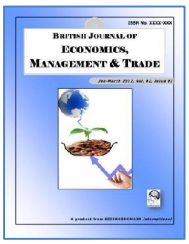

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# Agricultural Credit Allocation and Constraint Analyses of Selected Maize Farmers in Ghana

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***Authors' contributions***

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript*

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## ABSTRACT

The study analyzes factors influencing agricultural credit allocation and constraint condition of maize farmers in the Upper-Manya Krobo District in the Eastern region of Ghana. The study uses primary data solicited from 130 maize farmers through the administration of a structured questionnaire. Using the paired sample t-test to test for significant differences between the amounts of credit demanded and the amount received by farmers, it is revealed that the amount of credit received was significantly lower than the amount of credit demanded by farmers. The Probit regression model was then used to estimate the parameters of the determinants of credit constraint condition of the farmers. The empirical results reveal that gender, household size of farmers, annual income of farmers and farm size have significant influence on credit constraint conditions of the farmers. The Tobit regression model was also used to estimate the parameters of the determinants of the rate of agricultural credit allocated to the farm sector. The empirical results of the Tobit regression model reveal that age, bank visits before credit acquisition and the amount (size) of credit received have significant influence on the rate of agricultural credit allocation to the farm sector. The study provides the following recommendations: it is imperative that bank officials visit farmers on their farms before granting them loans, and also farmers must be granted the required amounts of loan to enhance the rate of agricultural loan allocation to the farm sector to ensure increased productivity of crops grown for increased welfare and livelihood of these farmers and the citizens of the country as a whole.

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## 1. INTRODUCTION

The Agricultural sector in Ghana plays a crucial role in reducing poverty and achieving economic growth. In Ghana, about 60 percent of the population relies on Agriculture for their livelihood [1]. The potential of the Agricultural sector in securing incomes, employment and food supply and thus to reduce poverty among the Ghanaian population has greatly reduced. The greatest challenge to the development in the sector is low productivity and the reasons for this are numerous. Producers have little access to financial resources and modern technologies and their organizational structures are weak.

Agriculture in the pre-historic period sustained humanity over the years with little or no significant attachment to capital for production [2]. However, in this modern period, lack of capital is regarded as one of the major constraints in expanding production and modernizing agriculture [3]. Credit is considered as a major aspect of financial services which is fundamental in all production units [4]. There has been a general awareness of the importance of credit as a tool for agricultural development [5]. In view of this, the need to provide farmers with credit is inevitable due to its importance in fostering agricultural development and also ensuring efficiency in the production process. In recent years, there has been a growing interest in understanding the impact of financial structure on production as well as on the efficiency of production [6].

Credit to farmers can be categorised into cash credit (loans given to farmers by financial institutions), and non-cash credit which comprise the supply of inputs to farmers by companies, individual entrepreneurs/businessmen etc., for which these farmers make payments after harvesting. This study is focused on cash credit (i.e., loans that farmers received from the financial institutions). In most developing countries, agricultural credit is considered an important factor for increased agricultural production and rural development because it enhances productivity and promotes standard of living by breaking the vicious cycle of poverty of small scale farmers [7]. Credit is regarded as more than just another resource such as land, labor and equipment, because it determines access to most of the farm resources required by farmers. The explanation is that farmer's adoption of new technologies necessarily requires the use of some improved inputs which may be purchased. Credit also acts as a catalyst for rural development by motivating latent potential or making under-used capacities functional [8].

Generally, the accessibility of a good financial service is considered as one of the engines of economic development. Governments of less developed countries have frequently practiced the policy of providing cheap credit to the agricultural sector through financial intermediaries. This cheap credit, it was hoped, would lower the dependence on the rural money lenders [9]. The provision of credit has increasingly been regarded as an important tool for raising the incomes of rural populations, mainly by mobilizing resources for more productive uses. As development takes place, one question that arises is the extent to which credit can be offered to the rural poor farmers to facilitate their farm operations, all things being equal. Thus, the usefulness of any agricultural credit program does not only depend on its availability, accessibility and affordability but also on its proper and efficient allocation and utilization for intended the purpose by beneficiaries Oboh [10]. However, credit diversion, poor repayment rate and loan default among farmers continue to be a challenge.

In Ghana, the problems of agricultural credit to farmers arise from the following: source, availability and use. There is inadequate or complete absence of financial projections and planning, and also high level of illiteracy among farmers and lack of relevant information as to how, when and where to obtain credit. There is also lack of skilled personnel in our credit institutions to supervise and monitor loan packages as well as manage them, and diversion of credit to non-agricultural purposes by farmers. Every segment of agricultural production requires the availability of adequate capital since capital determines access to all other resources on which farmers depend for their operation [11]. Nevertheless, small-holder farmers in the Upper Manya Krobo district as in other parts of Ghana are constrained by inadequate credit to carry on with meaningful agricultural activities. Accessibility to credit alone without good management by beneficiaries cannot guarantee the expected improvement in farmer's food production level, income and hence prompt loan repayment. It has been shown that farm level credit if well applied, enhances capital formation and diversified agriculture, increases resource productivity, size of farm operations, innovations in farming, marketing efficiency, value added and net farm incomes [12].

The study, therefore, will help determine the credit situation of the farmers in the study area; help provide information that will enable financial institutions to understand credit usage by farmers and thereby formulate appropriate lending policies accordingly; help identify innovative options and institutional arrangements that would serve as an input for policy makers in formulating rural credit policy; and help policy makers in designing proper extension training programs regarding efficient credit utilization. A better understanding of the farmers' behavior in allocating credit may assist policy makers in designing sustainable financial systems that can serve resource poor farmers better than before.

