DETERMINANTS OF AGRICULTURAL COMMERCIALIZATION AMONG SMALLHOLDER RICE FARMERS IN EKITI-STATE, NIGERIA.

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ABSTRACT

The purpose of the paper is to examine the determinants of agricultural commercialization among smallholder rice farmers in Ekiti-state, Nigeria. Examining factors influencing agricultural commercialization among smallholder rice farmers is important for boosting rice production and making price of rice affordable. However, study focusing on factors influencing agricultural commercialization among smallholder rice farmers are very few. Hence the need for this study. The paper used cross sectional data obtained from a simple random sampling where a sample of 420 smallholder rice farmers was obtained. Descriptive statistics and double hurdle regression analysis were employed as analytical methods to obtain results on respondents' socioeconomics characteristics and factors influencing agricultural commercialization. The findings indicate that men engaged more in rice production than women irrespective of their commercialization status and commercializing respondents produce more tonnes of rice than their non-commercializing counterparts. Some of the determinants of the decision to commercialize and intensify commercialization include: education, earning income from other crops, access to credit, being member of agricultural production group and reduced cost of transportation. Therefore, in order to boost rice production there is the need for government and NGOs to support rice farmers (particularly the young male) in terms of improving their level of education and access to credit via group lending which would promote group formation. Also, efforts in the direction of reduction of transaction costs via good road networks, subsidizing price of means of transport and as well as mobile phone and improving extension services delivery should be prioritized.

Keyword: Agricultural commercialization, Ekiti, Household, Rice, Smallholder

INTRODUCTION

Rice is an important crop that doubles as both food crop and cash crop in most economies of the world. It is a staple food for half of the world population and about, three quarter of a billion of the world's poorest people depend on the staple to survive (Akinyele, 2019). It ranks high among the most commonly consumed staple food in Nigeria as such, a significant amount of money used to go to its importation before the Nigerian present government introduced a policy that discouraged rice importation so that domestic production may be encouraged. In Nigeria, all the agroecological zones supports the production of rice (Bello, Baiyegunhi & Danso-Abbeam (2021); USDA, (2022); Attamah, Aguh and Agwu (2023).

Also, rice production in Nigeria is commonly practised by the smallholder farmers in either upland or lowland agro-ecology. Some important features of the smallholder rice production in Nigeria include: smallness of area of land under cultivation, poor resource endowment (Ojo, 2020); lack/ limited access to credit, lack of access to input/output market (Okeke, Mbannasor and Nto, 2019). Rice cultivation has attracted the attention of more farmers in Nigeria making the country to be ranked the second largest producer of rice in Africa as a result of a 70 percent increase in production in the past decade (United States Department of

Agriculture – Foreign Agricultural Service, 2019). Yet demand-supply gap exist in the rice sub-sector of the Nigerian economy (Okpiaifo, Durand-Morat, West, Nalley, Nayga Jr. and Wailes (2020) as a result of low productivity technology of rice production (Olasehinde, Qiao and Mao, 2019). Statistics showed that rice demand-supply gap in Nigeria on the average is about 2.4 million metric tonnes a year (Okpiaifo *etal.,* 2020) This demand-supply deficit accounts for rice importation to make up for the supply gap thereby making Nigeria rank very high among the countries importing rice (Yusuf, Yusuf, Adesope and Adebayo (2020). The demand for rice is fuelled by factors such as rapid population growth, dietary shifts and growth in urbanization, per capita income, change in the taste of consumers (Mohidem, Heshim, Shamsudin and Man, 2022; Arouna, Fatognon, Saito, and Futakuchi, 2021). Ideally, the demand for rice is expected to be taken as an opportunity for smallholder farmers to improve their livelihoods, reduce poverty, improve food security, create jobs and accelerate economic growth through participating in rice value chain as

