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Estimation of the Determinants of Credit Demand by Farmers and Supply by Rural Banks in Ghana's Upper East Region

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Abstract

Credit is a strategic empowerment tool that has the potential to change the life of a person, family or community from a situation of abject poverty to a more dignified life. It can transform self-image, unlock potential and boost the productivity and well-being of the poor and vulnerable, especially farmers. This paper estimates the determinants of credit demand by farmers and supply by Rural Banks in the Upper East Region of Ghana. Semi-structured questionnaire complimented by key informant interviews and focus group discussions were used in gathering data from 250 farmers in 5 districts of Upper East Region. The logit model was used to estimate the determinants of credit demand by farmers and the Tobit model used to estimate the determinants of credit supply by Rural Banks. The findings showed that age of farmers, gender and political affiliations among others are the main determinants of credit demand by farmers. Type of crop grown, farm size and the amount of savings made are some determinants of credit supply by the Rural Banks. It is concluded that demand for credit by farmers and supply of it by Rural Banks in Ghana's Upper East Region are determined by socio-economic and politico-cultural factors. It is recommended that government; the Bank of Ghana and the Rural Banks themselves should develop strategies that aim at enhancing the positive determinants of credit demand and supply and mitigating the negative ones to ensure credit widening and deepening among farmers.

Keywords: Credit, Farmers, Ghana, Logit, Rural Banks

Introduction

Credit is a major component of agricultural production and access to it ensures increased output and food security (Diange and Zeller, 2000; Duong and Izumida, 2002). In developing countries, lack of it constitutes a critical constraint to the adoption and use of improved inputs and modern technologies of farming (Akudugu, *et al*., 2012). A small but growing empirical literature suggests that in rural areas of developing countries, credit constraints have significant adverse effects on farm output (Petrick, 2004), farm profit (Foltz, 2004) and farm investments (Carter and Olinto, 2003). Lack of working capital and low liquidity limit the ability of farmers to purchase inputs that enhance productivity. This leads to inadequate use of improved inputs such as fertilizers, pesticides, and seeds among others (Nyoro, 2002). It has been noted that the average production efficiency levels of producers who are able to secure formal credit are higher (Awudu and Richard, 2001). In Kenya for example, it has been reported that access to credit has resulted to higher technical efficiency of maize producers (Kibaara, 2005). The impact of credit access in facilitating agricultural production and economic growth is only possible provided the capital is used efficiently (Yunus and Alan, 2003).

Lack or inadequate access to credit (capital constraints) is a crucial militating factor against farmers in financing their farm operations and is one of the major underlying factors of low agricultural productivity in Ghana (Nani-Nutako, 1998). There is evidence in Latin America, for instance, of the prevalence of credit constraints and their impacts on farm efficiency as pressure to relax or overturn the financial liberalization policies widely implemented in the past two decades rises (Guirkinger *et al.,* 2007). Access to capital in general and credit in particular, is crucial for increased agricultural production and improvement in livelihoods. It is expected that access to credit will give beneficiaries the chance to expand their production ventures thereby taking the responsibility of establishing self-dignity and integrity. Despite the numerous positive impacts of credit on agricultural production, empirical studies reveal that several factors limit access to it (*examples include* Crook, 2001; Magri, 2002; Thaicharoen *et al.,* 2004; Crook and Hochguertel, 2005; Del-Rio and Young, 2005; Akudugu *et al.* 2009a; 2009b).

To be able to devise strategies to enhance farmers' access to credit for their farming activities, there is the need to identify and describe the determinants of their credit demand and the supply of credit by formal financial institutions such as Rural Banks, particularly in Ghana's Upper East Region. The essence is that knowing the factors that influence farmers' credit demand and the supply of it by Rural Banks will help decision makers and implementers formulate policies that will take advantage of the positive factors and mitigate the negative ones. The findings of this paper constitute a critical input for the formulation of credit delivery strategies that are socially acceptable, culturally agreeable, economically viable, politically neutral, gender sensitive and environmentally sustainable to both farmers as well as other marginalized groups and the Rural Banks. The focus on the Rural Banks is as a result of the fact that, in Ghana, Rural Banks have the mandate of providing financial services, particularly credit to rural dwellers most of who are farmers. As such, this paper estimates the determinants of credit demand by farmers and the supply of it by Rural Banks in the Upper East Region of Ghana.

Methodology

The Study Area

Carved out of the former Upper Region on 1st April, 1983, the Upper East Region covers a total land area of 8,848 square kilometres (km^2) which is about three per cent (3%) of Ghana's land area and has its capital at Bolgatanga (Asiseh, 2000). The region is situated in the North-Eastern corner of Ghana. It lies within 10^0 45^1N and 0^0 45^1W. It is bordered to the North by Burkina Faso, to the East by the Republic of Togo, to the South by the Northern Region and to the West by the Upper West Region. This means the Upper East Region is strategically located because it provides access to the land locked Sahel countries such as Burkina Faso, Mali, Benin and Niger as well as Northern Togo. The region is divided into nine (9) administrative areas comprising seven districts and two municipalities. These are the Bolgatanga Municipality, Bawku Municipality, Garu/Tempane District, Bawku West District, Talensi/Nabdam District, Bongo District, Builsa District, Kasena/Nankana East and the Kasena/Nankana West Districts.

