

Original Research Article

Factors Influencing Market Participation among Food Crop farmers in Oyo State: A Double Hurdle Approach

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Abstract: Market participation among farmers has long been on agricultural economist research agenda in both developed and developing nations. Farmers' market participation is very vital for sustaining economic growth, food security and poverty alleviation. This study analyzed the factors influencing market participation among food crop farmers in Oyo State, Nigeria. A multistage random sampling technique was employed to select one hundred and eighty one (181) food crops farmers. Primary data were collected through the use of well-structured interview schedule and the data collected were subjected to descriptive and double hurdle analysis. Findings revealed that the mean age of respondents was 48 years while 82.9% of the respondents were males. Majority (81.2%) claimed to be married while 79.0% of them had formal education. The first hurdle analysis indicated that coefficients of farmer's sex, years spent in school, household size and farmer's distance from the farm to the market were statistically significant at 1%, 10%, 10% and 10% respectively. The result of the second hurdle showed that coefficients of farmer's age, sex, farm size and distance from the farm to the market were statistically significant at 1%, 1%, 5% and 10% respectively. It is recommended that policy makers and old aged farmers that are married and highly experienced should encourage singles and youth to engage in farming activities. This will make them to have access to hectares of land and to become large scale farmers.

Keywords: Market participation, Food crops, Double hurdle.

INTRODUCTION

Nigeria is blessed with large land area of about 92.4million hectares with 91million hectares of this land – being suitable for agricultural cultivation. Approximately, half of this cultivated land is used under permanent and arable crops while the rest is covered by forest, woodland, permanent pasture and build up area [1]. Nigeria in general produces both cash and food crops including yam, cassava, sorghum, millet, sweet potato, peanut, palm oil, sugarcane, soybean, cocoa, coffee and many other fruits and vegetables like tomato, carrot and cabbage. The econometric analysis by Pender and Alemu [2] shows that increasing production of food crops is the most important factor contributing to increased sales and that increased smallholder access to roads, land, livestock, farm equipment, and traders are key to enabling increased smallholder production and commercialization of these crops. Moreover, Ele, Omini, and Adinya [3] find out that total quantity of food crops produced, farming experience, access to agricultural extension service, size of land used for cultivation, membership in cooperatives and household family size are important factors determining the level of commercialization of smallholder farms. An increase in efficiency in food crop production could lead to an improvement in the welfare of farmers and consequently a reduction in their poverty level and food insecurity.

Market participation refers to any market related activity which promotes the sale of produce [4]. Market participation among farmers has long been on agricultural economist research agenda in both developed and developing nations [5]. In sub-Saharan Africa, the question has taken a renewed urgency as policy makers seek ways of reducing external payment imbalances, caused largely by secular declines in per capita food production and concomitant reduction in marketed food surpluses [6]. Market participation impacts farmers' supply responses and hence is important for agricultural policy analysis [4]. According to Egbetokun and Omonona [7], the major determining factors influencing

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farmer's participation in the market are age, marital status, source of labour, farming experience and farm size. The probability of participating in output markets depends on household size, distant to the nearest marketing channel, price of the commodity and sex of the farmer [8].

Given the fact that it is hard to strike a balance between population, food production and economic growth, the government seeks to ensure the country's continued ability to sustain food self-sufficiency, increases in agro-industrial production and productivity, improvement in employment opportunities and increasing access to markets as one of the key elements in its strategy to increase incomes of rural households, enhance food security and to facilitate further expansion of the economy [11]. This necessitates well- functioning markets and increased market participation. It is well established that majority of the smallholder farmers are located in remote areas with poor road networks and market infrastructure, contributing to the high transaction costs, which has been seen to be one of the key reasons for smallholder farmers' failure to participate in markets [9]. Oparinde and Daramola [10] reported that lack of credit facilities and inadequate agricultural inputs were some of the reasons the maize farmers do not participate in market.

