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**THE DETERMINANTS OF LOAN DEFAULT
AND DELINQUENCY IN RURAL
CREDIT PROGRAMS IN
GHANA**

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TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
I. INTRODUCTION	1
II. LITERATURE REVIEW	4
III. SAMPLE DESIGN AND DATA COLLECTION PROCEDURES	
Secondary Data Source	6
Primary Data Set	6
The Field Survey Questionnaire	7
IV. METHODOLOGY	11
V. EMPIRICAL FINDINGS	
Analysis of the Secondary Data on Loan Default	14
Analysis of the Primary Data on Creditworthiness	17
VI. SUMMARY AND CONCLUSIONS	25
REFERENCES	28

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Summary of Distribution of Questionnaires by Region	8
2	Number of Bad Questionnaires by Region	9
3	Summary of Discriminant Analysis Results	15
4	Group Level Means and Percentages for Loan Recipient Characteristics with Significant Discriminant Results	16
5	Variable Definitions and Proportions & Means	18
6	Coefficients for Logistic Regression on the Probability of Loan Default	20
7	Proportions & Means of Variables Used in Tobit and Ordinary Least Squares Equations	22
8	Tobit and O.L.S. Coefficients on Loan Delinquency	23
9	Summary of Results	26

I. Introduction

Many analysts believe that an infusion of agricultural credit to rural farmers in developing economies is necessary to increase agricultural production. To accomplish this objective, specialized government farm credit institutions were established in most low-income countries for the purpose of providing loans for agricultural production. The experience of these institutions, however, has not been satisfactory. Sanderante (1978), for example, reported that many countries in Africa, the Middle East and Latin America experienced high rates of default, ranging from 50 percent to as much as 95 percent, in small farmer credit programs. Similarly poor results were experienced in some Jamaican programs where a recovery rate of only 6 percent was achieved after a year of operation (Graham and Bourne 1980). As J.D. Von Pischke (1983) has stated: "their efforts to achieve institutional and financial viability and to expand their clientele are complicated by the vagaries of agricultural production and prices, and some of their activities have more in common with social welfare than with commercial practice."

A number of reasons have been advanced for the poor showing by these state institutions. One of the more compelling explanations is associated with the source of funds. Since the source of funds is largely from budgetary deficits and foreign aid, a consequence of this perceived free money is a lack of fiscal responsibility on the part of these lending agencies. Therefore, the lending institutions in many of these low-income countries did not structure incentives within their particular financial agencies that encouraged borrowers to repay the loans. The lack of incentives is thought to be exemplified in a number of ways. 1) The lending agencies may not provide sufficient penalties or other inducements that encourage borrowers to repay their loans. 2) The lending agencies may provide poor services, such as irregular hours of operation, discourteous clerks, etc., all of which might influence a borrower to stay away from the credit agency, ultimately defaulting on the loan. 3) The lending agencies may not adequately screen the borrowers to determine their creditworthiness. This last category may be a consequence of the lender being divorced from the local information networks that may accompany funds generated from the local economies. However, as appealing and critical as this viewpoint is, there has been little empirical testing in developing countries other than in India and a few eastern countries.

This study investigates the determinants of individual loan default rates and loan delinquency rates for rural banks in a developing country. It focuses on the effect of the characteristics of borrowers and indicators of the efficiency of the particular branch where the loan is serviced upon default and delinquency rates. Data for this study were collected by sampling both the files and the customers of the Rural Banks of Ghana. The Rural Banks are private unit banks organized in the rural communities for the purposes of specializing in the extension of credit to small farmers and other small entrepreneurs. The bank belongs to the people in the region and its management, control and general operations are vested in the people. The Rural Banks are a division within the Central Bank of Ghana. The role of the Bank of Ghana is first that of a shareholder and second that of a supervisor in accordance with the Bank of Ghana Act of 1963 (Act 182) and the Banking Act of 1970 (Act 339). The Rural Banks are empowered to collect savings and make loans and advances under approved terms to small scale farmers, fishermen and entrepreneurs in rural areas. In general, the rural banks have the power to carry out the following functions: (a) provide checking, savings, and time deposit accounts for its customers; (b) act as an agent of other financial institutions in the country; (c) rediscount its papers and accept and discount bills of exchange; (d) accept securities for safe custody; (e) act as executors and trustees of wills of small scale farmers, fishermen and merchants; (f) provide finance for small scale farmers, fishermen, merchants, industrialists and cooperatives of such farmers, fishermen, and industrialists residing in the area; (g) engage in any economic activity that will promote social and economic development of its areas of operation. These functions specifically preclude the rural banks from engaging in foreign operations of any kind.

This study is important for three reasons. First it expands upon the what little work has been done on the indicators of creditworthiness of borrowers in rural areas of developing countries. Second, by determining the characteristics that affect the probability of default, it will help credit agencies in rural areas screen potential borrowers more effectively and therefore improve their loan repayment record. Third, by analyzing the effects of bank behavior on defaults, the study will show these agencies how to improve bank efficiency in ways that lower default rates.