Demographically, the region had a total population of 914,016 in 2000 (GSS, 2000). Out of this, 484, 428 representing about 53 percent are females with the remaining 47 percent being males. This is indicative of the need to incorporate gender interests in financial capital policy formulations. The region is predominantly rural with about 772,131 (84%) of the population living in rural settlements and 141,885 (16%) in urban areas (Harold, 2005). However, there are concentrations of population in the main urban centres of Bolgatanga, Bawku, Navrongo, Sandema, Bongo, Zebilla, Garu, Tongo and Paga which serve as service centres and administrative capitals of their respective municipalities and districts.

The region is characterized by long dry conditions. The dry season begins in November and ends in late April or early May. Even in the wet season, there are still some irregular drought spells. The dry season is characterized by hazy weather conditions as a result of the dusty winds (harmattan) blown from the Sahara desert by the northeast trade winds. Temperatures reach a maximum of 45°C in the mid-dry season and a minimum of 20°C in the mid-wet season. The average annual rainfall is about 1002mm/p.a. with the maximum recorded in July/August and the minimum in October/November. Relative humidity reaches the peak of 86% in the rainy season and the lowest of 17% in the dry season (Akudugu and Gbene, 2005).

The major off-farm economic activities prevailing in the area include sheabutter extraction, pito (local beer made of sorghum and maize) brewing, pito malt processing, rice processing/parboiling and "kulikuli" (groundnut cake) making. Farming of cereals, roots such as sweet and frafra potatoes, vegetables such as onions and tomatoes and rearing of small and large ruminants such as goats, sheep and cattle are some of the on-farm activities. The farm activities with great potentials are sorghum, rice, onions and tomatoes production as well as guinea fowl rearing.

A number of institutional and non-institutional financial capital intermediaries operate in the region. The institutional ones include the Ghana Commercial Bank (GCB) with three branches at Bolgatanga, Bawku and Navrongo; the Agricultural Development Bank (ADB) with three branches at Bolgatanga, Navrongo and Bawku; the National Investment Bank (NIB) at Bolgatanga; SSB at Bolgatanga; Barclays at Bolgatanga and Bawku with a mobilisation centre at Navrongo; five Rural Banks with eleven branches across the region; savings and loans companies at Bolgatanga and Bawku and insurance companies. The non-institutional financial intermediaries include the Credit Unions, Special Government Programmes, private money lenders, Susu collectors, distributors of farm inputs, Rotating Savings and Credit Associations (ROSCAs), friends and relatives. All these form sources of credit to the people in the region.

The Survey

Two hundred and fifty farmers (250) comprising one hundred and thirty-five men (135) and one hundred and fifteen (115) women were interviewed. This indicates close gender parity in sampling which implies that the findings are to a large extent representative of both men and women. The multistage sampling technique was

employed. The first stage included the purposeful selection of the five out of nine districts of the Upper East Region. The selected districts are the Garu-Tempane District where the Bawku East Small Scale Farmers Association (BESSFA) Rural Banks is located, the Bawku West District where the Toende Rural Bank is located, the Builsa District where the Builsa Community (BUCO) Bank is located, the Kassena-Nankana West District where the Naara Rural Bank is located, and the Bongo District where the Bongo Rural Bank is located.

After selecting the districts, stratified random sampling was employed. Each of the selected districts was divided into five strata (i.e. North, East, South, West, and Central). This implies that the whole study area was divided into twenty-five strata. Simple random sampling was then used to select one community from each stratum. Ten (10) farmers were then randomly sampled from each stratum which gave a sample size of two hundred and fifty (250) mentioned earlier. Managers of the Rural Banks and in some cases their representatives were also interviewed. In each selected community, individuals were selected for the interviews using the random numbers technique. Semi-structured questionnaire supplemented with key informant interviews and focus group discussions were used for the data collection.

The Theoretical and Analytical Framework

Two levels of analyses were carried out. The first was to estimate the determinants of credit demand by farmers using the logit model. The second level of analysis was to estimate the determinants of credit supply to farmers by Rural Banks using the Tobit Model. The analyses accounted for the possibility of selectivity bias (Johnston and Dinardo, 1998) on the part of farmers in their credit demand and the Rural Banks in their supply of credit. When people are selected for a particular intervention based on factors that are not physical and difficult to measure, it may result in selection bias. For instance, when a farmer for any reason is prevented by his/her colleagues from joining a solidarity group for credit disbursement, then, selectivity bias is introduced. Better still, when credit is supplied to farmers by Rural Banks because of their political or religious inclinations, selectivity bias is introduced. All these affect the demand and supply of credit. To account for selectivity bias, the Inverse Mills Ratio (IMR) was computed from the logit model employed to estimate the determinants of farmers' credit demand from the Rural Banks. This means that the decision to demand credit from the Rural Banks by the farmers may not only be influenced by those factors specified in the model but also by factors which could not be captured by the researcher. For instance, a farmer may decide to demand credit from a Rural Bank because he/she is a brother/sister to the credit officer of that bank. The computed IMR was included as an explanatory variable to estimate the determinants of supply of credit to farmers by the Rural Banks using the Tobit model in the second level of analysis. A significant IMR implies presence of selectivity bias and the vice versa.

