MARKET PARTICIPATION STATUS OF SMALLHOLDER RICE FARMERS IN EKITI STATE, NIGERIA: IMPLICATION FOR SUSTAINABLE WELFARE

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Abstract: *This study examined the implication of market participation status of smallholder rice farmers for sustainable welfare proxied by calorie consumption in Ekiti- state, Nigeria. Multi-stage sampling procedure was used to select sample for the study. Structured questionnaire was used to collect data during the pre-harvest and post-harvest periods for the study. The data collected were analysed using descriptive statistics and Endogenous Switching Regression (ESR) models. The ESR results showed that smallholder rice farmers' participation in market has positive and significant impact on household welfare proxied by amount of calorie consumed per capita. The empirical findings indicate that participation in market was significantly influenced by farm size, access to market information, membership of Agricultural production Networks (APNs), distance to market and access to credit. The results further revealed that farm size, access to credit, education, asset value and APNs significantly increased calorie consumption of market participants. Moreover, the result showed that while farm size, education and off-farm income increased calorie consumption, household size reduced calorie consumption for households that did not participate in market. The study recommended governmental interventions with respect to the significant variables for improved farmers' welfare.*

Keywords: Market participation, calorie, descriptive, endogenous switching regression, welfare.

INTRODUCTION

In most developing nations including Nigeria, it is apparent that improving market orientation of smallholder farmers has a direct link to positive welfare outcomes such as improved income, poverty reduction and access to food among others. According to Oguntade (2021), subsistence farming households sell in the market the excess of the requirements to meet the needs of their households in order to acquire other needs of the households. Often times, the size of the marketed surplus is so small that farming households are incapacitated to acquire food not produced by them since they are net food buyers let alone other non-food needs of the households. Kilmani, Buyinza & Guloba (2020) argue that participating in markets in developing economies contributes to socio-economic transformation.

In anticipation of such benefit, Nigerian government has embarked on promotion of market participation as one of the initiatives aimed at mainstreaming the Sustainable Development Goals (SDGs) into national policy. This is done in the spirit that is consistent with the aspiration of Agenda 2030 and SDGs which include "end hunger, achieve food security and improved nutrition and promote sustainable agriculture"; (Federal Government of Nigeria – FGN, 2017); United Nations Development Programmes – UNDP, 2015). Some of the initiatives include: The Green Alternative Agriculture Promotion Policy; Stable Crops Processing Zones, Nigeria Incentive-Based Risk-

sharing System for Agricultural Lending, Rural Finance Institution Building Programme, Anchor Borrowers Programme among others. This is informed by the understanding that these initiatives have some built-in marketing related incentive packages such as access to inputs, storage, processing, marketing and trade, promotion of agribusiness, linking farmers in cluster to food manufacturing plants, de-risking lending to the agricultural sector, access to basic banking services among others (FGN, 2017).

Smallholder farmers are expected to take advantage of the foregoing initiatives to engage in both rice production and marketing as rice is a staple food for half of the world population and approximately three quarter and a billion of the world poorest people depend on the staple to survive (Akinyele, 2019). Also, their participation in rice market particularly now that Nigeria is striving to attain rice self-sufficiency and meet the future demand from population growth is an opportunity for them to earn improved income.

It is therefore essential that this study investigates the welfare (measured by calorie consumption) implication of smallholder rice farmers' participation in markets. This study follows the literature on participating in markets and welfare outcomes and found out that Oparinde, Aturamu, Ojo & Kulogun **(**2020) reported a positive impact of market participation (measured by agricultural commercialization) on food security in Akure south local government area of Ondo-state, Nigeria. Similarly, Ojo (2020) finds that market participation (also measured by agricultural commercialization) reduced rice farming households' vulnerability to food insecurity in Ekiti-state, Nigeria.

Moreover, Kilmani *et al*., (2020) in their work on crop commercialization and nutrient intake among farming households in Uganda, found that commercialization proved beneficial for household income generation which did not necessarily translate into improved nutrient intake. Furthermore, Gani & Adeoti (2011) in their study on Analysis of market participation and rural poverty among farmers in Northern part of Taraba state, Nigeria, discover a negative and significant relationship between market participation and poverty, implying that market participation reduced poverty. Also, Ntakyo & van den Berg (2019) worked on the effect of market production on rural household food consumption in Uganda. They reported that while market participation is associated with households' consumption of less calories than required per adult equivalent per day, at the same time, it is associated with a positive and significant effect on household dietary diversity. These findings reveal the ambiguity in the literature on the effect of market participation on households' welfare.

Therefore, this study contributes to literature by examining the implication of market participation on sustainable smallholder farming households' welfare (measured by calorie consumption). This study deviates from Ntakyo & van den Berg (2019) who used propensity score matching for their empirical estimation because it used endogenous switching regression (ESR) model. The reason is that farmers self-select themselves into participation or non-participation in market and this can result into selection bias due to existence of unmeasured characteristics that could potentially bias the PSM estimates (Smith & Todd, 2005). Therefore, this study accounts for selection bias due to both observable and unobservable characteristics using an ESR model approach (Lockshin & Sajaia, 2004).

