

ANALYSIS OF FACTORS AFFECTING DECISIONS TO PARTICIPATE AND LEVELS OF PARTICIPATION BY GENDER AMONG HEADS OF HOUSEHOLDS IN MINITUBER YAM MARKETING IN ABIA STATE, NIGERIA

Vincent O. Onyenobi

National Root Crops Research Institute Umudike P.M.B. 7006 Umuahia Abia State, Nigeria

Email: onyenobivincent@yahoo.co.uk.

ABSTRACT

The study was carried out in Abia State using multistage random sampling technique in the selection of 158 wholesaler heads of households used for the study. This comprised 84 male wholesaler heads of households and 74 female wholesaler heads of households. Structured questionnaire administered to the 158 respondents were used to collect cross-sectional data on factors influencing the market participation decisions by wholesalers in minituber yam marketing in the study area. Results of the two-step Heckman regression used in this study indicated that male wholesaler heads of households participated relatively more than female wholesaler heads of households in terms of the level of participation (quantity of minituber yam sold) in the study area. Among the male wholesaler heads of households, the (OLS) linear regression result (Heckit step 2) indicated that the goodness of fit of the model measured by the Wald chi-square χ^2 (12) of 15.05 was significant at 5.0 percent probability level. Comparatively among the female wholesaler heads of households the (OLS) linear regression result (Heckit step 2) indicated that the goodness of fit of the model measured by the Wald chi-square χ^2 (12) of 3.70e+07 was significant at 1.0 percent probability. Among the wholesaler heads of households, decrease in negative effects of socio-economic factors on market participation as well as increase in positive effects of socio-economic factors on market participation significantly increased the decision to sell minituber yam and the level of participation in minituber yam marketing in the study area. These results called for public policy for increased gender access to good roads and railways and adequacies of transport, credit, education, cooperative society membership and minituber yam, in order to significantly increase the decision to participate in selling minituber yam and the level of participation by marketers in the supply of minituber yam from the minituber yam producer to the seed yam producer in the study area.

Keywords: Market participation, wholesaler heads of households, probability of market participation, level of market participation and minituber yam marketing

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INTRODUCTION

Advances in the marketing of root and tuber crops in sub-Saharan Africa had laid emphasis on market participation by farmers in the marketing of cassava (Okoye, *et al.*, 2010), sweet
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potato (Ohajianya and Ugochukwu, 2011) and potato (Sebatta *et al.* 2012). Madueke (2013) reported on market participation by male and female heads of households (middlemen) in the marketing of ware yam in Abia state. Male and female heads of households also participate in the marketing of minituber yam in response to aggregate demand for minituber yam. Yam (*Dioscorea rotundata*) is an important tropical tuber crop with socio-cultural and economic values. In Nigeria, the crop contributes significantly to national economy and rural income by providing employment to many rural dwellers (Asumugha *et al.*, 2010) and cheap carbohydrate staple for over 80 percent of the populace (Nwachukwu, 2008), and reduces poverty level (Emokaro and Law-Ogbomo, 2008). However, increasing world population mainly in developing countries of Africa (IITA, 1985) has forced the production of ware yam to fall short of meeting the aggregate demand for ware yam for food consumption and industrial uses. Yam production in Nigeria was estimated at 38 million metric tonnes annually representing 63.1 percent of the total world annual production figure estimated at 60,196,312 metric tonnes (FAO, 2013). In 2012, production of yam in Nigeria was estimated at 36.2 million metric tonnes annually representing 64 percent of the total production of yam in the world estimated at 57 million tonnes (FAO, 2012). This implies that Nigeria contributed 63.1 percent to world production of yam in 2013 down from 64 percent contribution to world production of yam in 2012. Therefore in developing countries of Africa, there is need to increase the production of yam in response to aggregate demand for yam. In some households, yam is consumed on a daily basis thus limiting the availability of planting material to yam producers. Minituber yam becomes a cheaper and readily available planting material for seed yam in the study area.