The logit model (Amemiya, 1981) as stated earlier was employed to examine the determinants of credit demand by farmers from the Rural Banks. The study used the threshold decision-making theory proposed by Hill and Kau (1973) and Pindyck and Rubinfeld (1998) to analyse the determinants of credit demand by farmers. The theory points out the fact that when farmers are faced with a decision to adopt or not to adopt an innovation, in this case demand credit from Rural Banks, every farmer has a reaction threshold, which is dependent on a certain set of factors. As such, at a certain value of stimulus below the threshold, no adoption is observed while at the critical threshold value, a reaction is stimulated. Such phenomena are generally modeled using the relationship:

$$Y_i = \beta X_i + u_i \quad (1)$$

Where Y_i is equal to one (1) when a choice is made to adopt and zero (0) otherwise; this means:

Y_i = 1 if X_i is greater than or equal to a critical value, X^* and
Y_i = 0 if X_i is less than a critical value, X^*

Note that X^* represents the combined effects of the independent variables (X_i) at the threshold level. Equation 1 represents a binary choice model involving the estimation of the probability of adoption of a given technology, innovation or intervention *(Y)* as a function of independent variables *(X)*. Mathematically, this is represented as:

$$Prob(Y_i = 1) = F(\beta' X_i) \quad (2)$$
$$Prob(Y_i = 0) = 1 - F(\beta' X_i) \quad (3)$$

Where Y_i is the observed response for the i^{th} observation of the response variable, *Y*. This means that Y_i = 1 for an adopter (i.e. farmers who decide to demand credit from the Rural Banks) and Y_i = 0 for a non-adopter (i.e. farmers who decide not to demand credit from the Rural Banks). X_i is a set of independent variables such as literacy, farm size, gender, interest rate charged and distance from residence of farmers to the Rural Banks among others, associated with the i^{th} individual, which determine the probability of adoption (i.e. making the decision to demand credit), (P). The function, F may take the form of a normal, logistic or probability function. The logit model uses a logistic cumulative distributive function to estimate, P as follows (Pindyck and Rubinfeld, 1998):

$$P(Y=1) = \frac{e^{\beta' X}}{1+e^{\beta' X}} \quad (4)$$

$$P(Y=0) = 1 - \frac{e^{\beta' X}}{1+e^{\beta' X}} = \frac{1}{1+e^{\beta' X}} \quad (5)$$

According to Greene (2008), the probability model is a regression of the conditional expectation of Y on X giving:

$$E(Y/X) = 1[F(\beta' X)] + 0[1 - F(\beta' X)] = F(\beta' X) \quad (6)$$

Since the model is non-linear, the parameters are not necessarily the marginal effects of the various independent variables. The relative effect of each of the independent variables on the probability of adoption (i.e. making the decision to demand credit) is obtained by differentiating equation (6) with respect to X_{ij} resulting in equation (7) (Greene, 2008):

$$\frac{\partial P_i}{\partial X_{ij}} = \left[\frac{\lambda^{\beta' X}}{\left(1+\lambda^{\beta' X}\right)^2}\right]\beta = F(\beta' X)[1 - F(\beta' X)]\beta \quad (7)$$

The maximum likelihood method was used to estimate the parameters.

The implication for applying the logit model in this paper is that, the farmer would decide to demand credit from the Rural Bank at a given point in time when the combined effects of certain factors exceed the inherent resistance to change in him/her. The preference for the logistic regression model to the conventional linear probability regression model in analysing the determinants of farmers' credit demand from Rural Banks is based on the fact that, the parameter estimates from the former are asymptotically consistent and efficient. The estimation procedure employed also resolves the problem of heteroscedasticity and constrains the conditional probability of making the decision to demand credit to lie between zero (0) and one (1). The main reason for choosing the logit model over the probit model for this paper is because of its mathematical convenience and simplicity (Greene, 2008) and the fact that it has been applied in similar studies by Akudugu *et al.* (2009a) and Ayamga *et al.* (2006) among others.