LITERATURE REVIEW

The pioneering works with regard to welfare outcomes of market participations (measured by agricultural commercialization) usually ended with mixed results thus setting in motion a continuous debate. The absence of consensus inherent in these inconclusive and contradictory results can be linked to the context in which studies were conducted, the nature and utility of the crops considered (Kilmani *et al*., 2020).

However, Kilmani *et al*., (2020) observe that while streamlining the process of research relating to market participation and welfare outcome, the International Food and Policy Research Institute (IFPRI) provided a framework that expressed in clear terms a set of interactions involved in the process of market participation, the results of which reflect some welfare outcomes at the

household level. The IFPRI framework had made possible the quest for a separate investigation of how some processes of market participation lead to certain welfare outcomes for example, food consumption both at the national and household levels. Investigating food consumption separately at the national and household levels has a major implication. Food may be available at the national level through agglomeration of various means, including: domestic production (resulting from interventions and conquest of seasonality factor) and food imports and assistance, yet, food may not be accessible at the household level. Therefore, it is essential to identify the factors that promote the ability of households to gain access to the available food.

Although, it is apparent that participation of households in market enhances their ability to generate marketable surplus which invariably translates to income needed by them to survive as net food buyers (Ojo, 2020). However, a number of factors influence how this income is spent. These factors include: gender factor in terms of control of household income (usually income controlled by women tend to be spent on food), intra-household cum individual income elasticity and food preferences. Other factors influencing food availability at the household level include heterogeneity in households' distribution of food with respect to consumption with preference usually for adult males (Carletto, Corral & Guelfi, 2017).

Also, participation in market motivates allocation of scarce households' resources in favour of cash crop production which in effect reduces the level of available food and ultimately raise food price. From the foregoing, it can be concluded that the interplay of a number of factors involved in the process of market participation is associated with a number of different welfare outcomes given the prevailing factors in each case (Kilmani *et al*., 2020).

A review of empirical studies on market participation and welfare revealed various ways that market participation had impacted welfare. Ndlovu, Thamaga-Chitja and Ojo (2022) investigate the impact of value chain participation on household food insecurity (an indicator of welfare) among smallholder vegetable farmers in Swayimane KwaZulu-Natal, their result showed that 66.7% of the farmers in the sample were food secure, 17.65% were mildly food insecure, 7.84% were moderately food insecure and 7.84% were severely food insecure. According to them value chain participation, age of the household head, marital status, formal education, farm income, lease rent on land, access to NGOs, access to agricultural agency, access to credit, access to television, access to extension services and access to an irrigation scheme were significant in impacting household food insecurity. The study concluded that participation in value chains was significant in reducing food insecurity among smallholder farmers in Swayimane.

Similarly, Tabe Ojong, Hauser and Mausch (2022) in their work titled "Does Agricultural Commercialisation Increase Asset and Livestock Accumulation on Smallholder Farms in Ethiopia?" find a positive impact of agricultural commercialisation (that can be measured by market participation) on assets, livestock ownership and income (welfare indicators). They concluded that increased agricultural commercialisation can contribute to economic development of households and reduce rural poverty.

Again, Julius, Carlo, Shiferaw, Bekele, Lieven and Mateete (2021) in their research: "Welfare impacts of smallholder farmerresearchcipation in multiple output markets: Empirical evidence from Tanzania", find that smallholder farmers' participation in both single–and multiple–commodity markets was positively and significantly associated with household income and food security. Also, Cele and Mudhara (2022) in their paper titled "Impact of Market Participation on Household Food Security among Smallholder Irrigators in KwaZulu-Natal, South Africa" identify collective action and market participation to be contributing to food-insecurity alleviation.

Contrastingly, Ntakyo and van den Berg (2019) investigate "Effect of market production on rural household food consumption in Uganda". On one hand, their results showed evidence of negative significant effects of market production on

calorie consumption. They further noted that more market participant households are more likely to consume less than the required calorie per adult equivalent per day. On the other hand, they found positive significant effects on household's dietary diversity. According to them, this result implies that the substitution effects due to higher shadow prices of food outweighs the income effects of additional crop sales.

METHODOLOGY

Study Area

The study was carried out in Ekiti-state, Nigeria. The state is one of the six states that made up the south western Nigeria. Ekiti state has sixteen local government areas and three geo-political zones. It has a population of 2,384,212 (NPC, 2006) and a land area of 5,435sqkm (EKSG, 2006). The state is located within the tropics and also located between longitude $4^0 52'$ and $5^0 52'$ east of the Greenwich meridian and latitude $7^0 52'$ and $8^0 52'$ north of the equator. The state is bound in the south by Kwara and Kogi states and Ondo state in the south (EKSG, 2006). Ekiti-state is an upland zone having tropical climate with two distinct seasons. The state was chosen as the study area for this work because rice is cultivated in nearly all its local government areas mostly through rain fed upland mode of rice farming (Basorun, 2013). Majority of the people in the state engage in agriculture and related activities to generate their primary income (NBS, 2006).