In Nigeria, scarcity and high cost of seed yam has made minituber yam marketing by male and female heads of households assume great importance. Minituber yam is a whole yam tuber used for seed yam production. Minituber yam ranges in weight from 30-150 grams realized from 6-10 grams cut setts, and could be planted directly on ridges, mounds or beds. It is cultivated at a seed rate of 80,000 stands ha⁻¹, and the average yield ranges from 9-11 tha⁻¹ (Ogbonna *et al.*, 2010). Minituber yam production and marketing enable adequate supply of minituber yam to seed yam producers. Use of minituber yam in seed yam production is gender sensitive; both male farmers (74%) and female farmers (26%) adopt the minituber yam technique of seed yam production (Asumugha *et al.*, 2007). In this study, market participation by minituber yam marketers describes the involvement of the male and female wholesaler heads of households in the movement of minituber yam from minituber yam producer to the seed yam producer. Market participation by intermediaries is affected by numerous factors (Jagwe *et al.*, 2008). The factors that determine the participation by male and female heads of households in agricultural markets include socio-economic characteristics (age, marital status, educational level, household size, dependency ratio, membership of cooperative society, road condition between markets, access to product traded, access to market information), and specific marketing factors (quantity of product traded, price of product, marketing cost and income from trade) that influence the supply of agricultural products from the farmer to the final consumer (Onyenobi, 2015). Market

participation by marketers of agricultural products provides benefits such as income and rural employment from farming (Ngqangweni, 2000), and transition from subsistence farming to commercial farming (Makhura, 2001). Lyster (1990) noted that market participation by marketers of agricultural products is important for sustainable economic growth, alleviation of poverty and inequality. It implies that effective gender roles in minituber yam marketing by male and female marketer heads of households has implications for increasing the supply of minituber yam (planting material) from minituber yam producers to seed yam producers, and thereby increase farm employment, income and food security in Nigeria, especially Abia State (Onyenobi, 2015). The objective of the study was to determine and compare the factors influencing market participation decisions by male and female wholesaler heads of households in minituber yam marketing in Abia State.

RESEARCH METHODOLOGY

Study Area

The study was carried out in Abia State. The state is one of the thirty-six states of the Federal Republic of Nigeria. The state is located in the south-east agro-ecology in the rain forest zone of Nigeria. The state has 3 agricultural zones and 17 local government areas (LGAs). Agriculture is the main occupation of the state. The population of the state is estimated at 2.8 million, with population density of about 500 to 600 persons/km² on a land area of 4900km². It is bounded on the north by Anambra and Ebonyi States, on the south by Rivers and Akwa-Ibom States, on the east by Cross River State, and on the west by Imo State. It lies approximately between longitudes 7° 00¹E and 8° 00¹E and latitudes 4° 45¹N and 6° 17¹N of the equator (NPC, 2006).

Data Collection

Multistage random sampling procedure was used for the study, following other studies (Ohajianya and Ugochukwu, 2011; Okoye *et al.*, 2010; and Sebatta *et al.*, 1012). The three agricultural zones in Abia State, namely Aba agricultural zone, Ohafia agricultural zone and Umuahia agricultural zone were used for the study. The 9 local government areas (LGAs) used for the study were randomly selected as follows: Osioma, Ukwa East and Ugwunagbo LGAs from Aba agricultural zone; Ohafia, Bende and Arochukwu LGAs from Ohafia agricultural zone; and Umuahia North, Ikwuano and Isiala Ngwa South from Umuahia agricultural zone. This was followed by a random selection of 36 markets for the study comprising 4 markets randomly selected from each LGA selected for the study. A total of 360 heads of households used for the study comprised 10 heads of households from each of the 36 markets randomly selected for the study. The respondents were selected from a list of registered marketers (males and females) in each selected markets, with the assistance of the agricultural extension agents and enumerators assigned to the local government areas (LGAs) studied. In other words, the 360 heads of households selected for the study comprised 120 heads of households randomly selected in each agricultural zone. The 360 heads of households selected for the study comprised 158 wholesaler heads of households and 202

retailer heads of households. Structured questionnaires administered to the 158 wholesaler heads of households were used to collect cross-sectional data on factors influencing the market participation decisions by the wholesalers in minituber yam marketing in the study area. Data collected on the marketers' socio-economic characteristics include age, marital status, household size, educational level, marketing experience, cooperative membership, access to credit, dependency ratio, access to minituber yam, access to market information, market distance and road conditions between individual markets in the study area.

