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Determinants of Participation in Non-Farm Activities among Rural Households in Osun State- An Application of Multinomial Logit (Mnl) Model

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Abstract
Recently, there is a growing recognition that rural households receive their income from a diverse portfolio of activities and that one of the most important of these activities is the rural non-farm sector. The study was carried out in Osun – State, Nigeria. The study is based on primary data obtained through the use of 354 structured questionnaire administered to selected rural household head in the area, adopting a multistage sampling procedure. The model of analysis was a multinomial logit model.The result of the analysis shows that the log-likelihood value of the model is -165.9833, the likelihood ratio (X^2) value of 441.9926 which is greater than critical chi-square at 1% level of significance and this confirm that all the slope coefficient are significant different from zero, that is the explanatory variables are collectively significant in explaining determinants of non-farm participation, an indicative of goodness of fit for the estimated model. Individual variables like Age of the household head, its square, Gender, and farming experience are found to be significant for non-farm self-employment. While only education and Gender coefficient were found to be significant for non-farm wage employment. Household variables like household landholding is one of the most important household level determinants of non-farm self-employment in the study area, membership of cooperative and the value of asset were also significant in determine non-farm self- employment. For non-farm wage employment, the major determinant were household size, access to credit, total farm size and membership of cooperative. Among the community variables, distance to the nearest market and index of access to communication facilities were determinant of non-farm self-employment in the study area. For non-farm wage employment, only land productivity index has a strong negative effect on its participation.The study therefore recommended provision of social amenities like good road, potable water, electricity, availability of modern market facilities in rural areas by government and private developers will go a long way in promoting non-farm activities in rural area. Community development association and non-governmental organization (NGOs) can also help in this issue.
Keywords: Determinants, Participation, Non-farm activities, Rural-household.

Introduction

In the past many researchers and policy makers have viewed the rural economy of developing countries as synonymous with agriculture. According to the view, rural households receive most of their income from the production of food and export crops. (Adams, 1999). This view is due to the fact that agriculture is still the mainstay of the rural economy in most developing countries and it has continued to employ over 70 percent of the people (NBS 1999; 2004), and produces over 90 percent of the food consumed in Nigeria (Olayide, 1980; Mijindad *et al.,* 1995; Oluwatayo, 2007).

Despite the importance attached to agriculture in rural economy, it has long been recognized that the productivity of the farmers is low and insufficient individually (Olayemi, 1980), and that there is a continuous decline of the contribution of agriculture to the national economy. The reasons for this is that farmers earn low income from their activities due to low farm productivity coupled with inadequate access to marketing facilities, poor storage and preservation technique. In many rural areas, agriculture alone cannot provide sufficient livelihood opportunities. Migration is not an option for everyone and where possible, policy- makers may in any case prefer to limit the worst excesses of urbanization with its associated social and environmental problems

Recently, there is a growing recognition that rural households receive their income from a diverse portfolio of activities (Ellis, 1998; Adejobi, 2004; Agbola, 2005) and that one of the most important of these activities is the rural non farm sector. (Agbola, 2005; Haggblade *et al.*, 2007). In some cases the rural non farm sector accounts for the bulk of income to rural households. (Adams, 1999; Ellis and Freeman, 2005).

Islam (1997) reported that the share of the non-farm sector in rural employment in developing countries varied from 20 percent to 50 percent. Reardon (1997) found that rural non-farm income shares in Africa ranges from 22 percent to 90 percent, and Newman and Canagarajah (2000) pointed to a large body of recent research that indicated that the rural non-farm income sector is now thought to be more dynamic and important than previously believed.

In Africa, the average share of rural non-farm income as a proportion of total rural income is 42 per cent. This is higher than in Latin America and higher still than in Asia (Reardon *et al.,* 1998). In Nigeria almost

90 per cent of all households have at least some off- farm income and on the average, off-farm income accounts for 50 percent of total household income (Babatunde, 2008).

