

## A DOUBLE-HURDLE MODEL OF ACCESS AND UTILIZATION OF CREDIT AMONG YAM FARMERS IN IMO STATE, NIGERIA.

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### ABSTRACT

This study determined decision variables that influence access to credit and extent of utilization of accessed credit in yam production in Imo State, Nigeria.

Primary data were collected with structured questionnaire from proportionately and randomly selected 183 yam farmers in the study area. Data on socioeconomic characteristics were analyzed using descriptive statistics such as mean, standard deviation frequency distribution and percentages. An independent double – hurdle model was used to realize the factors that influence access to credit and extent of utilization of accessed credit in yam production on the assumption that access to credit and extent of its utilization by yam farmers were two independent decisions influenced by different factors. Empirical estimates of the first hurdle show that household size, farm size, farming experience, value of output, extension contact, distance from home to bank, availability of credit, collateral and annual farm income are statistical decision variables that influenced the probability of access to credit by yam farmers in Imo State. Estimates of the second hurdle show that the decision to utilize proportion of accessed credit in yam production by the farmers in the study area was influenced by age, household size, level of education, farm size, value of output, extension contact, cooperative membership, distance from home to bank, credit availability, collateral and annual farm income. To improve the utilization of accessed credit in yam production, the banks should disburse approved credit to the farmers early enough during the planting season to prevent credit diversion. There is need for extension agents to enlighten farmers regularly on importance of credit and how to obtain credit so as to increase the probability of access to credit among the farmers in Imo State.

**Key words:** Double – hurdle, Credit, Access, Utilization, Yam farmers, Imo State.

### 1.0 INTRODUCTION

Yam (*Dioscorea* spp) is widely cultivated and produces edible tubers which are used for food in Imo State. Nigeria is the greatest producer of yam in the world with an annual output of about 36.77 million metric tonnes (FAO, 2008).

Yam gives more calories per unit of land area than most crops and matures within 7 months (Oluwatayo, 2008). Yam is the most valued tuber crop because of its cultural and economic importance, and festivals are celebrated in its name before the commencement of eating it every year (Okworet *et al*, 1998). Yam has numerous uses and can be eaten as boiled, roasted, fried, pounded or even baked (Scot *et al*, 2000).

Yam production is labour intensive and requires staking and weed control is manual as only a few herbicide formulation are effective in yam production.

Current researches (Ohajianya *et al*, 2006; Awoniyi and Omonona, 2006; Oluwatayo *et al*, 2008, Eluagu and Chinaka, 2010; Nwosu, 2008) show that output of yam which earlier on used to be very high between 25 tons/ha in 2000 to 28 tons/ha in 2005 has continued to fall as low as 20 tons/ha, which is far below the production figure of most other major food crops, and this decline is traceable to inadequate capital to acquire needed resource and maintenance inputs for the production of yam, and extent of utilization of capital where procured.

It is however noted that the production of yam, due to its labour intensiveness and high cost of maintenance inputs depends on availability and accessibility of credit.

The credit that farmers access are expected to potentially ensure increased yam output and enhance food security and serve as a major driving component for increased agricultural production (Chloupkova and Bjonskov, 2001; Duong and Izumida, 2002; Lawalet *et al*, 2009).

The problem however, is that yam farmers in Imo State access credit and utilize proportion of the credit in farming, but the factors that influence their access to credit and utilization of accessed credit are yet to be determined in Imo State.

Therefore, following the current situations of low yam outputs where the farmers access and utilize credit, there is need to uncover factors which could hinder desired access and extent of utilization of credit among yam farmers in Imo State. The study specifically determines factors that influenced access and utilization of credit among yam farmers in Imo State, Nigeria.

**2.0 MATERIALS AND METHODS**

The study was conducted in Imo State, Nigeria. The state is grouped into three agricultural zones of Owerri, Orlu and Okigwe; and sub divided into 27 Local Government Areas (LGAs). Yam production is more concentrated in the rural communities of the state. Imo state covers an area of 5100 square km with an estimated population of about 4.3 million people (NPC, 2016). Agriculture is the major occupation of the people, and all the farm families farm either as primary or secondary occupation. The humid tropical and rainforest zone favours the growing of roots and tubers, cereals, vegetables and nuts, which are normally grown on smallholder plots (Nwaru, 2004). Yam farmers in the state access and utilize proportion of the credit in their farming activities.