Data Analysis and Model Specification

The male and female heads of households in the study area were characterized as net sellers, net buyers and autarkic (Ohajianya and Ugochukwu, 2011; Okoye *et al.*, 2010; and Sebatta *et al.*, 2012). Out of the 158 wholesaler heads of households, a total of 84 male wholesaler heads of households comprised 68 net sellers, 8 autarkic and 8 net buyers, while a total of 74 female wholesaler heads of households comprised 60 net sellers, 8 autarkic and 6 net buyers. Data collected from the net sellers were analyzed using the two-step Heckman correction for self-selection model, as previously used by Heckman (1979) and later by Goetz (1992), Makhura *et al.* (2001), Heltberg and Tarp (2002), Sebatta *et al.* (2012), Okoye *et al.* (2010) and Shephard *et al.* (2011), to determine the probability of market participation (minituber yam selling) and the levels of market participation (minituber yam sales) by male and female wholesaler heads of households in minituber yam marketing in the study area.

The two-step Heckman regression for correction of self-selection bias evolved out of sound economic theory. Heckman (1979) observed bias from the use of non-random samples to estimate behavioral relationships as a specification error. The two-step Heckman regression involves the use of probit model and ordinary least squares (OLS) linear regression model (linear probability model) in estimating the factors influencing the decision of the marketers to participate in the marketing of minituber yam in the study area. Both the probit model and the linear probability model are qualitative response regression models because the regressands are binary or dichotomous. In this study, in the bid to determine the probability of market participation (minituber yam selling) and the level of market participation (minituber yam sales) by wholesaler heads of households, the researcher only had access to observations for those who participate in the market. Following Goetz (1992), it can be reasonably hypothesized that at least some households are prevented from selling in the market because of some of the factors that influence market participation decision. Since people who choose to participate are selected non-randomly from the population, estimating the determinants of level of participation from the subpopulation that choose to participate may introduce bias.

The first step (or stage) of the Heckman correction for self-selection which motivates the probit equation was used to determine the probability of market participation (minituber yam selling) by wholesaler heads of households in the output market. The probit model is implicitly specified as:

$$\Pr(Y_i = 1) = X_i \beta_i + u_i \dots\dots\dots (1)$$

The explicit form of model is as follows:

$$Y_i^{(\text{minituber yam selling})} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + u_j \dots\dots\dots (2).$$

where:

$Y_i^{(\text{minituber yam selling})}$ = probability of market participation ($Y_i = 1$ if the respondent participates and $Y_i = 0$ otherwise); X_1 = Age of household head (years); X_2 = Marital status (1 = married; 0 = unmarried); X_3 = Household size (number); X_4 = Education level (number of years); X_5 = Marketing experience (years); X_6 = Cooperative membership (dummy variable: 1 = member; 0 = non member); X_7 = Access to credit (dummy variable: 1 = formal; 0 = informal); X_8 = Transportation cost (N kg^{-1}); X_9 = Access to minituber yam (kg); X_{10} = Access to market information (dummy variable: 1 = yes; 0 = no); X_{11} = Dependency ratio (index); X_{12} = Distance between markets (km); b_0 = Constant intercept; $\beta_1 - \beta_{12}$ = Coefficients estimated; u_i = Error term.

