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Loan Repayment and Credit Worthiness of Farmers under the Nigerian Agricultural Cooperative and Rural Development Bank (NACRDB)

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Abstract: This study determined the factors influencing loan repayment and credit worthiness of farmers in Abia State under the Nigerian Agricultural Cooperative and Rural Development Bank (NACRDB). A random sample of 90 smallholder agricultural loan beneficiaries of NACRDB, Abia State were interviewed. The result of the semi-log regression model showed that amount of loan borrowed, annual income and distance between home and loan source were key determinants of repayment. However, the discriminant function analysis showed that farming experience, total operating expenditure-income ratio, farm size, level of education and age of farmers made positive contributions to credit worthiness, while outstanding loan-asset ratio, operating expenditure income ratio, distance between home and loan source made negative contributions to credit worthiness. However, the result also showed that group case correctly classified was 75.6%.

Key words: Agricultural, bank, credit, farmers, loan, nigerian, repayment, worthiness

INTRODUCTION

The recognition of credit as a powerful instrument for the reduction of poverty in the developing countries has led to a multitude of programs on agricultural credit, co-operative and integrated rural development in the past few decades (Yasmeen, 1993). The loan repayment in these programs often have been very low, which together with low interest rate imposed by government has resulted in the stagnation of most third world credit institutions aimed at "small borrowers". However, in Nigeria, due to population increase, there is an increased demand for food. In the last decade, Nigeria witnessed a progressive decline in its domestic food supply both in calories and animal protein. As a result, the Federal Government of Nigeria resorted to massive importation of foodstuff, (Ogunbanmeru, 1986). Various studies identified the smallholder farmers as constituting the greatest force in food production in Nigeria (Ijere, 1986; FMAWARRD, 1987; Ruthenberg and Jonke, 1985). Unfortunately, these farmers have meager financial resources to undertake innovative farming activities. The rural financial markets have not satisfied their credit needs. Therefore, they have to resort to formal loan sources. However, the history of agricultural credit administration in many parts of Nigeria has not been impressive when evaluated on the basis of their repayment performance (Arene, 1992). Poor loan repayment has also been reported by the various studies (Ijose and Abelu, 1973; Osuntogun and Oludimu, 1981; Bottomley, 1983; Babalola and Odoko, 1996; Ukoha and Agwamba, 2002; Njoku and Odii; 1991).

The inability of the borrower to repay the borrowed fund in accordance with the loan terms constitutes a major issue to the bank. This involves non-repayment in both principal and interest by farmer borrowers. Loses in both principal and interest to banks can result in loan shrinkage, liquidation and ineffectiveness (Arene, 1993). Thus, there is the need to identify the credit worthy and non-credit worthy farmers for future loan disbursement. It is therefore the objective of this paper to identify the factors which influence the repayment of loans borrowed by farmers from NACRDB, determine the effects of the factors on loan repayment and determine the credit worthy and non-credit worthy farmers.

Literature review: Abundant Literature exist on loan repayment and credit worthiness of farmers. For instance, Khan (1971) in his study on Comilla Co-operation model in Bangladesh concluded that the extent of indebtedness, inadequate supervision from credit officers, improper utilization of loan were the factors causing repayment default. Bottomley (1983) and Nwaru (2004) discovered that there is a positive relationship between borrowers net income and loan repayment. Okorie (1986) and Aneke

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(1981) observed that the time of disbursement of the loan and the profitability of the enterprise, education, adoption of improved technology and time spent on farming business had decisive influence on loan repayment. According to Okorie (1986), loan repayment default in Nigeria is caused partly by high level of illiteracy among farmers. Low returns on investment could delay the repayment of loan and may result in an outright default (Oluwasanmi and Aloa 1965). Arene (1992) and Okorji and Mejeha (1993) identified size of loan, farm size, income, age of farmers, farming experience as having significant positive relationship with loan repayment, while distance from loan source, household size are negatively related to loan repayment. According to Njoku and Odii (1991) factors that significantly influence loan repayment are amount borrowed, farming experience, major occupation of the borrowers, level of education, household size, loan period, farm size, farm output, value of assets and interest on loan.