Several studies have analyzed the use of credit among resource-poor rural dwellers and concluded that credit was allocated mainly for agricultural and non-agricultural productive activities as well as for consumption purposes though at varying allocative proportions [13, 14], and that constraint to agriculture financing due to lack of access to credit may be reduced if innovative and sustainable smallholder farmers are identified Olatunbosun [15]. Consequently, this study would contribute to the literature on the extent of farmers' credit allocation to the farm sector and the factors influencing the credit allocations. This research would also contribute to the body of literature on the credit constraint condition of farmers in developing countries. Therefore, the objectives are fourfold: to analyze the amount of credit demanded and the amount received by farmers; to estimate the percentage of credit allocated to the farm and the non-farm sectors by farmers based on the amount of credit received; to analyze the factors that affect credit constraint condition of farmers; and to estimate the factors that affect the rate of credit allocation to the farm sector.

This rest of the paper is organized as follows. Section two provides the literature review. Section three describes the research methodology that includes a brief description of the study area, data collection procedures and analytical techniques. Section four presents the empirical results. Finally, the conclusions and recommendations are presented in Section five.

## 2. LITERATURE REVIEW

Agricultural credit has been defined by several authors. For instance, [16] defined agricultural credit as the present and temporary transfer of purchasing power from a person who owns it to a person who wants it, allowing the later the opportunity to command another person's capital for agricultural purposes but with confidence in his willingness and ability to

repay at a specified future date. It is the monetization of promises and exchanging of cash in the present for a promise to repay in future with or without interest. Without the willingness and ability to repay, the promise to repay at a future date would be futile.

Credit can be in cash or in kind. However, in this study we consider credit in cash. The control over the use of money, goods and services of another person termed credit is at a price usually regarded as the interest rate [17,18]. The interest rate is required to be paid together with the amount borrowed at a specified time in the future.

Credit is an instrument whose effectiveness depends on the economic and financial policies that go with it [16]. If well applied, credit should increase the size of farm operations, introduce innovations in farming, encourage capital formation, improve marketing efficiency and enhance farmers' consumption [12,16]. The demand for credit tends to be a derived demand, which indicates that the borrowers will demand for credit based on the need for it and the satisfaction to be derived [19].

The financial institutions in Ghana can be classified into three categories: formal, semi-formal and informal. The formal finance sector is predominately made up of commercial banks, which are normally within urban areas; and for rural areas there are Rural Community Banks (RCBs) and their association the ARB Apex Bank. Ghana's semi-formal financial sector consists of credit unions, savings and loans (also known as Microfinance institutions), and non-governmental organizations (NGOs). The informal financial sector consists of moneylenders, traders, family members, friends, neighbors, and the traditional Susu system. The *susu* system is a traditional savings collection system, and is taught to have originated in Nigeria and was introduced in Ghana in the early twentieth century [20]. Under the *susu* system, farmers and other small scale businessmen deposit money with the operators periodically (e.g., daily, weekly, monthly), for which they could access loans (cash credit) from these operators in the near future (i.e., after some number of times of contribution) for their individual business. Currently, there are roughly 4,032 susu operators and clubs that operate within Ghana [21].

Traders have also been a major component of rural finance in Ghana, who operates between producers in rural areas and urban markets. They provide credit in the form of inputs on supplier's credit or an advance against future purchases of crops. Traders do not usually require collateral, but rather the agreement of the farmer to sell them crops over an agreed period [22].

Financial institutions that fall into this category are incorporated under the Companies Code 1963 (Act 179), which gives them legal identities as limited liability companies, and subsequently licensed by the Bank of Ghana under either the Banking Law 1989 or the financial Institutions (Non-Banking) Law 1993 to provide financial services under Bank of Ghana regulation [22]. Most of these banks target urban, middle-income clients and higher net worth clients. However Rural Community Banks and the Agricultural Development Bank concentrate on the rural areas. Therefore, these two institutions have become the main source of financial resources for smallholder farmers in Ghana.

Semi-formal institutions in Ghana consist of credit unions, savings and loans associations, and financial NGOs. Credit unions are organizations that offer savings and credit facilities exclusively to its members. However, these organizations are performing poorly because a majority of their focus is on welfare programs, and therefore cannot impose higher interest rates on their clients [22].

The credit union association (CUA) is similar to ARB Apex Bank, however, it does not have any control over portfolios. There are some credit unions that operate within banks whose tasks are to look for clients and to report back to the bank [23]. There are a total of 47 Savings and Loans reporting institutions in Ghana. As of 2009, services from Savings and Loans are provided to 358,717 borrowers, with an average loan balance of US$ 290.9 per borrower [24]. According to Mix Market there are 47 reported microfinance institutions in Ghana.

Ghana's Savings and Loans have 6 percent of portfolios at risk for more than 30 days. This is the at-risk average compared to its peer groups with East Asia and the Pacific at 4 percent, Eastern Europe and Central Asia at 4 percent, Latin America and the Caribbean at 5 percent, Middle East and North Africa at 3 percent, and South Asia at 2 percent [24].

Informal financial services refers to all transaction, loans and deposits that take place outside the regulated monetary system and these include activities of intermediaries such as relatives and friends, traders and moneylenders [25]. In Ghana, informal credit is defined to embrace all financial transactions that take place beyond the functional scope of banking and other financial sector regulations.

Informal credit transactions can be grouped into noncommercial transactions, such as transactions between relatives and friends or small-scale group arrangements, and commercially based ones, conducted by savings collectors, estate owners, landlords, traders, and moneylenders. Informal financial units have been formed to meet the demand of a diverse customer base [26]. There has been substantial increase in demand for informal credit and savings in Ghana. This is due to an increase in unsatisfied demand for formal sector credit, which has been continuously restrained as part of stabilization efforts.

Household size maintained a negative relationship with the rate of agricultural credit allocation to the farm sector [27]. In his study he found out that, farmers with high household sizes tended to divert their loans for the sustenance and upkeep of family members.