The dependent variable Y_j is not observed if the respondent does not participate in the market. The discrete decision of heads of households to participate (minituber yam selling) in the market is observed as:

$$Z_j \gamma + v_j > 0 \text{ (the selection model)} \dots\dots\dots (3)$$

$$\text{Prob}(Y_i = 1|Z) = \Phi(Z\gamma) \dots\dots\dots (4)$$

where:

$Y_i^{(\text{minituber yam selling})}$ = probability of market participation ($Y_i = 1$ if the respondent participates and $Y_i = 0$ otherwise)

$Z_1 - Z_{12}$ = standardized normal form of explanatory variables ($X_1 - X_{12}$) in equation (2)

$\gamma_1 - \gamma_{12}$ = unknown parameters to be estimated

Φ = cumulative distribution function of the standard normal distribution.

Estimation of the model yields results that can be used to predict this probability for each individual.

The second step (or stage) of the Heckman correction for self-selection which motivates the OLS regression model was used following other studies (Heckman, 1979; Shephard *et al.*, 2011; and Jagwe, 2011) to estimate the level of market participation (minituber yam sales) by heads of households in the output market. The OLS regression model is implicitly specified as:

$$Y_j^* = X_j \beta + u_j \dots\dots\dots (5)$$

The explicit form of model is as follows:

$$Y_i^{(\text{minituber yam sales (kg)})} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + u_j \quad \dots\dots\dots (6).$$

where:

$Y_i^{(\text{minituber yam sales (kg)})}$ = level of market participation ($Y_i = 1$ if the respondent participates and $Y_i = 0$ otherwise)

The dependent variable $Y_j^{*(\text{minituber yam sales (kg)})}$ is not observed if the respondent does not participate in the market.

The expected value of Y_j when y is observed in the selection equation (3) is given as:

$$E(Y_j/Z_j\gamma + v_j > 0) = X_j\beta + \rho\sigma_u\lambda_i \quad \dots\dots\dots (7)$$

where:

$Y_i^{(\text{minituber yam sales (kg)})}$ = level of market participation ($Y_i = 1$ if the respondent participates and $Y_i = 0$ otherwise)

$$Z_j\gamma + v_j > 0 \text{ (the selection model)} \quad \dots\dots\dots (3)$$

$X_1 - X_{12}$ = explanatory variables in equation (6)

$\beta_1 - \beta_{11}$ = unknown parameters to be estimated in equation (6)

$Z_1 - Z_{12}$ = standardized normal form of explanatory variables ($X_1 - X_{12}$) in equation (6)

$\gamma_1 - \gamma_{12}$ = unknown parameters to be estimated

$\mu \approx N(0, \sigma)$;

$v \approx N(0, \sigma)$;

$\text{corr}(\mu, v) = \rho$ (rho) = correlation between unobserved determinants of propensity to participate and unobserved determinants of level of participation u . When $\rho \neq 0$, standard regression techniques applied to the OLS regression equation (7) yield biased results;

σ_u = the standard deviation of u ; and

λ = inverse Mills ratio.

OLS estimation of equation (7), inclusive of λ , produces consistent estimates, eliminating selectivity bias (Greene, 2003).

Technically, the Heckman (heckit) specification for the study was run using maximum likelihood estimation procedure (Makhura *et al.*, 2001).

RESULTS AND DISCUSSION

Factors influencing the Decision to Participate in Selling Minituber Yam and Level of Participation by Male Wholesaler Heads of Households in Minituber Yam Marketing in the Study Area

Table 1 is a two-step regression estimation of factors influencing the decisions to participate in selling minituber yam and level of participation by male wholesaler heads of households in minituber yam marketing for sustainable employment, income distribution, poverty alleviation, food security and economic development in the study area. This two-step regression procedure was previously used by Heckman (1979) and later by Goetz (1992), Makhura *et al.* (2001), Heltberg and Tarp (2002), Sebatta *et al.* (2012), Okoye *et al.* (2010) and Shephard *et al.* (2011).

Probit Analysis of Factors Influencing the Decision to Participate in Selling Minituber Yam by Male Wholesaler Heads of Households in Minituber Yam Marketing in the Study Area

Table 1 shows based on the probit result (Heckit step1) that in the male wholesaler heads of households' model equation, 4 explanatory variables (age, transportation cost, cooperative society membership and access to minituber yam) significantly influenced the decision to participate in selling minituber yam in the study area.