Credit worthiness is a function of ability and willingness to repay loans (Agu, 1998). Farmers may be either credit worthy or not credit worthy. The discriminant function analysis is used for predicting membership in these two mutually exclusive groups (Tabacknick and Fidell, 1996). There are other tools for handling dichotomous response variables such as Linear Probability Model (LPM), the logit model, the probit model and tobit model (Damodar, 1995). However, the discriminant analysis model has been proven a more powerful and efficient analytic tool (Tabacknick and Fidell, 1996). It was also found to provide more accurate classification and hypothesis testing (Grimm and Yarnold, 1995).

Empirical work by Arene (1993) showed that income, farm size, age of farmers, farming experience and level of formal education of farmers contributed positively to the credit worthiness of farmers. On the other hand, the distance of the farmer's residence from the source of loan reduced his credit worthiness, probably because the loans received by the farmers are relatively small. The classification performance of the discriminant function was about 94%, the higher the rate the better the predictive power of the function (Arene, 1993). Nwankwo (2004) reported that level of education made the highest absolute positive contribution to the total discriminant score followed by farm size and family size. On the other hand, age, loan size, annual farm income and farming experience made negative contributions. The overall classification performance of the function was 100%.

Eze (1993) also revealed that age of the farmers, annual farm income, farm size and family size made positive contributions to the total discriminant score. The group cases correctly classified was 56.3%. Eze (2003) also showed that the nearer the farmers' homes to a credit lending institution the greater the probability that the farmers will be classified credit worthy. The variables namely, off-farm income, farming experience and family size contributed positively to the credit worthiness of the farmers. On the contrary, farm income, farm size and farmers' age made negative contributions. The classification performance was 70%.

Topho *et al*. (1995) carried out a predictive analysis of the Former Farmer Home Administration (FMHA) borrowers using relevant financial ratios such as debt to asset ratio, debt service ratio, working capital and rate of return to asset to determine their success and failure in loan repayment. The result showed that debt to asset ratio is an important factor for determining loan success or failure. However, the predictive accuracy of the model was 77%.

Limsombunchi *et al*. (2005) estimated a credit scoring model for agricultural loans in Thailand. The logistic regression model and neural network model were used to predict borrowers credit worthiness and default risk. The result of the logistic regression confirmed the importance of total asset value, capital turnover ratio and duration of bank-borrower relationship as important factors in determining credit worthiness. The result showed that higher value of assets implied a higher credit worthiness.

Turkey (1991) in his research reviewed four alternative credit scoring models for agricultural loans, namely the linear probability model, discriminant analysis, logit and probit. The economic models were based on 9,403 loan applications from Canada's farm credit corporation. Results indicated that there was not a great deal of difference in underlying assumptions and statistical properties. The predictive accuracies of the four models were as follows; Discriminant analysis 71.5%, logit 69.7%, probit 69.4% and linear probability model 67.1%.

MATERIALS AND METHODS

A list of smallholder farmers in Abia State who benefited from NACRDB loan was collected from NACRDB. From each of the three agricultural zones in Abia State namely Aba, Ohafia and Umuahia a random sample of 30 beneficiaries was selected giving a total of 90 beneficiaries for the state. A structured questionnaire was used to elicit and collect information from the farmers. Data analysis involved the use of mean, frequencies, percentages multiple regression and the discriminant analysis.