The logit model provides information only with respect to the farmers' decision to demand credit from the Rural Banks or not to demand, but not on the extent of supply of credit by the banks after their demand is made. To estimate the determinants of the extent of supply of credit to farmers by the Rural Banks, the Tobit model is employed. The Tobit model allows us to indentify the factors that determine how much credit is supplied to every farmer who applied for it from the Rural Banks. The Tobit model was developed by Tobin in 1958 and has been used by a number of researchers including Oladele (2005), Dankyi *et al.* (2005) and Akudugu *et al.* (2009b) in various studies. According to Greene (2008) and Cameron and Trivedi (2005), the general formulation of the Tobit model is usually given in terms of an index function. This is given in equation (8) as:

$$y_i^* = X'_i\beta + \varepsilon_i \quad (8)$$

Where y_i^* is the unobserved latent variable or the threshold which must be exceeded for a reaction to take place; X_i is a set of explanatory variables and ε_i is assumed to be an independently and normally distributed stochastic term with zero mean, μ and constant variance, σ^2.

Assume that there is a perceived utility *U(y)* from adopting an intervention, say, demanding credit from Rural Banks, y_i, and, a utility *U(0)* for not adopting it, say, not demanding credit from the Rural Banks. Further assume that there is a cluster of the population with no decision to make at the limit (Baidu-Forson, 1999; Oladele, 2005; Dankyi *et al.*, 2005; Akudugu *et al.*, 2009b), then:

$y_i = 0 \ \ if\ y_i^* \le 0,\ \ for\ not\ demanding\ credit\ from\ Rural\ Banks$
and
$y_i = y_i^* \ \ if\ y_i^* > 0, for\ demanding\ a\ given\ amount\ of\ credit$

Where y_i is the dependent variable, in this case, the extent (i.e. the ratio of the amount of credit supplied to the farmer to the amount of credit applied for) of credit supplied to farmers by the Rural Banks. The expected intensity, E(p) of credit supply by the Rural Banks to farmers is given as follows:

$$E(p) = X_i\beta F(z) + \sigma f(z) \quad (9)$$

Where X is the vector of explanatory variables; F(z) is the cumulative normal distribution of z; f(z) is the value of the derivative of the normal curve at a given point (i.e. the unit normal distribution); z is the Z-score for the area under the normal curve, given as z = Xβ/σ; β is a vector of Tobit maximum likelihood estimates; and σ is the standard error of the model. The relationship between the expected value of all observations, E_p and the expected conditional value above the limit E_p* is given by:

$$E_p = F(z)E_p^* \quad (10)$$

Analyzing the policy implications of changes in the relevant explanatory variables is a major component of this paper. To this end, the effect of the k^{th} variable of X on y_i leads to the following decomposition:

$$\delta E_p / \delta X_k = F(z)(\delta E_p^* / \delta X_k) + E_p^*(F(z)/\delta X_k) \quad (11)$$

This (equation 11) suggests that the total change in elasticity of y_i can be disaggregated into two parts

namely: The change in probability of the expected level of intensity and change in the elasticity of being a beneficiary of credit from the Rural Banks.

To obtain the marginal effect of the observed variable that is of interest in this paper, the following formula (Greene, 2008: 765) is used:

$$\frac{\delta E(y \mid X_i)}{\delta X_i} = \beta^* \Pr ob(0 < y^* < 1) \quad (12)$$

According to Greene (2008), the log-likelihood of the Tobit model is specified as:

$$lnL = \sum_{yi>0} -1/2[\log(2\pi) + ln\sigma^2 + (y_i - x_i'\beta)^2/\sigma^2] + \sum_{yi=0} \ln[1 - \emptyset(x_i'\beta)/\sigma]$$

Maximising this likelihood function with respect to β and σ gives the maximum likelihood estimates of these parameters. STATA (Version 10) was the statistical software employed to estimate the empirical parameters by MLE.

Choice of Variables for Logit and Tobit Models and Hypotheses

The choice of variables for the above models was based more on related studies by researchers such as Nathan *et al.* (2004); Ayamga *et al.* (2006); Akudugu *et al.* (2009a; 2009b); and Fakayode and Rahji, (2009). The age of a farmer (X_1) was included in the models because it is used as a proxy for maturity and the potential ability to utilize and repay credit by borrowers (Fakayode and Rahji, 2009; and Akudugu *et al.* 2009a). It was measured in years for both the logit and Tobit models. It was hypothesized to assume a quadratic function, and that younger farmers are considered immature to be able to utilise credit effectively and to repay and therefore may not demand credit from the banks. Besides, as farmers grow beyond their economically active age (X_2) group, their economic activities become less which negatively influences their decision to demand credit from the Rural Banks.

The literacy level of farmers (X_3) was included in the estimations. Given the quality of education in the study area, those who had less than nine (9) years of formal schooling (i.e. completed Junior High School) were considered illiterate and assigned a dummy value of zero (0), while those who had nine (9) or more years of formal schooling were considered literates and assigned a dummy value of one (1). Literacy was hypothesised to have positive relationships to the decision to demand credit and the amount that they could receive from the Rural Banks. This is because formal education is said to be a major factor that influences the decision to participate in credit programmes (Ayamga *et al.* 2006; Lukytawati, 2009).

