At the apex (State) level is the Karnataka State Co-operative Agriculture and Rural Development Bank (KSCARDB) which came into existence in the year 1929. At the primary (taluka) level, there are 177 Primary Co-operative Agriculture and Rural Development Banks (PCARDBs) spread over all the 175 taluks in the State of Karnataka. The KSCARDB lends to PCARDBS which in turn directly finance the agriculturists.

This study is an attempt to evaluate the performance of PCARDBs in Karnataka in terms of the growth in selected parameters.

Methodology

The compound growth rates (CGR) were computed (Appendix I) for selected variables such as total membership, share capital, working capital, deposits, loans advanced, loans recovered and loans overdue for a period covering 15 years (1976-77 to 1990-91). For analysis, districtwise data were obtained for the State of Karnataka from the annual reports maintained by the Research and Evaluation cell, Office of the Registrar of Co-operative Societies, Government of Karnataka, Bangalore.

A multi-dimensional measure of performance of the PCARDBs in the various districts of Karnataka was attempted by selecting seven performance indicators which have been mentioned above. Principal component analysis, a multivariate technique, was used to identify the factors or group of factors contributing to the performance of PCARDBs. It was later employed for arriving at a weighting scheme for aggregating the ratios into a composite index of performance. The growth rates of

seven selected indicators were used and a correlation matrix (7x7) was developed. From this, the latent roots and latent vectors were extracted.

The linear transformation accomplished by the first component is given by

$$S_1 = a_{11} X_1 + a_{12} X_2 \ldots\ldots\ldots\ldots\ldots + a_{17} X_7$$

where, the a_i are the co-efficients of the principal component factors,

$X_1, X_2 \ldots\ldots\ldots\ldots X_7$ are the variates under study.

Similarly, the second linear combination can be expressed as

$$S_2 = a_{21} X_1 + a_{22} X_2 + \ldots\ldots\ldots\ldots + a_{27} X_7$$

This step is carried out only for the important components which account for a substantial proportion of the variation. S_1 gives the principal component score of the first component, S_2 for the second component and so on.

Further, a linear discriminant function was fitted to gain an insight into the relative importance of the different variables in discriminating between high performing and low performing districts.

The linear discriminant function is expressed as

$$Z = \sum_{i=1}^{P} L_i X_i$$

where,

Z = composite discriminant scores for the two groups

X_i's = variables or characteristics selected to discriminate the groups

L_i's = linear discriminant co-efficients

The probability of misclassification was worked out as the total number of individuals assigned to the wrong groups by the estimated discriminant function.

The contribution of each variable to the distance between the groups was computed by calculating the individual distances as

$$d_i \, L_i$$

and expressing it as percentage of the total.

$$\sum_{i=1}^{P} d_i L_i$$

where, P is the number of variables in the discriminant function. This helped in understanding how each performance indicator contributed to the disparity between the groups.

Results and Discussion

The PCARDBs advance long term loans to agriculture in the state. It would be worthwhile to know whether their activities are concentrated in some districts or uniformly spread throughout the State. However, when performance is measured on many variables, it is quite possible that some of them may be in conflict with others, which will tend to obscure the performances. Therefore, a composite index which is based on the dimensions (an aggregate of variables) of performance would be useful in measuring overall performance. This is achieved by working out the performance indices using the principal component analysis or growth rates of seven selected variables. In the process, broad dimensions of performance are identified. These are the "fund-endowment" dimension comprising share capital and working capital, "fund flow" dimension consisting of loans advanced and loans recovered and the "equity" dimension comprising deposits and membership (Table 1). The principal component coefficients of the first three components together accounted for 83 per cent of the variation which was used to work out the composite performance index. The thumb rule for determining the significance of a component in principal component analysis is based on its eigen root value of unity or more. To aggregate these component scores into a single index the individual component score was based on the weighted percentage of variation explained by each eigen vector of 0.437, 0.228 and 0.170 (Table 2).

