Characteristics of Defaulters in Agricultural Credit Use: A Micro Level Analysis with reference to Kerala

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INTRODUCTION

Credit has become an indispensable input to the practitioners of modern agriculture. In spite of better productivity and income compared to traditional agriculture, the higher cash outlays have substantially increased the demand for credit. Good credit, if well utilised, could play a vital role in the growth of farms and its role as a powerful instrument for softening the rigid production-inhibiting stratification of class structure in the agricultural economy depends on its fruitful utilisation. On the supply side, the complementary role of commercial banks to that of co-operatives was instrumental in building up a comprehensive institutional support to agriculture through various priority sector lending programmes. A major share of the priority sector lending is disbursed as short-term production oriented credit, the crop loans. The viability of intended programme rather than the creditworthiness of the person is the basic criterion of finance and its disbursement should coincide with the beginning of the crop season and recovery immediately after harvest. The credit supplied is capable of raising the production and productivity only if it satisfies the credit requirement of the farmer. The availability and utilisation of credit in time and in adequate quantity tends to become a pre-requisite for sustained agricultural growth. At the same time, the prompt repayment of the credit is of crucial importance for recovery as well as to instill confidence among the depositors. Mounting overdues have adverse effects on both the institutions and farmers, and very often lead to the collapse of the institution. Recovery performance, as a measure of operational efficiency and managerial competence of financial institutions, can have a creative influence on the public.

At the present context, the conception of the proper function of credit requires reorientation. From the institution's point of view it is essential to understand the factors responsible for default in repayment of loan so that necessary measures can be taken to reduce the extent, if not avoiding it, of overdues. The literature on this area mainly focuses on identification of the characteristics of delinquency in repayment of credit. Pandey and Muraleedharan (1977), Pradhan and Sharma (1981), Chand and Sidhu (1985), Kalyankar and Rajmane (1987) and Chengappa (1990) had identified the factors such as percentage of income from sources other than crop production income, percentage of loan utilised for crop production, per capita consumption expenditure, size of holding, efficiency of loaning, ratio of dependents in a family and proportion of cash crops, that discriminate between defaulters and non-defaulters by employing linear discriminant function analysis. Naidu *et al.* (1986) make use of Bayer's theorem to identify the discriminators between defaulters and non-defaulters. In this backgdrop, this study attempts to identify the characteristics responsible for default with particular reference to crop loans specific to paddy (*punja* season), the principal food crop of Kerala.

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DATA AND METHODOLOGY

The study region pertains to Alappuzha district, which forms a part of Kuttanad region, the rice bowl of Kerala. The basic objective of the study was to identify the factors that discriminate the potential creditors into defaulters and non-defaulters. For this, a two-stage random sampling method was employed for sample selection with branches of the lead bank as primary units and borrowers as secondary units. State Bank of Travancore (SBT) is the lead bank of the district. From the list of branches (out of 53 branches in Alappuzha), with more than 60 crop loan accounts for paddy for *punja* season 1992-93 were classified and out of them, two branches, viz., Edathua and Kainakary were selected at random. From the list of borrowers for paddy cultivation (*punja*) of these branches, 60 borrowers from each branch were selected at random. The borrowers were grouped into two, viz., non-defaulters and defaulters. The non-defaulters are those who repaid the loan within the due date and the defaulters are those who did not repay the loan within the due date. Accordingly, out of the 120 borrowers, 55 were defaulters and 65 were non-defaulters. Among the total sample selected, 32 non-defaulters and 28 defaulters were from Edathua branch and the rest 33 non-defaulters and 27 defaulters from Kainakary branch. The data for the study were collected from the sample through primary survey. The information on the costs and returns of paddy cultivation, credit requirement, availability and repayment of the loan taken for paddy cultivation were gathered. Paid-out cost of cultivation was taken as the base for estimating the credit requirement, as the short-term production credit is self-liquidating type which is to be recovered from gross returns from the crop (Ramesha, 1990). Credit availability is the amount of credit disbursed by the bank based on the scale of finance fixed for paddy and the credit gap refers to that part of credit requirement which is not met by the bank's scale of finance.