Agriculture is a source of livelihoods for an estimated 86 percent of rural people. It provides jobs for 1.3 billion smallholders and landless workers, "farm financed social welfare" when there are urban shocks, and a foundation for viable rural communities [12]. The importance of agriculture in the Nigeria economy cannot be overemphasized. It is a major occupation providing employment for about 70 percent of the people [13]. Though Nigeria is often cited as one of the largest oil exporting countries, agriculture still remains the main employer of over 70 percent of the country's labour force and accounts for at least 40 percent of exports, 30 percent of GDP and up to 30 percent of foreign exchange earnings [14]. Consequently, the importance of this sector in national development and poverty alleviation cannot be overemphasized. Over time, agriculture has declined in importance. According to Ojo and Imoudu [15], the significant imbalance between food production and the expanding population has resulted in an ever-increasing demand for agricultural products. It has also placed a serious stress on the marketing system.

According to International Fund for Agricultural Development [IFAD] [16], market participation can be an effective route for rural smallholder farmers to move out of abject poverty and increase income. Studies show that market participation by smallholder farmers in developing countries is very low [5]. This scenario has slowed down agriculture driven economic growth and exacerbated poverty levels. As such farmers cannot benefit from the welfare gains and income growth associated with market participation. However, for agriculture to meaningfully contribute to economic growth, smallholder farmers have to commercialize their farming activities to produce marketable surpluses [18]. Market participation is directly associated with the generation of a market surplus, thus production technologies and productive assets affect a household's market participation by influencing its productivity. Hence an understanding of factors influence market participation among food crop farmers will help in identifying interventions to unlock and release benefits associated with marketing agricultural produce such as food crops.

Further still, this study can give a better insight into the importance of market participation among food crop farmers. According to Nguagweni [19], market participation by farmer plays a crucial role in that human derives benefit such as, income and rural employment in the farming. This study will allow policy makers to know the direction to which policies that will improve the factors influencing market participation among food crop farmers in the study area can be made. In the light of this, it is very important to conduct a study to determine the factors influencing market participation among food crop farmers. The general objectives are to determine the factors influencing market participation among food crop farmers in Oyo State, Nigeria. The specific objectives are to describe the socio- economic characteristics of the food crop farmers in the study area, examine the determinants of market participation among food crop farmers, examine the factors determining the level of benefits derived from market participation and identify the constraints faced by food crop farmers in market participation in the study area. The study tested a null hypothesis that there is no relationship between selected socio-economic characteristics of food crop farmers and factors determining the level of benefits derived from market participation among food crop farmers.

METHODOLOGY

The study was carried out in Oyo State in Nigeria. The state is made up of 33 local government areas. The population of Oyo State in 2006 was 6, 617, 720 (National Population Commission [NPC], [11]). It is located between latitudes 7°03' and 9°12' north of the equator and longitudes 2°47' and 4°23' east of the Meridian. The State covers a land area of 27, 000 square kilometres. The state is located in the South-western area of Nigeria. Oyo State has a land area of about 27,249 square kilometers. The average annual rainfall is estimated at between 1,194mm in the North and 1,278mm in the South. Mean temperature is 27°C.

Population of the study comprises of food crop farmers in Oyo State, Nigeria. Multi-stage random sampling technique was employed to select the respondents. In the first stage, two agricultural zones were selected randomly from the four in Oyo State. These are Ibadan/Ibarapa zone and Oyo zone representing 50 percent of the ADP zones. In the

second stage, 40 percent of the local government areas in the ADP zones were selected randomly and comprised of five (5) local government areas from Ibadan/Ibarapa and two (2) local government areas from Oyo. Ibadan/Ibarapa zone include Egbeda, Ido, Ibarapa North, Lagelu and Akinyele local governments areas while Oyo zone include Atiba and Afijio local governments areas. In the third stage, 20% of the villages in each local government areas were considered. Lastly, 5 percent of the registered farmers in each village were selected randomly. A total of 181 food crop farmers formed sample of the study. Primary data were collected from the selected food crop farmers through a structured interviewed schedule. Data collected were analyzed using descriptive statistics and double hurdle model.