The study proceeds as follows: Section II presents a selected review of the literature on lending activities in the developing world. This review touches upon how creditworthiness is typically identified in the informal lending sector and contrasts this with lending activities undertaken in the formal sector. Section III discusses the sample design and data collection procedures. Section IV describes the methodology used in the study. Section V presents the empirical findings. The conclusions are discussed in Section VI.

II. Literature Review

A review of the literature on informal lending activities indicates that informal lending and borrowing arrangements have effectively persisted for a long time in low-income countries. The loans typically are small and unsecured, with high real interest rates. However, as pointed out by Wai (1957) the interest rates are not out of line given the high level of risk. The middle man is an important ingredient in these credit transactions. In many instances this individual is the village shopkeeper. He is generally in an excellent position to know the resources and character of those in the area. Ward (1960) suggests that the middle man is limited in the number of loans he can carry because of the size of his own resources and his need to have close and accurate personal knowledge of each debtor. Moreover, in those rural societies where it is customary for borrowers to pledge land and/or its product to creditors, each creditor is further limited by the small number of farms he can effectively supervise. Corroborative evidence concerning the market area for lending activities in informal settings comes from Nisbet's (1967) study in Chile. He found that rural moneylenders operated within a two-mile radius of their home villages. Nisbet agrees that moneylenders and shopkeepers have and need close personal knowledge of their borrowers' circumstances.

The studies by Ward and Nisbet suggest that credit information, that is, the knowledge of who are and who are not good credit risks, is valuable information and may limit the geographical size of rural informal credit markets. Ward further suggests that some of the methods of entering into a credit relationship in peasant producing populations and in the West are more similar than might be expected. As she states; "if a private individual in England wants to borrow money or open a credit account, he too has to establish his credentials, and in the last resort this means that he too depends on personal knowledge on the part of his creditor."

As noted above, a few studies have examined the determinants of default rates in low-income countries in the case of formal lending situations. The vast majority of work in this area has taken place in India or other eastern countries. Reddy (1976) tried to identify characteristics of defaulters and non-defaulters based upon data from rural credit cooperatives from 12 villages in two separate

regions in India. The author found some similarities and many differences between these characteristics in the final discriminant functions. In both regions, primary occupation made a difference in the default rate. For example, borrowers depending primarily on agricultural occupations for their incomes were more likely to repay debts promptly than those who had to supplement their income with highly uncertain non-farm employment. The purpose of the loan also was a good predictor of defaults. For example, farmyard manure applications were positively associated with timely repayment.

Pandy and Muralidharan (1979), using data from the Uttar Pradesh State in India, attempted to develop criteria for classifying borrowers as to their willingness to repay their loans on the basis of differences in their socio-economic characteristics. The discriminant function analysis indicated that the percentage of total income derived from sources other than crop production, the amount of loan, the purpose of loan, per capita consumption expenditure, and the ratio of cash expenditure to total expenditure were the major characteristics that classified borrowers into defaulters and non-defaulters. Finally, Meier (1987) developed a model for predicting loan defaults. Fifteen defaulters and fifteen non-defaulters in Karnataka, India, were randomly selected from four cooperatives in the district of Mandya. During April, 1985, the author conducted 115 interviews. The independent variables were a measure of political influence, the education level of the household head, acres of irrigated land owned, the ratio of short-term loans to expenses, debt to asset ratio, and a measure of the household's average propensity to consume. As the author states, the study was not successful in its primary goal of describing how defaulters differ from non-defaulters. Of the six variables, only household average propensity to consume even remotely contributed to the model's discriminatory power.

Clearly, if lending agencies in developing countries want to improve their default record, they need more information than is currently available on the determinants of loan default.

III. Sample Design and Data Collection Procedures

The data for this study were collected from two different sources. The secondary data were collected from files of the Rural Bank of Ghana. The primary data set was collected by sampling the bank's customers. This section describes in some detail the sampling and collection procedures used in this study.

Secondary Data Source

The files of the Rural Bank of Ghana contained information about the repayment behavior, the amount of the loan, and certain characteristics of each borrower and each loan. To ensure comparability in lending experience, only data from the files of the 29 banks established in the same year, 1983, were examined. Information on all of the 2,433 borrowers in the archives as of 1987 was used in the analysis. In addition to the borrower's payment record and the amount of the loan, this information included the interest on the loan, the year the loan was granted, the expiration date of the loan, the type of security provided, the office or body that approved the loan, the purpose of the loan, and the occupation of the borrower. These characteristics of the borrower and the loan could have an effect upon whether or not a loan is repaid.

The archival data set is important because it provides complete information about each loan. However, the only individual information in these files was the occupation of each borrower. Other characteristics of borrowers, such as sex, marital status, number of children, income, wealth, as well as cultural and attitudinal factors, may well have influenced loan default or loan delinquency. To overcome these deficiencies in the data available at the banks, a nationwide survey was conducted between November 1987 and April 1988. This survey provided the primary data.

Primary Data Set

The primary data set was collected from individual interviews with a nationwide sample of rural bank customers. Approximately 60 rural banks out of the existing 114 were given questionnaires. The number of questionnaires given each bank ranged between 10 and 50 depending on the number of customers at the particular bank. The average per bank was approximately thirty. Other than the

northern parts of the country, where there are only four rural banks, the entire country was covered.