The linear discriminant function analysis (Tintner, 1952) was the tool employed to identify the variables that are important in discriminating between non-defaulters and defaulters and to classiy borrowers accordingly on the basis of the differences in the selected characteristics. In multivariate analysis, linear discriminant function which is better than any other linear function, will discriminate between any two chosen classes (Rao, 1952). The concept underlying the discriminant function analysis is that linear combinations of the independent variables are formed and serve as the basis for classification. Thus information contained in multiple independent variables is summarised in a single index. Two groups of roughly equal size are required for the application of the linear discriminant function.

The discriminant function employed was of the following form:

$$Z = \sum_{i=1}^{n} I_i X_i$$

where
Z = Total discriminant score for defaulters and non-defaulters.
X_1 = Educational level : upto SSLC = 0, above SSLC = 1,
X_2 = Type of farmer : upto 1 ha = 0, above 1 ha = 1,
X_3 = Main occupation of borrower : non-agriculture = 0, agriculture = 1,
X_4 = Variety used : non-HYV = 0, HYV = 1,
X_5 = Operating area (ha),
X_6 = Percentage of crop production income to total agricultural income,
X_7 = Percentage of crop production income to total income of the farmer.

X_8 = Consumption expenditure (Rs.),

X_9 = Fertiliser consumption : below recommended level = 0, above recommended level = 1,

X_{10} = Time of sowing : late sowing = 0, early sowing = 1,

X_{11} = Incidence of pests/diseases : severe attack = 0, normal attack = 1,

X_{12} = Natural calamities : occurrence = 0, normal condition = 1,

X_{13} = Disbursement of loan : untimely = 0, timely = 1,

X_{14} = Input-output ratio : upto one = 0, above one = 1,

X_{15} = Marketed surplus : absence = 0, presence = 1, and

X_{16} = Credit gap.

l_i's are the coefficients of the variables estimated from the data.

Using the mean values and mean differences of the variables between the two groups of borrowers, coefficients were determined. The discriminant function was tested for significance to know whether the variables taken together were sufficiently discriminating the two groups. Mahalanobis D^2 statistic was used to measure the discriminating distance between the two groups.

$$D_{ab}^2 = (n-g) \sum_{i=1}^{P} \sum_{j=1}^{P} W_{ij}^* (\overline{X}_{ia} - \overline{X}_{ib})(\overline{X}_{ja} - \overline{X}_{jb})$$

where n is the total number of cases, g is the number of groups, p is the number of variables X_{ia} is the mean of i-th variable in group 'a' and w_{ij} is an element from the inverse of the within-groups covariance matrix, obtained by averaging the separate covarience matrices for the groups and then computing the correlation matrix. Group 'a' denotes non-defaulter and group 'b' denotes defaulter. The significance of D^2 was tested by

$$\frac{(n-1-p)(n_1 n_2)}{p(n-2)(n)} D^2 \sim F_\alpha, (P, n-p-1)$$

where n_1 and n_2 are the number of non-defaulters and defaulters and $n = n_1 + n_2$.

The non-significant variables were dropped by step-wise selection of variables and the discriminant function was re-run only with significant variables to get the desired equations. To predict whether any borrower is likely to be a defaulter or non-defaulter on the basis of the significant variables, the mean value of Z score was worked out for non-defaulter(Z_1) and defaulter (Z_2) and the critical mean discriminant score was calculated as $Z = (Z_1+Z_2)/2$.

RESULTS AND DISCUSSION

Among the selected variables, operating area, percentage of crop production income to total agricultural income, percentage of crop production income to total income of the farmer, consumption expenditure and credit gap, which are on ratio scale, their average values were taken to explain their influence in discrimination. The selected socio-economic characteristics of the borrowers are shown in Table 1 along with the means and F-value for the two groups viz., defaulters and non-defaulters (using the computer program SPSS/PC+). The discriminant function based on these characteristics fitted to the data for defaulters and non-defaulters was of the following form:

$$Z = \quad 0.0970\,X_1 \quad - 0.0106\,X_2 \quad - 0.2048\,X_3 \quad + 0.0457\,X_4 \quad + 0.2539\,X_5 \quad - 0.5092\,X_6$$
$$- 0.3132\,X_7 \quad - 0.1943\,X_8 \quad + 0.0829\,X_9 \quad - 0.3728\,X_{10} \quad + 0.1358\,X_{11} \quad + 0.2668\,X_{12}$$
$$- 0.1895\,X_{13} \quad - 0.0415\,X_{14} \quad + 0.9054\,X_{15} \quad + 0.3048\,X_{16}$$