A closer examination of the scores revealed that higher values of scores corresponded to higher performance. The scores facilitated the identification of good performing districts *vis-a-vis* poor performing districts which constituted

Table 1: Principal Components of the Growth Rates of Selected Indicators

Sl. No.	Variables	Principal Components 1	2	3	4	5	6	7
1.	Membership	0.343	-0.144	-0.478	0.679	0.348	0.224	0.022
2.	Share capital	0.514	0.047	0.108	0.023	-0.671	0.469	-0.225
3.	Working capital	0.437	0.441	0.054	0.218	-0.120	-0.740	-0.046
4.	Deposits	0.020	0.062	0.851	0.396	0.285	0.179	0.031
5.	Loans advanced	-0.270	0.657	-0.135	0.170	-0.187	0.266	0.585
6.	Loans recovered	0.350	0.485	-0.055	-0.475	0.541	0.278	-0.210
7.	Loans overdue	0.481	-0.335	0.106	-0.282	0.067	-0.048	0.748

Table 2. Percentage Contribution of the Principal Components for the Growth Rates of PCARDBs.

Sl. No.	Principal components	Latent roots	Percentage variance	Cumulative variance
1.	Component 1	3.058	43.68	43.68
2.	Component 2	1.593	22.75	66.43
3.	Component 3	1.193	17.05	83.48
4.	Component 4	0.628	8.97	92.45
5.	Component 5	0.317	4.52	96.97
6.	Component 6	0.124	1.77	98.74
7.	Component 7	0.088	1.26	100.00

the *a priori* groups for discriminant analysis. The results indicated that the districts of Hassan, Dakshina Kannada, Chickmagalur, Uttara Kannada, Tumkur, Belgaum, Bijapur and Kodagu can be classified as high performing districts with relatively higher scores, whereas the low performing districts were Mysore, Bidar, Gulbarga, Bangalore and Mandya. The remaining districts, which constituted the grey area in performance, do not come into either of these two groups and were classified under medium performance districts (Table 3).

Table 3: Ranking of Districts Based on Performance of PCARDBs in Karnataka

Sl. No.	Districts	Principal component scores	Ranking of performance
1.	Hassan	18.39	
2.	Dakshina Kannada	18.08	
3.	Chickmagalur	17.40	
4.	Uttara Kannada	16.37	
5.	Tumkur	16.20	High
6.	Belgaum	15.41	
7.	Bijapur	14.11	
8.	Kodagu	14.05	
9.	Kolar	11.88	
10.	Bellary	11.52	
11.	Dharwad	11.45	
12.	Shimoga	11.24	Medium
13.	Chitradurga	10.62	
14.	Raichur	10.34	
15.	Mandya	9.76	
16.	Bangalore	9.66	
17.	Gulbarga	8.60	Low
18.	Bidar	7.17	
19.	Mysore	6.32	

Discriminant function analysis was carried out using variables which constituted different dimensions of the performance. A perusal of Table 4 reveals that relatively high performance districts were characterised by higher mean values (average of 15.63) with respect to all indicators except for loans advanced when compared with the low performing districts (average of 7.41). The mean differences in growth rates between high and low performance districts were tested for their significance by applying 't' test. The results indicated that the variables such as share capital, deposits, loans recovered and loans overdue were significant at 5 per cent level of significance. The other variables such as membership, working capital and loans advanced were non-significant. The co-efficients of the discriminant function were negative for the variables such as membership (-0.426) and share capital (-0.150), whereas the remaining variables had positive co-efficients. The analysis was extended

Table 4: Discriminant Function for Districts with High and Low Performing PCARDBs

Sl. No.	Variables	Mean of high performance districts (G)	Mean of low performance districts (B)	Mean difference (C)	Co-efficient of discriminant function (D)	Distance (B-B) x D	Percentage contribution to total
1.	Membership	5.082	4.942	0.14 NS	-0.426	-0.0596	-0.73
2.	Share capital	11.126	5.282	5.844*	-0.150	-0.8766	-10.69
3.	Working capital	11.746	6.906	4.84NS	0.842	4.0752	49.70
4.	Deposits	20.706	7.694	13.012*	0.207	2.6935	32.85
5.	Loans advanced	13.589	17.642	-4.053NS	0.020	-0.0810	-0.99
6.	Loans recovered	11.184	6.432	4.752*	0.058	0.2756	3.36
7.	Loans overdue	21.60	10.79	10.81*	0.201	2.1728	26.50
						8.1998	

* Significant at 5 per cent level
NS Non-significant

to examine which of the variables contributed most to the divergence in performance. The contribution to the distance between the two groups was high with respect to working capital (49.70 per cent), deposits (32.85 per cent) and loans overdue (26.50 per cent). On the other hand, the variables such as share capital and membership reduced the distance between the two groups as indicated by the negative values (Table 4). A high Chi-square (X^2) value (17.81) indicated that the two groups were distinct. The adequacy of the discriminant function was evident from the percentage of misclassification being zero. This confirmed that discriminant function is able to clearly classify individual districts into high and low performing groups.