ANALYTICAL FRAMEWORK

Double Hurdle

Cragg [20] modified Tobit model to overcome the restrictive assumption inherent in it. He suggested the “double – hurdle” model to tackle the problem of too many zeros in the survey data by giving special treatment to the participation decision. The model assumes two hurdles to overcome too observe positive values.

The first hurdle, determining whether the individual is a zero type and the second hurdle, determining the level of participation given that the individual is not a zero type. A key feature of the model is that there are two types of zero observations: an individual can be a zero type, and the outcome will always be zero whatever his or her circumstances at the time of decision; alternatively the individual might not be a zero type, but his or her current circumstances might dictate that the outcome is zero – this sort of zero is usually classified as a censored zero after [21]. The double – hurdle model contains two equations and can be given the interpretation of a combined probit and tobit estimator.

$$d_i^* = Z_i' \alpha + \epsilon_{1,i} \dots\dots\dots (1)$$

$$y_i^{**} = X_i' \beta + \epsilon_{2,i} \dots\dots\dots (2)$$

$$\begin{pmatrix} \epsilon_{1,i} \\ \epsilon_{2,i} \end{pmatrix} \sim N \left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & \sigma^2 \end{pmatrix} \right] \dots\dots\dots (3)$$

The variance of $\epsilon_{1,i}$ is normalized to 1, as required for identification, because the outcome of the first hurdle is binary. The diagonality of the covariance matrix implies that the two error terms are assumed to be independently distributed.

The first hurdle is represented by

$$d_i = 1 \text{ if } d_i^* > 0 \dots\dots\dots(4)$$

$$d_i = 0 \text{ if } d_i^* \leq 0 \dots\dots\dots(5)$$

The first hurdle is thus assumed to be defined by the latent variable d_i^* . The second hurdle closely resembles the tobit model (1):

$$y_i^* = \max (y_i^{**}, 0) \dots\dots\dots(6)$$

Finally, the observed variable, y_i is determined as

$$y_i = d_i y_i^* \dots\dots\dots(7)$$

Furthermore, double hurdle model offers a more flexible version of the Tobit in that they allowed the household decision regarding whether to sell food crop (participation) and what quantity to sell to be determined by different underlying processes. In this regard, the double – hurdle model can be considered as an improvement both on the standard Tobit and generalized Tobit (heckit) models. The double hurdle model is designed to analyse instances of an event that may or may not occur, and if it occurs, takes on continuous positive values. In the case of household food crop sales, the decision to sell or not is made first, followed by the decision on how much to sell quantity of food crop sold. The structure of double – hurdle model is as follows:

$$d_i^* = X_1 B_1 + \epsilon_{1,i} \dots\dots\dots(8)$$

$$\epsilon_{1,i} \sim N (0, \sigma^2) \dots\dots\dots(9)$$

$$d_i^* = \begin{pmatrix} 1 \text{ if } d_i^* > 0 \\ 0 \text{ if } d_i^* \leq 0 \end{pmatrix} \dots\dots\dots (10)$$

$$y_i^* = X_2 B_2 + \epsilon_{2,i} \dots\dots\dots(11)$$

$$\epsilon_{2i} \sim N(0, \sigma^2) \dots \dots \dots (12)$$

$$y_i = \begin{pmatrix} 1 \text{ if } y_i^* > 0 \text{ and } d_i = 1 \\ 0 \text{ if } y_i^* \leq 0 \end{pmatrix} \dots \dots \dots (13)$$

The subscript *i* refers to the 1th household, d_i is the observable discrete decision of whether or not to sell food crop while d_i^* is the latent (unobservable) variable of d_i . y_i^* is an unobserved, latent variable (desired quantity of food crop sold), and y_i is the corresponding observed variable, actual quantity of food crop sold. X_1 and X_2 represent vectors of explanatory variables. B_1 and B_2 are vectors of parameters to be estimated and ϵ_1 and ϵ_2 are random errors.