enshrined the Nigerian Agricultural Transformation Agenda and Agricultural promotion policy documents (Federal Ministry of Agriculture and Rural Development (FMARD), 2016). Considering the central position occupied by rice among other food crops, the immediate past Nigerian government led by President Muhammadu Buhari introduced a number of programmes/policies aimed at ensuring self-sufficiency in rice production through agricultural commercialization. Agricultural commercialization according to Govereh, Jane and Nyoro, (1999) is "the proportion of agricultural production that is marketed". According to these researchers, agricultural commercialization aims to bring about a shift from production for solely domestic consumption to production that is dominantly market-oriented. Notable among the pro-agricultural commercialization programmes/policies introduced by the Nigerian government are: Anchor Borrowers' Programme (ABP), improved input supply, ban of imported rice to remove stiff competition of the local producers with the foreign producers, outgrowers' scheme among others. Against the background of the existing demand-supply gap in the rice sub-sector of the Nigeria economy, there is the need to identify the factors influencing farmers' participation in agricultural commercialization. To the best of the knowledge of the researcher, there is a dearth of information about the socio-economic, production and marketing factors that could help the Nigeria government achieve its objective of attaining a status of self-sufficiency in rice production, improve farmers' income, reduce poverty as well as food insecurity (FMARD, 2016). Therefore, this study examined the determinants of agricultural commercialization among smallholder rice farmers in the Ekiti-state, Nigeria.

MATERIALS AND METHODS

The study was carried out in Ekiti State, Nigeria. The state is situated in the South-West geo-political zone of Nigeria. It is located between longitudes 7°45′ and 5°45′ East of Greenwich meridian and latitudes 7°45′ and 8°05′ north of equator. It lies South of Kwara and Kogi States as well as East of Osun State. It is bounded in the East by Edo State and in the South by Ondo State.

The state has sixteen Local Government Areas. It enjoys tropical climate with two distinct seasons: the rainy season (April – October) and dry season (November – March). The temperature ranges between 21°C and 28°C with high humidity. Tropical forest exists in the South and guinea savannah in the North. The state is endowed with water resources like Ero, Osun, Ose and Ogbese rivers. Ekitis are culturally homogenous and they speak a dialect of Yoruba language known as Ekiti.

The major food crops grown in the state include yam, maize, cassava, cocoyam and rice; also the tree crops grown include cocoa, kolanut and oil palm tree. The main livestock species include sheep, goat, pigs and poultry.

The people are predominantly farmers while women engage in food processing, trading, in addition to farming activities. The climate favours the state in the cultivation of crops like maize, yam, cassava, millet, rice, plantains, cocoa, palm produce, cashew etc.

The study was conducted using cross-sectional data obtained from rice farmers who are the target population in the study area. The study employed multi-stage sampling procedure in selecting the respondents. The first stage involved a purposive sampling of rice producing communities in Ekiti state.

Secondly, twenty-three rice growing communities were randomly selected in a manner that ensured representation of the three Agricultural Development Projects zones (ADPs). The ADPs zones were located in each of the three senatorial districts in the study area. In the third stage, a total of four hundred and forty-six rice farmers were selected from the list of rice farmers obtained from the ADPs office (state headquarters), for the study based on probability proportionate to size. However, out of the 446 questionnaire administered, 420 were correctly filled. Following Yamane, (1967), the following sample size determination was used in this study:

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

Where, N (1556) is the population size and e is the level of precision (4%), n is the sample size. The proportionality factor used in the selection of the sample for equal representation is stated as:

$$x_i = \frac{n}{N} *$$
$$No \ of \ registered \ rice \ farmers \ in \ ith \ community$$
$$(2)$$

Where, x_i = sample selected from ith community, n = total sample estimate obtained from Yamane 1967 formula and N= population of registered rice farmers in the study area. The sampling procedure is as shown in table one.