Sampling Technique and Method of Data Collection

A multi-stage sampling procedure was used to select samples for the study. The first stage involved a purposive sampling of rice producing areas in Ekiti-state. At the second stage, a random sampling of twenty-three communities was done across the three agricultural development projects (ADPs) zones, in the state. At the third stage, a total of three hundred and thirteen rice farmers were randomly selected based on probability proportionate to size from the list of rice farmers prepared by the community opinion leaders in collaboration with agricultural extension workers. However, out of the 313 questionnaires administered, 300 were correctly filled. Following Yamene (1967), the sample size determination formula shown below was used for the study:

$$n = \frac{N}{1+N(e^2)} \text{ ---------- 1}$$

Where N =1445 (the population size), e is the level of precision (5%), n is the sample size.

The proportionality factor used in the selection of the sample for equal representation as used by Amao & Ayantoye (2015), is stated as:

$$x_i = \frac{n}{N} \text{ ---------- 2}$$

$x_i = sample\ selected\ from\ ith\ community,$

$n =$ $total\ sample\ estimated\ obtained\ from\ Yamen$ (1967) formula and N = population of rice farmers listed in the study area.

Analytical Framework and Estimation Techniques

The data collected were analysed using descriptive statistics such as percentage and mean and Endogenous Switching Regression (ESR) model to assess the impact of market participation on rice farming households' welfare (measured by calorie consumption).

Estimation of Calorie Consumption

To estimate calorie consumed by households in the study, food consumption recall data that covered quantities of various food items eaten by all household members for a 3-day period were collected. Thereafter, the edible portions were calculated and converted to calorie using the table developed by Oguntona & Akinyele (1995). Furthermore, the calorie consumption at households' level was computed using adult male equivalence (equation 3) as done by Kilmani *et al*., (2020) by adopting Stefan & Pramila (1998) rather than using per capita household consumption that is fraught with overestimation of calorie intake by household members. AME also allows for easy comparison of households of different size and composition (Weisell & Dop, 2012). Further to the foregoing, a minimum threshold of 2850 kcal/ AE/day recommended by food and Agriculture

Organization-World Health Organization (FAO-WHO-UNU), (1985) was adopted in considering adequacy of household calorie consumption or otherwise. Therefore, households whose calorie consumption is equal to or more than 2850kcal/AE/day for both the pre-harvest and post-harvest seasons are considered to have a sustainable welfare, otherwise, such households' welfare is not sustainable.

Adult male equivalent = (no of adults + no of children less than 18years) 0.5 ---------- 3

Endogenous Switching Regression (ESR) Model

In this study ESR model was preferred to other regression models and used because it is able to overcome the weakness (inconsistent estimates) of models like Ordinary Least Square (OLS) regression, Instrumental Variable (IV) and Heckman selection bias models. Although, Heckman (1979) develops a model that used inverse mill ratio generated from the first stage of his two- stage estimation procedure to correct selectivity bias, however, Lokshin & Sajaia (2004) argue that a demerit of the two- stage approach is that it produces residuals that are heteroskedastic and cannot be used to obtain consistent standard errors without awkward adjustments. Thus, ESR was used in this study to account for both endogeneity and sample selection bias. In the ESR model, a two-stage estimation procedure is done simultaneously. At the first stage, estimation of an equation called the selection equation (equation 4) is usually done to determine the factors affecting market participation.

A probit model is specified for market participation as:

$$M_i^{*} = \alpha^i X_i + u_i \; with \; M_i = \sum.\begin{pmatrix} 1 \; if \; M_i*>1 \\ 0 \; otherwise \end{pmatrix} \text{------} \quad 4$$

Where $M_i *$ is the unobservable or latent variable for market participation, $M_i$is the observable counterpart (i.e. equals 1, if the rice farming household has sold any quantity of rice (proxied by monetary value) produced by him/her in the market and zero otherwise)

X_i is a vector of observed farm and non-farm characteristics influencing market participation, α is the coefficient estimates and U_i is random disturbances associated with the market participation.

At the second stage of ESR estimation the impact of market participation on welfare measured by calorie consumption (the outcome variable) is specified for two regimes of participants and non-participants of market as: Regime 1 (participants): $y_{ip} and \; y_{in}$are outcome variables for market participants respectively; W is a vector of exogenous variables of household I, expected to influence calorie consumption, B is the coefficient vector to be estimated; μ is the error term and p is dummy for market participation.

The ESR model is structured such that an overlap of X in equation (4) and W in equations 5a and 5b is permitted. However, in estimating the outcome equation, all the variables in the selection equation except one (called the identifying instrument) are good candidates. This is done for the identification purpose. A valid instrument should affect participation but not outcome (calorie consumption). In this study for instance, distance from source of credit which affect access to credit but not the outcome (calorie consumption) was considered to be a valid instrument.