A cash crop grown (X_4) was expected to have positive effect on the decision to demand credit. This is because those into cash crop production are into farming as a business and therefore are more likely to demand credit to finance their production activities. Cash crop in this study was defined as a crop, 70 percent of the output of which is for sale. Farmers into cash crop production are considered as being more entrepreneurial and business oriented. Those respondents who did not cultivate cash crops were assigned a dummy value of zero (0) and those who cultivated cash crops were assigned a dummy value of one (1). It was used for both the logit and Tobit estimations.

The perception of farmers regarding the application procedures (X_5) was included in the study because earlier studies (*example* Akudugu *et al.* 2009a) found it to negatively affect the decision to demand credit. It was hypothesised that those who considered the application procedures as cumbersome were less likely to make the decision to demand credit from the Rural Banks and the vice versa. Those farmers who said the application procedures were not cumbersome were assigned a dummy value of zero (0) and those who said the application procedures were cumbersome were assigned a dummy value of one (1). It was included in only the logit model estimation.

Savings (X_6) was included in the study because it serves as a proxy for the net worth of the farmer. The more savings that is made by the farmer, the more the likelihood he or she is able to repay and therefore can take a higher amount of credit. It was measured as a dummy for the logit model and absolute amount of savings made in Ghana Cedis for the Tobit model estimation. The reason for using dummy for the logit was to capture the perceptions of farmers regarding the 'savings before credit policy' by the Rural Banks. Farmers who did not have savings with the Rural Banks were assigned a dummy value of zero (0) and those who had savings with the Rural Banks assigned a dummy value of one (1). On the other hand, since a dummy for savings captures perceptions which may not necessarily be true, the real amount of savings made in Ghana Cedis with Rural Banks by farmers was used for the Tobit estimation. In both cases, it was hypothesized to have positive effects on farmers' decisions to demand credit and the amount supplied to them by the Rural Banks.

The farm size (X_7) was also included because it can be used to estimate the potential income of the borrower and was expected to have a positive influence on both the decision to demand credit and the extent of supply of it by

the banks. It was measured in hectares. It was however, dropped from the Tobit estimation because it was not only insignificant but also correlated strongly with the amount of savings made by farmers with the Rural Banks.

The higher the perception of farmers that interest rate is high (X_8), the lower the probability that they will decide to demand credit from Rural Banks. As such, it was hypothesized to be a negative determinant of credit demand. Those farmers who said they did not perceive the interest rate charged by the Rural Banks to be high were assigned a dummy value of zero (0) and those who said they perceived the interest rate charged by the Rural Banks to be high were assigned a dummy value of one (1). It was used for the logit estimation only.

The gender (X_9) of farmers was also included in the estimation and was expected to be either positive or negative. Men were assigned a dummy value of zero (0) and women assigned a dummy value of one (1). It was used in only the logit model estimation. The more difficult it is to access land for farming (X_{10}), the lesser the probability that farmers would demand credit from the Rural Banks for farming. It was hypothesized to have positive effect on the decision to demand credit from the Rural Banks by farmers. Farmers who said they did not have access to farm lands were assigned a dummy value of zero (0) and those who said they had access to farm lands were assigned a dummy value of one (1). It was used for the logit model estimation only.

Active political affiliation (X_{11}) was hypothesized to be positively related to the farmers' credit demand from Rural Banks. This is because it has been observed that some poverty alleviation interventions by the Metropolitan, Municipal and District Assemblies (MMDAs) have credit components which are channeled through the banks for disbursement. Political appointees of the MMDAs use these credit facilities to appease their followers. It was therefore envisaged that active affiliation with a given political party will have a positive influence on the demand for such credit facilities from the Rural Banks. Those who said they were not actively affiliated to any political party in Ghana were assigned a dummy value of zero (0) and those who said they were actively affiliated to one political party or the other in Ghana were assigned a dummy value of one (1). It was used for the logit model estimation only.

Membership of solidarity groups or associations (X_{12}) is said to be a fundamental requirement for demanding credit by small borrowers (Lukytawati, 2009). Group based lending is a way of circumventing adverse selection and moral hazard issues (Armendariz and Morduch, 2005). Farmers who belong to social or income generating groups are more likely to demand credit from the Rural Banks than those who do not. This is because most of the social groups are formed by the Rural Banks for credit disbursements and savings mobilizations. The Rural Banks rely on these social groups for the provision of social collateral provided by poor borrowers, particularly farmers for the advancement of credit. This implies that once a person belongs to a social group, such a person is not required to provide collateral to be able to access credit. Members of the group jointly guarantee for each other. As such, membership of social groups was expected to be a positive determinant of credit demand from the Rural Banks by farmers. Farmers who did not belong to social groups were assigned a dummy value of zero (0) and those who belonged to social groups were assigned a dummy value of one (1). It was used for only the logit model estimation.