Table 1: Sampling Procedure

ADP Zone	Communities		Number of Registered Rice Farmers		Number of Sampled Rice Farmers		Number of Questionnaire correctly filled	
Ikole	Ikole	Esun	114	52	33	15	31	13
	Oke-Ako	Ayedun	42	59	12	17	12	16
	Isaba	Itapaji	47	45	14	13	14	13
	Ijesa-Isu	Ifaki	61	107	18	31	18	28
Aramoko	Aramoko	Efon	127	139	36	40	33	36
	Erio	Erinjiyan	46	48	13	14	13	14
	Ipole	Ijero	49	137	14	39	13	35
	Iroko	Ikoro	50	56	14	16	14	15
Ikere	Ogotun	Ijan	60	46	17	13	15	13
	Ilumoba	Aisegba	49	57	14	16	14	16
	Agbado	Igbemo	42	62	12	18	12	17
	Ode	-	61	-	17	-	15	-
	Total		**1556**		**446**		**420**	

Source: Author's computation from survey data

Primary data were obtained through field survey using structured questionnaire and oral interview to elicit response from respondents regarding household food consumption, socio-economic attributes of the respondents, Physical and Financial endowments of the households, Social capital variable of the household, Transaction costs variables of the household, households' exposure to shock, and agricultural commercialization participation of farm households.

Data collected were analysed with the use of descriptive statistics such as frequencies, averages and percentages and Heckman sample selection model.

The use of the Heckman selection bias model was predicated on the concern that in modelling, factors influencing participation in agricultural commercialization, a non-trivial portion of observation located at zero sales exists. (Muricho, 2015).

A distribution of this sort has the potential to bias the estimates from OLS regression model (Wooldridge, 2010). This potential problem can be avoided as done by previous researchers by employing a two-step decision making process whereby an individual decides whether to participate or not in agricultural commercialization followed by the extent of participation (intensity) having decided to participate (Ojo, Aturamu and Obasuyi, 2022; Mmbando, Wale and Baiyegunhi 2015; Muricho 2015, Ademe, Legesse, Huji and Goshu, 2017) Huilua, Manjurab and Aymutc 2015)

The aforementioned studies either employed Heckman sample selection model, double hurdle model or Tobit regression model. However, Heckman selection and double hurdle models have advantage over the Tobit model. The two-step models relax the Tobit model's assumptions that: a given set of independent variables produce the same effect on the probability of participating in agricultural commercialization as well as the intensity of participation (Wooldridge, 2010), Also, Tobit model assumes that non-participation in agricultural commercialization and invariably zero traded volumes are borne out of rational choice of the individual which Komarek (2010) ascribed to probable market entry barrier. Again, Tobit model is weak as its estimation is based on the condition that the dependent variable meets a certain cut-off point, this could interfere with the true estimates of the intercept and the slope.

Nonetheless, the Tobit model's assumptions are relaxed by the Heckman sample selection and double hurdle models (that are two-step models) by allowing separate approaches to determine the discrete probability of agricultural commercialization participation and the intensity of participation. In the two-step models, step one involves estimation of a probit model while step two takes different functional distributions (lognormal or truncated normal). For Heckman sample selection model developed by Heckman (1979), a probit regression is employed in the first stage (selection model) to estimate the probability of participation and also the inverse mills ratio (IMR). The IMR so computed is added to the

other explanatory variables in the second stage (that involves an OLS regression) to account for the variation in the continuous (non-zero) outcome variable. By doing so, non-agricultural commercialization participating group which is not a random sub-sample of the population that selects itself into the group due to both observed and unobserved covariates would have been corrected (Greene, 2007) for its potential to distort the correct value of the regression estimates. Literature on agricultural commercialization posits that Heckman's two-step model (Heckman, 1979) is an appropriate tool of analysis when the correlation between two error terms is greater than zero because of its ability to correct selection bias problem (Johannes, Le, Zhou, Johnston, Dworkin, 2010). According to Wooldridge (2010), self-selection bias is considered an omitted variable in the selected sample and it is corrected by adding the IMR to the explanatory variables in the second stage of the analysis (OLS). This methodology is informed by the restrictive assumption of normally distributed error terms (Wooldridge, 2010). So, Heckman two- step model is employed when there is sample selection bias indicated by the significance of the inverse mills ratio. However, when the inverse mill ratio computed from the first step of Heckman two-step model is not significant as a result of selection bias, the double hurdle model is appropriate for use for the analysis (Kelifa, 2023). Following Andaregie, Astatkie and Teshome (2021), the decision to participate in agricultural commercialization and the extent of participation (intensity of participation) is modelled and employed in this study thus:

