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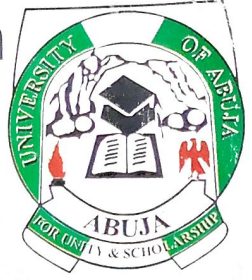
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A BINARY LOGIT REGRESSION MODEL OF FARMERS' PARTICIPATION IN FADAMA II PROJECT IN NIGER STATE, NIGERIA

[1]*Adeyemi R. A. and H.U. Muhammed[2]

[1]Department of Crop Production, [2]Department of Agricultural Economics and Extension, Federal University Of Technology, P.M.B 65 Minna – Nigeria

ABSTRACT

This paper is aimed at determining the factors that characterized the farmers' participation in Fadama II project as a way of improving their livelihood. The study was conducted in 2009 in Niger State in the North central Nigeria, situated on longitude $9^0 36'N$ and latitude $6^0 20'E$ of Greenwich meridian. A two-stage sampling plan was adopted in this study. Three local governments in which Fadama II project is being implemented were randomly selected in the state. The sampling frame of all farmers in the 3 LGAs were stratified into two : Fadama project beneficiaries (farmers) and Non Beneficiary (farmers) who lived in Fadama II project LGAs but did not participate in the project. In each stratum, 75 questionnaires were administered each (25 per LGA); totaling 150 respondents. A binary logistic (logit) regression model was employed to analyze the data. The model indicated that the goodness of fit of observed data was adequate. 87.3% of the (respondents) farmers were correctly classified by the model. The model chi-square value for goodness of fit was 133.657. The results showed level of education and age of the respondents were significant ($p<0.05$) and ($p <0.01$) respectively. They both had inverse (negative) relationship on log of odds of farmers' participation in Fadama II project. However, income and membership of cooperative society had positive relationship with the odds of farmers' participation in Fadama II project and they were both significant ($p< 0.01$). Others factors such as sex, household size, farm size and major occupation of the respondents were not significant ($p < 0.05$) in this study.

Keywords: Farmers, Participation, Fadama II project, Binary logit model.

INTRODUCTION

In Nigeria, like most developing countries, majority of the population lives in the rural areas where agriculture is the predominant occupation of the 70 percent of the dwellers. Available records has shown that most rural dwellers are small-scale holders farmers who lack access to financial assistance to improve their livelihood unless assisted (Adebisi and Olalekan 2004). Agricultural incentive encompasses all loans and advances granted borrowers to finance and service production activities relating to agriculture, fisheries and forestry and also for processing, marketing, storage and distribution of products resulting from these activities. Small scale farmers are among the potential beneficiaries of agricultural credit in Nigeria but because of their low level of literacy they are mostly unaware of existing loan facilities. Information regarding agricultural credit gets to small scale farmers usually through channels such as relations, friends, neighbours, government officials, commercial and credit banks. Grassroot organs such as village heads and local government officials are used to diffuse such information because of their personal touch with small scale farmers.

Increasing reduction in production and productivity has continued to characterize Nigerian agricultural sector thereby limiting the ability of the sector to perform its traditional role in economic development. In order to break this cycle and improve the performance of the agricultural sector, the Nigerian government over the years introduced and implemented several policies and programme aimed at revamping the sector (Ajibefun and Aderinola, 2004). A recent effort towards boosting production and enhancing farmers' welfare was the introduction of Second National Fadama

* Correspondence Author: R.A. ADEYEMI : Email adeyemira@yahoo.ca

Development Project. Fadama II project is a follow - up to Fadama I (phase I of the National Fadama Development project), which was implemented during the period 1993-1999. Fadama I focused mainly on crop production and largely neglected support of post production activities such as commodity processing, storage and marketing (downstream agricultural sector). The emphasis was on providing boreholes and pumps to crop farmers through simple credit arrangements aimed at boosting aggregate crop output (Nkonya et.al., 2008).

