

Analysis of Loan Repayment Among Small Scale Farmers in South Western Nigeria- A Discriminant Approach

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ABSTRACT The study examined loan repayment among small scale farmers in South Western Nigeria. It specifically identified the socio-economic characteristics that discriminate between loan defaulters and non defaulters. A multi stage sampling technique was used to select the respondents and structured questionnaire administered on them. A linear discriminant function considering the socio-economic characteristics postulated for the loan defaulters and non defaulters showed that six variables i.e age of farmers, gross farm income non farm income, net farm income, interest rate charged and farming experience were significant in discriminating between defaulters and non defaulters. The mean value (Z_c) for non defaulters was 0.26276458 while the mean value (Z_c) for defaulters was 0.35384001. The critical mean value (Z) for both groups was 0.3083029 and has the same variability for the two groups. This means that if the value for any farmer is higher than Z (i.e 0.3083029), that farmer probably belong to the group of defaulters. On the other hand, if the Z value is lower than Z (i.e 0.3083029) such a farmer probably belongs to the group of non-defaulters.

INTRODUCTION

Agricultural credit is very important for sustainable agricultural development to be achieved in any country of the world. Imoudu and Onaksapnomo (1992) contended that agricultural loan is a crucial input in smallholder agriculture because it enables small scale farmers to establish and expand their farms as this would increase their income and ability to repay loan. Afolabi and Fagbenro (1998) found that informal sources of credit is more popular among the small scale farmers which may be due to the relative ease of obtaining credit devoid of administrative delays, non insistence on security or collateral and flexibility built into repayment programme. Afolabi (2004) in his study found that 4.17% of the small scale farmers in Oyo state patronized moneylenders while 33.33% of them relied on loans from friends and relations for their farming activities. About 59.38% and 72.92% of these respondents obtained their loans from cooperatives and Esusu respectively. Only 45.83% of them got their loans from community banks. His findings also pointed out that most of the respondents patronized more than one source for their credit needs. The study also showed that despite their small farm size, their loan repayment performance was high particularly to the money lenders. The high interest rate charged by the money lenders may be responsible for this because these farmers are always in fear of losing

their pledged farmland in case of default. According to Afolabi (2002) institutionalized sources of credit are not willing to extend loan to small scale farmers which may be due to low level of loan repayment among the small scale farmers as a result of small size holdings and hence gross income. He said that gross income, net farm income and non farm income had positive correlation with loan repayment.

Balogun and Alimi (1988) identified the major causes of loan default as loan shortages, delay in time of loan delivery, small farm size, high interest rate, age of farmers, poor supervision, non-profitability of farm enterprises and undue government intervention with the operations of government sponsored credit programmes. Akinwumi and Ajayi (1990) found out that farm size, family size, scale of operation, family living expenses and exposure to sound management techniques were some of the factors that can influence the repayment capacity of farmers. According to Olomola (1999), loan disbursement lag and high interest rate can significantly increase borrowing transaction cost and can also adversely affect repayment performance.

In view of the fact that high level of loan delinquency has a crippling effect on the lending institution's credit ratings, this study therefore examines the socio-economic factors that can discriminate between loan defaulters and non defaulters.

ANALYTICAL FRAMEWORK

Over the years, the estimation of the linear discriminant function has received much theoretical attention, both in the marketing literature (Dillon, 1979; Crask and Perreault, 1977; Frank, Massey and Morrison 1965) and in mathematical statistics (Randles et al., 1978; Kraznowski, 1975).

The technique of discriminant analysis has been widely used in literature. Fisher (1936), Singh and Pandey (1981) among others have applied the technique to the analysis of various socio-economic problems. Also, Olayemi and Olayide (1977) used this technique to study expenditure patterns in selected areas of Western Nigeria.