$$Y_i = \beta X_i + \cup_i \dots\dots\dots\dots\dots\dots\dots\dots 3$$

Y_i = a dummy dependent variable (1 = agricultural commercialization; 0 = non- agricultural commercialization) indicating the agricultural commercialization participation of the ith rice farmer. If it is 1, it means the rice farmer sells at least some of his/her output in the market and 0 means he/she does not sell.

β = a vector of coefficients of the explanatory variables

X_i = a vector of the explanatory variables that influence agricultural commercialization participation measured on the ith rice farmer, $\cup_i$ is the ith error term.

In the second step, the quantity of rice offered for sale, that is intensity of agricultural commercialization participation was estimated by including an estimate of the inverse mill's ratio (λ_j) in equation 4 (outcome equation) as;

$$Y_j = \beta_j X_j + \lambda_{i\mu} + \mu_j \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 4$$

where Y_j = The quantity of rice offered for sale (a measure of intensity of participation) by the ith rice farmer.

β_j = unknown parameters to be estimated in equation 4 (the outcome equation).

X_j = factors that are expected to influence the quantity of rice offered for sale by the ith rice farmer

λ = factor for correcting selection bias known as inverse mills ratio.

$$\lambda_i = \varphi(\rho + \alpha X_i) \div \emptyset(\rho + a X_1) \dots\dots\dots\dots\dots\dots\dots\dots 5$$

Where φ is standard normal density function and

$\emptyset$ = Standard normal distribution function

Definitions of variables and measurement
Dependent variable
Y_i = commercialization (1=commercialization participation, 0, otherwise)
Y_j = Intensity of commercialization (continuous; value of rice sold in naira)
Independent variables
X_1 = *Sex of the Household head* (Binary (1=male; 0=otherwise)
X_2 = *Age of the Household head* (Continuous in years)
X_3 = *Age of the Household head squared* (Continuous in years)
X_4 = *Adult equivalence* (Number)
X_5 = *Years of formal education of the household head* (Years)
X_6 = *Livestock value* (Naira)
X_7 = *Other crops income* (Naira)
X_8 = *Credit value* (Naira)
X_9 = *Contact with extension agents* (Yes =1, 0 otherwise)
X_{10} = *Membership of agricultural production group* (Yes = 1; 0=otherwise)
X_{11} = *Trust in traders* (Yes=1; 0=otherwise)
X_{12} = *Ownership of means of transport* (Yes =1; 0=otherwise)
X_{13} = *Cost of transportation per ton* (Naira)
X_{14} = *Mobile phone ownership* (Yes=1; 0=otherwise)

RESULTS AND DISCUSSION
Commercialization status of respondents
Table 2 presents distribution of respondents by participation in agricultural commercialization. About 64% of the surveyed respondents commercialized i.e. sold at least some of the rice they

had produced on their farms. On the other hand 36% of the sampled respondents did not commercialize. In other words, about one-third of the sampled respondents practised subsistence farming with respect to rice production. Since there are more participants of commercialization, it is expected that a reasonable proportion of respondents that commercialized should be able to generate marketable surplus which is expected to increase the quantity of rice produce in Nigeria with an attendant reduction in the tendency to import rice. Muricho (2015) found in his study that a large percentage of his respondents (75%) commercialized.