The multiple regression model is implicitly stated as:

$$LR = F(LB, AGE, SEX, ED, FE, HHS, IR, LP, LS, FNI, DS, FS) \quad (1)$$

Where
- LR = Amount of Loan Repaid (N)
- LB = Amount of Loan Borrowed (N)
- AGE = Age of farmers (years)
- SEX = Sex of the farmers (SEX = 1 for female 0 otherwise)
- ED = Education (Number of years of Schooling)
- FE = Farming Experience (Number of years of farming)
- HHS = Household Size
- IR = Interest Rate (%)
- LP = Loan Period (Years)
- LS = Loan Supervision (Number of times the farmers were supervised by loan agents)
- FNI = Farm and Non farm Income (N)
- DS = Distance between home and source of loan (km)
- FS = Farm Size (Ha)

In estimating the regression model, functional forms namely, the linear, semi-log, double log and exponential were tried out.

The discriminant analytical model classified the smallholder farmers by the same set of independent variables used in estimating the loan repayment equation into two mutually exclusive and exhaustive categories. Using the loan repayment values as a basis, smallholder loan beneficiaries were classified into two groups; group 1 consisted of farmers who had repaid less than 50% of the loans borrowed, whereas group 2 were the farmers who repaid at least 50% of the loans. Farmers in group 2 were assumed to be relatively credit worthy while those in group 1 were assumed to be relatively non-credit worthy. The variables used in the discriminant analysis are: AGE, SEX, ED, FE, DS, FS, LAR, EIR and OT. Apart from LAR, EIR and OT, the other variables have the same definition as in equation (1). EIR = total operating expenditure-income ratio, LAR = loan-asset ratio and OT = outstanding loan-asset ratio.

The model is presented implicitly as:

$$D_i = b_0 + b_1Z_{1\,i} + b_2Z_{2\,i} + \ldots\ldots\ldots\ldots\ldots\ldots\ b_nZ_{ni}, \quad (2)$$

Z_i is derived by the formular $Z_{\,i} = x_{ij} - x$

Where Z_i = the i^{th} individuals discriminant score or the contribution of each independent variable to the total Discriminant score (D_i)

D_i = Total discriminant score

x_{ij} = The i^{th} individual value of the j^{th} independent variable

b_{ij} = The discriminant coefficient for j^{th} variable

x = Mean value of the independent variables

α = Standard deviation of the independent variables

Let each individual score Z_i be a function of the independent variables; that is,

$$Z_i = b_0 + b_1x_{1i} + b_2x_{2i} + \ldots\ldots\ldots\ldots\ b_nx_{ni} \quad (3)$$

Classification procedure is as follows;

If $Z_i = Z_{crit}$, classify individual i as belonging to group 2 (Credit worthy farmers) and if $Z_i < Z_{crit}$; classify individual I as belonging to group 1 (Non- credit worthy farmers). The classification boundary is the locus of points where $b_0 + b_1x_{1i} + b_2x_{2i} + \ldots\ldots\ldots\ b_nx_{ni} = Z_{crit}$

RESULTS AND DISCUSSION

Determinants of loan repayment: The result of the estimation of loan repayment equation (Eq. 1) is presented in Table 1. The semi-log functional form is the lead equation. The regression is significant at 1%t level and the coefficient of determinant (R^2) is 0.30. The possible reason for the low R^2 is that interest rate and loan period were the same for all the farmers because only one institution was studied and the loan period was one year. Consequently, the variables disappeared during the estimation of Eq. (1) and this probably affected the explanatory power of the model.

The amount of loan borrowed had a positive coefficient, suggesting increase in loan repayment as the amount or size of loan increases. This is possible due to