Further to estimating factors affecting market participation, the ESR model can equally be used to assess the effect of market participation on household welfare. The effect of market participation is assessed by comparing the expected outcomes of the counterfactual / imaginary cases that participants did not participate.

The expected values of the outcome y on participation and non-participation can be expressed as in equations (5a) and (5b):

$$E\big(y_{ip}|p=1)\big) = W'\beta_{ip} - \sigma_{p\varepsilon}\lambda_p ----- \quad 5a$$

$$E(y_{iN}|p=1)) = W'\beta_{iN} - \sigma_{N\varepsilon}\lambda_p ----- \quad 5b$$

A change in the outcome as a result of participation referred to as the average treatment effect on the treated (ATT), is expressed in equation (6) as the difference in the expected

outcomes from equations (5a) and (5b) (Lokshin & Sajaia, 2004):

ATT = $E(y_{ip}|p = 1) - E(y_{iN}|p) = 1$

W $(\beta_{ip} - \beta_{iN}) + \lambda_p(\sigma_{p\varepsilon} - \sigma_{N\varepsilon}$ ---------- (6)

Where r is the covariance of error terms and λ, the inverse mills ratios. Therefore, the effect of market participation on welfare measured by calorie consumption can be estimated using ESR model.

Table 1: Conditional Expectations, Returns Effects and Level Effects

Household type	**Market participating households' response to characteristics**	**Non-market participating households' response to characteristics**	**Returns effects (difference caused by difference in resources use efficiency)**
Participant households	$\mathrm{E}(Y_{Pi} \,/\, H = 1)$	$\mathrm{E}(Y_{Ni} \,/\, H = 1)$	$\mathrm{E}(Y_{Pi} \,/\, H = 1)$-$(Y_{Ni} \,/\, H = 1)$
Non-participant household	$\mathrm{E}(Y_{Pi} \,/\, H = 0)$	$\mathrm{E}(Y_{Ni} \,/\, H = 1)$	$\mathrm{E}(Y_{Pi} \,/\, H = 0)$-$E(Y_{Ni} \,/\, H = 1)$
Level of effect (difference caused by differences in resources quantities)	LE_N	LE_P	

Table 2: Definition of Variables

Variables	Definition and Measurement of Variable
Dependent variable:	
Market participation	1 if household sells any rice in the market, 0 otherwise
Calorie consumed	Amount of calorie consumed by household in kilo calorie
Independent variable	
Farm size in hectares	Area of farm cultivated in hectares
Access to market information	Yes =1, 0 otherwise
Gender	1 male, female 0
Household size	No of people eating in the same pot
Own land	Yes=1, 0 otherwise
Education	Year of formal education
Distance to market	Distance to market in kilometres
Own livestock	Yes=1, 0 otherwise
Access to credit	Yes=1, 0 otherwise
Age	Age in years
Off-farm income	Income received outside farm engagement
Asset value	Value of cash and non-cash possessed in Naira
Agric production networks membership	Yes=1, 0 otherwise
Distance to source of credit	Distance to credit source in kilometres

Source: Author's compilation

RESULTS AND DISCUSSION

Descriptive Statistics

Table 1 presents the descriptive statistics of the sampled respondents. 69% of the sampled respondents participated in rice market while 31% did not participate. This result is in line with Murich (2015), on the argument that more of the surveyed households in his study were market participants. About 79% and 21% of the market participants were male and female respectively while 76% and 24% of the market non – participants were male and female respectively. The result agrees with Akinlade, Balogun and Obisesan (2013) who conclude that male participates more in farming activities than female. In terms of membership of APNs, 59% and 41% of the participants are members and non-members of APN respectively, while 28% and 72% of non-participants were members and non-members of APN respectively. This result is in line with Muricho (2015) affirming that a significantly higher proportion of market participants belong to agricultural production network groups than market non-participants. With respect to access to information, 88% and 40% of market participants and non- participants had access respectively while 12% and 60% of the market participants non- participants had no access respectively. This implies that market participants have more of market participants have access to market information than market non-participants. This result corroborates with Mmbado (2014) report that access to market information improves market participation. Average farm size of market participants was 1.9ha while that of non-participants was 0.6ha. Also, this result and Muricho (2015) claim together that market participant had a significantly bugger farm size compared to market non-participant. The mean age of the market participants and non-participants were 48.2years and 51years respectively. This implies that market participants are relatively younger than market non participants the result support Muricho (2015) who concludes that market participants are relatively younger than market n on-participants.