**2.1 Sampling Techniques and Data Collection**

A multi-stage sampling technique was employed for the study. In the first stage, Owerri and Orlu agricultural zones were purposively selected based on number of yam farmers that accessed credit from banks in the state, as provided in the credit records of the banks.

In the second stage, three LGAs were purposively selected from each agricultural zone to get six LGAs. The purposive selection was to ensure that the LGAs selected are rural where yam production activities takes place and the yam farmers accessed credit. In the third stage, two communities were randomly selected from each LGA to get 12 communities. In the fourth stage, the list of yam farmers that accessed credit as obtained from the banks were compiled by the extension agents of the State Agricultural Development Project (ADP) to get a sampling frame of 765 farmers. In the fifth stage, proportionate and simple random sampling techniques were employed to select a sample size of 183 yam farmers for the study. Data were collected using structured and validated questionnaire.

**2.2 Analytical Procedure**

Descriptive statistics such as mean, standard deviation, frequency distribution and percentages were used to analyze the socio-economic characteristics of the farmers, while the Double – Hurdle Model was used to determine factors that influence credit access and utilization by the yam farmers.

The double – hurdle model assumes that access to credit and utilization are two distinct or independent decision. Double – hurdle model was formulated by Cragg (1971); the model assumes that farminghouseholds heads make two sequential decisions with regard to credit access and utilization. The first hurdle is the credit access equation estimated by using a Probitmodel as specified in equation 2.1

$$di^* = X_1^i \beta_1 + U_i, U_i \sim N(0,1) \dots \dots \dots 2.1$$

Threshold index Equation  $di = \{1 \text{ if } di^* > 0, \text{ and is } 0 \text{ if } di^* \leq 0\}$

Where  $di^*$  is the latent discrete credit access choice variable that denotes binary consoring,  $X_{1i}$  is vector of explanatory variables hypothesized to influence credit access choice and  $\beta_1$  is vector of parameters.  $U_i$  is the standard error term and  $di$  is the observed amount of credit accessed representing the farmer's participation decision (ie, 1 means the farmer is reporting credit access greater than 0, and 0 if otherwise). The second hurdle involves an outcome equation, which uses a truncated model to determine the extent of utilization of accessed credit in yam production. This stage uses observations only from farmers who reported positive and greater use of accessed credit in yam production. The truncated model, which closely resembles Tobit's model, was expressed as shown in equation 2.2.

$$Y_i^* = X_{2i} \beta_2 + V_i, V_i \sim N(0, \sigma^2) \dots \dots \dots 2.2$$

(Double – Hurdle Model,  $Y_i = (Y_{1i}^* \text{ if } d_{1i} = 1 \text{ and } Y_{1i}^* > Y_{10} \text{ and is } 0 \text{ if } d_{1i} \leq 1 \text{ and } Y_{1i}^* \leq Y_{10}.$

$Y_i$  is the observed extent of utilized amount of accessed credit in yam production by the farmers.  $Y_0$  is the threshold or the minimum extent of accessed credit utilized in yam production in the study area.

In this study, the threshold level is kept at 67%. This percentage was arrived at by using the reports from the Imo State Ministry of Finance and ADP and supported by the data obtained from the field. Therefore, the truncated model of credit utilization estimated by Burke (2009) maximum likelihood is stated as follows:

$$\ln l = \sum [n \{1 - \Phi(z_i/a) \Phi(x_i/\beta)\}] + \sum [n \{\Phi(z_i/a) 1\Phi(Y_i - X_i/\beta)\}] \dots \dots \dots 2.3$$

If  $Z_i a = 1$ , then there is no zero access to credit and in fact we have a Tobit model, which just estimates the extent of utilization of accessed credit in yam production. Where,  $Z_i$  is the vector of socioeconomic characteristics and otherfactors that determine the extent of utilization of accessed credit;  $a$  and  $\beta$  are parameters estimated.

However, the empirical model for this model adapted from equation 2.3 is specified as follows:

$$\ln Y_i = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + b_9 X_9 + b_{10} X_{10} + b_{11} X_{11} + b_{12} X_{12} + b_{13} X_{13} + e \dots \dots \dots 2.4$$

Where;

$Y_i =$  Access to credit by yam farmers which takes the value of 1 for access above 50% and 0 if otherwise.