The basic strategy of the project was that of a Community - Driven Development (CDD) approach with strong emphasis on stake holder participation, especially at the community level. The project activities were centered on Fadama User Groups (FUGs) and Fadama Community Associations (FCAs). An FUG is composed of Fadama users with a common economic interest- called economic interest groups (EIGs). FCAs are associates of FUGs that operates in a given area. Facilitators supported under the project helped in organizing the Fadama Community Associations (FCAs) and guided them through an intensive process of group decision - making using a range of participating techniques, resulting in Local Development Plans (LDPs). The LDPs were the basis for support under the project. In this manner, the project ensured that every activity funded by the project was conceived after informed discussion by the whole community, which resulted from consensus building and social inclusiveness (Ingawa et al, 2004). The Community – Driven Development (CDD) approach has become a major strategy used by both government and development assistance programs (Gillespie, 2004; Manusuri and Rao, 2004; Platteau, 2004).

Out of the 18 states that are participating in Fadama II project, 12 of them are assisted by the World Bank, and Niger state was one of the beneficiary states. The project was designed also to assist rural dwellers to improve on their income generation activities. Participating Local Government Areas are to undertake project related activities at the level of Fadama Community Associations (FCAs) and other beneficiary groups. Fadama II was designed to operate for six years (2004 2010) with a goal of contributing to poverty reduction in Nigeria (NFDO, 2007). The overall objective of this component is to enhance the improvement in Fadama Users' productivity and income by facilitating the acquisition of productive assets by individuals or Fadama User Groups (FUGs) to mobilize their own funds and by providing matching grants for income generating activities (IGAs) to Fadama User Groups. The pilot scheme component of the project was to promote the acquisition of productive assets, and reduce the impact of market failures in rural finance sector on the poor Fadama User Groups through matching grants. It was reported that matching grant of Seventy percent (70%) had been supplemented to the beneficiaries financing share of thirty percent (30%) of cost of the assets (Okonjo, 2005).

This paper aimed at determining the factors that characterized the farmers' participation in Fadama II project as a way of improving their livelihood. The paper was organized into five sections. Next presents the methodology, which includes the sampling procedure and the statistical models used in the analysis. Section 3 presents the results of the analysis, which was followed by discussion. Section 5 summarized the findings of this article and made relevant recommendation for policy formulation.

METHODOLOGY

Study Area

This study was conducted in Niger state, Nigeria. The state is located in the Guinea Savannah vegetation zone in the North central part of Nigeria lying on latitude $9^0 36' N$ and longitude $6^0 20'$ of the Greenwich meridian. It has total land area estimated as 84,800 square km and an estimated population of 3.95 million (CBN-NPC 2006). It is made of 25 local government Areas. The state is characterized by 6-7 months of rainfall (April-October) and 4-5 months of dry season (November to April) and two tropical

temperatures. The annual rainfall is between 1100mm — 1600mm with average monthly temperature ranges from 23°C and 37°C (NSAP, 1994). The vegetation consists mainly of short grasses, shrubs and scattered trees. The state is agrarian and well suited for production of arable crops such as cowpea, yam, cassava and maize because of favourable climatic conditions.

Sampling procedure

A multistage sampling technique was adopted in this study. First, three Local Government Areas (LGAs) were randomly selected from the list of all participating LGAs in the state using a table of random number. The LGAs include Suleja, Lapai and Mariga LGAs. The list of all participants was collected from the local Fadama Desk office situated in the local government headquarters. A baseline study conducted by the State Fadama office, which provided the information about the Fadama Beneficiary group and the Non – Beneficiary group, where a complete sampling frame was obtained from. The second stage involved obtaining sampling frame of all farmers within the selected LGAs, which were stratified into two: Beneficiaries (Partaking farmers in Fadama II project) and Non-beneficiaries (Non partaking farmers within the selected LGAs). This was followed by a random selection of 75 farmers from each of the two strata (25 per each LGA) totaling 150 respondents, while a chosen candidate was not available at the time of the interview, a replacement was made from the remaining list, this ensured equal number of respondents from each group. The data were collected using structured questionnaire designed in line with objectives of the study. Information was collected on the FADAMA II project involvement in the state and the factors that may influence it. The other input data include: total land area for agricultural activities (ha), average annual income from agriculture and non agricultural sources, major occupation and level of participation in cooperative society other than FADAMA project. Data were also collected on the household socio– economic variables such as level of education, farming experience, sex, age, household size and number of extension contact.