Table 2: Distribution of Respondents by Commercialization Status

Commercialization Status	Frequency	Percentage
Commercialized Respondent	269	64.0
Non-Commercialized Respondent	151	36.0
Total	420	100

Source: Source: Author's computation from survey data

Socio-economics characteristics of respondents

Table 3 showed that majority of the respondents are within 60 years in terms of age irrespective of their commercialisation status. Furthermore, the average age of the sampled respondents regardless of their commercialization status was 47.2years. This implies that the sampled respondents were in their active and productive age. It is expected that being in their active and productive age would enable them engage in income – generating activities such as agricultural commercialization that has positive welfare implication.

Also from table 3, 68.4% of the respondents that commercialized were male while the rest were female. However, for non-commercialized respondents, 67.5% were male while the rest were female. This implies there were more male rice farmers than female rice farmers in the sample. This finding could be associated with the possibility that rice farming is a labour and resource-intensive enterprise (requires much productive resources that men are usually more endowed with than women especially in African setting). The usual practice in farming enterprise is that women tend to support their husbands in the processing aspect of rice production activities. Nonetheless, the need for self-sufficiency in rice production in Nigeria calls for involvement of both men and women in rice production particularly now that various programmes have been in put in place by government to encourage participation in rice commercialization.

Moreover, it can be seen from table 3 that all the commercialized respondents acquired varying levels of formal education. In the case of non-commercialised respondents, 8.6% of them did not have formal education while the rest showed varying levels of acquisition/completion of formal education like their commercialised counterparts. The average number of years that commercialized and non-commercialized respondents spent to acquire formal education were about 10.5years and 9.3 years respectively. This implies that commercialized respondents were more educated than their non-commercialized counterparts. The level of education acquired by someone could influence his/her ability to process information at his/her disposal and take decisions or make choices capable of improving his/her livelihood strategies (Ukpe, Nweze & Arene, 2016). Furthermore, table 3 depicts that the commercialized respondents had (about 69%) of their members in associations than non-commercialized respondents that had 40.4% of their members belonging to one association or another. This may be because belonging to association confers some benefits on members of such associations. Such benefits include: access to important production and marketing information and reciprocity which are incentives to participation in agricultural commercialization. Furthermore, the results on table 3 showed that while all the non-commercialized respondents produced varying quantities of rice which were less than 1 tonne, no commercialized respondent produced quantity of rice that was less than 1 tonne. Intuitively, farmers who produce above the level of need of his household would consider selling the surplus in the market. The results on table 3 with respect to the quantity of output produced, supports Muricho (2015) who found that respondents that produced large quantity of produce are more likely to commercialize. Another result presented on table 3 is means of transportation owned by the respondents. The result showed that both commercialized and non-commercialized respondents either trekked to their farms or used different types of means of transport as shown in table 3 to get to their farms. However, more than half (51%) of the non-commercialized respondents trekked whereas about 54% of the commercialized respondents go to their farms on their motor cycle. Ownership of means of transportation can help respondents to reduce transaction costs, enhance access to market and ultimately motivate a farmer to

participate in agricultural commercialization. Farms that are located at far distance (remote) from the market tend to make farmers incur more transaction / transportation cost which in turn reduces the potential income of such respondents. Therefore, remote farms reduce income potential of farm due to high transaction cost which reduces respondents' profit margin which may discourage the farmer from participating in agricultural commercialisation. This finding is in line with Renkow, Hallstrom, and Karanja. (2004), who found that ownership of transportation is associated with reduced transaction cost and increased market access.