The questionnaires were administered by the bank managers and their project officers, who were shown how to complete the questionnaires. They were given between 2 to 4 weeks to administer the surveys. The managers and their project officers were told to select customers at random; for example, select every third customer. A sampling bias may, however, have been introduced if a manager or project officer only approached those customers that were more likely to respond. Table 1 gives the number of banks by region, the number of banks that received questionnaires by region, and the number of questionnaires administered in each region. As initially structured, the sample represented a random sample of the rural bank customers in all but two regions of the country. Since those two regions represent an insignificant fraction of the Rural Banks customer base, the sample was representative of the rural banks customer base. However, of the approximately 2000 surveys collected, 20% were duplicates or were so badly answered, that they were excluded from the analysis. To see whether these problem surveys were concentrated in certain regions rather than in others, the information shown in Table 2 was calculated. The findings suggest that the poorer quality surveys occurred across all regions at rates somewhat related to the number of questionnaires distributed in the region. This data set, therefore, remains representative of the rural bank customer base excluding the insignificant Upper East and Upper West regions of the country.

The Field Survey Questionnaire

The questionnaire utilized in collecting the field data on loan repayment behavior was designed to collect three types of information. The first section focused on the respondents' attitudes toward the rural credit services provided by the rural bank, including their evaluations of why they use these services and the factors that account for repayment behavior. The respondents' evaluations of the credit services were elicited via a scale that ranged from "strongly disagree", coded as 1, to "strongly agree", coded as 5.

The second section of the questionnaire collected attitudinal information similar to that in the

TABLE 1**Summary of Distribution of Questionnaires by Region**

<u>Region</u>	<u>Number of Banks</u>	<u>Number of Banks with Questionnaires</u>	<u>Number of Questionnaires Administered</u>
Central	23	12	455
Western	12	6	135
Eastern	21	11	405
Greater Accra	5	2	68
Brong Ahafo	16	9	189
Volta	12	5	230
Ashanti	21	15	313
Upper East	2	-	-
Upper West	2	-	-

Source: Rural Bank of Ghana Records and Ghana Loan Survey Data.

TABLE 2**Number of Bad Questionnaires by Region**

<u>Region</u>	<u>Number of Bad Questionnaires</u>	<u>Percent of Bad Questionnaires</u>
Central	139	30.5%
Western	49	36.3%
Eastern	75	18.5%
Greater Accra	1	1.5%
Brong Ahafo	27	14.3%
Volta	64	27.8%
Ashanti	49	15.7%

Source: Ghana Loan Survey Data

first section, but about informal financial institutions (eg., rotating credit unions, revolving credit unions, money lenders, etc.). The same scale used in the first section was used in coding the information concerning the informal financial institutions. The third and final section of the questionnaire focused on the respondents' characteristics, including their income, assets, wealth, education, marital status, sex, age, and number of children.

The questionnaire development and pretest involved several steps. First, the principal investigators visited the senior executives of the rural banks and other senior bank policy makers to explore the nature of their credit programs. At this time, the principal investigators examined the records of the rural bank division of the Bank of Ghana to develop a feel for the credit program, the adequacy of the available data, and the nature of additional information needed in a survey.

The second step involved designing and pretesting the instrument. The instrument design was based on extensive review of the relevant literature on survey instruments. The instrument was pretested using a group of rural bank employees who had considerable familiarity with the bank and its customers. The final version of the instrument reflected the pretest information.

IV. Methodology

To analyze the determinants of default and repayment behavior among rural villagers in Ghana, two general analytical procedures were utilized. The first procedure, discriminant analysis, was applied to the secondary data on default behavior, while the second approach used logit, ordinary least squares, and tobit regressions to analyze the secondary data. These techniques were applied to two dependent variables: (1) whether or not the loan recipient defaulted and (2) the length of time the loan was in arrears. This section begins with a discussion concerning the estimation of default behavior.

Loan default behavior is represented by a binary dependent variable 1 if the loan is defaulted, and 0 otherwise. This Binary-choice model assumes that individuals are faced with a choice between two alternatives and that the choice they make depends on the characteristics of the individuals, of the loans, and of the financial institutions where the loan was granted. Ordinary least squares regression (OLS) is a possible estimation method. The regression equation can be interpreted as describing the probability that an individual will default, given information about the independent variables. The slope of the regression line measures the effect of a particular independent variable on the probability of default. The regression form of this model is:

$$1.1 \quad Y_i = bx_i + e_i$$

where Y_i is the dependent variable, which takes on two values, 1 if default and 0 otherwise; x_i is the value of the independent variable for the i th individual, and e_i is the error term.