The coefficient of transportation cost (-0.096) was negatively and significantly related to the decision to participate in selling minituber yam at 1.0 percent level in conformity with *a priori* expectation. This indicates that an increase in transportation cost usually due to bad road conditions and long distances between markets significantly led to a decrease of 0.10 percent in the decision by male wholesaler heads of households to sell minituber yam in the study area, in support of other studies (Okoye *et al.*, 2010; Makhura *et al.*, 2001).

The coefficient of age (0.066) of the male wholesaler heads of households was positively and significantly related to market participation at 1.0 percent probability level, and not in conformity with *a priori* expectation, because marketing activities involve a lot of drudgeries. This implies that a 1.0 percent increase in age significantly led to an increase of 0.07 percent in the decision by male wholesaler heads of households to participate in the selling of minituber yam. This may be due to the positive effect of age on market participation resulting from increased access to education, marketing information, cooperative society membership and marketing experience, in support of Bonabana-Wabbi (2002). The coefficients of cooperative society membership (0.675) and access to minituber yam (0.008) were positively and significantly related to market participation at 5.0 and 1.0 percent probability levels respectively, and according to *a priori* expectations. These imply that a 1.0 percent increase in cooperative society membership and access to minituber yam significantly led to increases of 0.67 and 0.01 percent respectively in the decision by male wholesaler heads of households to participate in the selling of minituber yam. This may be due to the positive implications of

increased access to minituber yam and cooperative societies' effect of low cost of bulk trading on income of marketers (Onyenobi, 2015).

OLS Analysis of Factors Influencing the Level of Participation by Male Wholesaler Heads of Households in Minituber Yam Marketing in the Study Area

Table 2 shows the ordinary least squares (OLS) linear regression result (Heckit step 2) of factors influencing the level of participation (quantity of minituber yam sold) by male wholesaler heads of households in the study area, as reported in other studies (Sebatta *et al.*, 2012; Okoye *et al.*, 2010; Jagwe, 2011; Shephard *et al.*, 2011). The goodness of fit of the (OLS) linear regression model measured by the Wald chi-square χ^2 (12) of 15.05 was significant at 5 percent probability level. This indicates that 15 percent of the variations in the level of market participation (quantity of minituber yam sold) by male wholesaler heads of households in the study area were significantly explained at 5.0 percent probability level by the choice of explanatory variables used in study. The inverse mills ratio λ (lambda) was 81.4232 for the quantity of minituber yam sold. This implies that the quantity of minituber yam sold was estimated by taking into account the decision to participate in the market, thereby eliminating sample selection bias in the study area. OLS estimation inclusive of λ , produces consistent estimates, eliminating selectivity bias (Greene, 2003). Heckman selection model allows the use of information from non-market participants to improve the estimates of the parameters in the regression model. Heckman estimated correlation of the residuals in the two equations, ρ (rho) was 0.800, and the standard error of the residuals of the level of participation equation, sigma σ was 81.4232. In this case the null hypothesis that $\rho = 0$, was rejected to enable the use of the sample selection model on this data. The Heckman selection model provides consistent, asymptotically efficient estimates for all parameters in the model. Table 1 shows based on the (OLS) linear regression result (Heckit step 2) that in the male wholesaler heads of households' model equation, 5 explanatory variables (age, educational level, cooperative society membership, access to credit and transportation cost) significantly influenced the level of market participation (quantity of minituber yam sold) in the study area.

The coefficients of transportation cost (-98.342) was negatively and significantly related to the level of market participation by male wholesaler heads of households at 5.0 percent probability level in conformity with *a priori* expectation. This indicates that a 1.0 percent increase in transportation cost usually due to bad road conditions and long distances between markets significantly led to a decrease of 98.34 percent in the quantity of minituber yam sold by male wholesaler heads of household in the study area.