Table 3: Socio-economic characterises of respondents

Status/	Commercialized		Non-commercialized	
Characteristics	Frequency	Percentage	Frequency	Percentage
Age				
≤30	27	10.0	15	9.9
31-40	47	17.5	27	
40-50	85	31.6	48	31.8
51-60	72	26.8	43	31
>60	38	14.1	18	11.9
Total	269	100.0	151	100.0
Mean	47.2		47.2	
Sex				
Male	184	68.4	102	67.5
Female	85	31.6	49	32.5
Total	296	100.0	151	100.0
Years of formal education				
0	-	-	13	8.6
1-6	24	8.9	72	47.7
7-12	167	62.1	45	29.8
13-18	78	29	21	13.9
Total	269	100.0	151	100.0
Mean	10.5		9.3	
Membership of Agricultural Production Network Group				
Yes	84	31.2	9	6.0
No	185	68.8	142	94.0
Total	269	100.0	151	100.0
Ownership of Means of Transportation				
None	50	18.6	77	51.0
Bicycle	9	3.3	8	5.3
Tricycle	19	7.1	12	7.9
Motorcycle	146	54.3	35	23.2
Vehicle	45	16.7	19	2.6
Total	269	100.0	151	100.0
Quantity of Rice Produced (Tons)				
< 1	-	-	151	100.0
1 – 4.9	84	31.2	-	-
5 – 8.9	129	48.0	-	-
9 – 12.9	32	11.9	-	-
13 – 16.9	16	5.9	-	-
> 16.9	8	3.0	-	-
Total	269	100.0	151	100.0
Mean	8.0		0.5	

Source: Source: Author's computation from survey data

Determinants of Agricultural Commercialization Participation/Intensity of commercialization among Sampled Respondents

The econometric results of the Heckman sample selection model are presented in table 4. In general, the model performs well. The goodness of fit measure Prob>Chi^2 is significant at 1%. Ownership of mobile phone was used as exclusion restriction variable for identification purpose. It was significant at 1% level. Again, Inverse mills ratio that was generated to correct for selection bias was significant at 1%, similarly Sigma and rho were also significant at 1%. These statistic justified the use of Heckman sample selection bias regression. Sex did not significantly influence the decision to commercialize but had positive relationship with it. However, sex significantly and positively influenced intensity of commercialization at 5% level of significance. This implies that male-headed respondents are more likely to intensively commercialize than female-headed respondents. This may be because male-headed respondents are less resource – constrained than female-headed respondents. Male-headed respondents tend to have better access to productive resources (land, labour and capital) which they can leverage on to produce more intensively than their female counterparts who are resource-constrained. This finding is consistent with Mmbado *et al* (2015), who found that male- headed respondents tend to be more resource endowed.

Age significantly and positively influenced respondents' decision to participate in agricultural commercialization and respondents' intensity of commercialization at 1% level of significance in both cases. This implies that young respondents are more likely to commercialize than old respondents. Since age squared had no significant relationship to both participation and intensity, it means that this finding could be informed by the possibility that young respondents are more active, daring, vigorous and vibrant than old respondents. Young farmers are less risk averse and are more willing to try new highly productive agricultural technologies that enable them to produce more marketable surplus than older farmers. Young farmers are more likely to venture into high-return but highly – risky cash crop to earn more money. This result agrees with Abu (2015), who argued that young farmers are more willing to undertake high risk but high returns agribusiness.