A problem with applying the OLS method, in this instance, is that the error term is heteroscedastic; i.e., the variance of the error term is not constant for all observations. Consequently, the classical statistical tests can not be applied to the estimated parameters. Referring back to equation 1.1 and rearranging terms,

$$e_i = y_i - bx_i \quad i = 1, 2, \dots, n.$$

When $y_i = 0$, $e_i = -bx_i$; when $y_i = 1$, $e_i = 1 - bx_i$. The requirement that $E(e_i) = 0$ still holds, but because the respective probabilities of the events are bx_i and $(1 - bx_i)$,

$$\begin{aligned} \text{Var}(e_i) &= bx_i(1 - bx_i)^2 + (1 - bx_i)(-bx_i)^2 \\ &= (bx_i)(1 - bx_i) \\ &= E(Y_i)[1 - E(Y_i)] \end{aligned}$$

Thus, the variance of the error term is not a constant but varies with the dependent variable Y_i . Moreover, because of this heteroscedasticity problem, the ordinary least squares (OLS) estimates of b from equation (1.1) will not be efficient. A number of solutions are available to solve this problem. One solution is to use a method such as discriminant analysis, which constructs a linear discriminant function of the independent variables that are used to predict whether an observation belongs to one of the two groups. An alternative approach to the OLS method is to use a logit model, which uses a logistic probability function to analyze the data.

Discriminant analysis involves the choice of a criterion for classification into one or more groups. In this particular case there are only two groups, default and not default. Tests of statistical significance evaluate whether the groups are in fact distinct, and if they are, whether the variables used in the analysis provide enough information to enable one to discriminate between the groups with some degree of accuracy. The standardized discriminant coefficients, when the sign is ignored, indicates the relative contribution of its associated variable to that discriminant function. The sign denotes whether the variable is making a positive or negative contribution. Discriminant analysis is used to analyze the secondary data.

The logit model recognizes that the object of the analysis is to estimate a probability and is confined to the 0, 1 interval. A monotonic transformation is applied to the probability, using a logistic probability function. Since the binary variable is coded as 1 if defaulted and 0 otherwise, the coefficients of the independent variables measure the probability of default given a unit change in a variable if it is continuous, or given if the variable occurs when it is a binary independent variable. The logit model is used to analyze the probability of default with the primary data.

The discriminant analysis is used with the secondary data set and logit model with the primary because of the different types of data in the two sets. The secondary data set gives mainly information about the nature of the loan. In this case the interest is whether or not being in a particular category significantly affects the probability of default. Then, for comparison, an examination will be made of the proportions of default and non-default for each significant category in order to make comparisons within classifications. The effect of marginal changes (for example

a marginal change from being a farmer to being a trader) would be relatively meaningless for all variables except the amount of the loan. The primary data set shows characteristics of the borrowers. In this case the interest is in the effects of marginal changes upon the probability of default, which the logit regression model provides.

The third model used in this study is the tobit model. This model is appropriate when estimating a function in which the dependent variable is continuous but the observations on this variable are bunched together either from above or from below. For example, the survey data on consumer expenditures indicates that most households report zero expenditures on automobiles or major household goods during any year. However, among those households that make any such expenditures, there will be wide variation in the amounts. Thus most of the observations are concentrated around zero. Tobin (1958) analyzed this problem by formulating the regression model

$$y = x + e \quad \text{if } y > 0$$

$$y = 0 \quad \text{otherwise}$$

where y is expenditures on a particular type of good, x is a set of explanatory variables, and e is a vector of residuals. In the case of the second dependent variable, the length of time a loan is in arrears, a similar problem exists because for a large number of observations the length is zero. Therefore, a positive value is assigned to the length of time a loan is in arrears only if it is greater than 0; otherwise the value of the dependent variable is 0. For comparison, OLS is used to explain the length of time a loan is in arrears. The intercepts of the Tobit and the OLS estimations will differ as will the regression coefficients. The regression coefficients for the Tobit estimation will be higher because they show how an independent variable affects the probability a loan will be in arrears and how it affects the time a loan is in arrears, given that it is in arrears. The OLS regression coefficients show only the effect on the time in arrears.

V. Empirical Findings

Analysis of the Secondary Data on Loan Default

The purpose of the secondary data analysis was to identify the characteristics of groups of rural borrowers and the types of loan which predict loan repayment behavior. A discriminant analysis was deemed the appropriate technique since the dependent variable is binary. A defaulter was identified as a loan recipient who had been sent at least one notice of default. A non-defaulter was identified as a loan recipient who had not been sent a formal notice of default under the rural banks credit program.

Table 3 lists the borrower characteristics considered in the discriminant analysis along with the results of the estimation. As Table 3 indicates, the multivariate F-value from the analysis was highly significant ($p \leq .00$) implying "strong" differences in characteristics across borrower groups (i.e., defaulters and non-defaulters). That is, the independent variables influence whether or not a loan is in default. The univariate F-values show that all five categories of the characteristics -- amount of loan, occupation of borrower, purpose of the loan, officer or agent who authorized the loan, and type of security provided to back the loan -- contributed to the observed overall differences. Each yielded characteristics with F-values that were statistically significant at the .01 levels or better. The only characteristics not significant at this level were the occupations of teacher and public servant, a personal loan, and a lien on the loan. Thus, all other characteristics appear to be able to discriminate between defaulters and non-defaulters.