TABLE 1. GROUP MEAN OF SELECTED VARIABLES FOR NON-DEFAULTERS AND DEFAULTERS

Variable (1)	Non-defaulter $(n_a=65)$ (2)	Defaulter $(n_b=55)$ (3)	F-ratio (4)
Educational level (X_1)	0.37	0.42	0.29
Type of farmer (X_2)	1.00	0.98	-0.22
Main occupation (X_3)	0.65	0.60	0.27
Variety (X_4)	0.77	0.71	0.56
Operating area (X_5)	1.29	1.23	0.36
Percentage of crop production income to total agriculture income (X_6)	36.12	36.24	-0.01
Percentage of crop production income to total income (X_7)	23.41	22.84	0.22
Consumption expenditure (X_8)	20,363.38	21,310.18	1.38
Fertiliser consumption (X_9)	0.95	0.94	-0.43
Time of sowing (X_{10})	0.40	0.58	4.01*
Incidence of pest/disease (X_{11})	0.94	0.95	-0.26
Natural calamities (X_{12})	0.95	0.89	1.69
Disbursement of loan (X_{13})	0.58	0.64	0.33
Input-output ratio (X_{14})	0.98	0.96	0.53
Marketed surplus (X_{15})	0.97	0.69	19.90**
Credit gap (X_{16})	8,611.38	8,645.08	-0.14*

* and ** Significant at 5 and 1 per cent level respectively.

Since the interdependence among the variables affects the multivariate analysis, the correlation matrix of the independent variables was examined. To eliminate the interdependence among the variables, the step-wise selection was done using forward selection and backward elimination procedure (Norusis, 1988). In the step-wise method, the first variable to be included in the analysis has the largest acceptable value for the selection criteria. Mahalanobis distance D^2 was the criterion for variable selection. Mahalanobis distance between the groups were calculated and the variable that has the largest D^2 for the two groups was selected for inclusion. After the first variable was selected, the value of the criterion was re-evaluated for all variables not in the model, variable with largest acceptable criterion value was entered next. Variable selection terminated when no more variables meet entry criteria. At each step the variable chosen for inclusion was one with the largest F-value. The results of step-wise selection revealed that the variables such as X_{15} (marketed surplus), X_{10} (time of sowing) and X_{16} (credit gap) are to be included in respective order.

Marketed surplus is that quantity of produce which the producer farmer actually sells in the market irrespective of his reequirement for family consumption, farm needs and other payments. As all the selected farmers possess the repayment capacity,[2] none of the borrowers had a genuine reason for default. The time of sowing has considerable bearing on the productivity of the crop. If the sowing is completed a little early, there is a greater probability to fetch a high price. Late sowing results in poor harvest and at the same time during the peak season, generally the price crashes due to glut in the market.

Credit gap for a borrower is the absolute difference between the credit availability and the credit requirement. Credit requirement was estimated based on 75 per cent of the paid-out cost of cultivation, as it was reasonable to expect the borrower himself to contribute a part of the proposed outlay from his own resources in the form of margin money. Paid expenditures, viz., expenses on activities such as land preparation, bunding, sowing, weed control.