Statistical Model

The data collected was analyzed using logistic regression model (Logit). Logistic regression model is a branch of the generalized linear models and is widely used in many areas of scientific research. The logit link function and the binary dependent variable of interest make the logistic regression model distinct from the linear regression model. This regression technique can suitably be used with categorical dependent variables, and can also accommodate explanatory variables which are both continuous and discrete. When the response is binary, the linear regression model:

$$E(y/\mathbf{X}) = \pi(\mathbf{X}) = \alpha + \mathbf{X}'\beta \qquad (1)$$

This probability $\pi(\mathbf{X})$ is assumed to fall between 0 and 1 over a finite range of x values.

The goal of logistic regression models is used to model the probability of the occurrence of an event depending on the value of covariates x. The model is of the following form:

$$P(y = 1/\mathbf{X}) = \frac{e^{X\beta}}{1 + e^{X\beta}} \qquad (2)$$

In other words, we want to find a model that fits the observed data well. A model is said to fit poorly if the model's residual variation is large and systematic (Hosmer et.al, 1997). This is usually the case when the estimated values produced by the logistic regression model do not accurately reflect the observed values.
To capture the data at hand, the model can be simply stated as:

$$B_i = \theta X_i + \varepsilon_i$$

$$(3)$$

Where

B_i = Variable that indexes the framers' participation in FII project (B 1, if i^{th} farmer actually participated in FII project; B=0, if i^{th} farmer did not participate in Fadama II project in the selected LGAs, where FADAMA programme is being implemented).

θ = Vector of unknown coefficients

X_i = Vector of explanatory variables

ε_i = Stochastic error term

The explanatory variables (X_i) included in the model are:

SEX= Sex of the respondent (Male =1, Female =0)

AGE = Age (in years)

HHS= Household size (members in the family include husband, wife, children and the dependants)

EDU= Educational level of farmers (no formal education 0, primary education 1, secondary=2, tertiary =3, adult education 4)

MOP= Major Occupation of the respondent (Farming =1, Civil servant 2, artisan 3 others =4)

MEB= Participation in cooperative society other than Fadama (No participation 0, low 1, moderate=2, high=4)

FAM= Farm size (Arable crops, livestock and fish ponds)

INC= Income (average yearly accrued income from farming and non farm activities)

RESULTS OF ANALYSIS

The model classification table 1 indicates that the goodness of fit of the model is adequate. 87.3% of the (respondents) farmers were correctly classified by the model. The model chi-square value was 133.657. The table 1 presents the estimate parameters measuring the goodness of fit of the fitted logistic model. The -2 log likelihood ratio test (-2LL) shows that the estimated model including the constant and the set of explanatory variables fit the data better compared with the model containing the constant only. This implies better relationship between odds ratio (or log of odds). Probability of farmers' benefiting through participation in FII project and the explanatory variables including in the model collectively contribute significantly to the explanation of the interest in Fadama II project; although some factors coefficients were not significant on individual basis. The R^2 value, model chi-square and overall percentage of correct prediction also suggested that the fitted model has an excellent predictive power.

The table 2 below reveals that age and major occupation of the respondents had negative influence on the farmers' participation in Fadama II project. This might be attributed to the fact that some of the respondents involved in other occupation other than farming, and they felt that their involvement or active participation in Fadama activities might hinder them from other businesses. Also, negative influence of age on the response variable (odds of farmers' participation) could be related to the fact that the older people are generally believed the aversive risk of participle in project might adversely affect their farming operations. This implies that the younger age participate more in Fadama II project. However, coefficient of age was significant (P< 0.05) while coefficient of major occupation of the respondents was not significant (p> 0.05). The education variable (EDU) had a significant inverse relationship with the log of odds of the farmers' participation in Fadama II project. This coefficient implies that if the coefficient of education is increase by a unit keeping all other variables equal, then the odds of the farmer participating in Fadama II project would be reduced. This could be explained by

the fact that the well educated farmers are likely to go out of the community in search of better employment opportunities elsewhere.

The variables of gender and household size had positive relationship with the odds of farmers' participation in Fadama II project, although the both coefficients were not significant (p>0.05) in contributing to the odds of farmers participation in Fadama II project. This implies that sex and household size were not significant to decide farmers' participation in Fadama II project. The income of the farmers had positive and significant (p<0.001) influence on farmers' participation in the Fadama II project. This shows that farmers participated more actively in Fadama II project as their source(s) of livelihood (income) are improved. Membership of cooperative society had positive relationship with the odds of farmers' participation in Fadama II project; in fact the level of participation had a great effect on odds of farmers' participation in Fadama project too. Its coefficient in the model was highly significant (p <0.01). The positive effect of cooperative association efforts can be seen in the fact that all the respondents belong to association or the other, this might enhance their access to loans and farm inputs ,which they benefited from their membership of the cooperative association. In fact, the association was the main thrust behind the acquisition of tangible assets, and enhanced equal opportunity for group membership.