As Table 4 shows, 30.9% of all loans were defaulted. The table also gives the mean values of the loans of defaulters and non-defaulters. Defaulters had, on average, 32% larger loans than non-defaulters. Thus the amount of the loan appears to make a difference.

As column 1 of the table shows, 50% of all borrowers who defaulted were farmers and 40% of all defaulted loans were for the purpose of farming. Loans secured by security other than liens made up 80% of all defaulted loans. Also, local boards of directors approved 70% of all defaulted loans.

The percentages of loans for each statistically significant classification that were defaulted are presented in column 3. Drivers had the largest rate of default among all occupations, 100%, while the default rates for the other occupations were well below this rate, ranging from 47.2% for trading

TABLE 3

Summary of Discriminant Analysis Results

Borrower Characteristics	F-Value	P ≤
I. Univariate tests		
A. Amount of loan	4.31	.03
B. Borrower's occupation		
1. Trading	18.62	.00
2. Farming	21.29	.00
3. School Teacher	1.37	.24
4. Public Servant	3.35	.06
5. Driver	8.00	.01
6. Local manufacturing	7.50	.01
C. Purpose of loan		
1. Trading	14.96	.00
2. Personal needs	0.10	.75
3. Farming	47.75	.00
4. Artisan	26.42	.00
D. Type of Security provided for loan		
1. Lien	3.44	.06
2. Other type of security	10.00	.00
3. None	47.56	.00
E. Loan authorized by		
1. Local board of directors	21.65	.00
2. Bank manager	17.79	.00
3. Other authority	34.62	.00
II. Multivariate tests (Wilks' criterion)	39.26	.00

a. Similar results, as reported here, were obtained for other multivariate test statistical (e.g., the Pillai's Trace)

Source: Rural Bank of Ghana Records

TABLE 4

**Group Level Means and Percentages
for Loan Recipient Characteristics with Significant Discriminant Results**

Significant Borrower Characteristics	Borrower Groups		Percent ¹ Default
	Defaulters (n=728, %=30.9)	Non-Defaulters (n=1631, %=69.1)	
A. Amount of loan (Average in Cedis)	¢53,485.4	¢40,483.5	30.9
B. Borrower's occupation (%)			
1. Trading	20.0	10.0	47.2
2. Farming	50.0	60.0	27.1
3. Driver (not taxi)	10.0	0.0	100.0
4. Artisan	20.0	30.0	22.9
C. Purpose of loan (%)			
1. Trading	30.0	20.0	40.0
2. Farming	40.0	60.0	22.9
3. Artisan	20.0	10.0	47.2
4. Other Purpose	10.0	10.0	30.9
D. Type of Security provided for loan (%)			
1. Types of security other than a lien	80.0	60.0	37.3
2. Lien	10.0	10.0	30.9
3. None	10.0	30.0	13.0
E. Loan authorizing agent/body			
1. Local board of directors	70.0	30.0	51.0
2. Bank manager	0.0	10.0	0.0
3. Other individuals	30.0	60.0	18.0

Source: Rural Bank of Ghana Records

¹ The percent default for each category was computed as the number of defaulters in a specific group divided by total number of defaulters and non-defaulters in the group.

to 22.9% for artisans. However, the average default rate for purpose of loans were respectively; 47.2 % for artisan, 40% trading and 22.9% for farming.

Surprisingly, only 13% of all unsecured loans were defaulted. This may indicate that only those with the best credit did not have to put up security; 37.3% of all loans with security other than liens were defaulted. Finally, no loans approved by bank managers were defaulted while 51% of all loans approved by local boards of directors were in default. It appears that bank managers were more careful about which loans they approved.

Table 4 therefore implies ways that banks can improve their default rate; for example, they could require more liens and less of other types of security, require more loans to be approved by managers and less by boards of directors, be more careful when making loans for purpose of artisans. The next section examines a similar set of issues using the primary data source.

Analysis of the Primary Data on Creditworthiness

The analysis in this section is based upon logit regressions when the dependent variable is binary (default) and ordinary least squares and tobit regressions when the dependent variable is continuous (time in arrears). The purpose is to investigate measures of creditworthiness using the primary data set. Two measures of creditworthiness are examined. The first measure is whether or not the loan recipient defaulted. The second measure is how many months a loan payment is in arrears.

Table 5 shows the definitions, the means and proportions of the independent variables used in estimating the probability of defaulting on a loan. The independent variables consist of information such as the sex, marital status, number of children, education level, age, amount of loan, and total annual income in cedis of the borrower, along with the purpose of the loan, and a variable measuring the borrower's perception of the efficiency with which the branch bank operates. The dependent variable is coded as one if the person interviewed responded "yes" to the question, "Did you ever have difficulty making payment to the extent that your loan was written off," and zero if the answer was no.