RESEARCH METHODOLOGY

Study Area: This study was carried out in Oyo State, Nigeria. The state is one of the 36 states in Nigeria and located in South Western part of the country. The study area lies between latitude 7° and 9.3° N and longitude 2° and 4° E and characterized by two climatic seasons. These are dry season between November and March and the rainy season between April and October. This favourable condition made the state to be agrarian suited for the production of permanent crops such as Kolanut, cocoa and oil palm as well as arable crops like yam, cocoyam, cassava etc. Farmers in the state are predominantly small scale that still depends on traditional method of farming. Apart from farming, the inhabitants also engaged in other occupations like trading, manufacturing and commerce.

Source of Data: The primary data used for this study were collected from a cross section of small scale farmers that borrowed for farming activities during 2002/2003 year for farming activities and structured questionnaire administered on them. Information obtained include age of respondents in years, farm size measured in hectares, family size, gross farm income in naira value (₦), gross farm expenses (₦), non farm expenses (₦), Net Farm income (₦), Interest rate charged (in percentage), amount granted (₦) and farming experience (yrs).

Sampling Technique: A multi – stage sampling technique was used to select the respondents. The first stage was a purposive sampling of five local government areas because of the predominance of small scale farmers in the study area. The selected local government areas were Akinyele,

Ibarapa East, Ona-Ara, Oluyole and Ogo Oluwa Local Government area. The list of farmers that borrowed for farming activities during the 2002 and 2003 was compiled with the help of the extension agents and officials of Oyo State Agricultural Credit Corporation operating in the area that revealed the defaulters and non defaulters. One hundred and eighty copies of structured questionnaire were administered on random basis on the loan defaulters but one hundred and fifty-six copies were retrieved for analysis. On the other hand, one hundred and eighty copies of questionnaire were also administered on random basis on non-defaulters but one hundred and thirty copies were used for analysis due to inconsistencies observed in the remaining copies.

Analytical Technique: The Linear discriminant function was used as an analytical technique in this study. The Linear discriminant function (Z) of the following form was used to discriminate the socio-economic characteristics of loan defaulters and non-defaulters.

$$Z = \sum_{k=1}^{11} I_k X_k \dots\dots\dots \text{equation(1)}$$

Where

Z = Total discriminant score for loan defaulters and non-defaulters.

X_1 = Age of farmers (yrs)

X_2 = Farm size (ha)

X_3 = Family size

X_4 = Gross farm income (₦)

X_5 = Gross farm expenses (₦)

X_6 = Non farm income (₦)

X_7 = Non farm expenses (₦)

X_8 = Net farm income (₦)

X_9 = Interest rate charged

X_{10} = Amount granted (₦)

X_{11} = Farming experience

I_K (K = 1, 211) are coefficient of linear function.

The method seeks to obtain coefficient (I_k 's) such that the squared difference between mean Z – score for one group and the mean Z score for the other group is as large as possible in relation to the variation of the Z – scores within the group (Pandey and Muralidharan 1977).

$$SL = D \dots\dots\dots \text{equation (2)}$$

$$S = \begin{bmatrix} S_{11} & S_{12} & \dots & S_{1k} \\ S_{21} & S_{22} & & S_{2k} \\ \vdots & \vdots & \ddots & \vdots \\ S_{k1} & S_{k2} & & S_{kk} \end{bmatrix} L = \begin{bmatrix} I_1 \\ I_2 \\ \vdots \\ I_k \end{bmatrix} \text{ and } D = \begin{bmatrix} d_1 \\ d_2 \\ \vdots \\ d_k \end{bmatrix}$$

Where K = 11

The calculation of discriminant function involves the solution of the above eleven

equations shown in the matrix notation (Brandow and Potter, 1953 as reported by Singh and Pandey, 1981) $L_{k \times 1}$ is the vector of the coefficients of discriminant function, ' $S_{k \times k}$ ' is the pooled dispersion matrix and differences between the means of the two groups.