Adult equivalent significantly and positively affected decision to commercialize at 5% level of significance. However, adult equivalent had no significant relationship with intensity of commercialization. This implies that large-size adult equivalent respondents are more likely to commercialize than small-size adult equivalent respondents. This may be attributed to the possibility that as the number of adults in the respondent's household increases, the more the availability of free or cheap family labour for rice production which in turn can inform the decision to commercialize. This result supports Agwu, Anyanwu and Mendie (2012), who found that respondents that commercialize usually have a large-size adult equivalent household. Number of years spent in school to acquire formal education significantly and positively affected decision to commercialize at 5% level of significance. This is in line with Gebremedhin and Jaleta (2010), who found that educated respondents are more likely to manipulate available resources to obtain a better pay-off. Similarly, number of years spent in school to acquire formal education significantly and positively affected intensity of commercialization at 10% level of significance. This implies that respondent having one more of year of formal education is more likely to commercialize as well as produce more intensively compared with a similar respondent having one year less of formal education. This finding could be associated with better skills and better access to information that enable the respondent to process information accurately (Mottaleb, Mohanty and Nelson (2015). This accurate information processing is likely to make respondents to decide to commercialize in a more profitable manner than otherwise. Earning income from other crops significantly and positively influenced decision to commercialize at 5% level of significance. Similarly, earning income from other crops significantly and positively influenced the intensity of commercialization. This implies that respondents earning income from other crops are more likely to commercialize not only that and commercialize more intensively than similar respondents without income from other crops. This may be linked to the possibility that income from other crops may serve as production credit for respondents that earn it. Access to farm inputs particularly high yielding crop varieties and improved technology can be facilitated by earning income from other crops. The result agrees with Kibirige (2016), who found that earning from other source insures respondents against loss. Amount of credit obtained significantly and positively influenced decision to commercialize at 1% level of significance. Similarly, amount of credit obtained significantly and positively influenced the intensity of commercialization at 1% level of significance. This implies that respondents that obtain a higher amount of credit are more likely to commercialize and produce more marketable surplus (intensity of commercialization) than a similar respondents with lower amount of credit. This may be because credit has potential to improve productivity. Also, amount of credit obtained can aid expansion of farm and invariably the intensity of commercialization. This result is consistent with Sekyi, Abu and Nkegbe (2020), who found that farm expansion is associated with amount of credit obtained. Membership of association significantly and positively affected

decision to commercialize at 1% level of significance. Similarly, membership of association significantly and positively affected the intensity of commercialization at 5% level of significance. This implies that respondents that are members of associations are more likely to commercialize and also produce more marketable surplus compared to similar respondents that are non-members of association. This finding could be related to potential benefits (such as economy of scale/ reduced transaction costs, market linkages opportunities, access to credit and sharing of important farm business information) inherent in belonging to association. This result corroborates Akinlade, Balogun and Obisesan (2013). Also, Ntakyo and van der Berg (2019), found that respondents who are members of association have access to important production and marketing information and reduced transaction cost which could serve as an incentive for a respondent to intensify his level of commercialisation. Ownership of phone significantly and positively affected decision to commercialize at 5% level of significance. This implies that respondents that possess mobile phone are more likely to commercialize than similar respondents that did not possess mobile phone. This could be informed by the possibility that phone can be used to gather market information. Mobile phone being a communication asset enables the owner to gather both favourable and unfavourable market price information that can be processed in order to take a decision with respect to commercialize or otherwise. Nigeria is characterized by instability of government policies (e.g government may ban rice importation today and lift the ban tomorrow) as such producers have to gather information and process such information in order to arrive at an economically justifiable and worthwhile decision. This result agrees with the findings of Muricho (2015), who found that respondents that possess phone have access to important information at reduced cost thereby encouraging them to intensify production for market.

Ownership of means of transportation significantly and positively influenced the decision to commercialize at 1% level of significance. This indicates that respondents that possess means of transportation are likely to commercialize compared to similar respondents that did not possess means of transportation. This could be associated with the fact that respondents that possess these means of transportation have overcome the hurdle of moving their produce to a better market where they can get a fair price. This would reduce per unit transport costs for such respondents thus increasing their profit margin as such commercialization becomes appealing. This finding is consistent with Muricho (2015), who found that respondents that own means of transportation have access to market at reduced cost and by extension increased welfare outcome. Cost of transportation per ton significantly and negatively influenced the decision to commercialize at 1% level of significance. Similarly, this variable also significantly and negatively influenced the intensity of commercialization at 1%. This implies that respondents that incurred lower cost of transportation per ton to transport their produce to main market are more likely to commercialize and increase their intensity of commercialization compared to similar respondents that incurred higher cost of transportation per ton in doing so. This could be linked to the possibility of increasing profit margin. A rational and profit – maximizing producer would commercialize and increase his intensity of commercialization if the difference between his revenue and average cost of transportation increases. These results agree with Obisesan (2017), who found that low transaction cost is positively associated with high intensity of commercialisation and vice versa.