Distance (X_{13}) was expected to have a negative effect on both the decision to demand credit and the extent of supply of credit by the banks. This implies that those who are far away from the Rural Banks are less likely to demand credit from them and the vice versa. Those who live far away and decide to demand credit are most likely to have lesser amounts compared to those closer. This is because people who live far away may have to board cars to the Rural Banks at a cost which eventually affects the amount they actually get for their farming activities since part of it is used to pay for transport. It was measured in kilometres for both the logit and Tobit estimations.

The Results and Discussion

Determinants of Credit Demand by Farmers

The estimated determinants of credit demand by farmers from Rural Banks using the logit model included the age of farmers, literacy, type of crops grown (i.e. cash or food crops), the application procedures, savings habit, farm size, perception of interest charged, gender, access to farm land, political affiliation, membership of solidarity groups, and distance from residence of farmers to the Rural Banks. The estimated logit regression model (Table 1) gave an adjusted Pseudo R – squared of about 0.73 which implies that all the explanatory variables included in the model were able to explain about 73 per cent of the probability of the decision of farmers to demand credit from the Rural Banks. The log likelihood ratio (LR) statistic is significant at 1 percent, meaning that the explanatory variables included in the model jointly explain the probability of farmers deciding to demand credit from the Rural Banks. Given these two goodness of fit measures, it is concluded that the logit model used has integrity and is appropriate. The validity of the logit model in estimating the determinants of farmers' credit demand from the Rural Banks is consistent with related studies by Akudugu *et al.* (2009); Akram *et al.* (2008);

Ayamga *et al.* (2006); Benerjee (2001); and Malik (1999), who employed it in similar empirical studies.

The age of respondents met the apriori expectation of quadratic relationship with the probability of farmers demanding credit from the Rural Banks. The findings revealed that younger farmers are less likely to demand credit from the Rural Banks than elderly farmers. This is consistent with the findings of Akudugu *et al.* (2009a); Akram *et al. (*2008); Benito and Mumtaz (2006); Thaicharoen *et al.* (2004); and Crook (2001) that age is a significant determinant of credit delivery and access. Literacy conformed to the apriori expectation of positive influence on the demand for credit from Rural Banks by farmers. It was found to be significant at 1 per cent. This implies that farmers who had at least, nine years of formal schooling are more likely to demand credit from the Rural Banks than those who had less number of years of formal schooling. This finding regarding formal schooling is consistent with the findings of Ayamga *et al. (*2006); Thaicharoen *et al. (*2004); and Arvai and Toth (2001) that formal schooling significantly influences the decision to participate in formal credit schemes. This is attributed to the fact that persons who are literate are able to read and make better applications to the banks than those who are illiterate.

The cultivation of cash crops also met the apriori expectation of positive relationship and was found to be significant at the 10 per cent level. This means that farmers who cultivated cash crops such as rice, groundnut, maize and soybeans are more likely to demand credit from the Rural Banks for their production activities than those who cultivated staple food crops for household consumption. This is because those who are into cash crop production are into farming as a profit making venture and are therefore more inclined to expand their production activities in order to take advantage of economies of scale than those who are not into cash crop production.

The perception of farmers regarding how cumbersome and long the application procedures are have negative influence on the probability of their demand for credit from the Rural Banks. Though it met the apriori expectation of negative relationship, it was not significant. This finding of negative influence of long and complicated application procedures on the demand for credit from Rural Banks by farmers is consistent with the findings of Akudugu *et al.* (2009), Nathan *et al.* (2004) and Johnson (2004) that cumbersome application procedures deter people, especially illiterates, from demanding credit from formal sources. Savings made with the Rural Banks by farmers met the apriori expectation of positive relationship with the probability of farmers demanding credit from Rural Banks. It was significant at the 1 per cent level. Due to the savings before credit policy by most Rural Banks, people who saved with them mostly demanded credit from them (Rural Banks) since the principal motive for saving with the banks is to get credit in return. This finding of positive effect of savings on probability of demanding credit from the Rural Banks is supported by the finding of Akudugu *et al.* (2009b) and Akram *et al.* (2008) that savings form a basic requirement of accessing credit from many formal financial institutions.

Farm size was also found to be positively related to the probability of farmers' demanding credit from the Rural Banks for their farming activities. This was found to be significant at the 5 per cent level. Though the perception of farmers on interest rate charged met the apriori expectation of negative relationship, it was an insignificant determinant of the demand for credit from Rural Banks by farmers. This finding of negative influence of interest charged on the probability of farmers demanding credit from the Rural Banks is supported by that of *Business Week* (2005) and *The Financial Express* (2005) that the exorbitant interest rates charged by financial institutions deter many people from demanding credit from such sources. This implies that farmers who perceived the interest charged by the Rural Banks to be high are less likely to demand credit from them. Gender of farmers was also found to be a significant determinant of the demand for credit from the Rural Banks. This means that female farmers are more likely to demand credit from the Rural Banks than their male counterparts. It was found to be significant at 1 per cent. This is understandable given that most credit schemes designed by banks and other development institutions such as NGOs focus more on women. This is as a result of the fact that they are considered the most disadvantaged, vulnerable and above all, credit worthy.