- $X_1 =$  Age of farmer (years)
- $X_2 =$  Household size (number of persons)
- $X_3 =$  Level of education (years)
- $X_4 =$  Farm size (Ha)
- $X_5 =$  Farming experience (years)
- $X_6 =$  Value of yam output (₦)
- $X_7 =$  Extension contact (Number of visits per annum)

- $X_8$  = Co-operative membership (Dummy variable, 1 for membership, 0 if otherwise)  
 $X_9$  = Marital status (Dummy variable, 1 if married, 0 if otherwise)  
 $X_{10}$  = Distance from home to the bank (km)  
 $X_{11}$  = Availability of credit (Dummy variable, 1 for availability, 0 for non-availability).  
 $X_{12}$  = Collateral (Dummy variable, 1 if the farm possesses desired collateral, 0 if otherwise)  
 $X_{13}$  = Annual farm income (₦)  
 $e$  = Stochastic error term.

### 3.0 RESULTS AND DISCUSSION

#### 3.1 Average Characteristics of yam farmers

The average characteristics of yam farmers is presented in Table 1. Results show that mean age of the farmers was 42 years with standard deviation of 19 years, which implies that the yam farmers are in their active stage of life to perform the activities associated with yam production. Mean farm size was 1.3 ha with standard deviation of 0.42 ha, indicating that most of the farmers are smallholders.

**Table 1. Average Characteristics of yam farmers in Imo State**

Variable	Mean	Standard Deviation	Minimum	Maximum
Age (years)	42	19	28	74
Household size (Number)	9	3	4	14
Level of education (years)	9	4	0	18
Farm size (Ha)	1.3	0.42	0.55	4.3
Farming experience (years)	17.2	6.8	7.2	32
Value of output (₦/ha)	467108	126152	213095	613095
Extension contact (Number of visits)	0.52	0.23	0	2.4
Distance from home to bank (km)	6.7	1.6	4.2	10.7

**Source:** Survey Data, 2019

The mean farming experience was 17.2 years with standard deviation of 6.8 years, which implies that the farmers have acquired reasonable farming experience and not new entrants in yam production. The mean level of education was 9 years with standard deviation of 4 years, suggesting that most of the farmers had secondary school education and are literate. The mean extension contact was 0.52 visit with standard deviation of 0.23 visit, which implies that extension contact in the study area was poor.

#### 3.2 Factors that influence probability of access to credit and extent of utilization of accessed credit in yam production

Table 2 presents the maximum likelihood estimates of the independent double – hurdle model. The Likelihood Ratio (LR) and the information criteria attest to the reliability of the model. The maximum likelihood is revealed to have a chi – square significance of 1%, showing that the model fits the variables properly. Heteroskedasticity was found and correlated for as shown with a significant sigma. This implies that the factors that influence the two-stage decision relating to access to credit and extent of utilization of accessed credit in yam production in the study area can well be expressed in the independent double – hurdle model. Coefficients in the first hurdle indicate how a given decision variable affects the likelihood (probability) to access credit. Those in the second hurdle indicate how decision variables influence the extent of utilization of accessed credit in yam production.

The result of the first hurdle (Probit model) indicates that household size, farm size, farming experience, value of output, co-operative membership, distance

from home to bank, availability of credit, collateral and annual farm income are statistically significant decision variables that influenced the probability of access to credit among yam farmers in the study area. The marginal effects of the Probit model show changes in the probability of access to credit for additional unit increase in the independent or decision variables.

The probability of access to credit reduces by 1.02% for every member increase in household size. This implies that, as the household size of the yam farmers increase, the probability of access to credit reduces. The result satisfies *a priori* expectation, because increase in household size would increase the household expenditure and probably lead to diversion of credit that would have been invested in yam production.

A unit increase in farm size increases the likelihood of access to credit by 14.23%.

The probability of access to credit by yam farmers increased by 10.42% for every additional year they spent as farmers. This could be attributed to the experience acquired over the years in coping with the constraints of credit in yam production. The result also shows that increase in the value of yam output increases the probability of access to credit by 5.39%.

Increase in extension visits increases the probability of access to credit by 2.41%. The result indicates that the extension agent visit has the tendency of creating more awareness and better information to the farmers on the importance of credit in their farming business. This finding agrees with those of Akpanet *al.*, (2012) and Temitopeet *al.*, (2010)

The probability of access to credit by yam farmers decreased by 4.72% for every additional kilometer they cover from their homes to the bank.

Increase in availability of credit in the banks increases the probability of access to credit by 3.7%. Increase in the value of desired collaterals increases the probability of access to credit by 1.8% in the study area.