TABLE 5

Variable Definitions and Proportions & Means

<u>Variable</u>	<u>Definition</u>	<u>Proportions & Means</u>
Sex	1 = Male; 0 = Female	.745
Sing	Single	.049
Marr	Married	.870
Sep	Separated/Divorced	.081
Children	Number of Children	5.4
Income	Annual Yearly Income (Cedis)	252,709
Amount	Loan Amount (Cedis)	84,244
Age	Age in Years	45.6
School	No Formal Schooling	.248
School 1	Elementary Level	.446
School 2	Secondary Level	.147
School 3	College Level	.159
Farm	Purpose - Farming	.514
Trade	Purpose - Trading	.243
Other	Purpose - Other Business	.120
Person	Purpose - Personal	.089
House	Purpose - Housing Construction	.034
Agree	Agree That Bank Service is Prompt	.767
Diss	Disagree That Bank Service is Prompt	.074
Ir.diff	Indifferent	.159

Source: Ghana Loan Survey Data

Table 6 presents the results of two sets of logistic equations. The coefficients and asymptotic t-statistics in equation one were estimated without regional control variables, whereas the estimated coefficients in the second equation include regional controls. The following variables were assigned a value of zero: female, separated for marital status, no formal schooling for education, farming for purpose of loan, and agree for perception of bank efficiency. As the t-statistic shows, only married in both equations is statistically significant at the 5% level. A person who is married is less likely to default than one who is separated or divorced. The t-statistics for single are close to significant at the 5% level and suggest that a single person is also less likely to default than one who is separated or divorced.

Other non-regional variables with t-statistics greater than one are sex, amount of loan, and elementary and secondary education, but not college. A male is approximately .03 more likely to default than a female. Holding everything else constant, the larger the loan, the less likely a person is to default. The schooling variables are counter-intuitive. Borrowers with an elementary or secondary education are more likely to default compared to those with no formal schooling; however, borrowers with a college level education are less likely to default, but the t-statistic is only -.73. All of the t-statistics for the purpose of the loan were under one.

The final three variables attempt to capture the effect of a bank's efficiency on the probability of an individual defaulting. The measures are the response to the question "the bank where I mostly have my loan is a good source of credit because service is prompt and involves a short waiting time." Three variables were constructed from this question, those persons that responded indifferent, those who strongly agree or agree (assigned zero), and those who disagree or strongly disagree. The hypothesis is those persons who experience poor service and long waiting times are more likely to become discouraged with their bank, and decide to walk away from their loan, when compared with those who perceive just the opposite treatment or are indifferent. Although the findings in this regard are not statistically significant, the signs and relative magnitude of the coefficients are consistent with the hypothesis. Those persons who disagree or strongly disagree with the statement that their bank provides prompt service are more likely to default compared with those who are

TABLE 6

Coefficients for Logistic Regression on the Probability of Loan Default

Independent Variable	Logistic Coefficients Equation 1 dy/dx	Logistic Coefficients Equation 2 dy/dx
Intercept	-.098	-.079
Sex	-.033	-.029
	(-1.90)	(-1.68)
Sing	-.080	-.073
	(-1.72)	(-1.57)
Marr	-.044	-.044
	(-2.1)	(-2.07)
Children	.001	.001
	(.662)	(.62)
Income	$-.471 \times 10^{-8}$	$-.532 \times 10^{-8}$
	(-.246)	(-.28)
Loan Amount	$-.112 \times 10^{-6}$	$-.136 \times 10^{-6}$
	(-1.01)	(-1.12)
Age	-.0001	-.0001
	(-.172)	(-.183)
School 1	.027	.022
	(1.12)	(1.12)
School 2	.031	.030
	(1.30)	(1.22)
School 3	-.022	-.024
	(-.730)	(-.796)
Trade	-.016	-.014
	(-.790)	(-.716)
Other	.017	.018
	(.740)	(.751)
Person	-.018	-.014
	(-.620)	(-.488)
House	-.014	-.010
	(-.320)	(-.231)
Diss	.020	.021
	(.802)	(.822)
Indiff	.0007	.006
	(.040)	(.284)
Ashanti		-.028
		(-1.19)
Brong Ahafo		-.031
		(-1.13)
Eastern		-.021
		(-1.02)
Greater Accra		-.028
		(-.737)
Volta		-.062
		(-1.68)
Western		-.010
		(-.336)

Source: Ghana Loan Survey Data

(1) The Assymtotic t-Statistics are in parenthesis below the Derivative dy/dx.

indifferent or who strongly agree with this perception.

The estimated coefficients presented in the second equation in which the Central Region was assigned a value of zero include controls for region. The coefficients in equation 1 and equation 2 are similar. None of the coefficients for region are significant at the 5 % level: Based upon the coefficients, holding everything else constant, those persons located in the Central Region are more likely to default when compared with those in every other region in our sample. This difference is largest when the Central is compared with the Volta Region. A person from the Volta Region, holding everything else constant, has .062 less chance of defaulting compared with a similar person from the Central Region.

The above analysis was based upon the propensity for default. An alternative indicator of creditworthiness is payment delinquency, measured as the time in months that a loan is in arrears. The independent variables are the same as those used in the preceding analysis. The proportion and means of the independent variables used in the Tobit and OLS estimation are presented in Table 7. Because the dependent variable is now continuous, the Tobit model is used to derive the estimation results. As noted above, the Tobit method corrects for the bunching of observations when the value of the dependent variable is zero, and when the loan is not delinquent. This approach captures the effect of the independent variables on both the probability a loan will be delinquent and then the length of time a loan is delinquent, given that it is delinquent. For comparison, an OLS equation was also estimated. The sample size for this analysis, however, was only 577 observations. Well over half the sample chose not to respond to the arrears question. The results, as such, may be biased because of this selectivity problem.