Table 4: Results of Heckman Sample Selectivity bias for Analysing Agricultural Commercialization Participation and Intensity among Rice Farming Respondents

Variable	Selection equation		Outcome equation	
	Coefficient	Std. error	Coefficient	Std. error
Sex	0.005	0.007	0.677**	0.312
Age	0.003***	0.0004	0.080***	0.014
Age^2	-0.002	0.003	-0.156	0.153
Adult Equivalent	0.004***	0.002	-0.051	0.067
Years of Formal Education	0.003**	0.002	0.1811***	0.041
Livestock Value	4.75e-09	6.11e-08	3.42e-07	3.01e-06
Other Crops Income	1.32e-07**	5.85e-08	6.29e-05***	1.43e-05
Credit value	4.38e-07***	1.16e-07	2.20e-05***	5.92e-06
Extension contact	0.004	0.015	0.788*	0.454
Membership of Agricultural Production Group	0.026***	0.007	0.998**	0.472
Trust in Trader	0.007	0.006	0.025	0.289
Ownership of Means of Transport	1.217***	0.413	0.002	0.015
Cost of Transport Per Tonne	-0.0002***	8.39e-06	-1.33e-03***	2.08e-04
Ownership of Mobile Phone	0.086***	0.018		
Mills Ratio	0.056***	0.015		
Constant	8.704***	1.047	4.326***	0.563
Number of Observation	420			
Prob >chi^2	0.0000***			
Rho			0.781***	0.118
Sigma			0.072***	0.018

Note: Coefficients followed by *, **, and *** indicate significance at the 10%, 5% and 1% levels respectively
Source: Source: Author's computation from survey data

CONCLUSION AND RECOMMENDATION

This study explores the determinants of agricultural commercialization among smallholder rice farmers in Ekiti-State, the results of the econometric analysis revealed that farmer and household characteristics such as age and years of education significantly influenced both the decision to participate in commercialization and the intensity of participation in commercialization. However, adult equivalence and sex significantly influenced the decision to participate in agricultural commercialization and the intensity of the participation respectively. Also, receiving income from production of other crops in addition to rice, assessing credit and being a member of agricultural production group significantly influenced both the decision to participate in agricultural commercialization and the intensity of participation. Further significant influence was found with respect to cost of transportation per tons of rice produced for both the decision to participate in agricultural commercialization and the intensity of commercialization. This emphasizes the significant role been played by transaction costs in influencing agricultural commercialization in terms of the decision to participate and the intensity of participation. Other transaction cost variables that significantly influenced the decision to participate in agricultural commercialization from our results are ownership of means of transportation and phone. The results further showed that contact with extension agents significantly influenced the intensity of participation in agricultural commercialization.

These findings have important policy implications, market production related programmes in respect of rice should target mostly young people who can cope with the laborious nature of rice production as well as take risks involved in rice production and marketing. Involving the youth in participating in such programmes would address the issue of unemployment that prevails in the society. In the same vein provision of education opportunities potential participants in agricultural commercialization via adult education programme would impact positively on adoption of production/ marketing innovation that usually accompanies programmes aimed at boosting participation in agricultural commercialization. Encouragement of educated people particularly youths should be prioritized in accomplishing the promotion of agricultural commercialization because they would be receptive to production and marketing innovations that are usually composites of programmes aimed at

boosting agricultural commercialization. Government can encourage this group of people to participate in agricultural commercialization by marking their access to production inputs relatively easy as well as ensuring the effectiveness of marketing institution and infrastructures. To participate in agricultural commercialization and intensify the participation, financial resource is required. Engagement in the production of other crops in addition to rice, accessing credit either from credits groups consequent upon membership or other credit sources are important means of raising funds to participate in agricultural commercialization. As such, government, non-government organization (NGO) and other credit providers should be made. The bulk of their credit disbursement through production groups. This idea of credit disbursement through group would spur formation of groups especially cooperatives which will facilitate other receipt of other advantages including important production and marketing information sharing in addition to credit access

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