Nuryartoon et al. [28] in assessing credit rationing of farm households and agricultural production in the rural areas of central Sulawesi, Indonesia employed a Probit regression model in identifying the determinants of credit constrained condition of farm households in that area. The results of the Probit regression analysis indicated that education, age and annual income were significant variables in determining whether a household is credit constrained.

A study on credit constrained condition and output supply of Country Women Association of Nigeria (COWAN) farmers in Oyo state was conducted by Omonona et al. [5], Nigeria. In this study they found out that majority of the farmers (80 percent) were credit constrained and therefore this affected their productivity. His results showed that age, sex, farm size, level of education, marital status, contact with extension agent, land acquisition and income of household head were the determinants of credit constrained conditions of farmers.

Oyedele et al. [29] in assessing credit constrained condition of farm households and profitability of agricultural production in Nigerian agriculture employed a probit regression model in identifying the determinants of credit constrained conditions of farm households in that area. The results of the probit analysis showed that farmer's age, household size, gender, size of landholding, access to other credit, value of other assets, monthly household

expenditure and choice of crop and livestock enterprises were the significant variables that determined the credit constrained condition of the credit beneficiaries.

Oboh and Ekpebu [30] in their study on determinants of formal agricultural credit allocation to the farm sector by arable crop farmers in Benue State, Nigeria employed the multiple regression models in determining factors affecting the rate of credit allocation to the farm sector. The study revealed that age, education, farm size, loan delay, bank visit and household size were significant variables that affect the rate of credit allocation to the farm sector.

Omonona et al. [31] in assessing the determinants of credit constraint conditions and production efficiency among farming households in South Western Nigeria employed the probit regression model to identify the determinants of credit constrained condition of farmers in that area. The results of the probit model showed that age, gender, education and dependency ratio of farmers are significant variables that influenced credit constraint conditions of the farmers.

Baiyegunhi et al. [32] in assessing credit constraints and household welfare in the Eastern Cape Province, South Africa employed a probit regression model in identifying the determinants of credit constrained conditions of farmers in that area. The results of the probit regression model indicated that the age of the household head, access to land, and asset value and repayment capacity are statistically significant factors determining the credit constraint condition of the sampled households.

## 3. METHODOLOGY

Quantitative data were collected from primary data sources. Structured questionnaire was prepared and administered to the sampled respondents to collect the necessary data needed for the study. Primary data source was the sampled farm households including both male and female headed maize farmers receiving agricultural credit from the Asesewa Rural Bank in the Upper Manya-Krobo district. Secondary data source was the district office of Ministry of Food and Agriculture (MoFA) located in Asesewa. The questionnaire was pre-tested to evaluate for consistency, clarity, ambiguity and to avoid duplication, and to estimate the time requirement during data collection.

The data collection process required a preliminary survey in order to construct the sampling frame and draw a sample. A pilot study was conducted for this purpose. A multi-stage sampling procedure was employed for selecting individual respondents in the study. A population of smallholder maize farmers who receive agricultural credit from the Asesewa Rural Bank was identified in the study area with the help of the district office of the Ministry of Food and Agriculture (MoFA). A list of maize farmers who received agricultural credit for the 2011 cropping season was provided by the district office of MoFA. With the aid of the list provided three zonal areas namely: Asesewa, Sekesua and Anyaboni were purposively selected. A random sampling technique was then used to select 50 farmers each within the three zones to get a total of 150 maize farmers. In the end 130 properly filled questionnaires were returned and utilized for analysis.

The paired-sample t-test was used to test for significant differences between the amount of credit applied by farmers and the amount of credit received by the farmers. Descriptive statistics (means, frequency distribution, percentages) was used to analyze the percentage of credit allocated to the farm and the non-farm sectors based on the amount of credit

received. The Probit regression model was employed to analyze the factors that influence credit constraint conditions of farmers.

According to Nagler [33], the Probit model constraints the estimated probabilities to be between 0 and 1 and relaxes the constraint that the independent variable is constant across different predicted values of the dependent variable. This is normally experienced with the Linear Probability Model (LPM). The Probit model assumes that while we only observe the values of 0 and 1 for the variable Y, there is a latent, unobserved continuous variable $Y^*$ that determines the value of Y. The other advantages of the Probit model include believable error term distribution as well as realistic probabilities [34]. Therefore, for this analysis the Probit model is preferred and used. The dependent variable Y is the credit constraint condition of the farmer (i.e., a credit constraint farmer is the farmer who has not received all the loan applied for (received only a part of the loan applied for), from the bank, and this condition is dummied 1, otherwise 0 when the farmer received all the loan amount applied for, from the bank). We assume that $Y^*$ can be specified as follows:

$$Y_i^* = \beta_0 + \sum_{j=1}^{8} \beta_j X_j + \varepsilon_i \quad (1)$$

$$Y_i = 1 \text{ if } Y^* > 0$$

$$Y_i > 0 \text{ Otherwise}$$

Where $X_1, X_2, X_3, ....., X_K$ represent vector of random variables, $\beta_i$ represent a vector of unknown parameters and $\varepsilon_i$ represent a random disturbance term (Nagler, 2002).
The empirical probit model specified to analyze the credit constraint condition of the maize farmers can be expressed as follows:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 \quad (2)$$

where $X_1$ denotes age of the farmers; $X_2$ denotes the square of the age of the farmers; $X_3$ denotes gender of the farmers; $X_4$ denotes the household size of the farmers; $X_5$ denotes the number of years of formal education of the farmers; $X_6$ denotes the annual income of the farmers; $X_7$ denotes farming experience; $X_8$ denotes farm size.

The descriptions, measurements and a priori expectations of the variables used in the Probit Model are presented in Table 1.