DISCUSSION

A number of empirical studies have been carried out to assess the role of Fadama II project in improving the income and living conditions of the rural dwellers in Nigeria. For instance, the study conducted by IFAD-CBARDP(2004) to assess rural people's participation in farming in Jigawa state , reported that majority (about 90.62%) of the rural household heads have farming as primary occupation and a small proportion engaged in other forms of occupation as secondary and this serve as non-farm source of income. Ayanwale and Alimi (2004) also reported that participation in cooperative association had significantly improved the income of the small scale farmers in Osun state. These reports were in line with the findings of this paper.

Ephraim et.al.,(2008) also carried out a study to assess the socio-economic characteristics of Fadama II project beneficiaries, revealed that most the beneficiaries belong to younger age class, who have more land and other assets than the older age class, but reside far away from their assets. The result suggests that richer class do not reside in the rural areas, so Fadama II project are targeted to the poor, vulnerable and people living in remote local.

However, a study conducted by Babatunde (2008) to examine the total income portfolios and determinant of total income among rural farm household in Kwara state. The study indicated that for the poor households, farming (crops and livestock) is the most important income source accounting for the two-thirds of the total income. But the rich households derived their larger share of income from non-farm activities. Also , similar study conducted in different state viz Niger, Kebbi, and Kaduna , found that crop production was by far the most important single source of income, providing at least over 46% of their income for all categories of respondents before and after the commencement FII project. (Umar,2007; Adeyemi et.al.,2008; Ephraim et.al., 2008). Umar(2007) reported that in Kebbi state, the average household income for all Fadama II beneficiaries estimated income ranged from ₦ 86,894.04 to ₦126,151.70 per annual. He ascribed this increased in net annual income due to participation in Fadama II project, which contributed to 32.8 % increase as against the target value of 20% increase that the project set to achieve for 50 beneficiaries in six years of operation. A similar study conducted in Osun state stated the farmers' income had substantially increased more than baseline estimation as result of Fadama II project (Ayanwale and Alimi, 2004)

CONCLUDING REMARK

The study concerned with the determination of the factors that influence farmers' participation in Fadama II project in Niger Sate, Nigeria. Findings of the study however

revealed that income of the farmers and level of participation in cooperative society were significant factors in determining the probability of farmers' participation in Fadama II project. The socio-economic and cultural factor of farmers such as educational level as well as membership of association were also found to be significant factor (P<0.05 and p<0.1) respectively. However, of all the factors investigated, sex of the respondents, major occupation, household size and farm size were found not to have significantly influenced the possibility of farmers' participation in Fadama II project. Positive significant relationship existed between the family size, farm size, and sex of the respondents and their participation in Fadama II project, but these positive relationships were not significant factors in determining farmers' participation the project.

The findings of this study has suggested the fact that the National Fadama Program have some positive impact on the participating farmers in Niger State of Nigeria, as a model of such programmes in Nigeria and other developing countries. The programme has increased the asset base of the participants, increased their income and enhanced access to farm inputs and increased knowledge base of participants though their group membership. These results suggest that the programme has a positive impact on the participants and has a wide potential of alleviating rural poverty in the study area.

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Appendix

Table 1: Summary Statistics of the Logit model analysis

Total number of respondents farmers	150
Overall number of farmers prediction	87.3%
Model Chi-square	133.56
- 2Log likelihood	0.0001
Cox and Snell R square	0.639
Nagelkerke R square	0.786

Table 2: Maximum likelihood estimate of the logit model for factors determining Farmers' participation in Fadama II project

Variables	Regression Coefficients	T-vale
Constant	-7.569	< 0.0001**
SEX	2.609	0.265ns
AGE	-0.046	0.006**
HHS	0.137	0.145ns
EDU	-0.556	0.043*
MOP	-.387	0.203ns
MEB	0.363	0.002**
FAM	0.091	0.623ns
INC	0.0001	< 0.0001**

Ns= not significant, * = significant at 5% level, ** = significant at 1% level.
Field Survey 2009