As expected, access to land for farming was found to be a positive determinant of the demand for credit from Rural Banks by farmers though insignificant. This finding is inconsistent with the finding of Benerjee (2001) that land constitutes a major factor in deciding whether or not to demand credit from formal sources. This is because access to land for farming is not a serious challenge in the study area. Active political affiliation met the apriori expectation of positive relationship with probability of the decision to demand credit from the Rural Banks. This was found to be significant at the 10 per cent level. The implication of this finding is that farmers who are actively affiliated to one political party or the other are most likely to demand credit from Rural Banks especially when their supposed party is in power than their counterparts who are not. This can have negative implications on credit recovery by the Rural Banks because of the fact that such people always regard credit advanced to them by virtue of

their political affiliation as gifts from their political godfathers. Also, membership of social groups also conformed to the apriori expectation and was found to be significant at 1 per cent (Table 1). This implies that when farmers joined social groups, then, the probability that they will demand credit from the Rural Banks to support their farming activities is most likely to increase. This is more so given that most of such social groups are formed by the Rural Banks for mobilizations of savings and credit delivery. The decision to join such social groups is mostly driven by the desire to access financial services, particularly credit from the Rural Banks. This finding is consistent with the findings of Akudugu *et al.* (2009a), Armendariz and Morduch (2005), and Kah *et al.* (2005) that formation of economic and social associations helped improve access to credit since there is a joint guarantee by association members.

The distance from the residence of farmers to the Rural Banks conformed to the apriori expectation of negative relationship with the probability of farmers demanding credit from Rural Banks. It was found to be significant at 5 per cent. The negative relationship between distance and the probability of demanding credit from the Rural Banks by farmers is consistent with the findings of Fakayode and Rahji (2009) and Ayamga *et al.* (2006) that the closer the source, the higher the probability of the decision to demand credit and vice versa. This is because those close to the Rural Banks tend to know more about the services rendered by the banks and are most likely to demand such services.

Table 1: Logit regression results of determinants of credit demand by farmers

Dependent variable: Farmers' decision to demand credit (Binary)			
Variable	**Coefficient**	**Std. Err.**	**Marginal effects**
Age	-0.2110	0.1488	-0.0425
Age^2	0.0022	0.0013*	0.0004
Literacy	2.6781	0.9245***	0.5110
Cash crop	1.2520	0.7218*	0.2310
Application	-0.2025	0.6895	-0.0405
Savings	3.2476	0.9209***	0.6576
Farm size	1.8231	0.7682**	0.3814
Interest rate	-0.4948	0.7081	-0.1029
Gender	1.8992	0.7638***	0.4062
Politics	1.2093	0.7012*	0.2548
Land access	0.5315	0.8940	0.1113
Group member	2.3090	0.7355***	0.4499
Distance	-1.0068	0.4382**	-0.2029
Constant	-0.3533	4.0238	-
Goodness of fit measures			
LR Chi-square (13)	=	193.96	
Prob > Chi-square	=	0.0000	
Log likelihood	=	-36.313334	
Pseudo R^2	=	0.7276	
*** = Significant at 1%; ** = Significant at 5%; * = Significant at 10%			

Source: Field Survey Data, 2010

In summary, the significant determinants of credit demand from Rural Banks by farmers in the Upper East Region of Ghana are found to be the age of farmer, literacy, type of crop grown (cash or food crop), savings, farm size, gender, political affiliations, membership of social groups, and distance from residences of famers to the Rural Banks. The conclusion is that any strategy that aims at improving farmers' demand for credit from Rural Banks must of necessity target these socio-economic and politico-cultural characteristics of farmers.

Determinants of Credit Supply to Farmers by Rural Banks

The Tobit model estimation gave a Pseudo R^2 of 0.73 which implies that the variables included in the model are able to explain about 73 per cent of the variability in credit supply to farmers by Rural Banks in Ghana's Upper East Region (Table 2). The age of farmers conformed to the apriori expectation of quadratic function though insignificant. This implies that the banks are more inclined to supplying credit to farmers within the economically active age group. This finding is consistent with Akudugu *et al* (2009b) that the amount of credit that farmers are able

to access from Rural Banks is influenced by their age which is used as a proxy for maturity and ability to use credit and to repay. Literacy was also found to positively relate to the extent of credit supply to farmers by Rural Banks. This is in conformity with the apriori expectation and literature. This means that the amount of credit that the Rural Banks are ready to supply to farmers is positively determined by the level of formal education of the applicants. Farmers who had at least nine years of formal education are likely to be supplied with higher amounts of credit by the Rural Banks than those with less number of years.

The only tangible significant determinant of the amount of credit the Rural Banks supply to farmers is savings made. This determinant was found to be significant at the 1 per cent significance level and is positively related to the amount of credit that the Rural Banks are ready and willing to supply to farmers. This means that farmers who are able to save higher amounts are supplied with much more credit than those who are unable to do so. This finding is supported by the 'savings before credit policy' of the banks. By this policy, farmers are expected to save continuously for at least three months before they could be supplied with credit. From the interviews with bank officials, the most important tangible determinant of their supply of credit to farmers is the ability of the farmers to keep active savings accounts with the Rural Banks. This simply means that farmers who do not keep active savings accounts are shut out of credit supply.