Table 1:Regression analysis for loan repayment

Variables	Linear	Exponential	Double log	Semi-log
Constant	38482.272	11.277***	3.326	-3712369*
	(1.150)	(12.226)	(0.592)	(-1.719)
LB	0.319**	8.310e-06**	0.640	32341.957**
	(2.324)	(2.129)	(1.502)	(1.974)
AGE	-856.054	-3.909e-02**	-1.439	-40426-02
	(-1.239)	(-2.049)	(-1.520)	(-1.101)
SEX	-3879.957	-1.723E-02	0.227	3815.114
	(0.266)	(-0.042)	(-0.561)	(0.247)
ED	887.624	1.361E-02	0.505	20426.046
	(0.821)	(0.717)	(1.353)	(1.412)
HHS	1691.007	3.472E0-92	0.323	14591.420
	(0.973)	(0.735)	(0.922)	(1.061)
LS	540.457	-0.102	-0.191	-3598.604
	(0.157)	(-1.015)	(-0.852)	(-0.417)
FNI	1.428E-02	5.002E-07	0.363**	12062.567*
	(0.765)	(0.947)	(2.085)	(1.764)
DS	-1694.032*	-4.949E-02	-0.352*	-16787.53**
—	-(1.824)	(-1.825)	(-1.824)	(-2.251)
FS	252.256	0.165	-2976E-02	3815.14
	(0.059)	(1.344)	(-0.117)	(0.247)
R^2	0.203	0.249	0.270	0.30
F-cal	2.007*	2.359**	2.252**	2.685*

Source: Computed from field survey, 2004. Note: ***, ** and * mean significant at 1, 5 and 10%, respectively + = Lead Equation

the advantages associated with the economics of scale, which comes about through the expansion of purchases and production (Okorji and Mejeha, 1993). The annual farm income had positive coefficient showing that the more productive the enterprise is, the higher the probability of loan repayment. On the contrary, the distance of the farmers residence from the source of loan had a negative coefficient implying that the amount of loan repaid increases with decrease in distance between home and loan sources of farmers. This result is in consonance with the findings of Arene (1992).

Discriminant function analysis of credit worthiness: Grouping of farmer borrowers into two was based on loan repayment levels. Using this criterion, (40) farmers were found to be relatively credit worthy while the remaining (50) were relatively non-credit worthy. The loan repayment level used as a benchmark for classification is 50%. Group 1 consists of farmers who had repaid less than 50% of the loans borrowed (non-credit worthy farmers), whereas group 2 are the farmers who repaid at least 50% of the loans (credit-worthy farmers). The estimated function for the farmer borrowers is presented in Table 2.

The estimated centroid for relatively non-credit worthy farmer borrowers was found to be-0.637, while that of the relatively credit worthy farmers was found to be 0.796. This means that the higher the composite score of any farmer borrower, the higher the probability that the farmer will be classified as being credit worthy and vice versa.

Table 3 the relative high canonical coefficient of 0.584 and low Wilks' lambda value of 0.659 indicated that the discriminant function developed in this study provides significant amount of information required for measuring credit worthiness of farmer borrowers. The estimated standardized canonical discriminant function coefficient was subjected to chi-square test of significance. The calculated chi-square at 5% level of significance was found to be 34.853, whereas the tabulated value at the same level of significance is 16.92. Since the calculated chi-square is greater than the tabulated value, we reject the hypothesis that all the discriminate coefficients are equal to zero. The implication is that the combined estimated function coefficients developed in the course of this study can be used to discriminate between relatively credit worthy and relatively non-credit worthy farmer borrowers as initially defined.

Table 4 showed that most of the variables in the function made some contributions to the farmer-borrowers' credit worthiness. Farming experience, total operating expenditure-income ratio, farm size, level of education and age of farmers made positive contributions, while outstanding loan asset ratio, loan-asset ratio, distance between home and source of loan of farmer-borrowers made a negative contribution. The positive sign obtained for farming experience, total operating expenditure-income ratio, farm size, level of education and age of farmers suggests that a farmer borrower's chances of belonging to the group of credit-worthy farmers improve as the values of the positive variables increase. The positive sign obtained for total operating expenditure-income ratio is against a priori expectation. The negative sign obtained for outstanding loan-asset ratio, distance between home and loan source suggests that farmer-borrowers' chances of belonging to the group of non-credit worthy farmers increase as the value of the negative variables increase.

In order to know how well the function developed performed in classifying the farmer borrowers, the function was evaluated for each of the 90 farmer borrowers. The result is presented in Table 5. Since the usefulness of discriminant function lies in its power to classify correctly, then the higher the rate is, the better is the predictive power of the function (Arene, 1993). The estimated discriminant function developed classified the farmer borrowers into two distinct groups; credit worthy and non-credit worthy farmers.