This work made use of double hurdle regression analysis to estimate the factors influencing market participation among food crop farmers focusing on age, sex, years spent in school, household size, marketing experience, farm size, credit, distance from farm to the market and involvement in contract marketing. The double-hurdle model was found to be the most appropriate modeling technique based on relevant specification testing procedures. Also according to Burke [22], double hurdle model is useful because it allows a subset of the data to pile – up at some value without causing bias in estimating the determinants of the continuous dependent variable in the second stage, hence you can obtain all the data in the remaining sample for the participants [22]. Thus in double hurdle model, there are no restrictions regarding the elements of explanatory variables in each decision stages.

The first hurdle was probit model and it is written as;

$$d_i^* = Z_i' \alpha + \epsilon_{1,i}$$

Step 1: Participation (d_i^*)

$$d_i^* = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \alpha_7 X_7 + \alpha_8 X_8 + \alpha_9 X_9 + \epsilon$$

$$d_i^* = \alpha_0 + \alpha_1 \text{AGE} + \alpha_2 \text{SEX} + \alpha_3 \text{YSCH} + \alpha_4 \text{HSIZE} + \alpha_5 \text{SELPDC} + \alpha_6 \text{SOFFARM} + \alpha_7 \text{CREDIT} + \alpha_8 \text{DFFM} + \alpha_9 \text{MRKTCONTR} + \epsilon \dots \dots \dots (1)$$

- X_1 = Age (years)
- X_2 = Sex (dummy variable; 1 = male, 0 = female)
- X_3 = Years spent in school (Actual years)
- X_4 = Household size ((Actual number)
- X_5 = Marketing experience (Years)
- X_6 = Farm size (Hectare)
- X_7 = Credit (dummy variable; 1 = Yes, 0 = No)
- X_8 = Distance from farm to the market (Kilometer)
- X_9 = Involvement in contract marketing (dummy variable; 1 = Yes, 0 = No)
- ϵ = Error term

The second hurdle resembles the Tobit model which is as follows:

$$y_i^{**} = X_i' \beta + \epsilon_{2,i}$$

Step 2: Benefit index (y_i): Benefit derived by the respondents/Total number of Benefit available.

$$y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \epsilon$$

$$y_i = \beta_0 + \beta_1 \text{AGE} + \beta_2 \text{SEX} + \beta_3 \text{YSCH} + \beta_4 \text{HSIZE} + \beta_5 \text{SELPDC} + \beta_6 \text{SOFFARM} + \beta_7 \text{CREDIT} + \beta_8 \text{DFFM} + \beta_9 \text{MRKTCONTR} + \epsilon \dots \dots \dots (2)$$

- X_1 = Age (years)
- X_2 = Sex (dummy variable; 1 = male, 0 = female)
- X_3 = Years spent in school (Actual years)
- X_4 = Household size (Actual number)
- X_5 = Marketing experience (Years)
- X_6 = Farm size (Hectare)
- X_7 = Credit (dummy variable; 1 = Yes, 0 = No)
- X_8 = Distance from farm to the market (Kilometer)
- X_9 = Involvement in contract marketing (dummy variable; 1 = Yes, 0 = No)
- ϵ = Error term

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Respondents

Table 1 revealed that 32.6% of the respondents were between the ages of 51-60years while 10.5% were less than 30years of age. The mean age of the respondents was 48.2years. This implies that the food crop farmers have past their youthful age and tending towards old age. They are still agile and active to effectively involve in market participation of food crops in the study area. This finding is also in consonance with Chalwe [23] where the mean age of the respondents was 48.7 years. This finding is not in consonance with Hlomendlini [24] where the mean age of the respondents was 54years.

Result also showed that 82.9% of the respondents were male while 17.1% were female. The result of the findings therefore implies that more male engaged in market participation than the female. This result agreed with the study of Gobena [25] where majority (86.7%) of the respondents were male. This result disagrees with the work of Matsane and Oyekale [26] where 59.6% of the respondents were female.