The market participants had 6.7years of education while non-participants had 6.5years of education. This result is similar to Muricho, 2015 who found that level of education of market participants on the average is higher compared to that of market non-participant. Average distance to market with respect to market participants was 50 kilometres while it was 48 kilometres for the non-participants. This result agrees with Mmbado, (2014) claiming that a higher percentage of maize

and pigeon pee sellers lived farther away from the nearest market than their counterparts who sell maize and pigeon pee. Average off-farm income of N12, 640 and N46, 000 was earned by the market participants and non- participants respectively. This result partly agrees with Mmbado (2014), which affirms that more pigeon pee sellers have access to all farm income than the pigeon pee non-sellers while, maize sellers have less access to all farm income than maize non-sellers. Interestingly, both market participants and non-participants had equal average household size and distance to source of credit. The percentage of market participants that had access to credit was more than non-participants that had access to credit. Similarly, market participants produced more quantity of rice than non-market participants. In terms of calorie consumed, market participants consumed more calories than the 2850kcal/AE/day recommended by FAO-WHO-UNU (1985) during both pre-harvest and post-harvest seasons. However, the non-market participants were only able to meet up their minimum required calories during the post-harvest season.

Table 3: Descriptive Statistics

Characteristics	**Market participant (N=207)**	**Non-participant (N=93)**
	Mean (%)	Mean (%)
Gender:		
Male	79	76
Female	21	24
Agri prod network membership (APN):		
Yes	59	28
No	41	72
access to market information:		
yes	88	40
no	12	60
farm size (ha)	1.9	0.6
Age (years)	48.2	51
Education (years)	6.7	6.5
distance to market (km)	50	48
off-farm income (naira)	29,000	46,000
asset value (naira)	12,640	68,214
household size (number)	6	6
access to credit		
yes	53	26
no	47	74
distance to source of credit (km)	5	5
Quantity of rice produced (Kg)	5000	500
calorie consumed kcal/AE/day		
pre-harvest	2987.80	2724.40
post-harvest	3075.6	2970.2

Source: Authors' computation from field survey (2020)

Table 4 presents the results of the ESR model used to jointly estimate the selection and outcome equations. Specifically, the coefficients of the ESR estimates presented in the second column of the table are the selection equation estimates, while the fourth and sixth columns show the impact of market participation on participants and non-participants. As shown in the empirical specification, for a model to be identified, such model must have all the variables in the selection equation minus at least one in the outcome equation. In this study, distance from source of credit was used as identifying instrument. Expectedly, distance from source of credit would

influence access to credit but not directly the outcome (calorie consumption). The estimate of the credit residual is not statistically significant suggesting that the estimate of the credit variable was consistent.

The likelihood ratio test for joint independence of the equations in the ESR specification indicates that the equations are dependent. The correlation coefficients (p) in the ESR specifications are significant, implying that the selection bias due to unobservable factors is present in participation. Therefore, the use of ESR model in this study has merit (Lokshin & Sajaia, 2004). The negative and significant signs for p show positive selection bias implying that farmers with above average calorie consumption have higher likelihood of participating in market. The result is similar to Mmbado (2014) but contrasts with Ntakyo and van den Berg (2019). Further to the foregoing results, some of the independent variables in the selection equation significantly influenced market participation. Farm size positively and significantly influenced market participation at 5% level of significance. This could be as a result of resulting large-size marketable surplus associated with increase in farm size which farming households would have no other choice than to take it to the market for sale. In this instance, the farm size has a direct link with marketable surplus which in turn motivates farmers to participate in market (Mmbado, 2014).

Also, access to market information positively and significantly influenced market participation at 1% level of significance. This could be possible because farmers already know the price they will buy their inputs, sell their output and the most profitable market outlets to sell their output. This does not contrast with Mmbado (2014) that access to market information has the potential guide farmers in terms of the price to sell their outputs and the market outlets to sell their outputs. Similarly, membership of agricultural production networks (APNs) positively and significantly influenced market participation at 1% level of significance. This could be attributable to the fact that profitable production and marketing information is shared among members of associations. A similarity of findings was found in Muricho (2015) that farmers who were members of APNs had 13% more chance of participating in market. Distance to market negatively and significantly influenced market participation at 1% level of significance. This may be possible because the longer the distance to the market the more the transaction cost that will be incurred and the less the chance of the farmer to participate in market. The estimated result agrees that increased cost of transportation to the market (a proxy for market distance) decreases the probability of participating in market and vice versa (Muricho, 2015). The access to credit variable positively and significantly influenced market participation at 1% level of significance. This may be because credit assessed could be used in such a way to produce goods that meet standard and quality requirement to participate in market. In this case, it does not deviate from Ojo (2020) that farmers who obtained certain amount of credit participated in the market.

The outcome equation columns of the ESR model results for market participants and non-participants showed the impact of the independent variables on their calorie consumption (welfare). The impact estimate showed that farm size positively and significantly influenced market participants' calorie consumption at 5% level of significance. This may be because as farm size increases marketable surplus increases too (all things being equal) and this will translate to increased income that may lead to increased calorie consumption. Although this study and Mmbado (2014) are in agreement on the significance of farm size having association with increase in the consumption expenditure per capita of farm households that participated in the maize market, others like Ntakyo and van der Berg (2004) has different outcome. They argued that producing rice for market is associated with decreased calorie consumption.