The coefficient of age (10.323) was positively and significantly related to the level of market participation at 1.0 percent probability level, and not according to *a priori* expectation. This implies that in spite of the drudgeries associated with marketing activities, a 1.0 percent increase in age significantly led to 10.32 percent increase in the quantity of minituber yam sold, as a result of increased access to education, marketing information, and cooperative membership of male wholesaler heads of households in the study area. According to *a priori*

expectations, the coefficients of educational level (4.772), cooperative society membership (81.291) and access to credit (7.524) were positively and significantly related to the level of market participation at 1.0 percent probability level. These imply that a 1.0 percent increase in educational level, cooperative society membership and access to credit significantly led to increases of 4.77 percent, 81.29 percent, and 7.52 percent respectively in the quantity of minituber yam sold in the study area, in agreement with Onyenobi (2015).

Factors Influencing the Decision to Participate in Selling Minituber Yam and Level of Participation by Female Wholesaler Heads of Households in Minituber Yam Marketing in the Study Area

Table 2 is a two-step regression estimation of factors influencing the decision to participate in selling minituber yam and level of participation by female wholesaler heads of households in minituber yam marketing for sustainable employment, income distribution, poverty alleviation, food security and economic development in the study area. This two-step regression procedure was previously used by Heckman (1979) and later by Goetz (1992), Makhura *et al.* (2001), Heltberg and Tarp (2002), Sebatta *et al.* (2012), Okoye *et al.* (2010) and Shephard *et al.* (2011).

Probit Analysis of Factors Influencing the Decision to Participate in Selling Minituber Yam by Female Wholesaler Heads of Households in Minituber Yam Marketing in the Study Area

Table 2 shows based on the Probit result in Heckit (step1) that in the female wholesaler heads of households' model equation, 5 explanatory variables (marital status, household size, educational level, cooperative society membership and transportation cost) significantly positively influenced the decision to participate in the selling of minituber yam in the study area.

According to *a priori* expectations the coefficients of marital status (12.416) and educational level (12.516) were positively and significantly related to market participation at 5.0 percent probability level, while the coefficients of household size (51.296) and cooperative society membership (257.006) were positively and significantly related to market participation at 1.0 percent probability level. The coefficient of transportation cost (1007.965) was positively and significantly related to market participation at 1.0 percent probability level and not according to *a priori* expectation. The positive effect of marital status on market participation indicates that marriage led to increased decision for selling of minituber by female wholesaler heads of households in order to get more money to take care of their family needs, in agreement with Owolabi *et al.* (2012). The positive effect of household size on market participation indicates that increase in household size was implicated for more selling of minituber yam by female wholesaler heads of households, by taking advantage of cheap family labour to increase sales, in support of Mbanaso *et al.* (2012). The positive effect of increase in the level of education was significant in determining the decision for more selling of minituber yam by female wholesaler heads of households. Increase in minituber yam trade therefore provided an

important avenue for income generation by female wholesaler heads of households with increased level of education, in agreement with Atieno (2002). The positive effect of cooperative society membership on market participation was significant because it made female wholesaler heads of households to sell more minituber yam in the market. This agrees with Olwande and Mathenge (2012) who argued that cooperative society membership increases access to information important to production and marketing decisions. The positive effect of transportation cost on market participation by female wholesaler heads of households was significant because of the positive effect of low transportation cost on the decision to sell more minituber yam in the market, in support of Onyenobi (2015).

OLS Analysis of Factors Influencing the Level of Participation by Female Wholesaler Heads of Households in Minituber Yam Marketing in the Study Area