It was indicated that 49.2% had between 6 and 10 members in their households, while 45.9% had 5 or less members. The mean of household size was 6. This is an indication of a medium household size this study corroborates with the work of Gobena [25] where the average family size was 6.2. Moreover, 81.2% of the respondents were married while 2.8% were divorce and separated. It implies that most of the respondents were married which indicates that most of them are responsible. This corroborates with the findings of Gani and Adeoti [27] where majority (75%) of the respondents were married. This is not in line with the work of Boniphace, Fengying, and Chen [28] where 8.7% of the respondents were separated and 13.3% were widow. Also 39.8% of the respondents had secondary school education while 1.1% had adult education. The result of the findings indicated that majority of the respondents had formal education which will be of help in business and transaction. This result disagreed with the study of Boniphace *et al.* [28] where majority (66.2%) of the respondents had primary education and 8.6% had secondary education. This corroborates with the findings of Rios *et al.* [29] where majority of respondents had primary and secondary education in their community. Also 39.2% of the respondents spent 10years or less in farming while 2.8% spent above 40years in farming. The mean year of farming experience was 17.7years. This indicated that most of them had been in the food crop farming for more than 10years. This implies that farmers with higher experience have full information and better knowledge of farming activities. This could boost their marketing performance. This is not in line with the work of Namazzi *et al.* [30] where the average farming experience of respondents was 2.47years.

Table-1: Socio- Economic Characteristics Distribution of Respondents, n=181

Variable	Frequency	Percentage
Age		
<=30	19	10.5
31-40	29	16.0
41-50	50	27.6
51-60	59	32.6
Above 60	24	13.3
Mean = 48.2years		
Total	181	100.0
Sex		
Male	150	82.9
Female	31	17.1
Total	181	100.0
Household size		
< = 5(Small)	83	45.9
6-10 (Medium)	89	49.2
Above 10 (Large)	9	5.0
Mean = 6		
Total	181	100.0
Marital Status		
Single	16	8.8
Married	147	81.2
Divorced	5	2.8
Widow/Widower	8	4.4
Separated	5	2.8
Total	181	100.0

Education Level		
No formal education	38	21.0
Primary school	57	31.5
Secondary school	72	39.8
Tertiary school	12	6.6
Adult education	2	1.1
Total	181	100.0
Farming Experience		
<=10	71	39.2
11-20	55	30.4
21-30	25	13.8
31-40	25	13.8
Above 40	5	2.8
Mean = 17.7 years		
Total	181	100.0

Source: Field Survey, 2016

Table 2 revealed the result of the first hurdle (i.e. Probit model). The log pseudo likelihood ratio statistic (20.0) is significant meaning that the explanatory variables included in the model jointly explain the probability of farmers deciding to participate in market. The Wald chi-square value of 198.2 is statistically significant at 1% indicating that the explanatory variables jointly explain the probability of participating in market by food crop farmers. The factors that influence the two-stage decision relation to market participation and benefit derived by food crop farmers in the study area were better expressed in the independent double – hurdle model. The coefficient in the first hurdle indicates how a given variable affects the likelihood (probability) to participate in marketing. Those in the second hurdle indicate how a decision variable influences the benefit derived by food crop farmers from market participation.

The result of the first hurdle (Probit model) indicates that coefficients of farmer’s sex is negatively signed and is at 1% statistically significant with respect to the decision to participate in market by food crop farmers in the study area. The result revealed that the probability to participate in market decreases among male food crop farmers in the study area. This result could be attributed to the multi-functional roles of African males. The coefficient of farmer’s years spent in school is negatively signed and is at 10% statistically significant. The result implies that as food crop farmers’ years spent in school increases, the decision to participate in market decreases. This corroborates with the findings of Mignouna *et al.* [31] where education was negative and significantly related to decision to participate in yam market. The coefficients of farmer’s household size are negatively signed and are at 10% statistically significant with respect to the decision or probability to participate in market by food crop farmers in the study area. The result implies that as the food crop farmers’ household size increases the chance to market participation decreases. The coefficients of farmer’s distance from the farm to the market is negatively signed and is at 10% statistically significant with respect to the decision or probability to participate in market by food crop farmers in the study area. The distance of farmers’ farm to market was found to have a negative relationship with market participation. The result implies that farmers’ whose farm is further away from the market are less likely to consider decision to participate in market compared to those whose farms are closer to the market. This is in line with the work of Achandi and Mujawamariya [32] where distance to the market negatively affects decision to participate in the market.