Table 2: Standard canonical discriminant function coefficients

	Variables	Discriminant coefficient
AGE	Age of farmers	-0.229
SEX	Gender	-0.077
ED	Level of Education	0.246
FE	Farming Experience	0.45
DS	Distance between Home and loan source	0.32
LAR	Loan-Asset Ratio	0.415
EIR	Total operating Expenditure-Income Ratio	0.15
OT	Outstanding loan-asset ratio	-1.178
FS	Farm Size	0.294

Source: Calculated from field survey, 2004

Table 3: Statistical test of significance for the discriminant function coefficients

Canonical correlation	0.584
Wilks' lambda	0.659
Chi-square	34.853
D.f	9

Source: Calculated from field survey data, 2004

Table 4: Pooled within group correlation between the canonical discriminant function and discriminating variables

	Variables	Correlation coefficient
OT	Outstanding loan-asset ratio	-0.804
FE	Farming Experience	0.230
LAR	Loan-Asset Ratio	-0.223
EIR	Total operating expenditure-Income Ratio	0.153
FS	Farm Size	0.102
ED	Level of Education	0.067
DS	Distance between home and loan source	-0.065
AGE	Age of farmers	0.037
SEX	Gender	0.011

Source: Calculated from field survey data, 2004

Table 5:Classification performance of the estimated discriminant function

Actual group	No. of cases	Predicted group	Membership
Group 1		1	2
Non-credit worthy farmers	50	37	13
Sub file Group 1		74.0%	26.0%
Group 2	40	9	31
Credit-worthy farmers		22.5%	77.5%
Sub file Group 2			
Ungrouped cases	0	0	0
Sub file ungrouped cases	0	0	0

Source: Calculated from field survey data, 2004

The classification performance of the function which is about 75.6% is sufficient to alleviate the fear associated with mis-classification error. The result is tolerable when compared with 75% obtained by Bauer and Jordan (1971), 74% recorded by Matiezo (1978) and 56.4% obtained by Ezeh (1993).

CONCLUSION

The major conclusion derived from this study is that the determinants of loan repayment are amount of loan borrowed, income and distance between home and loan source of a farmer borrower. The study also revealed that credit worthiness is directly influenced by age, income, educational level, farm size, total operating expenditure-income ratio of the farmer-borrowers and is inversely related to outstanding loan-total asset ratio and distance between home and loan source. The classification performance of the discriminant function shows that 22.5% of the 40 farmers known to be relatively credit worthy are not credit worthy while 26.0% of the 50 farmers known to be relatively non-credit worthy are credit worthy. This information provided by the discriminant analysis helps to reduce loses by banks.

However, in order to improve the banks over all performance and cut down loan default rates among farmers, the following recommendations are tenable:

- Efforts should be made by farmers to improve on their income level by way of increased production. This will enhance their ability to repay their loans at maturity. Such farmer characteristics to be considered for credit worthiness include:
- Banks should show priority to relatively aged farmers in granting loans because age contributed positively to loan repayment and credit worthiness.
- High level of preference should be shown to educated farmers in loan approval because farmers' level of education contributed positively to credit worthiness.
- Farming experience contributed positively to credit worthiness, showing that relatively more experienced farmers are more credit worthy than the less experienced ones. The relatively more experienced farmers are therefore better credit visits and should be given preference in loan approval.
- Loans should be given to farmers whose homes are not far from the bank so as to ensure effective monitoring and supervision.
- Farmers with large farms should be given preference in loan administration to those with smaller farms.
- Preference should be shown to farmers with very low total expenditure income ratio, loan-total asset ratio and outstanding loan total asset ratio.

Finally, the management of banks should consider these policy recommendations critically and possibly re-structure the content of the loan application forms issued to farmers by placing more emphasis on the above stated farmer characteristics which promote loan repayment and credit worthiness. This might improve the banks overall performance.

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