water management, fertilising, spraying, harvesting, winnowing, drying and tansporting as labour cost, and cost of seed, fertilisers, plant protection chemicals, miscellaneous inputs and interest on borrowing as material cost were taken into consideration while calculating the cost of cultivation. The credit availability to a farmer for raising a crop is in accordance with the scale of finance fixed by the bank. Sixty-five per cent of the crop loan for paddy (*punja*) in Alappuzha district (Rs.3,250/ha) was disbursed as cash component (A) to meet the working capital expenditure and the remaining 35 per cent (Rs.1,750/ha) as kind component (B) for meeting the cost of seed, fertiliser and plant protection chemicals. Generally for disbursement of kind component, the financing agency has to make necessary arrangements for the supply of fertilisers and plant protection chemicals. Practically the distribution of kind component took place untimely and most of the farmers were reluctant to take kind component from the financing agency. As a solution to this problem, the financial institutions are now distributing the kind portion also in cash after submitting the bill or voucher for the kind portion of the loan. By insisting 25 per cent of the margin money, the bank could meet 52.47 per cent of the credit requirements of the farmers (Table 2). Actually all the farmers had incurred labour cost and material cost over and above the cash and kind component of the loan. The credit gap was to the extent of 47.53 per cent for an average farmer. Thus only three among the socio-economic characteristics, viz., marketed surplus (X_{15}), time of sowing (X_{10}) and credit gap (X_{16}) were the significant discriminators between non-defaulters and defaulters. Other characteristics did not have any significant influence on discriminating between the two groups.

TABLE 2. CREDIT REQUIREMENT, AVAILABILITY AND GAP IN PADDY (*PUNJA*) CULTIVATION

Items (1)	Amount (Rs./ha) (2)
Credit requirement	9,528.55 (100.00)
Credit availability	5,000.00 (52.47)
Cash 3,250 Kind 1,750	
Credit gap	4,528.55 (47.53)

Figures in parentheses indicate percentages to the total.

When the three significant variables were included, the relevant discriminant function was of the form:

$$Z = -0.9023\, X_{10} + 2.8184\, X_{15} - 0.0018\, X_{16}.$$

D^2 and variance ratio were worked out as 0.8883 and 8.6714 respectively. The tabulated $F_{3,\,116}$ (8.67) was significant at one per cent level of significance, showing that the three characteristics considered together were useful in discriminating the borrowers into defaulters and non-defaulters. Thus the difference between the two groups was mostly oriented towards marketed surplus (X_{15}), time of sowing (X_{10}) and credit gap (X_{16}). The discriminating variables obtained are quite contrary to the variables obtained by Pandey and Muraleedharan (1977), Pradhan and Sharma (1981), Chand and Sidhu (1985) and Mehta and Prasher (1987).

The magnitude of the coefficients is an indication of the relative importance. Variables

with large coefficients are thought to contribute more to the overall discriminant function. The sign of l_i's in the Z equation as shown in Table 3 suggested that higher level of marketed surplus, lower credit gap and comparatively less chances of the late sowing which is indcated by the lower value of time of sowing, contributed towards high values of Z, thus placing the borrower in the non-defaulter group. The Z score for non-defaulters (0.4320) was higher compared to defaulters (-0.5105). On the other hand, the borrowers with large credit gap along with lower level of marketed surplus and with comparatively high chances for late sowing contributed towards default.

TABLE 3. RELATIVE IMPORTANCE OF THE SIGNIFICANT VARIABLES
FOR NON-DEFAULTERS AND DEFAULTERS

Significant variable	Mean value		Mean of mean value for both groups	Coefficients (per cent)
	Non-defaulter	Defaulter·		
(1)	(2)	(3)	(4)	(5)
Time of sowing (X_{10})	0.4000	0.5818	0.4909	-0.9023
Marketed surplus (X_{15})	0.9692	0.6909	0.8301	2.8184
Credit gap (X_{16})	8,611.3808	8,645.0819	8,628.2310	-0.0018

In order to know the relative importance of the characteristics in their power to discriminate between the two groups of borrowers, the percentage of total distance measured was calculated. The percentage contribution of each selected variable to the total distance measured was shown in Table 4. The marketed surplus was found to be the major characteristic which discriminated one group from the other, followed by time of sowing and credit gap. The contribution of these variables to the total distance measured was 77.78, 16.27 and 5.95 per cent respectively. The D^2 value in the case of each of the relevant variables was found to be significant at 1 per cent level.