The variance covariance matrix of non defaulters and defaulters can be calculated as follows

$$S_{11} = \frac{1}{N_a + N_b - 2} \left[\frac{\sum X_1^2 - (\sum X_1)^2}{N_a} + \frac{\sum X_1^2 - (\sum X_1)^2}{N_b} \right] \dots \dots \dots \text{equation (3)}$$

$$S_{12} = \frac{1}{N_a + N_b - 2} \left[\frac{\sum X_1 X_2 - (\sum X_1)(\sum X_2)}{N_a} + \frac{\sum X_1 X_2 - (\sum X_1)(\sum X_2)}{N_b} \right] \dots \text{equation (4)}$$

Where

N_a = Number of non-defaulters

N_b = Number of defaulters.

RESULTS AND DISCUSSION

The discriminant function considering the socio-economic characteristics postulated in equation (1) was fitted to the data of loan defaulters and non-defaulters i.e

$$Z = -0.107 X_1 + 0.010 X_2 + 0.621 X_3 + 0.163 X_4 + 0.083 X_5 + 0.013 X_6 + 0.398 X_7 + 0.097 X_8 - 0.631 X_9 + 0.128 X_{10} - 0.101 X_{11} \dots \dots \dots \text{equation (5)}$$

$$D^2 = 0.82917$$

$$F_c = 186.601$$

The F tabulated ($F_{11, 194}$) at one percent level is 2.32 i.e it is less than F_{cal} , the discriminant function is therefore highly significant. This indicates that all the eleven variables in the model were useful in classifying the sampled farmers into loan defaulters and non-defaulters. To indicate the relative importance of the characteristics in their power to discriminate between the two groups, the percentage contribution to the total distance measured was calculated (see Table 1) as age of farmers (-7.74), farm size (0.29), family size (62.91), gross farm income (-6.29), gross farm expenses (-2.80), non farm income (1.44), non-farm expenses (27.84), Net farm income (-8.19), interest rate charged (38.81), amount granted (0.31) and farming experience (-6.58).

The result showed that gross farm income and net farm income had negative relationship with level of loan repayment which is contrary to the findings of Afolabi (2002). This may be due to

diversion or unwillingness to repay loans by these respondents. Analysis also revealed that farm size had positive relationship with level of loan repayment which is in agreement the findings of Imoudu and Onoksaopome (1992) and Akinwumi and Ajayi (1990). The result showed that age of farmers and farming experience had negative effect on loan repayment. This may be due to the fact that the older the farmer the less innovative he becomes and hence ability to manage the loan successfully. This result is in agreement with Balogun and Alimi (1988) in their study in which they identified age of farmers as one of the major causes of loan default. According to Olomola (1999) high interest rate can have a negative effect on loan repayment performance but a positive relationship is obtained in this study which is in agreement the findings of Afolabi (2004). Family size had positive relationship with loan repayment in this study which may be due to extensive utilization of family labour by these respondents. This study agreed with Akinwumi and Ajayi (1990) in their study in which they also identified family size as one of the factors that can influence the repayment capacity of farmers. Analysis also revealed that amount granted, non farm income and non farm expenses had positive relationship with level of repayment.

The stepwise test of mean differences among the eleven socio-economic characteristics included in the model showed that six variables (i.e., age of farmers, gross farm income, non farm income, net farm income, interest rate charged and farming experience) were significant. Therefore, the discriminant function was re-run considering only these significant characteristics to see whether they can alone discriminate defaulters from non defaulters significantly (Table 2).

$$Z = -0.092 X_1 - 0.288 X_4 + 0.015 X_6 + 0.097 X_8 - 0.741 X_9 - 0.150 X_{11} \dots \dots \dots \text{equation (6)}$$

The equation (6) above revealed that the lower the age of farmers (X_1), gross farm income, (X_4) interest rate charged (X_9) and farming experience (X_{11}) would contribute to lower the value of Z. The D^2 and variance ratio were 0.27987 and 312.448 respectively. Since the tabulated $F_{6, 199}$ at one percent being 3.02, the discriminant function is highly significant. This indicated that the characteristics considered were very useful in classifying the farmers into loan defaulters and non-defaulters. In order to know the relative importance of the characteristics in their power to discriminate between the two groups, the

Table 1: Percentage contribution of individual characteristics to the total distance measured (Method: Forced entry)