Furthermore, the variable access to credit positively and significantly influenced calorie consumption of market participant households at 5% level of significance. This can be ascribed to the fact that the credit accessibility could be used to acquire improvement in technology that leads to high productivity. In turn, this translates to increased income and increased calorie consumption. This does not deviate from Ojo (2020) findings that access to credit by market participant households reduced their vulnerability

to food insecurity (a proxy for increased calorie consumption).

Also, education positively and significantly influenced calorie consumption of market participant households at 5% level of significance. This implies that level of education of the market participant could help them to process production and market information to their advantage and even play a beneficial role in spreading lump sum income realized from participating in market evenly in order to achieve smoothening of consumption against seasonal food shortage usually experienced during the pre-harvest season.

Asset value positively and significantly influenced calorie consumption of market participant households at 5% level of significance. This could be because assets could be sold in time of emergency to earn money to purchase food. This finding agrees with Kilmani *et al,* (2020) who found that calorie consumption increased with asset value.

In the same vein Agricultural production networks (APNs), positively and significantly influenced calorie consumption of market participant households at 1% level of significance. This might be due to the fact that APNs membership is loaded with production and marketing packages/incentives that in turn translate into improved income that can be spent on purchasing food. Again, with previous conclusion (Muricho, 2015), belonging to APNs confers 9% more chance of being food secure than not belonging to APNs.

For market non-participant households, off-farm income positively and significantly influenced calorie consumption by market non-participant households at 5% level of significance. This could be because market non-participant households used off-farm income for market purchase of food they needed above the level of their own produced food. Hence, we argue that consumption expenditure of households that did not participate in market usually increased the off-farm income (Mmbado, 2014). Farm-size positively and significantly influenced calorie consumption of households that did not participate in market at 5% level of significance. In other words, an increase in farm size could be associated with high marketable surplus and invariably improved calorie consumption (Mmbado, 2014).

Also education positively and significantly influenced calorie consumption by households that did not participate in market at 5% level of significance. This could be ascribed to the fact that education provides an array of opportunities for improving livelihood strategies and enhance food consumption. Conversely, household size negatively and significantly influenced calorie consumption of households that did not participate in market at 5% level of significance. This may be because large household exert pressure on available per capita calorie to the extent that household members consume less calorie than they could have consumed per capita if they did not have a large household size. Also, consistency was found in Oparinde *et al*. (2020) that small-sized household tend to be food secured and vice versa.

Table 4: Full information maximum likelihood estimates for endogenous switching regression model for model for market participation and impact of market participation on calorie consumption.

	Selection		Participants		Non-participants	
	Coefficient	Std. err	Coefficient	Std. err	Coefficient	Std. err
Constant	12.988***	2.115	9.133***	2.435	10.418***	1.774
Farm size	0.956**	0.398	0.633**	0.220	0.500**	0.226
Access to market information	0.256***	0.071	0.881	3.830	0.620	0.459
Gender	0.002	0.002	0.488	1.251	0.095	0.475
Household size	0.004	0.002	0.002	0.001	-0.005**	0.001
Own land	0.005	0.007	0.594	0.836	0.004	0.01
Education	0.104	0.179	0.005**	0.002	0.006**	0.002
Distance to market	-0.402***	0.07	0.551	0.586	0.001	0.002
Own livestock	0.946	18.92	0.357	0.410	0.188	0.508

Access to credit	0.587**	0.224	0.907**	0.319	0.302	0.335
Age	0.104	0.179	0.481	0.341	0.092	0.278
Off-farm income	0.019	0.040	0.285	0.271	0.131**	0.049
Asset value	0.626	0.812	0.52**	0.202	0.760	0.844
Agric production networks	0.01***	0.002	0.04***	0.009	0.034	0.033
Distance to source of credit	0.016	0.020	0.01	0.007	0.879	0.965
$\ln \sigma 1$			0.327***	0.052		
$\rho 1$			-0.006	0.241		
$\ln \sigma 2$					0.472***	0.031
$\rho 2$					-0.254**	0.052
Log likelihood	-3278.379					
Likelihood ratio of independence:	$x^2(1)$		12.40***			

Source: Source: Author's computation from field survey (2020)
Note: ***, **, *Significant at 1%, 5% and 10% respectively.

Table 5 presents the expected welfare outcome of smallholder rice farmers in the study area (measured by calorie consumption) under actual and counter-factual scenarios. The predicted calorie consumption per adult equivalent obtained from endogenous switching regression model was used to examine the average calorie consumption gap between an actual part5icipation of the farmers in the market and a counter-factual scenario of non-participation of these farmers in the market.