TABLE 4. PERCENTAGE CONTRIBUTION OF SIGNIFICANT VARIABLES TO THE TOTAL DISTANCE

Significant variable	Mean (d_i)	Coefficients (l_i)	Contribution of each variable ($l_i d_i$)	Percentage contribution	D^2
(1)	(2)	(3)	(4)	(5)	(6)
Time of sowing (X_{10})	-0.1818	-0.9023	0.1641	16.27	0.6680*
Marketed surplus (X_{15})	0.2783	2.8184	0.7844	77.78	0.8244*
Credit gap (X_{16})	-33.7011	-0.0018	0.0607	5.95	0.8833*
			1.0092	100.00	

* Significant at 1 per cent level.

The discriminant function can be used to predict whether any borrower is likely to be a defaulter or non-defaulter on the basis of the information on the above three selected characteristics. The mean discriminant scores for the non-defaulters and defaulters were found to be 0.4320 and -0.5105 respectively. The critical mean discriminant scores for the two groups was found to be -0.03925. So if the discriminant score for a borrower on the significant variable is found to be more than -0.03925, he can be predicted to be a non-defaulter, otherwise he is likely to be a defaulter. Thus high values of Z correspond to

non-defaulter and low values to defaulter.

The percentage of cases classified correctly is an indicator of the effectiveness of the discriminant function. While evaluating this measure, it is important to compare the observed misclassification rate to that by chance. Among the non-defaulters, 86 per cent were predicted correctly while 14 per cent were assigned incorrectly to that group. But among the defaulters, 40 per cent were identified correctly whereas 60 per cent were mis-classified (Table 5). Here 65 per cent of the respondents were correctly assigned to their groups by the discriminant function.

TABLE 5. CLASSIFICATION RESULTS (CONFUSION MATRIX)

Actual group	Number of cases	Predicted group membership	
		Defaulters	Non-defaulters
(1)	(2)	(3)	(4)
Defaulters	55	22 (40%)	33 (60%)
Non-defaulters	65	9 (14%)	56 (86%)
Grouped cases correctly classified = 65%			

CONCLUSION

Marketed surplus, time of sowing and credit gap were the major characteristics which discriminated the borrowers of crop loan for paddy into defaulters and non-defaulters. The discriminating variables as identified in the present study need to be brought under scrutiny for further justification. In this context, it is important to know (a) whether the marketed surplus is the real surplus after meeting own consumption; (b) the factors responsible for late sowing, such as labour non-availability for de-watering, ploughing, etc.; and (c) timing of credit disbursement. With the improvement in farming technology, the owned resources of the farmers may not be sufficient to meet the total financial needs of farming operations and the credit available was inadequate to meet the requirement. One reason responsible for this situation is the unrealistic estimation of the financial needs and its resultant impact on the scale of finance. To overcome this problem, the scale of finance is to be fixed separately for service area of each bank, rather than for the district as a whole, taking into consideration the area-specific variations. From institutional policy angle, general formulation regarding scale of finance and credit eligibility may have to be kept as broad criteria, but within this, credit supply should be elastic enough to satisfy the different demands arising from input requirements based on the soil-water-crop complex of individual holdings. Efforts should be taken by the financing institution to facilitate credit-linked marketing.

From the credit institution's point of view, it should be feasible to incorporate the probable cost items to be covered under cash and kind component within the application itself, so that the agriculture officer of the bank can easily assess the credit requirement per hectare of the crop that may vary within the region, depending on the topography and soil-water conditions. This may help to reduce the extent of default. The discriminant function would be a useful technique to the financial institutions to assess the degree of risk involved in

priority sector lending. For a policy maker, however, this function will help to identify the factors which reduce the creditworthiness of individuals and therefore, need to be suitably altered to ensure a larger flow of credit to individuals in accordance with their requirements.

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NOTES

1. The scale of finance for a crop for a season for a locality is fixed by a committee consisting of a compact group of knowledgeable persons. The committee fixes the scale of finance taking into consideration the geographical conditions, input recommendations given by the agriculture department and the prevailing market rates of inputs. This is fixed with reference to an average cultivator in that area (RBI Manual).

2. Repayment capacity worked out clearly implies that all the selected borrowers possess the capacity to repay the loan. As this is the case, it is not necessary to take marketable surplus, i.e., the absolute quantity that actually enters the market after meeting the home consumption, farm needs and other payments. In this context, marketed surplus itself is a sufficient discriminator.

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