Table 2 shows the ordinary least squares (OLS) linear regression result (Heckit step 2) of factors influencing the level of participation (quantity of minituber yam sold) by female wholesaler heads of households in the study area, as reported in other studies (Sebatta *et al.*, 2012; Okoye *et al.*, 2010; Jagwe, 2011; Shephard *et al.*, 2011). The goodness of fit of the (OLS) linear regression model measured by the Wald chi-square χ^2 (12) of 3.70e+07 was significant at 1.0 percent probability level. This indicates that 4.0 percent of the variations in the level of market participation (quantity of minituber yam sold) by female wholesaler heads of households in the study area were significantly explained at 1.0 percent probability level by the choice of explanatory variables used in study. The inverse mills ratio λ (lambda) was 54.6297 for the quantity of minituber yam sold. This implies that the quantity of minituber yam sold was estimated by taking into account the decision to participate in the market. OLS estimation inclusive of λ , produces consistent estimates, eliminating selectivity bias (Greene, 2003). Heckman estimated correlation of the residuals in the two equations, ρ (rho) = -0.6000, and the standard error of the residuals of the level of participation equation, sigma σ was 54.6297. In this case the null hypothesis that $\rho = 0$, was rejected to enable the use of the sample selection model on this data. The Heckman selection model provides consistent, asymptotically efficient estimates for all parameters in the model. Table 2 shows based on the (OLS) linear regression result (Heckit step 2) that in the female wholesaler heads of households' model equation, 4 explanatory variables (age, household size, transportation cost and access to minituber yam) significantly influenced the level of market participation (quantity of minituber yam sold) in the study area.

The coefficients of transportation cost (-64.180) was negatively and significantly related to the quantity of minituber yam sold by female wholesaler heads of households at 1.0 percent level in conformity with *a priori* expectation. This indicates that a 1.0 percent increase in transportation cost significantly led to 64.18 percent decrease in the quantity of minituber yam sold by female wholesaler heads of households in the study area.

The coefficient of age (2.171) was positively and significantly related to the level of market participation at 1.0 percent level and not in conformity with *a priori* expectation. The

coefficients of household size (8.513) and access to minituber yam (0.502) were positively and significantly related to the level of market participation at 1.0 and 5.0 percent probability levels, respectively. These imply that a 1.0 percent increase in age, household size, and access to minituber yam significantly led to increases of 2.171 percent, 8.513 percent, and 0.502 percent respectively in the quantity of minituber yam sold by female wholesaler heads of household in the study area.

The two-step Heckman regression estimates in Tables 1 and 2 indicate that male wholesaler heads of households participated relatively more than female wholesaler heads of households in terms of the level of participation (quantity of minituber yam sold) in the study area. In the male wholesaler heads of households' model equation (Table 1), the (OLS) linear regression result (Heckit step 2) indicates that the goodness of fit of the (OLS) linear regression model measured by the Wald chi-square χ^2 (12) of 15.05 was significant at 5.0 percent probability level. Comparatively in the female wholesaler heads of households' model equation (Table 2), (OLS) linear regression result (Heckit step 2) indicates that the goodness of fit of the (OLS) linear regression model measured by the Wald chi-square χ^2 (12) of 3.70e+07 was significant at 1.0 percent probability level. The two-step Heckman regression estimates in Tables 1 and 2 suggest that in the marketing of minituber yam in Abia State, there is a lower likelihood of market participation by female heads of households, in alignment with Jagwe *et al.* (2007). In most south-eastern states of Nigeria, yam production and marketing is seen as male's business because of the energy requirement in its farming activities as well as in its trade (Okwuokenye, 2006). However this finding disagrees with the reports in other studies (Adinya and Awoke, 2007 and Nze, 2008) on gender participation in the marketing of yam in Nigeria.

CONCLUSION

Marketing of minituber yam among male and female wholesaler heads of households in the study area was gender sensitive. The decisions to participate in selling minituber yam and levels of participation by male and female wholesaler heads of households in the study area were significantly estimated by taking into account the decisions to participate in the market. Among male wholesaler heads of household, decrease in negative effect of transportation cost on market participation, as well as increase in positive effects of age, cooperative society membership and access to minituber yam on market participation, significantly increased the decision to sell minituber yam, while decrease in negative effect of transportation cost on market participation, as well as increase in positive effects of age, educational level, cooperative society membership and access to credit on market participation, significantly increased the level of market participation (quantity of minituber yam sold) in the study area. Among female wholesaler heads of households, increase in positive effects of marital status, household size, educational level, cooperative society membership and transportation cost on market participation, significantly increased the decision to sell minituber yam, while decrease in negative effect of transportation cost on market participation, as well as increase in positive effects of age, household size and access to minituber yam on market

participation, significantly increased the level of market participation in the study area. These results call for public policy for increased gender access to good roads and railways and adequacies of transport, credit, education, cooperative society membership and minituber yam in the study area. These will significantly increase the decision to participate in selling minituber yam and the level of participation by marketers in the supply of minituer yam from the minituber yam producer to the seed yam producer in the study area.