Code	Variable	Coefficients (I_k)	Mean Difference (d_k)	Coefficient $\times$ Mean difference ($I_k d_k$)	Percentage
X ₁	Age of farmers	-0.107	*0.60(2.883)	0.06420	-7.74
X ₂	Farm size	0.010	*0.24(3.969)	0.00240	0.29
X ₃	Family size	0.621	*0.84(3.886)	0.52164	62.91
X ₄	Gross farm income	0.163	*-0.32(6.515)	0.05216	-6.29
X ₅	Gross farm expenses	0.083	*-0.28(3.646)	0.02324	-2.80
X ₆	Non-farm income	0.013	*0.92(5.120)	0.01196	1.44
X ₇	Non-farm expenses	0.398	*0.58(2.721)	0.23084	27.84
X ₈	Net farm income	0.097	*-0.70(6.136)	-0.06790	-8.19
X ₉	Interest rate charged	-0.631	*-0.51(2.296)	0.32181	38.81
X ₁₀	Amount granted	0.128	*0.02(1.550)	0.00256	0.31
X ₁₁	Farming experience	-0.101	*0.54(15.604)	-0.05454	-6.58
Total				0.82917	100

Figure in parenthesis are the calculated "t" values

* = Significant at 5 percent level of significance

Source: Computed from field data, 2004.

Table 2: Percentage contribution of individual characteristics to the total distance measured (Method: Stepwise)

Code	Variable	Coefficients (I_k)	Mean Difference (d_k)	Coefficient $\times$ Mean difference ($I_k d_k$)	Percentage
X ₁	Age of farmers	-0.092	*0.60(16.167)	-0.05532	-19.77
X ₄	Gross farm income	-0.288	*-0.32(7.648)	0.09216	32.93
X ₆	Non-farm income	0.015	*0.92(6.43)	0.01408	5.03
X ₈	Net farm income	0.097	-0.70(4.682)	-0.06790	-24.26
X ₉	Interest rate charged	-0.741	*-0.51(6.612)	0.37791	135.03
X ₁₁	Farming experience	-0.150	*0.54(19.981)	-0.08105	-28.96
Total				0.27987	100

Figure in parenthesis are the calculated "t" values

* = Significant at 5 percent level of significance

Source: Computed from field data, 2004

Table 3: Determination of Z – score for Group 1 (Non-Defaulters)

Code	Variable	Coefficients (a)	Mean (b)	Standard Deviation (c)	$d = b/c$	$e = (d \times a)$
X ₁	Age of farmers	0.00004860	50.90	9.93	5.125881	0.00024912
X ₂	Farm size	0.00003830	4.45	1.68	2.648810	0.00010145
X ₃	Family size	-0.58600000	7.21	4.07	1.771499	-1.03809828
X ₄	Gross farm income	0.00000123	175134.17	79191.58	2.211525	0.00000272
X ₅	Gross farm expenses	0.00000150	132470.44	65213.16	2.031345	0.00000304
X ₆	Non-farm income	0.00011310	4741.81	2151.77	2.203679	0.00024924
X ₇	Non-farm expenses	-0.00000782	33167.65	23991.27	1.382488	-0.00001081
X ₈	Net farm income	0.00000208	57538.00	100251.28	0.573938	-0.00000119
X ₉	Interest rate charged	0.45800000	20.10	5.57	3.608618	1.65274686
X ₁₀	Amount granted	0.00006141	18905.21	8120.90	2.327970	0.00014296
X ₁₁	Farming experience	-0.13300000	25.85	9.75	2.651282	-0.35262051

Z – score (Group 1) = sum of (d x a) = 0.26276458

Source: Computed from field data, 2004.

The mean value (Z_i) in Table 3 for non-defaulters was 0.26276458.