According to Lanjouw and Lanjouw (1995), many smallholder farm households complement their farm income with income from non-farm sources because of several advantages this strategy offers especially for poor households. The level of agricultural production is often too limited to allow efficient use of all household labour. Consequently, non-farm activities can offer an alternative remunerative allocation, especially during the lean season. Moreover, income from agriculture is subjected to high business risk, hence earnings from non- farm employment may help to buffer the resulting income fluctuation and improve household security (Lanjouw and Lanjouw, 1995). Rural non-farm activities may absorb surplus labour in rural area, help farm-based households spread risk, offer income remunerative activities to supplement or replace agriculture income, offer income potential during the agricultural off-season, provide a means to cope or survive when farming fails.

Rural non-farm opportunities can also have indirect effect on wages amongst the rural poor since expansion of non- agricultural employment opportunities is likely to tighten casual labour markets in general and thus raise wages in agricultural labour market (Lanjouw, 1999). A further indirect effect occurs where rural non-farm income enables poor household to overcome credit constraints and risk constraints on agricultural innovation (Taylor and Wyatt, 1996).

Therefore this study seeks to provide answer to this research question.

(i) What are the determinants of participation in non farm activities?

1.3 Objectives of the Study

The overall objective of the study is to analyze the determinants of participation in non-farm activities among rural households;

1.4 Hypothesis

The following hypothesis will be tested.

(i) $H0_1$:-Individual, Households, and Community variables do not determine household's participation in non-farm activities.

Theoretical Framework for Multinomial Logit (Mnl) Model in Participation Decisions.

The analytical approach that are commonly used in a participation choice decision study involving multiple choices are the multinomial logit (MNL) and multinomial probit (MNP) models. Both the MNL and MNP are important for analyzing household participation decisions as these are usually made jointly. These approaches are also appropriate for evaluating alternative combinations of adaptation strategies. The advantage of using a MNL model is its computational simplicity in calculating the choice probabilities that are expressible in analytical form (Tse, 1987). This model provides a convenient closed form for underlying choice probabilities, with no need of multivariate integration, making it simple to compute choice situation characterized by many alternatives. In addition, the computational burden of the MNL specification is made easier by its likelihood function, which is globally concave (Hansman and McFadden, 1984).

The main limitation of the model is the independence of irrelevant alternatives (IIA) property, which stated that the ratio of the probabilities of choosing any two alternatives is independent of the attributes of any other alternatives in the choice set (Hansman andMcFadden, 1984;Tse,1987)

Alternatively, the multinomial probit model (MNP) specification for discrete choice models does not require the assumption of the (IIA) (Hansman and Wise, 1978) and a test for this assumption can be provided by a test of the "covariance" probit specification versus the 'independent' probit specification which is very similar to the logit specification. The main drawback of using the MNP is the requirement that multivariable normal integrals must be evaluated to estimate the unknown parameters. This complexity makes the MNP model an inconvenient specification test for the MNL model (Hansman and McFadden, 1984).

Analytical Framework for Multinomial Logit

Let A_I be a random variable representing the different choice of participation in non-farm activities by any rural households. We assume that each rural household faces a set of discrete, mutually exclusive choice of participation in non-farm activities. The activities are assumed to depend on a number of variables including individual characteristics, household characteristics and community characteristics X.

The MNL model for participation choice specifies the relationship between the probability of choosing option A_i and the set of explanatory variables X as (Greene, 2003).

$$Prob\ (A_i = j) = \frac{e^{B_j^j X_i}}{\sum_{k=0}^{j} e^{B_k^j\ X_i}}, \quad J = 0,1\ldots\ldots J \qquad (1)$$

Where β_j is a vector of coefficient on each of the independent variables X. Equation (1) can be normalized to remove indeterminacy in the model by assuming that $\beta_0 = 0$ and the probabilities can be estimated as:

$$Prob\ (A_i = j\ /\ X_1) = \frac{e^{B_j^j X_i}}{1 + \sum_{k=1}^{j} e^{B_k^j\ X_i}}$$, J = 0, 2……J $\beta_0 = 0$ ……(2)

Estimating equation (11) yields the J log – odds ratio.