**Table 1. Description, measurement and a priori expectations of the variables used in the Probit Model**

| Variables | Description | Measurement | A priori expectation |
|---|---|---|---|
| age | Age of farmers | Years | + |
| agesquared | Age squared | Years | + |
| gend | Gender of farmers | Dummy:1 if male, 0 otherwise | -/+ |
| hhsiz | Household size of farmers | Number of people | + |
| edu | Number of years of formal education | Years | - |
| ann | Annual income | Ghana cedis | - |
| farmexp | Farming experience | Years | - |
| famsiz | Farm size | Acres | + |

## 3.1 Definition of Variables Used in the Probit Model

### 3.1.1 Dependent variable

The dependent variable for the probit analysis is a dichotomous variable representing credit constraint condition of the farmers. Credit Constraint can be defined as gap between demand for and supply of credit by lenders, the wider the gap, the greater the credit constraint level [35]. The dependent variable $Y_i$ which represent household credit constraint condition takes value of "1" for farmers who are credit constrained and "0" otherwise. A farmer is said to be credit constrained if the amount of credit received is lower than the actual amount of credit applied for and he/she is dummied "1" and a farmer is said not to be credit constrained if the amount of credit received by the farmer is equal to the amount of credit applied for and he/she is dummied "0".

### 3.1.2 Explanatory variables

Review of literature on factors that affect the credit constraint conditions of farmers, past research findings and the author's knowledge of the agricultural credit schemes of the study area were used to establish working hypotheses of this study. In other words, among a number of factors, which have been related to the credit constraints conditions of farmers, in this study, the following demographic, socio-economic and communication factors were hypothesized to explain the credit constraint condition of the farmers.

### 3.1.3 Age of farmers

This is a continuous variable, defined as the age of the farm household head at the time of interview measured in years. According to Zeller [36] and Omonona et al. [5], older farmers are more likely to be credit constrained. This might be because the younger farmers are still agile and more receptive to new technologies and activities that will generate income for them. Aside this, most financial institution will not like to lend out money to old people for the fear that they may not live long enough to pay back the money. Therefore, farmer's age was hypothesized to have a positive impact on credit constrained condition of the farmers. However Age squared is included in the model because of the nonlinear relationship it has with credit constraint. This was obtained by multiplying the age of household head by itself.

### 3.1.4 Gender of farmers

This is a dummy variable that assumes a value of "1" if the head of the farm household is male and "0" otherwise. Male headed households have mobility, participate in different meetings and have more exposure to information. According to Lawal et al. [37] and Omonona et al. [5] males are associated with reduced levels of credit constraints compared to their female counterparts. Therefore, it was hypothesized that male headed farm households will have more access to credit and therefore will be less credit constrained than female headed farm households. The expected sign for the coefficient of this variable is either positive or negative.

### 3.1.5 Household size of farmers

This is the total number of persons living in the farmer's house. It is expected that as a farmer's household size increases, their consumption requirements increase and as a result, there is stress on limited resources. According to Oyedele et al. [29] and Nuryartoon et al. [28] households with more household members have high probability of being credit constrained. It was therefore hypothesized that as household size increases the farmer becomes more credit constrained. The expected sign for the coefficient of this variable is therefore positive.

### 3.1.6 Farmers number of years of formal education

Education is measured as the number of years of the farm household heads formal education. Farmers with high number of years of formal education are expected to have more exposure to the external environment and accumulate knowledge. They have the ability to analyze costs and benefits. According to Musebe et al. [38], as the household gets more formal education, the probability of obtaining credit increases, therefore, it was expected that those farmers with high number of years of formal education will be less credit constrained. The expected sign for the coefficient of this variable is therefore negative.

### 3.1.7 Annual income of farmers

This is measured as the total income of the farmer for the year. Farmers with higher annual income will be able to sustain their family members well and may not have to supplement family expenditure with the credit they have obtained and because of this bank officials will be willing to grant such farmers high amount of credit because they would be able to pay back. According to Akram et al. [39], farmers with high income levels may significantly depress the probability of being credit constrained. It was therefore hypothesized that farmers with high annual income are less credit constrained. The expected sign for the coefficient of this variable is negative.

### 3.1.8 Farming experience

This is measured as the number of years the farm household head has been engaged in farming as at the time of the interview. A farmer having more experience in farming will know how to utilize resources efficiently and therefore will be less credit constrained. Hence, this variable is assumed to have a negative influence on the dependent variable.

### 3.1.9 Farm size

This is measured as the total land size cultivated by the farm household. It is a continuous variable. According to Omonona et al. [5] large farms have higher probabilities of being credit constrained that may arise from the need to purchase more variable inputs, which in turn leads to greater demand for credit. The larger the cultivated land size the more the demand for variable inputs that might be obtained through credit. The main hypothesis was that the farmer who cultivates larger size of land can utilize more variable inputs and therefore will be more credit constrained. The expected sign for the coefficient of this variable is positive.

### 3.1.10 Analysis of the factors that affect the rate of credit allocation to the farm sector

The objective which sought to analyze the rate of credit allocation to the farm sector was achieved with the use of the Tobit model. Following [40,41,42], the Tobit model can be defined as:

$$Y_i^* = \beta_0 + \sum_{j=1}^{13} \beta_j X_j + \varepsilon_i \quad (3)$$

$$Y_i = Y_i^* \text{ if } Y_i^* > 0$$

$$Y_i = 0 \text{ if } Y_i^* \leq 0$$

Where, $Y_i$ denotes the observed dependent variable; $Y_i^*$ denotes the latent which is not observable; $X_j$ denotes vector of factors affecting the rate of credit allocation to the farm sector; $\beta_j$ denotes vector of unknown parameters; $\varepsilon_i$ denotes residuals that are independently and normally distributed with mean zero and a common variance $\sigma^2$. The Tobit model shown above is also called a censored regression model because it is possible to view the problem as one where observations of $Y^*$ at or below zero are censored [42]. The empirical Tobit model specified to analyze the factors that affect the rate of credit allocation to the farm sector can be expressed as follows:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} \quad (4)$$

Where, $X_1,.....,X_8$ are as defined above, and $X_9, X_{10}, X_{11}, X_{12}, X_{13}$ denote Extension visits, Loan delay, Bank visit before loan acquisition, Bank visit after loan acquisition, and Amount of credit received, respectively.