Table 4: Determination of Z – score for Group 2 (Defaulters)

Code	Variable	Coefficients (a)	Mean (b)	Standard Deviation (c)	d = b/c	e = (d x a)
X ₁	Age of farmers	0.00000829	54.47	8.87	6.140924	0.00005091
X ₂	Farm size	0.39000000	5.34	2.25	2.373333	0.92560000
X ₃	Family size	-0.38000000	11.13	4.50	2.473333	-0.93986667
X ₄	Gross farm income	0.00000225	259618.82	267661.14	0.969953	0.00000218
X ₅	Gross farm expenses	0.00000281	175611.70	100223.46	1.752202	0.00000492
X ₆	Non-farm income	0.00013400	7273.07	7090.05	1.025814	0.00013746
X ₇	Non-farm expenses	0.00000978	53784.56	35719.14	1.505763	0.00001473
X ₈	Net farm income	-0.00000049	82026.37	83941.08	0.977190	-0.00000047
X ₉	Interest rate charged	0.33400000	14.62	6.27	2.331738	0.77880064
X ₁₀	Amount granted	0.00007529	2076.11	14904.29	0.139296	0.00001049
X ₁₁	Farming experience	-0.14800000	27.82	10.02	2.776447	-0.41091417

Z – score (Group 2) = sum of (d x a) = 0.35384001

Z – score separating Group 1 and Group 2 = (Z₁ + Z₂) = 0.3083029

Source : Computed from field data, 2004.

The mean value (Z₂) in Table 4 for defaulters was 0.35284001.

percentage contribution to the total distance measured is calculated and shown in table 2.

The critical mean value (Z) for both groups was 0.3083029 and has the same variability for the two groups. This means that if the value for any farmer is higher than Z (i.e. 0.3083029), that farmer probably belongs to the group of defaulters. On the other hand, if the Z value is lower than Z (i.e. 0.3083029) such a farmer probably belongs to the group of non-defaulters.

Olayemi and Olayide (1977) in their study of expenditure among two groups of households i.e. lower expenditure group and middle expenditure group in the Oshogbo-Ife-Ilesha of Western Nigeria using discriminant function analysis. A discriminant function involving the linear combination of five important household expenditure items was derived. This discriminant function was found to be very useful in discriminating between the two groups. Of the five variables considered, changes in the percentage expenditure on clothing, given other percentage expenditures make the highest positive contribution to the value of the discriminant function (Z). Others in a decreasing order of importance are household goods and food. On the other hand, changes in percentage expenditure s on accommodation and transport contribute negatively to changes in the value of Z. The critical value Z for the two groups was found to be 0.019561 while the critical values for lower expenditure groups (Z₁) and middle expenditure group (Z₂) to be 0.023371 and 0.012923 respectively. The interpretation of this result is

that if Z value for any household is higher than Z (0.019561), that household probably belongs to the lower expenditure group. On the other hand, if the Z value is lower than Z (0.019561), the household probably belong to the middle expenditure group. Singh and Pandey (1981) carried out an analysis of small farmers and landless in India using discriminant function analysis. They used the linear discriminant function to identify those factors which would make the majority of the small farmers and landless in India a viable entity. Analysis of their data indicated that per hectare fertilizer use, area under high yielding crop varieties, operational size of holding and working capital are the factors which affect the viability of the small farmers and the landless.

SUMMARY AND RECOMMENDATION

The study examined loan repayment among small scale farmers in South Western Nigeria using discriminant function approach. The discriminant function considering eleven socio-economic characteristics postulated for loan defaulters and non defaulters showed that six variables i.e age of farmers, gross farm income, non farm income, net farm income, interest rate charged and farming experience were significant in discriminating between defaulters and non defaulters. The mean value (Z₁) for non defaulters was 0.26276458 while the mean value (Z₂) for defaulters was 0.35384001. The critical mean value Z for both groups was 0.3083029 and has the same variability for the two

groups. This indicates that if the value for any farmer is higher than Z (i.e 3083029) that farmer probably belong to the group of defaulters. On the other hand, if the Z value is lower than Z (i.e. 0.3083029) such a farmer probably belong to the group of non-defaulters.

It is therefore recommended that credit institutions or lending agencies should look out for the socio-economic characteristics that significantly discriminate between defaulters and non-defaulters before granting loans and advances to small scale farmers to reduce the incidence of loan delinquencies and defaults.

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