The Tobit estimated coefficients and the chi-square statistics are shown in Column 1 of Table 8. Of the non-region coefficients, sex, marital status, secondary school, personal loans, and loans for housing were significant at better than the 5% level. Males were more likely to be in arrears and being a man increases the average delinquency, compared to a female. Single and married borrowers were not as far behind on their payments as those who are divorced or separated, as was the case of those with a secondary education. Those with personal loans and loans for housing were less likely

TABLE 7**Proportions & Means of Variables Used in Tobit and Ordinary Least Squares Equations**

<u>Variables</u>	<u>Means</u>
Sex	.765
Sing	.067
Marr	.853
Children	5.4
Income	207250
Loan Amount	61954
Age	45.5
School 1	.466
School 2	.147
School 3	.168
Trade	.238
Other	.134
Person	.086
House	.031
Diss	.075
Indiff	.130
Ashanti	.175
Brong Ahafo	.103
Eastern	.238
Greater Accra	.079
Volta	.108
Western	.091

Source: Ghana Loan Survey Data

- 1) The Excluded Variables Consist of (Separated/Divorced), No Schooling, Purpose of Loan - Farm, Agree with Statement, and Central Region.

TABLE 8

Tobit and O.L.S. Coefficients on Loan Delinquency (1)

Independent Variable	Tobit Estimated Coefficients	Ordinary Least Squares Estimated Coefficients
Intercept	4.8	8.01
Sex	4.24 (6.9)	2.16 (2.14)
Sing	-5.82 (3.55)	-2.83 (-1.45)
Marr	-5.97 (7.53)	-3.43 (-2.39)
Children	.263 (2.10)	.205 (1.8)
Income	-1.04×10^{-6} (.225)	1.57×10^{-7} (.110)
Loan Amount	-8.86×10^{-7} (.029)	-.000005 (-1.36)
Age	-.080 (1.34)	-.062 (-1.43)
School 1	-2.17 (1.89)	-1.09 (-1.07)
School 2	-4.49 (4.50)	-2.01 (-1.52)
School 3	-2.48 (1.51)	-1.09 (-.848)
Trade	-1.84 (1.28)	-1.53 (-1.47)
Other	-.499 (.291)	-.672 (-.567)
Person	-8.89 (13.7)	-4.59 (-3.31)
House	-6.37 (2.56)	-2.84 (-1.27)
Diss	1.29 (.349)	.884 (.618)
Indiff	-.064 (.001)	-.145 (-.127)
Ashanti	.409 (.040)	.647 (.522)
Brong Ahafo	.184 (.006)	-.046 (-.032)
Eastern	1.55 (.682)	1.38 (1.19)
Greater Accra	11.1 (21.0)	7.84 (5.01)
Volta	15.7 (53.9)	11.1 (7.95)
Western	13.8 (36.1)	8.12 (5.38)

Source: Ghana Loan Survey Data

(1) The chi-square and t-statistics are in parenthesis below the estimated Tobit and O.L.S. coefficients, respectively.

to be in arrears and were in arrears for a shorter period compared with people who had loans for farming. Coefficients with chi-square coefficients greater than one but not significant are number of children (+), age (-), college (-), and loans for trade (-). Positive (negative) coefficients indicate that the independent variable increases (decreases) the probability a loan is behind and the length of time it is behind. Loans in Greater Accra, Volta, and the Western Region all had large and significantly positive coefficients, compared to the Central Region. A borrower's attitude toward the bank apparently made little difference.

The coefficients and t-statistics for the OLS estimation are shown in Column 2 of Table 8. As is clear from Table 7, the OLS coefficients are consistent with the Tobit coefficient. In only two cases was the sign reversed (income and the Brong Ahafo Region), but in both estimations these coefficients were not close to being significant. Otherwise, the signs and relative effects are similar. The coefficients of the OLS regression are generally about half those of the Tobit. This is to be expected because the OLS coefficients show only the effect of the independent variables on the time of delinquency for loans that are delinquent, but not the effect on the probability a loan will be in arrears. The variables that are statistically significant at the 5% level are sex (being a man increases the average period of delinquency two months), married (decreases the period 3.5 months compared with divorced/separated), personal loans (4.5 months less), and four of the regional variables (delinquency periods in Eastern, Greater Accra, Volta, and Western were longer compared to the Central Region). Non-significant coefficients with t-statistics greater than one are single compared to divorced/separated (-), number of children (+), loan amount (-), age (-), elementary and secondary school compared to no formal school (-), and loans for trade and personal loans compared to farming (-).

Finally, comparing the Tobit and OLS coefficients, the Tobit coefficients may be loosely interpreted as follows: approximately one-half of the coefficient reflects the effect of the independent variable on the probability of a loan being delinquent and approximately half shows the effect on the period of delinquency.