$$\ln\left(\frac{P_{ij}}{P_{ik}}\right) = X_i^j\ (B_i - B_k) = X_i^j B_j, if\ k = 0$$ …….. (3)

The dependent variable is therefore the log of one alternative relative to the base alternative. The MNL coefficients are difficult to interpret, and associating the β_j with the jth outcome is tempting and misleading. To interpret the effects of explanatory variables on the probabilities, marginal effects are usually derived as (Greene, 2003) .

$$\delta_j = \frac{\delta P_j}{\delta X_i} = P_j\left[B_j - \sum_{k=0}^{J} P_k B_k\right] = P_j(\beta_j - \bar{\beta})$$ ……(4)

The marginal effects measure the expected change in probabilities of a particular choice being made with respect to a unit change in an explanatory variable (Long, 1997, Greene, 2000). The signs of the marginal effects and respective coefficients may be different, as the former depend on the sign and magnitude of all other coefficients.

Research Methodology

Description of Study Area

The study was carried out in Osun State, Nigeria. Osun was carved out from the old Oyo state in 1991. It is situated in Southwestern part of the country. The state is bordered in the west by Oyo state, in the east by Ondo and Ekiti State, in the north by Kwara state and south by Ogun State. It has a land area of 8,882.55square-kilometres and a population of 3,423,535 (2006 population census). The study area falls on Latitude $8^0$10' to the north and Latitude $6^0$5' to the south. It is also marked by Longitude 4^0 to the west and Longitude $5^0$4' to the east. The mean annual temperature is between 21.1^{0}C to 31.1^{0}C. Rainfall varies from 1100 millimetres per annum in the southern part to 800 millimetres per annum in the northern part. While the raing season starts in the late March and ends in October, the dry season stretches from November to early March. Soil types range from Itagunmodi series (fiable red clay), Araromi series to sedentary, sandy and loamy soils.

The above ecological features provide opportunities for various crops and cropping patterns in the state. In the forest region with a much higher rainfall and relative humidity, tree crops such as cocoa, kola, citrus and oil palm are grown. Equally grown are arable crops such as maize, yam, rice, cassava, tomato and pepper. On the other hand, the derived savannah region has mainly arable crops with tree crops grown in patches. The traditional language is Yoruba and the capital of the state is Osogbo.

Sources, Types and Method of Data Collection

This study was based on primary. The primary data was obtained through the use of a structured questionnaire administered to selected rural household heads in the study area. Primary data collected from each household include the following;

(i) Socio economic, demographic and community data such as age, gender, household size, level of education, major occupation, production assets, access to pipe borne water, electricity, credit, distance to nearest market and motorable road.

(ii) Sources, proportion and actual values of income from farming and non-farming activities which each household member engaged in.

The above primary data were complemented with secondary data that were obtained from various publications of the Food and Agriculture Organization (FAO), Central Bank of Nigeria (CBN), National Bureau of Statistics (formerly FOS) research reports and relevant journals.

Sampling Procedure and Sample Size

The population of the study was all rural households in Osun-State. A multi-stage (Three-Stage) sampling procedure was adopted in the study.

The first stage was the purposive selection of ten rural local government areas in the state. The second stage involved random selection of three to four rural communities/ villages with population of less than 20,000 inhabitants from each of the ten selected local government areas. While the third and final stage involved systematic selection of ten percent of the households in each of the rural communities / villages. This was achieved using the list of estimated number of households in each villages/ rural communities provided by the State Agricultural Development Project (ADP).

In the end, a total of 400 households were sampled and interviewed in 34 rural communities for the

purpose of this study. However, only three hundred and fifty-four (354) copies of questionnaires were used in the analyses because of the inadequate information and inconsistent responses of the 46 others.

Multinomial Logit Model

This was used to analyze the determinants of household Participation non-farm income generating activities (employment). Multinomial logit models which have been used by Theil (1969), Cragg and Uhler (1979) and Mcfadden (1976) have been extensively used in social research for problem involving more than two dependent variables.