Cell (a) and (b) depicts the expected calorie consumption per adult equivalent observed in the sample. The results show that the expected calorie consumption per adult equivalent by the farmers that actually participated is 19.04% higher than the average calories they would have consumed if they had participated. Also, for the farmers who did not participate in the market, they would have consumed 10.12% calories higher if they had participated in the market. Similarly, the value obtained for transitional heterogeneity effect for the samples with respect to their calorie consumption is positive. This implies that the effect is higher.

Table 5: Conditional Expectations, Returns Effects and Level Effects

Sub-samples	Decision stage		Return effects
	To participate	Not to participate	
households that participated	(a) 17.6220	(c) 17.4316	0.1904***
households that didn't participate	(d) 17.4122	(b) 17.3110	0.1012***
heterogeneity effects	0.2098***	0.1206***	0.0892***

Author's computation from field survey (2020)

CONCLUSION

This study used data from a cross-section of rice farming households in Ekiti-State Nigeria. It examines the implication of rice 'farmers' participation in market on their welfare measured by calorie consumption. Results from market participation mean difference indicated statistically significance difference in calorie consumption between market participants and non-participants. Although this mean difference could be accepted as impact, however, it does not account for the effects of other factors including those affecting market participation. Considering the fact that farmers self-select themselves into participants and non-participants, ESR model was used to estimate differential participation in market and impacts of the participation on calorie consumption.

At this point, it is not doubtful to argue that market participation positive impactful on calorie consumption. The impact of market participation on this outcome was estimated without accounting for both observable and unobservable factors in the market participation decision process. Thus, sample selection bias could have resulted.

In terms of market participation, factors including farm size, access to market information, membership of agricultural production networks (APNs) distance to market and access will continue to affect market participation. Except for the household size that negatively related to outcome, the off-farm income, farm size, education and household size are considerable factors that influences that are promoting household welfare.

Thus, we argue that market participation by the smallholder rice producers could contribute to sustainable welfare as measured by calorie consumption. Also, it is suggested that policy measures that increase farmers land holdings, improve access to market information; promote membership of APNs; reduce distance of farmers' farm from markets and improve access to credit will effectively promote smallholder rice farmers' market participation. The rise in market participation among the smallholder rice farmers requires increasing the farm size and education to promote mechanization and increase food production. While policy measure that encourage assets accumulation should be promoted among market participant households.

Again, for households that did not participate in the market, promoting off-farm income generating activity is a right policy to stimulate the smallholder rice farmers. Finally, education, through workshops, on family planning should be intensified among the smallholder rice farmers to control family size.

REFERENCES

Akinlade, R. J., Balogun, O. L. & Obisesan, A. A. (2013). *Commercialization of urban farming: The case of vegetable farmers in southwest Nigeria*. Invited Paper presented at the 4th International conference of the African Association of Agricultural Economists, September 22 – 25, 2013, Hammamet, Tunisia.

Akinyele, B.O. (2019). *Plant Genetics for Nutrition and Food Security*. Inaugural Lecture Series 110, the Federal University of Technology, Akure, Nigeria.

Amao, J.O. & Ayantoye, K. (2015). Correlates of Food Insecurity Transition and its Determinants among Farming Households in North Central, Nigeria**.** *Journal of Economics and Sustainable Development.*6(24),

Basorun, J.O, (2013): Assessing the Significant Factors Influencing the Location of Rice Marketers in Igbemo Region, Nigeria. *British Journal of Arts and Social Sciences*. 12(1),.

Carletto, C., Corral, P., & Guelfi, A. (2017). Agricultural commercialization and nutrition revisited: Empirical evidence from three African countries. *Food policy*, 67:106-118. DOI:10.1016/j.foodpol.2016.09.020

Cele, T. & Mudhara, M. (2022). Impact of Market Participation on Household Food Security among Smallholder Irrigators in KwaZulu-Natal, South Africa. *Agriculture*, *12* (2), 261; https://doi.org/10.3390/agriculture12020261

Dehejia, H.R., & Wahba, S. (2002). Propensity score matching methods for non-experimental casual studies. *Review of economics and statistics* 84(1),151-161

FAO &WHO. (1985). *Energy and protein requirements: report of a Joint*. FAO/WHO/UNU Expert Consultation.

Federal Government of Nigeria (FGN) (2017). *Implementation of the SDGs*. A National Voluntary Report Review, Office of the Senior Special Assistant to the President, Federal Republic of Nigeria

Gani, B.S. & Adeoti, A.I. (2011). Analysis of Market Participation and Rural Poverty among Farmers in Northern part of Taraba State, Nigeria. *Journal of Economics*, 2(1):23-26

Heckman, J. 1979. Sample selection bias as a specification error. *Econometrica*, 47(1):153162.