The distance from the Rural Banks to residences of farmers was found to have a negative relationship with the credit supply to farmers. This implies that farmers who live further away from the Rural Banks are more likely to be supplied with less credit compared to those who live closer to the banks. The type of crop cultivated by farmers is also a determinant of credit supply to them by the Rural Banks. It means that those farmers who cultivate cash crops are most likely to be supplied with credit by the Rural Banks than those who cultivate food crops for family consumptions.

The Inverse Mills Ratio (IMR) which measures selectivity bias in credit supply by the Rural Banks was found to be significant at the 1 per cent significance level (Table 2). This implies that there is selectivity bias in the supply of credit to farmers by the Rural Banks. This means that apart from the determinants captured in the Tobit model, there are other determinants that the Rural Banks consider in their supply of credit to their customers that were not captured in the model estimation. For instance, the criteria used by the Rural Banks in selecting people to form the social groups are not well documented and hence could not be captured. The fact that some factors were not captured in the model is further supported by the fact that the constant term is found to be significant at the 1 per cent level. Some of such factors which are difficult to measure but determine supply of credit to farmers by the Rural Banks are political interference and interpersonal relationships. This is because some social groups are formed by politicians. This is particularly so in situations where poverty alleviation funds from government through the MMDAs are channeled through financial institutions such as the Rural Banks for onward disbursement to beneficiaries as credit. In such cases, cohorts of political heads are put into social groups for such credit facilities. Also, the personal relationships come into play in the formation of social groups by the Rural Banks, especially where the credit officer is a native. Such a credit officer is most likely to select people who are close to him or her thereby introducing selectivity bias. Political influences come to bare on bank officials who are coerced by politicians to supply credit to their political sympathizers thereby introducing selectivity bias in credit delivery.

Table 2: Tobit results of determinants of credit supply to farmers by Rural Banks

Dependent variable: Proportion of credit accessed (i.e. a ratio of the amount of credit received to the amount applied for by farmers)			
Variable	**Coefficient**	**Std. Err.**	**Marginal effects**
Age	-0.0099	0.01087	-0.0099
Age^2	0.0001	0.0001	0.0001
Literacy	0.0476	0.0508	0.0476
Savings	0.0013	0.0005***	0.0013
Distance	-0.0088	0.0282	-0.0088
Cash crop	0.0425	0.0508	0.0425
IMR	-0.4245	0.0531***	-0.4245
Constant	1.0387	0.2768***	-
Goodness of fit measures			
LR Chi-square (13)	= 236.67		
Prob > Chi-square	= 0.0000		
Log likelihood	= -43.7305		
Pseudo R^2	= 0.7302		
*** = Significant at 1%			

Source: Field Survey Data, 2010

The issue of political interference came out strongly during discussions with bank officials and farmers. Some of the bank managers interviewed lamented that the political interference was worrisome and negatively affecting supply of credit to customers, especially farmers. According to them, the interference by politicians is worsened by the fact that the District Assemblies are major shareholders in the Rural Banks. As such, whosoever is appointed to head the District will always try to explore the avenue of credit supply to the advantage of his or her political favourites. From the above, it is concluded that the only measurable determinant that influences credit supply to farmers by Rural Banks in the Upper East Region of Ghana is their amount of savings. There is selectivity bias in the supply of credit to farmers by the Rural Banks.

Conclusion and Recommendations

Based on the findings, it is concluded that the age, literacy, type of crop grown (cash or food crop), savings with Rural Banks, farm size, gender, political affiliations, membership of economic or solidarity groups and the distance from farmers' residence to the Rural Banks are the significant determinants of credit demand by farmers in the Upper East Region of Ghana. Savings with the Rural Banks is the only tangible significant determinant of credit supply to farmers by Rural Banks. There is also selectivity bias in the disbursement of credit to applicants by the Rural Banks. Based on the findings, two main recommendations are made as follows:

First, to encourage farmers demand credit from the Rural Banks, policies should be formulated by government and other institutions that work to alleviate financial constraints of farmers to mitigate the effects of the negative determinants and enhance the positive ones. Such policies should target at:

i. The economically active age group of farmers
ii. Improving the literacy levels of farmers
iii. Encouraging farmers to cultivate cash crops
iv. Encouraging farmers to make savings with the Rural Banks
v. Increasing the farm sizes of farmers
vi. Depoliticising the supply of credit to farmers by Rural Banks and
vii. Encouraging farmers to join existing or form new social groups

Second, there is selectivity bias in the supply of credit to farmers by the Rural Banks which is largely caused by nepotism and political inclinations. It is therefore recommended that government, the Bank of Ghana and Rural Banks should come out with mechanisms that will make the supply of credit free of these biases.

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