In the multinomial logit, there are more than two dependent variables (> 2 events).So one event of category has to be arbitrarily selected as base (Tse,1978)

$$\text{Thus } P(Y=j) = \frac{e^{\sum_{k=1}^{k} \alpha + \beta_{jk} X_k}}{1 + \sum_{J=1}^{J=2} e^{\sum_{k=1}^{k} \alpha + \beta_{jk} X_k}} \quad \text{----------(35)}$$

Where J = 0, 1,2----i.e to distinguishing response categories (e.g No participation in Farm activities, non-farm self-employment and nonfarm wage employment.

K = number of Xs i.e for distinguishing x variables

β = vector of regression coefficients

$\propto$ =Constant

X = value of explanatory or independent variables for the i^{th} individual.

Individual level variables

Age of household head (in year)
Squared of age of household head
Gender (male = 1, female = 0)
Marital status (Married = 1, Not married = 0)
Years of formal Education
Experience in Primary Occupation

Household level variables

Household size (actual number)
Access to credit (Yes = 1, No = 0)
Residency status (Native = 1, Non- Native = 0)
Landowner (Yes = 1, No = 0)
Membership of Community association (Yes = 1, No = 0)
Total size of farm land that the Household owns or has direct access to for arable and tree crops production (Ha)
Value of other assets owned by household (Naira)

Community level variables

Distance to the nearest market (Km)
Access to electricity (Yes =1, No = 0)
Distance to the nearest motorable road (Km)
Index of access to communication facilities (Liker scale)
Land productivity Index: - measured as the log of the community average of the total output value per hectare.

Determinants of Non-farm participation

Table 1 contains the results of the estimated multinomial logic model. The log-likelihood value of the model is –165.9833. The likelihood ratio (X^2) value of 441.9926 is greater than the critical chi-square at 1% level of significance and this confirms that all the slope coefficients are significantly different from zero. In other words, the explanatory variables are collectively significant in explaining determinants of non-farm participation, an indicative of goodness of fit for the estimated model.

Individual variables:- At the individual level, the age of the household head and its square, gender, farming experience are found to be significant for non-farm self- employment, while only education and gender coefficient were found to be significant for non-farm wage employment category.

Age of the household head and its quadratic term were (both significant at five percent) positive and negative respectively and this indicates that age of the households head has a positive impact on the probability of participating in non-farm self-employment but this tendency tends to increase at a decreasing rate as the age advances. Coefficient of household head gender was negative and significant at one percent implying that female headed households are more likely participate in non-farm-self-employment than the male , and this may be connected to the difficulties associated with farming or physical strength required in farming activities. Years of experience in farming also had a negative and significant (at ten percent) impact on participating in non-farm self-employment. This imply that the more experienced the respondents are in farming the less-likely for them to participate in non-farm self-employment.

For non-farm wage employment, education level measured by years of formal education (schooling) had a positive and significant (at one percent) impact on probability of participating in non-farm wage employment, this indicates that the more educated the respondents the more likely for them to participate in non-farm wage employment. In addition to formal education of the household head, gender of the house head was positive and significant (at one percent) showing that the sex coefficient has positive and significant impact on non-farm wage employment participation, this revealed that male respondents are more likely to participate in non-farm wage employments than their female counterpart.

Household variables

Household land holding is found to be one of the most important household-level determinants of non-farm self-employment in the study area since annual crop land is the most important type of agricultural land and exert a strong and negative effect on participatin in non-farm self-employment, this is because having more lands may also drift households away from non-farm participation as it increases their concentration in agriculture. Coefficient of membership of cooperative was also negative and significant (at one percent) showing that those respondents that belong to cooperative societies were less likely to participated in non-farm self-employment but concentrated in agriculture. Coefficient of value of asset was also positive and significant at five percent implying that the value of asset have a positive impact on participation in nonfarm self-employment. This is reasonable since initial capital may be needed to start a non-farm self-employed business.