Julius, M., Carlo, A., Shiferaw, F., Bekele, K., Lieven, C. & Mateete, B. (2021). Welfare impacts of smallholder f armers' participation in multiple output markets: Empirical evidence from Tanzania. *PLoS ONE* 16(5). e0250848. https://doi.org/10.1371/journal.pone.0250848

Kilmani, N., Buyinza, F., & Guloba, M. (2020). *Crop Commercialization and Nutrient intake among Farming Households in Uganda.* AERC Working Paper BMGF-010. African Economic Research Consortium, Nairobi

Lokshin, M., & Sajaia, Z. (2004). Maximum likelihood estimation of endogenous switching regression models. *Stata Journal* 4(3): 282-289

Mmbado, F.E. (2014). *Market Participation, Channel Choice and Impacts on Household Welfare: The Case of Smallholder Farmers in Tanzania*. Ph.D. Thesis, University of KwaZulu-Natal, Department of Agricultural Economics, Pietermaritzburg.

Muricho, G.S. (2015). *Determinants of Agricultural commercialization and its impacts on welfare among smallholder farmers in Kenya*. Unpublished Ph.D. Thesis, University of Nairobi, Kenya.

National Bureau of Statistics (NBS), (2006). Population Census. Federal Republic of Nigeria.

Ndlovua, P.N., Thamaga-Chitjaa, J.M. and Ojo, T.O. (2022). Impact of value chain participation on household food insecurity among smallholder vegetable farmers in Swayimane KwaZulu-Natal. *Scientific African 16: 1-7.* https://doi.org/10.1016/j.sciaf.2022.e01168 2468-2276

Ntakyo, P.R. & M. van den Berg (2019). Effect of market production on rural household food consumption: evidence from Uganda. *Food security*. https://doi.org/10.1007/s12571-019-00959-2

Oguntade A.E. (2021). *Subsistence farms to farm firms: progress and challenges*. Inaugural lecture series 133. Federal University of Technology, Akure, Nigeria. Pp. 82.

Oguntona, E.B. & Akinyele, I.O. (1995). *Nutrient Composition of Commonly Eaten Foods in Nigeria: Raw, Processed and Prepared*, Ibadan, Oyo State.

Ojo, O.O. (2020). *Effects of Agricultural commercialization on smallholder rice farmers' vulnerability to food insecurity in Ekiti State, Nigeria*. Ph.D. theses department of Agricultural and resource economics, Federal University of Technology, Akure, Nigeria. Pp. 218.

Oparinde, L.O., O., Aturamu, O.A., Ojo, O.O. & Kulogun, O. S. (2020). Agricultural Commercialization and Food Security Nexus among Maize Farmers in Akure South Local Government, Ondo State, Nigeria. *Journal of Scientific Research and Reports*. 26(8): 79-87, 2020; Article No.JSRR.58584ISSN: 2320-0227. DOI: 10.9734/JSRR/2020/v26i830297

Smith, J.A., & P.E. Todd. 2005. Does matching overcome LaLonde's critique of non-experimental estimators? *Journal of Econometrics* 125(1-2):305-53

Stefan, D. & Pramila, K. (1998). *Changes in poverty in rural Ethiopia 1989-1995: measurement, robustness tests and decomposition*. Centre for the study of African Economics. Working series.

Tabe-Ojong, M.P, Hauser, M. & Mausch, K. (2022). Does Agricultural Commercialisation Increase Asset and Livestock Accumulation on Smallholder Farms in Ethiopia? *Journal of development studies* 58(3), 534-544.

https://doi.org/10.1080/00220388.2021.1983170.

United Nations Development Programmes (UNDP) (2015): *Sustainable Development Goals*. New York: United Nations.

Weisell, R., & Dop, M. C. (2012). The adult male equivalent concept and its application to household consumption and expenditures surveys (HCES). *Food & Nutrition Bulletin*, 33 (supplement 2), 157S-162S.

Yamene, T. (1967). *Statistics: An inventory analysis, 2nd edition*, New York: Haper and Row

APPENDIX 1

Nutrients composition of commonly eaten foods in Nigeria (Raw, processed and prepared)

Food item	**Kcal/kg**
Gari	3840
Cowpea	5920
Rice	1230
Soybean	4050
Melon (shelled)	5670
Groundnut	5950
Bread	2330
Sugar	3750
Orange	440
Mango	590
Powdered milk	4900
Agric egg	1400
Fish	2230
Meat	2370
Maize	4120
Okra	4550
Pepper	3930
Tomatoes	880
Plantain	770
Yam	3810
Cocoyam	3830
Cassava flour	3870

Source: Oguntona E.B. and Akinyele I.O. (1995)

APPENDIX 2

Nutrition (calorie) based equivalent scales

Years of age	Men	Women
0-1	0.33	0.33
1-2	0.46	0.46
2-3	0.54	0.54
3-5	0.62	0.62
5-7	0.74	0.70
7-10	0.84	0.72
10-12	0.88	0.78
12-14	0.96	0.84
14-16	1.06	0.86
16-18	1.14	0.86
18-30	1.04	0.80
30-60	1.00	0.82
60 above	0.84	0.74

Source: calculated from world health organization data (Stefan and Pramila, 1998)

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