Fund endowment in terms of working capital and deposits was high in the districts which recorded good performance. It is intriguing that high overdues were a significant performance indicator of high performing districts. This is perhaps due to the fact that overdues have become a part and parcel of PCARDBs loans. Since overdues are linearly associated with other performance indicators, though undesirable from the stand point of performance, they have emerged as a significant factor. Since the contribution of each variable is not looked at in isolation in multivariate

analysis such as discriminant function analysis, such results are inevitable. Thus, the districts which recorded high performance should check the overdues by increasing the recoveries. Despite the fact that PCARDBs are not deposit oriented, yet deposits have a major role in ensuring good performance and hence deposit mobilization should be included within the purview of banks' operation by providing reasonable incentives to attract deposits. This would help the PCARDBs to mobilize more funds thereby enabling them to advance more money resulting in better business performance.

Conclusions

The analysis indicated that working capital, amount of deposits and loans overdue emerged as major indicators in distinguishing the PCARDBs into low and high performance groups. The mounting overdues are not desirable for any bank. Though the PCARDBs are not deposit-oriented, yet deposits are playing a major role in achieving good performance and hence mobilization should be included within the purview of the bank's operation. The variables such as amount of share capital and membership reduced the gap between the groups of banks.

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Appendix I: District-wise Compound Growth Rates (CGR) for Selected Indicators of PCARDBs in Karnataka (1976-77 to 1990-91)

Sl. No.	Districts	Compound growth rate						
		Membership	Share capital	Working capital	Deposits	Loans advanced	Loans recovered	Loans overdue
1.	Bangalore	5.16**	6.79**	8.09**	10.44*	9.21**	6.37*	12.36**
2.	Chitradurga	4.14**	9.64**	9.20**	15.44**	19.18**	4.67 NS	8.75**
3.	Kolar	4.90**	6.29**	10.90**	19.20**	7.17**	5.64NS	14.01**
4.	Shimoga	2.69**	8.11**	8.31**	9.43*	17.36**	11.34**	13.03**
5.	Tumkur	4.62**	7.39**	9.39**	36.57**	11.30**	10.51**	16.14**
6.	Belgaum	4.65**	10.22**	10.18**	24.65**	15.14**	12.21**	14.73**
7.	Bijapur	5.18**	9.44**	11.45**	24.29**	19.77**	7.09**	13.50**
8.	Dharwad	5.74**	10.23**	10.49**	4.41NS	15.59**	9.34**	14.87**
9.	Uttara Kannada	7.40**	13.11**	14.37**	7.88**	14.20**	12.59**	25.17**
10.	Chickmagalur	4.33**	12.12**	11.95**	18.83**	17.14**	14.42**	23.84**
11.	Kodagu	3.87**	10.15**	9.41**	17.17**	4.65NS	6.10*	26.64**
12.	Hassan	5.31**	12.53**	13.91**	21.86**	14.37**	11.71**	26.89**
13.	Mandya	4.97**	7.04**	5.30**	10.06*	4.50*	4.57NS	21.90**
14.	Dakshina Kannada	5.30**	14.05**	13.31**	14.40**	12.11**	14.84**	26.66**
15.	Mysore	4.82**	1.20NS	3.70**	6.99*	10.33*	4.63NS	15.19**
16.	Bellary	3.95**	3.61**	10.33**	18.12**	25.71**	12.08**	6.81*
17.	Bidar	4.27**	4.83**	6.91**	19.24*	36.01**	3.07NS	-3.93NS
18.	Gulbarga	5.49**	6.55**	10.53**	-8.26NS	28.11**	13.52**	8.46*
19.	Raichur	3.28**	3.47**	10.67**	17.92**	40.44**	10.30*	1.11NS
	State	4.81**	7.78**	9.94**	14.11**	14.80**	9.57**	12.49**

** Significant at 1 per cent level

* Significant at 5 per cent level

NS Non-significant