For non-farm wage employment, the major determinants were household size, access to credit, total farm size and membership of cooperative. Household size have negative and significant coefficient (at one percent), this imply that households with large family size tend to concentrate in agricultural employment instead of participating in non-farm wage employment, this may be connected with intensity of family labour use in agricultural employment which will give them an added advantage if they concentrated on agricultural employment instead of participating in non-farm wage employments. Coefficient of access to credit was also negative and significant(at one percent), showing that access to credit have a negative impact on participating in non-farm wage employment, this is reasonable since initial capital was not required before engaging in non farm wage employment were-as available credit can be used to purchase new and improved technology in agriculture. Membership of associations also have a positive and significant (at one percent) impact on participating in non-farm wage employment.

Community-level variables

Among the community level variables, distance to the nearest market and index of access to communication facilities were significant determinants of non-farm self-employment in the study area. Distance to the nearest market was negative and significant (at one percent), this shows that the nearer the distance to market the stronger the incentive to participate in non-farm self-employment. Index of communication facilities was also significant (also at one percent) and positive, this imply that availability of communication facilities have a positive impact in participate in non-farm self-employment. For non-farm wage employment, only land productivity index has a strong negative effect on its participation. This result implies that residents in low potential agricultural area have a strong incentive to participate in non-farm wage employment, than those residing in high potential agricultural areas.

Table 1: Determinants of Participation in Non-farm activities (using multinomial logit model)

Variables	Group 1 Non-farm self employment		Group 2 Non-farm wage employment	
	Coefficient	t –value	Coefficient	t –value
Constant	21.049***	2.795	-0.0673	-0.11
Individual Variables				
Age	0.630**	(2.079)	0.0847	0.361
$(Age)^2$	0.006**	(1.975)	-0.0014	-0.590
Gender	-3.815***	-4.781	2.332***	-2.797
Marital status	-0.909	-1.468	-0.7184	-1.160
Education	0.01	0.479	0.1476***	2.692
Experience	-0.045*	-1.743	0.0319	1.519
Household Variables				
Household size	0.128	0.773	-0.9585***	-5.228
Access to credit	0.635	1.263	1.3064***	2.587
Residency Status	0.006	0.270	-0.1167	-0.063
Land Ownership	-1.326***	-3.264	-2.0513	-1.594
Total Farm size	-0.002	-0.195	-0.0016	-0.0541
Value of Asset	0.239-05**	2.343	0.0082	0.289
Member of Associations	2.333***	3.851	2.5031***	4.109
Community Variables				
Distance to nearest market	-0.0364***	-2.569	-0.249	-0.486
Access to electricity	-0.0813	-0.129	0.3042	0.583
Distance to the motorable road	0.0631	0.881	0.3727	0.648
Index of access to communication facilities	0.4181**	2.873	0.0249	0.137
Land productivity index	1.223	0.079	0.321*	1.991

Source: Field survey, 2010
Number of observation 354
Log likelihood function -156.98
Restricted log likelihood -377.9786
Chi-squared 441.9926***

Conclusions

The determinants of non-farm participation analysis show the major characteristics determining involvement in non-farm activities and the direction of its impact. At the individual level, the age of the household head and its square, gender, farming experience are found to be significant for non-farm self- employment, while only education and gender coefficient were found to be significant for non-farm wage employment category.

Among household variable, household land holding, membership of cooperatives and value of asset were significant determinants of nonfarm self- employment. While the major determinant of wage employment includes household size, access to credit, total farm size, and membership of cooperatives.

Among community level variable, distance to the nearest market, index of access to communication facilities were the determinants of non-farm seif- employment while only land productivity index has a significant impact on non-farm wage employment. This will go a long way in formulating policies to encourage or discourage non-farm participation in the study area or in similar areas.

Recommendations

(1). Provision of social amenities like good roads, poltable water, electricity, availability of modern market facility including lock-up shops and modern communication facilities in rural areas by government and private developers will go a long way in promoting non-farm activities in rural areas. Community development association and non-governmental organization (NGOs) can also help on this issue.

(2). Establishing credit institution/Agencies and cooperative societies or strengthening the already available one will also encourage/ promote credit access in rural areas and membership of cooperative societies since this will directly promote farmers participation in non- farm sectors.

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