The descriptions, measurements and a priori expectations of the variables used in the Tobit Model are presented in Table 2.

**Table 2. Farmer household characteristics affecting the rate of credit allocation to the farm sector**

| Variables | Description | Measurement | A priori expectation |
|---|---|---|---|
| perafsec | Percentage of credit allocated to the farm sector | Percentage | |
| age | Age of farmers | Years | + |
| agesquared | agesquared | Years | - |
| gen | Gender of farmers | 1 if male, 0 otherwise | -/+ |
| hhsiz | Household size | Numbers | - |
| edu | Number of years of formal education | Years | + |
| ann | Annual income | Ghana cedis | + |
| farmexp | Farming experience | Years | + |
| famsiz | Farm size | Acres | + |
| extvist | Extension visits | 1 if visited, 0 otherwise | + |
| londel | Loan delay | Days | - |
| banvbf | Bank visit before loan acquisition | 1 if visited, 0 otherwise | + |
| banvaf | Bank visit after loan acquisition | 1 if visited, 0 otherwise | + |
| amtrcvd | Amount of credit received | Ghana cedis | + |

## 3.2 Definition of Variables Used in the Tobit Model

### 3.2.1 Dependent variable

The dependent variable used in the Tobit Model is the percentage of credit allocated to the farm sector. This is derived by dividing the amount of credit allocated to the farm sector by the total amount of credit received and multiplied by 100.

### 3.2.2 Explanatory variables

The explanatory variables known to influence credit allocation to the farm sector are as follows.

### 3.2.3 Age of farmers

This is a continuous variable, defined as the age of the farm household head at the time of interview measured in years. According to Oboh and Ekpebu [30], credit allocation to the farm sector increases with the age of the farmers. It was therefore hypothesized that farmers with higher age will allocate more of their credit to the farm sector than the non-farm sector. The expected sign for the coefficient of this variable is positive. However Age squared is included in the model because of the nonlinear relationship it has with credit allocation. This was obtained by multiplying the age of household head by itself.

### 3.2.4 Gender of farmers

This is a dummy variable that assumes a value of "1" if the head of the farm household is male and "0" otherwise. Male headed households have mobility, participate in different meetings and have more exposure to information; therefore it was hypothesized that male headed farm households will allocate more of their credit to the farm sector than female headed farm households.

### 3.2.5 Household size of farmers

This is the total number of persons living in the farmer's house. It is expected that as the numbers increase, their consumption requirements increase and as a result, there is stress on limited resources and hence the likelihood of the farmer using some of the credit obtained for the sustenance and upkeep of family members. According to credit allocation to the intended farm sector decreases with increasing household size. It was therefore hypothesized that as household size increases the rate of credit allocation to the farm sector decreases. The expected sign for the coefficient of this variable is therefore negative.

### 3.2.6 Farmer's number of years of formal education

Education is a social capital which could impact positively on the farm household head's ability to allocate credit more efficiently. Education is measured as the number of years of the farm household heads formal education. An educated farmer, other things being equal, allocates farm resources more efficiently [43]. It was therefore hypothesized that farmers with longer years of formal education will allocate more of their credit to the farm sector. The expected sign for the coefficient of this variable is therefore positive.

### 3.2.7 Annual income of farmers

This is measured as the total income of the farmer for the year. Farmers with higher annual income will be able to sustain their family members well and may not have to supplement family expenditure with the credit they have obtained. According to Mejeha [27] low income households tended to divert part of their loans for the sustenance and upkeep of family members. It was therefore hypothesized that as farmer's income increases, the rate of credit allocation to the farm sector increases and vice versa. The expected sign for the coefficient of this variable is positive.

### 3.2.8 Farming experience

This is measured as the number of years the farm household head has been engaged in farming as at the time of the interview. A farmer having more experience in farming will have higher tendency of allocating more credit to the farm sector than an inexperienced farmer. Hence, this variable is assumed to have a positive influence on the dependent variable.

### 3.2.9 Farm size

This is measured as the total land size cultivated by the farm household. It is a continuous variable. The larger the cultivated land size the more the labor required that demands additional capital that might be obtained through credit. According to Emerole [44] increase in farm size necessarily requires the employment of more farm inputs which in turn require additional capital for their purchase. The main hypothesis was that the farmer who cultivates

larger size of land can utilize more capital and therefore will allocate more of the credit obtained to the farm sector. The expected sign for the coefficient of this variable is therefore positive.

### 3.2.10 Extension visit

This variable refers to whether or not a farmer had contact with extension agents during the farming season. This is a dummy variable that assumes a value of "1" if the farmer had extension contact and "0" otherwise. Farmers who had contact with extension agents are expected to have more information and training which will help them to allocate more of their credit to the farm sector. Therefore it was hypothesized that this variable positively influences the rate of credit allocation to the farm sector.

### 3.2.11 Loan delay

This refers to the number of days between loan application and receipt. Farmers tend to use less of delayed loan for farm activities. According to Nweze [45] untimely release of loan tends to tempt farmers to divert the loan for unintended uses. It was therefore hypothesized that farmers who receive their credit earlier will allocate more of the credit to the farm sector and vice versa. The expected sign for the coefficient of this variable is negative.

### 3.2.12 Bank visit before credit acquisition

This refers to whether or not a farmer was visited by a bank official before receiving the loan. It is a dummy variable which assumes a value of ("1") if the farmer had a bank visit before receiving the loan and ("0") otherwise. According to farmers visited by credit officers providing the loans tended to allocate more funds to the farm sector. It was hypothesized that farmers who are visited by bank officials before receiving the credit will allocate more of the credit to the farm sector and less to the nonfarm sector. Therefore, the expected sign for the coefficient of this variable is positive.