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APPENDIX

Table 1: Two-Step Heckman Regression Estimates of Factors Influencing the Decision to Participate in Selling Minituber Yam and Level of Participation by Male Wholesaler Heads of Households in Minituber Yam Marketing in Abia State, Nigeria : Heckit Result

Variable	Probit Result of Decision to Participate in Selling Minituber Yam: Heckit (Step 1)		OLS Result of Level of participation (Quantity of Minituber Yam sold): Heckit (Step 2)	
	Coefficient	Z-ratio	Coefficient	Z-ratio
Age of household head (years)	0.066 -0.481	5.89*** -1.10	10.323 -5.349	8.19*** -0.08
Marital status	0.090	1.10	4.432	0.37
Household size	0.023	0.47	4.772	3.33***
Educational level	-0.015	-0.29	-1.436	-0.33
Marketing experience (years)	0.675	2.48**	81.291	2.85***
Cooperative membership	-0.394	-0.80	7.524	6.21***
Access to credit	-0.096	-2.71***	-98.342	2.67**
Transportation cost (₦kg ⁻¹)	0.008	3.50***	0.342	0.35
Access to minituber yam (kg)	-0.528	-0.96	1.414	0.02
Access to market information	2.953	0.38	224.648	0.43
Dependency ratio	0.158	0.79	5.255	0.22
Distance between markets (kg)	-6.833	-0.73	-358.984 15.05**	-0.33
Constant			0.8000	
Wald chi-square χ^2 (12)			81.4232	0.27
ρ (rho)			81.4232	
Inverse mills ratio λ				
Sigma σ				

Observations of male heads of households : Total = 76; Censored = 23; Uncensored = 53

Source: Field survey data, 2014

Note: *, **, and *** = Significant at 10%, 5% and 1% of the t-values, respectively.

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Table 2: Two-Step Heckman Regression Estimates of Factors Influencing the Decision to Participate in Selling Minituber Yam and Level of Participation by Female Wholesaler Heads of Households in Minituber Yam Marketing in Abia State, Nigeria: Heckit Result

Variable	Probit Result of Decision to Participate in Selling Minituber Yam: Heckit (Step 1)		OLS Result of Level of participation (Quantity of Minituber Yam sold): Heckit (Step 2)	
	Coefficient	Z-ratio	Coefficient	Z-ratio
Age of household head (years)	-4.587	-0.29	2.171	2.81***
Marital status	12.461	-2.53**	-16.165	-0.43
Household size	51.296	3.35***	8.513	3.78***
Educational level	12.516	2.21**	0.505	0.16
Marketing experience (years)	-7.783	-0.54	0.197	0.09
Cooperative membership	257.006	12.1***	-10.790	-0.36
Access to credit	-134.852	-0.55	6.844	0.28
Transportation cost (N/kg ⁻¹)	1007.965	5.85***	-64.180	-5.07***
Access to minituber yam (kg)	0.674	0.12	0.502	2.07**
Access to market information	-40.526	-0.25	3.34	0.15
Dependency ratio	-119.489	-0.43	97.298	4.50
Distance between markets (kg)	-36.734	-0.25	2.084	0.14
Constant	-5307.463	1.34	268.488	0.36
Wald chi-square χ^2 (12)			3.70e+07***	
ρ (rho)			-0.6000	
Inverse mills ratio λ			-54.6297	-0.68
Sigma σ			54.6297	

Observations of female heads of households: Total = 76; Censored = 29; Uncensored = 47

Source: Field survey data, 2014

Note: *, **, and *** = Significant at 10%, 5% and 1% of the t-values, respectively.