Table-2: Food crop farmer’s decision to participate in market participation (1st Hurdle/Tier)

Variable	Coefficient	Robust Standard Error	Z	P> Z
Constant	6.50057***	0.99305	6.55	0.00
Age	0.01090	0.01988	0.55	0.58
Sex	-4.79545***	0.44162	-10.86	0.00
Years spent in school	-0.08248*	0.04918	-1.68	0.09
Household size	-0.10421*	0.05898	-1.77	0.08
Marketing experience	0.06404	0.04077	1.57	0.12
Farm size	0.16673	0.11106	1.50	0.13
Credit	0.26731	0.39385	0.68	0.50
Distance to market	-0.02600*	0.01366	-1.90	0.06
Involvement in contract marketing	6.50057	0.99305	6.55	0.00
Number of observation = 181				
Wald chi ² (9) = 198.19				
Pro > chi ² = 0.0000				
Log pseudo likelihood = 19.97				
Sigma	0.18933	0.00980	19.32	0.00

Source: Field Survey, 2016

***, **, * shows significance of the coefficients of 1%, 5% and 10% levels respectively

Table 3 showed that age of the respondents is positively significant at 1% probability level. This indicated that increase in age will increase the chance of deriving more benefit from the market. It was revealed that sex of the respondents is negatively significant at 1% probability level. This implies that increase in probability of male food crop farmers will decrease the benefit derived by food crop farmers in market participation. The result also indicated that farm size of the respondents is positively significant at 5% probability level. This implies that increase in the hectares of land will increase the chance of deriving more benefit from the market. It was observed that distance from farm to market to be negatively significant at 10% probability level. This indicated that increase in the distance between farm and market will decrease the chance of deriving more benefit from the market. This is not in consonance with the work of Lifeyo [33] where distance to the nearest market had a negative effect on both decisions to produce common beans and participate in the market, and intensity of participation in the market and significant at 1%, 5% and 1% respectively.

Table-3: Estimates of the benefit derived by food crop farmers in market participation (2nd Hurdle/Tier)

Variable	Coefficient	Robust Standard Error	Z	P> Z
Constant	0.48074***	0.08941	5.38	0.00
Age	0.00492***	0.00197	2.50	0.01
Sex	- 0.12416***	0.03801	-3.27	0.00
Years spent in school	-0.00248	0.00328	-0.76	0.45
Household size	0.00416	0.00621	0.67	0.50
Marketing experience	0.00158	0.00154	1.03	0.31
Farm size	0.01224**	0.00567	2.16	0.03
Credit	0.01171	0.03282	0.36	0.72
Distance to market	- 0.00229*	0.00126	-1.82	0.07
Involvement in contract marketing	0.00148	0.03523	0.04	0.97
Number of observation = 181				
Wald chi ² (9) = 198.19				
Pro > chi ² = 0.0000				
Log pseudo likelihood = 19.97				
Sigma	0.18933	0.00980	19.32	0.00

Source: Field Survey, 2016

***, **, * 1%, 5% and 10% significant levels respectively

CONCLUSION

The study concluded that most of the respondents were tending towards old age, and they were married. Sex, years of education, household size and distance to market are the significant determinants of market participation. The benefits derived from market participation were majorly influenced by age, sex, farm size and distance to market. The study recommends that old aged farmers that are married should encourage singles and youth to engage in farming activities. Also policy makers should also motivate youths through directional policies such as training of young graduates to become potential farmers, giving out loans and subsidies on agricultural inputs, they should also give out hectares of land to highly experienced small scale food crop farmers and organize series of seminars to food crop farmers on market participation. Furthermore, policy makers should increase and develop village markets.

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