### 3.2.13 Bank visit after loan acquisition

This refers to whether or not a farmer was visited by a bank official after receiving the loan. It is a dummy variable which assumes a value of ("1") if the farmer had a bank visit after receiving the loan and ("0") otherwise. According to farmers visited by credit officers providing the loans tended to allocate more funds to the farm sector. It was hypothesized that farmers who are visited by bank officials after receiving the credit will allocate more of the credit to the farm sector and less to the nonfarm sector. Therefore, the expected sign for the coefficient of this variable is positive.

### 3.2.14 Size of loan received

This is measured as the total amount of credit granted to the farmer. Low loan amount that seems inadequate for meaningful farm work tends to be easily diverted for non-farm activities. According to Rabo et al. [46] small scale farmers who received low amounts of institutional credit meant for farm activities in Bauchi State in Northern Nigeria diverted the funds for non-farm activities. It was hypothesized that famers who receive large amount of credit are likely to allocate more of the credit to the farm sector than those who receive small amount of credit. The sign for the coefficient of this variable is therefore expected to be positive.

## 4. EMPIRICAL RESULTS

### 4.1 Demographic Characteristics of Respondents

From the descriptive analysis majority (40%) of the farmers were between 41-50 years with a mean age of 46 years. Male headed households constitute 86.9 per cent and female headed households constitute only 13.1 per cent. The mean household size is 7 members per household. Majority of the farmers (62.3%) spent 10 years in formal education.

### 4.2 Credit Status of Respondents

The credit status of the farmers in the study area is shown in Table 3. The table shows that out of the 130 maize farmers interviewed, one hundred and twenty four (124) of them were credit constrained representing 95.38 % while the remaining six were credit unconstrained representing only 4.62%. This result shows that most of the maize farmers in the study area are credit constrained and this is a big challenge in the study area as it is likely to affect farm productivity and in effect also affect the profitability of the farm business.

**Table 3. Credit status of respondents**

| Credit Status | Constrained | Unconstrained | Total |
|---|---|---|---|
| **Frequency** | 124 | 6 | 130 |
| **Percentage** | 95.38 | 4.62 | 100 |

### 4.3 Amount of Credit Applied For and Amount Received by Farmers

The results of the t-test analysis used to determine whether significant differences exist between amount of credit applied for and amount received by farmers indicated that the mean value of credit received (GH¢ 2,114.60) was significantly lower than the mean value of credit applied (GH¢ 2,746.90) at 1% significance level (Table 4). The inadequate amount of credit granted to applicants might limit their capacity to finance their farm investment plans thereby affecting farm output and productivity negatively. This result confirms earlier findings of Oboh and Ekpebu [30] who reveal that the mean value of credit received by arable crop farmers in Benue State, Nigeria was significantly lower than the mean value of credit demanded at one percent (5%) level of significance.

**Table 4. The results of the paired t-test showing significant difference between amount of credit applied and amount received by farmers**

| Variables | Individual Mean | t-value | Degree of freedom | Significance (2-tailed) |
|---|---|---|---|---|
| Loan applied | 2,746.90 | 17.29 | 129 | .000*** |
| Loan received | 2,114.60 | | | |

*** *Significance at 1% level*

### 4.4 Percentage of Credit Allocated to the Farm and Non-Farm Sector Based on the Total Amount of Credit Received

The farm activities for which the loan is used are as follows: Land Preparation/Clearing, Seeds, Planting, Fertilizer, Fertilizer, Fertilizer Application, Weedicide, Labour, Machinery,

Weedicide application, insecticide, insecticide application, and Harvesting. The amount spent on each of these activities was part of the data collected from the farmers. We did a summation of all amounts spent on the farm sector. The Agricultural Budget Shares have been generated from the data collected, as the loan amount allocated to the farm sector divided by the total amount of loan received, multiplied by 100 (hundred). The assumption made is that all other amounts of the loan that are not spent on the farm sector (activities) are spent outside the farm sector (i.e., non-farm activities). However, the specific off-farm activities of each individual farmer are not known.

Table 5 below presents the amount and the respective percentage of credit allocated to the farm and the non-farm sectors across the various categories of loan amount. On a comparative basis, beneficiaries belonging to low loan amount category (≤ GH¢ 1000) allocated less of their loans to the farm sector and by implication, more to the non-farm sector. On the other hand, beneficiaries in the high loan amount category (GH¢ 5100-GH¢ 6000) allocated more of their loans to the farm sector. These results suggest that there is high propensity for low loan amount (which seems inadequate for meaningful farm work) to be easily diverted for non-farm activities. The results indicate that as farmers credit portfolio increases, the percentage of credit allocated to the farm sector increases whiles the percentage of the credit allocated to the non-farm sector decreases.

The average amount of credit allocated to the farm sector by all the famers in our sample was 72.43% leaving the balance of 27.57% to the non-farm sector. This is called the average budget share (ABS) and it is a measure of the percentage of total credit spent on each sector. Even though, the ABS value of 72.43 for the farm sector is relatively high, the value of 27.57% for the non-farm sector suggests that there is a reasonable level of loan diversion. This finding is consistent with the findings of Rabo et al. [46] in which about 36.7% of small scale farmers institutional credit intended for farm activities in Bauchi State in Northern Nigeria was diverted. This finding is also consistent with earlier finding by Oboh and Ekpebu [30] which reveal that 43.9% of the loan received by arable crop farmers in Benue State, Nigeria meant for farm activities was diverted and spent on non-farm activities.