VI. Summary and Conclusions

The results of the estimations are summarized in Table 9. These results should be useful to Banks in reducing the rate of of loan default, the probability of delinquency, and the time of delinquency. Banks that are aware of the loan and borrower characteristics that increase these probabilities and decrease this period of time can screen loans with these characteristics more closely. Given bankers' limited time, they probably cannot devote a large amount of additional time to examining every loan more extensively. Therefore, they can be more efficient in, for example, reducing the probability of loan default by devoting their additional time to loans and borrowers with characteristics that appear, on average, to increase the rate of default the most. They can devote more time to characteristics that are statistically most significant. For example, artisan loans and loans secured other than by a lien could be examined more carefully. Bank managers should take more of a role in approving loans because their record has been better than local boards. Married borrowers might be examined less carefully than others. Loans and borrowers with combinations of characteristics that raise the probability of default and delinquency should receive even more scrutiny. To summarize, this report could be a useful guide to show bankers in underdeveloped countries where to devote the most resources for loan analysis.

TABLE 9

Summary of Results

I. Secondary Data -- Characteristics of Loans and Borrowers, from Bank Records, Found Significant in Discriminant Analysis

A. Total Number of Loans	Default	Non-Default
2,359	728 (30.9%)	1,631 (69.1%)
B. Average Amount of Loan (Cedis)		
Defaulters ₦53,485.4	Non-Defaulters ₦40,483.5	
C. Borrower Characteristics and % Defaulting		
Trading 47.2	Driver 100.0	
Farming 27.1	Artisan 22.9	
D. Loan Characteristics and % Default		
1. Purpose		
Trading	30.9	
Farming	22.9	
Artisan	47.2	
2. Type of Security		
Other than a lien	37.3	
None	13.0	
3. Authorization of Loan		
Local Board	51.0	
Bank Manager	0.0	
Others	18.0	

II. Primary Data on Borrower Characteristics Using Questionnaires

A. Logit Estimation Using Regional Control Variables

1. Significant at 5% level
 - a. Married lowers probability of default relative to divorced/separated
2. t-statistics greater than 1
 - a. Male lowers probability of default
 - b. Single lowers probability of default
 - c. Larger loan lowers probability of default
 - d. Elementary and secondary schooling raises probability of default
 - e. Borrowers in all regions except Western and Greater Accra have, on average, a lower probability of default than Central region

B. Tobit Estimation of Loan Delinquency, Probability of Delinquency, and Length of Time of Delinquency

1. Significant at 5% level
 - a. Males higher and longer
 - b. Single and married lower and shorter than divorced/separated (little difference in the two coefficients)
 - c. Increases in children -- higher and longer
 - d. Secondary school higher and longer than no school
 - e. Personal and house loans lower and shorter, relative to farm loans
 - f. Greater Accra, Volta, and Western higher and longer, relative to Central

TABLE 9 Continued

Summary of Results

2. Chi-square statistics greater than 1
 - a. Age decreases probability and time
 - b. Elementary school and college lower and shorter, relative to no education but neither as much as secondary school
 - c. Loans for trade lower and shorter

- C. OLS Estimation of Loan Delinquency
Length of Time Delinquency
 1. Significant at 5% level
 - a. Male longer
 - b. Married shorter relative to divorced/separated
 - c. Personal loans shorter relative to farming

 2. t-statistics greater than 1
 - a. Single shorter relative to divorced/separated
 - b. More children increases time
 - c. Higher loan decreases time
 - d. Age decreases time
 - e. Elementary and secondary school decreases time

REFERENCES

- Graham, Douglas H. and Compton Bourne, "Agricultural Credits and Rural Progress in Jamaica: A Development Dilemma," Borrowers and Lenders, edited by Howell (London Overseas Development Institute, 1980) pp. 59-80.
- Meier, Charles E., "Predicting Cooperative Loan Default In Karnataka, India Using Discriminant Analysis." Economics and Sociology Occasional Paper #1346, March, 1987, Department of Agricultural Economics and Rural Sociology, Ohio State University.
- Nisbet, Charles, "Interest Rates and Imperfect Competition in The Informal Credit Market of Rural Chile." Economic Development and Cultural Change. October, 1967.
- Pandy, U.K. and M.A. Muralidharan, "An Application of Discriminant Function In Agricultural Finance." Indian Journal of Agricultural Economics, 1979.
- Reddy, Candi S., "Factors Discriminating Defaulters from Non-Defaulters in Primary Credit Cooperatives." Indian Cooperative Review, October, 1976.
- Sanderante, Nimal, "An Analytical Approach to Loan Defaults by Small Farmers," In Rural Financial Markets In Developing Countries, Von Pischke, J.D., Dale W. Adams, and G. Donald, editors, (Washington, D.C.: Economic Development Institute, World Bank) 1983.
- Wai, U Tun, Interest rates outside the organized money markets of underdeveloped countries. International Monetary Fund Staff Papers, November, 1957.
- Ward, Barbara, "Cash or credit crops? An examination of some implications of peasant commercial production with special reference to the multiplicity of traders and middlemen." Economic Development and Cultural Change, 1960.