**Table 2: Maximum Likelihood Estimates of Double – Hurdle Models of Access to Credit and Extent of Utilization of Accessed Credit in yam production in Imo State, Nigeria.**

Variables	Independent Double – Hurdle Model		
	First Hurdle (Probit)	Marginal Effect in Probit Model	Second Hurdle (Truncated Model)
Constant	-0.837 (-1.068)	-	-209.403 (-4.117)**
Age	-0.009 (-1.412)	-0.0003	31.209 (-2.875)**
Age <sup>2</sup>	-	-	-0.371 (-3.446)**
Household size	-0.416 (2.733)**	-0.0102	-3.063 (-1.803)
Level of education	0.027(1.506)	0.003	36.514 (2.0732)*
Level of education <sup>2</sup>	-	-	0.566 (1.429)
Farm size	3.108 (2.522)*	0.1423	-79.203(-1.962)*
Farming experience	-0.136 (3.065)**	-0.1042	0.849 (1.887)
Value of output	0.045 (3.457)**	0.0539	0.003 (2.416)*
Extension contact	1.263 (2.082)*	0.0041	0.096 (1.413)
Co-operative membership	0.175(1.046)	0.1103	0.106 (2.522)*
Marital status	0.042 (1.306)	0.0422	0.309 (1.493)
Distance from home to bank	-0.103 (-3.503)**	-0.0472	-6.105 (-3.117)**
Availability of credit	1.094 (2.419)*	0.0037	0.258 (2.843)**
Collateral	0.074 (2.434)*	0.0018	0.083 (2.697)**
Annual farm income	0.083 (3.402)*	0.0216	-22.034 (-3.105)**
Chi – square	56.37 (3.402)**	-	46.54 (3.702)**
Log – Likelihood	-41.82	-	-436.37
Sigma	-	-	0.392 (3.068)**

Figures in parenthesis are t-ratios

\*Significant at 5% level

\*\*Significant at 1% level

**Source:** Summarized from computer printout, 2019.

The result also indicates that increase in annual farm income earned by yam farmers increases the probability of access to credit by 2.16%. However, based on the magnitude of the slope coefficients, farm size, extension contact and availability of credit impacted more on the probability of access to credit compared to other significant variables. These findings however agree with the reports of previous researchers (Akpan *et al.*, 2012; John *et al.*, 2009; Olawale *et al.*, 2009; Sunday and Aya, 2009; Wanyama *et al.*, 2009).

The results of the truncated model show that age, household size, level of education, farm size, value of output, extension contact, co-operative membership, distance from home to bank, credit availability, collateral and annual farm income are statistically significant decision variables that influence the decision to utilize proportion of the accessed credit in yam production in the study area; level of education, farming experience, value of output, extension contact, cooperative membership, availability of credit and collateral are positive determinants of extent of utilization of accessed credit in yam production in the study area.

On the other hand, age, household size, farm size, distance from home to bank and annual farm income were negative determinants of extent of utilization of accessed credit in yam production in the study area. This finding corroborates the findings of many researchers (Akpan *et al.*, 2012; Amanze *et al.*, 2010; Okwale *et al.*, 2009; Wanyama *et al.*, 2009; Adeyemo and Salman, 2016).

#### CONCLUSION AND RECOMMENDATIONS

The study used a double – hurdle model to determine factors influencing access to credit and extent of utilization of accessed credit in yam production in Imo State, Nigeria. Econometric analysis of decision variables show that household size, farm size, farming experience, value of output, distance from home to bank, availability of credit, collateral and annual farm income are statistically significant decision variables influencing the probability of access to credit by yam farmers in the study area. However, the magnitude of farm size, extension contact and availability of credit were greater compared to other significant variables.

On the other hand, the decision to utilize a proportion of accessed credit in yam production by the farmers was influenced by age, household size, level of education, farm size, value of output, extension contact, cooperative membership, distance from home to bank, credit availability, collateral and annual farm income. To increase the probability of access to credit among farmers in Imo State, the extension service should be strengthened to enlighten farmers more on the importance of credit and how to access credit from the bank. Also, to increase the extent of utilization of accessed credit in yam

production by the farmers, requests for farm credit should be properly and adequately appraised by credit officers of banks and the approved credit supplied to farmers should be effectively supervised by credit officers to prevent credit diversion. Credit should be made available to the farmers as at when needed for their production activities to avoid diversion of the credit to other uses.

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