**Table 5. Allocation of credit by respondents between the farm and the non-farm sectors**

| | Credit Allocation (%) | | |
|---|---|---|---|
| **Amount of credit (GH¢)** | **Farm sector** | **Non-farm sector** | **Total** |
| ≤1000 | 49.00 | 51.00 | 100 |
| 1100-2000 | 69.89 | 30.11 | 100 |
| 2100-3000 | 72.25 | 27.75 | 100 |
| 3100-4000 | 78.21 | 21.79 | 100 |
| 4100-5000 | 81.89 | 18.11 | 100 |
| 5100-6000 | 83.33 | 16.67 | 100 |

## 4.5 Analysis of Factors that Influence Credit Constraint Conditions of Farmers

Probit regression model was used to identify factors influencing credit constraint condition of farmers. The socioeconomic variables included in the Probit regression model are age, age-squared, gender, household size, education, annual income, farming experience, farm size and extension visits. Table 6 below shows the maximum likelihood estimates of the Probit regression model. In the model, coefficients of four out of eight explanatory variables were found to be significant. The results reveal that the gender of farmers, household size of

farmers, annual income of farmers, farm size of farmers and extension visits are significant variables that influence credit constraint condition of the farmers.

**Table 6. Probit regression results of the factors influencing credit constrained condition of farmers**

| Variable | Coefficient | Robust Std. Err. | P-value |
|---|---|---|---|
| Age | .1497627 | .2179647 | 0.492 |
| Age squared | -.0008952 | .0023692 | 0.706 |
| Gender | 1.908175 | 1.098749 | 0.082* |
| Household size | .4529769 | .1505312 | 0.003*** |
| Education | .0019988 | .0725811 | 0.978 |
| Annual income | .001015 | .0003353 | 0.002*** |
| Farming experience | -.0549166 | .0666358 | 0.410 |
| Farm size | -.1636943 | .0478471 | 0.001*** |
| cons | -9.599127 | 5.792543 | 0.097 |
| Number of observations (130) | Wald chi $^2$(8) (18.11) | Prob>chi$^2$ (0.0204) | Pseudo $R^2$ (0.5528) |

*** *significant at 1%* * *significant at 10%*

Gender was found to be significant at 10% and has a positive coefficient. This result means that males are associated with high levels of credit constraints compared to the females. This result is contrary to expectation. For example, the study of Lawal et al. [37] and Omonona et al. [5] reveal that male farmers were associated with reduced levels of credit constraints as compared to their female counterparts.

Household size has a positive coefficient, which significantly influences credit constrained status of the farmers. The positive sign and significance of the coefficient imply that farm households with more household members have high probability of being credit constrained. This may be attributed to the high credit demands by larger families to cultivate large farm sizes, for the sustenance of these families. This result is consistent with that of [28]. This finding is also consistent with the findings of Oyedele et al. [29] who reveal that credit beneficiaries with more household members were more credit constrained.

Annual income was found to be a significant variable which influences credit constraint conditions of farmers positively. The positive sign for the coefficient of this variable suggests that farmers with high annual income are more credit constrained than farmers with low annual income. This finding is contrary to expectation. For example, the study of Akram et al. [39] observed a negative relationship between annual income and credit constrained condition of farmers.

Farm size was expected to impact positively on credit constrained condition of the farmers. The study however observed a negative relationship between farm size and credit constrained condition of the farmers. This finding is contrary to expectation. For example, the study of Omonona et al. [5] observed a positive relationship between farm size and credit constrained condition of farmers.

## 4.6 Analysis of Factors That Affect the Rate of Credit Allocation to the Farm Sector

The Tobit regression model was used to analyze the factors influencing credit allocation to the farm sector. Socioeconomic variables included in the Tobit model are age, age-squared, gender, household size, education, annual income, farming experience, farm size, extension visits, loan delay, bank visit before credit acquisition, bank visit after credit acquisition and size of loan received. The result of the Tobit model shows that four out of the thirteen variables were found to have significant influence on credit allocation to the farm sector (see Table 7). These variables were age of the farmers, age squared, bank visit before credit acquisition and size of loan received.

**Table 7. Tobit regression results of the factors influencing credit allocation to the farm sector**

| Variable | Coefficient | Robust Std. Err. | P-value |
|---|---|---|---|
| Age | -1.678647 | .8129167 | 0.041** |
| Age squared | .0197057 | .008404 | 0.021** |
| Gender | 1.616665 | 5.265839 | 0.759 |
| Household size | .7892378 | .522362 | 0.134 |
| Education | .3413959 | .2940639 | 0.248 |
| Annual income | .0000407 | .0006706 | 0.952 |
| Farming experience | -.1742334 | .2908091 | 0.550 |
| Farm size | .0890857 | .2552068 | 0.728 |
| Extension visit | -5.115038 | 3.750744 | 0.175 |
| Loan delay | -.0217141 | .0950807 | 0.820 |
| Bank visit before credit acquisition | 13.28136 | 3.414263 | 0.000*** |
| Bank visit after credit acquisition | -.8985074 | 3.115754 | 0.774 |
| Amount of credit received | .005823 | .0013291 | 0.000*** |
| cons | 77.26323 | 20.40017 | 0.000 |
| Number of observations (130) | Pseudo $R^2$ (0.0488) | Prob>$chi^2$ (0.0000) | LR $chi^2$ (52.66) |

*Source: Survey Data* ***+++*significant at 1%* **++*significant at 5%*

Age was found to be a significant variable which influences the rate of credit allocation to the farm sector by the farmers, negatively. The negative sign and significance of the coefficient of this variable imply that as the farmer increases in age, there is a decrease in credit allocation to the farm sector. However, age squared has a positive relationship with credit allocation to the farm sector. This result is consistent with the study of Oboh and Ekpebu [30] who reveal that credit allocation to the farm sector increases with the age of the farmers.

Bank visits before loan acquisition specified as a dummy variable was found to be a significant variable which affects the rate of credit allocation to the farm sector. The coefficient for this variable also had a positive sign implying that respondents visited by bank

officials tend to allocate more funds to the farm sector. This result is consistent with [30] who reveal that arable crop farmers in Benue State Nigeria, who were visited by bank officials, allocated more of their credit to the farm sector and in effect less to the nonfarm sector.

The size (amount) of loan received was also found to be a significant variable which affects the rate of credit allocation to the farm sector positively, implying that credit allocation to the farm sector increases with an increase in the amount of credit received. This means that as farmer's amount of credit received increase, the percentage of the credit allocated to the farm sector also increase. Thus, that there is a direct positive relationship between the amount of credit received by farmers and the rate of allocation to the farm sector. If the amount is large then credit allocation to the farm sector increases and vice versa. This result is somewhat consistent with earlier findings of Nosiru [47] who reveal that micro credit enabled farmers to buy the inputs they needed to increase their agricultural productivity.

## 5. CONCLUSIONS AND RECOMMENDATIONS

The study seek to analyze the effect of socio-economic factors on credit constraint of farmers and the rate of credit allocation to the farm sector in the Upper Manya Krobo District of Ghana. Primary and quantitative data was solicited from the sampled farm households receiving agricultural credit from the Asesewa Rural Bank in the Upper Manya Krobo District. All predictor variables were obtained from the primary data gathered. In order to determine the amount of credit demanded and the amount received by farmers, descriptive statistics and the paired-sample t-test were used. Descriptive statistics was also used to analyze the amount of credit allocated to the farm and non-farm sectors respectively. The probit regression model was used to identify the determinants of credit constrained condition of the maize farmers, while the Tobit regression model was then used to identify factors that affect credit allocation to the farm sector.

The results of the paired sample t-test analysis to determine whether significant differences exist between amount of credit applied and amount received by farmers revealed that the mean value of credit received was significantly lower than the mean value of credit applied at one per cent significance level. The study also revealed that farmers who received low loan amount allocated less of their loans to the farm sector and by implication more to the non-farm sector. Farmers who received high amount of loan allocated more of their loans to the farm sector and less to the non-farm sector. Averagely, farmers allocated 72.43 per cent of their loans directly to the farm sector while the remaining 27.57 per cent was diverted for non-farm activities.

The Probit regression model reveal that out of the eight explanatory variables considered, four were found to have significant influence on credit constrained conditions of the farmers: gender, household size, annual income and farm size. Also out of the thirteen explanatory variables considered in the Tobit regression model, four were found to have significant influence on credit allocation to the farm sector: age; age squared, bank visits before loan acquisition and the amount (size) of loan received.

The study provides the following recommendations. Bank visits before credit acquisition and the amount of credit received has a positive influence on the rate of agricultural credit allocation to the farm sector. Therefore, it is imperative that bank officials visit farmers on their farms before granting them loans, and also farmers must be granted the required amounts of loan to enhance the rate of agricultural credit allocation to the farm sector to

ensure increased productivity of crops grown for increased welfare and livelihood of these farmers and the citizens of the country as a whole.

The study provides the some contributions to the existing literature by assessing the credit constraint conditions of maize farmers and the factors influencing this condition, as well as analyzing the factors influencing the rate of credit allocations by these farmers to the farm sector vis-à-vis the non-farm sector. Therefore, the results of this study would enhance our understanding of credit constraint conditions and credit allocation decisions by farmers in developing countries, as well as provide a guide to lending institutions to the farm sector. The study provides suggestions for future research. This study is based on the Upper Manya Krobo District only, and the results may not be representative of maize farmer in the Country. Therefore, extending the study to cover maize famers in other parts of the country would be an avenue for future research. Moreover, extending this study to cover other crop farmers as well as entrepreneurs in Animal Husbandry are areas worth exploring.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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# APPENDIX

## Description of the Upper Manya Krobo District

This section presents the description of the study area. It also presents the types and sources of data used for the analysis and the sample and sampling method. The various methods used in achieving the specific objectives of the study are also outlined in this section.

The Upper Manya Krobo district is located within latitudes 6º 20" North and 6º50"North and longitudes 0º 30" East and 0º 00" West. The district covers an area of 885 sq. km, constituting 4.8% of the total land area of the Eastern Region. The district shares boundary with the Volta Lake in the North, Fanteakwa District in the West, Asuogyaman District in the East, Yilo Krobo District in the South-West and Lower Manya Krobo in the South-East. The estimated population of Upper Manya Krobo District as at 2000 stood at 89,646 people.

The district falls within the semi-equatorial climate belt. It has two major seasons, namely the wet and dry seasons. The wet season is from April to early August and from September to October. August is normally dry and cold with November to March being dry and warm. The total amount of rainfall is between 900 mm and 1, 150 mm. Relative humidity is high during the wet season between 70% and 80% and low in the dry season about 55% - 60%. Two major winds affect the climate of the district. These are the wet South-west trade winds which blow across the district from the Atlantic Ocean between March and July and the Northeast trade winds (harmattan) from the Sahara desert between November and early March. The temperatures are generally high with average ranging between about 26º C and 32º C.

The topography of the district can be generally described as undulating. The highest point in the district is over 660 meters above sea level located in the southern part of Sekesua. The lowest area which is located in the south- eastern part of the district is about 50 meters above sea level. The average height of the land is about 452 meters above sea level. Underlying these landmasses are several rocks or parent rocks from which several rocks have developed. The district is drained with several rivers such as the Volta, Dawado and Anyaboni. With the exception of the Volta River, almost all these rivers are seasonal with most of them overflowing their banks during the rainy season. The dominant vegetation cover is semi-deciduous forest and derived Savannah zone. Human activities on the vegetation have resulted in scattered patches of secondary or broken forest. Traditional practices such as collection of fuel wood, charcoal burning and overgrazing coupled with climate change have degraded the vegetation. Because of these the semi-deciduous forest is gradually turning into savannah woodland especially at areas like Akateng, Sesiamang and Akotoe. These activities have resulted in low crop yields, poor soil fertility, surface run-off and erosion among others.



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