

## Effect of Anchor Borrowers' Programme Access among Rice Farmers in Benue State, Nigeria: Application of Endogenous Switching Regression Model

\*Okeke, A.M.<sup>1</sup>; Mbanasor, J.A.<sup>2</sup>; Nto, P.O.<sup>2</sup>

<sup>1</sup>Department of Agribusiness, Federal University of Agriculture, Makurdi, Benue State, Nigeria.

<sup>2</sup>Department of Agribusiness and Management, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

\*Correspondence author: [anayomichaelokeke@gmail.com](mailto:anayomichaelokeke@gmail.com)

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### ABSTRACT

*The effect of Anchor Borrowers' programme (ABP) access among rice farmers in Benue State, Nigeria was examined. Data for the study were collected with the aid of structured questionnaires from 768 rice farmers consisting of 388 beneficiaries and 380 non-beneficiaries from 18 communities and 18 Local Government Areas using multi-stage sampling technique. The collected data were analysed using independent t-test and Endogenous Switching Regression Model (ESRM). The independent t-test results showed that the income and farm output of beneficiaries of Anchor Borrowers' Programme were significantly higher compared to the non-beneficiaries. The ESRM revealed that rice farmers' access to ABP was significantly influenced by their socio-economic characteristics and that beneficiary and non-beneficiary rice farmers were not better or worse in terms of farm income than a random rice farmer from the samples. Also, the ESRM showed that beneficiary rice farmers acquired lesser productive assets than what a random rice farmer from the sample would have earned while non-beneficiary rice farmers acquired more productive assets than what a random rice farmer from the sample would have earned. The study recommended that Federal government should consolidate on the gains of ABP in the State and extend the credit to more rice farmers.*

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**Keywords:** Anchor Borrowers' Programme, Income, Productive assets, Rice farmers, Endogenous Switching Regression, Benue State, Nigeria

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### INTRODUCTION

The inability of rice farmers to access tractors, credit and other requisite farm inputs at affordable prices make them to be perpetually poor as farm size and yield remain stagnated. Consequently, Nigeria has failed to bridge the gap between domestic production of rice and domestic demand for rice making the country to depend on the international markets to fill the demand-supply gap at a colossal amount of foreign exchange owing to the low productivity in the local production of rice. In response to these challenges pose by high cost of farm inputs among rice farmers in Nigeria, successive governments have adopted different policies such as tariff protection, subsidy, and credit support (USAID, 2008) for rice production which have all functioned to stimulate

smallholder rice production. One of such credit support schemes is the Anchor Borrowers' programme (ABP).

Several empirical studies have been carried out to appraise the Central Bank of Nigeria (CBN) programmes and schemes in agricultural development in Nigeria. For instance, Ayeomoni and Aladejana (2016) studied agricultural credit and economic growth nexus in Nigeria; Udoka *et al.* (2016) studied the effect of commercial banks' credit on agricultural production in Nigeria; Obasi (2015) looked at the efficiency of agricultural lending schemes in Nigeria; Eneche *et al.* (2014) examined the effect of Agricultural Credit Guarantee Scheme Fund (ACGSF) on production efficiency of rural farmers in Benue State, Nigeria; Ayegba and Ikani (2013) studied the impact of agricultural credit on rural farmers in Nigeria; Obilor (2013) studied the impact of commercial banks' credit to agriculture on agricultural development in Nigeria.

However, no study has been done on the effect of Anchor Borrowers' Programme access among rice farmers in Nigeria. Thus, this study aimed at bridging this knowledge gap.

The broad objective of this study was to investigate the effect of Anchor Borrower' Programme access among rice farmers in Benue State, Nigeria. Specifically, the objectives were to:

- i. compare the value of productive assets, farm output, income, and profit of beneficiary and non-beneficiary rice farmers; and
- ii. examine the effect of ABP access on the income and productive assets acquisition among rice farmers in the study area.

## METHODOLOGY

**The Study Area:** The study was conducted in Benue State, Nigeria. The State is situated between latitudes 6<sup>0</sup>25'N and 8<sup>0</sup>8'N and longitudes 7<sup>0</sup>47'E and 10<sup>0</sup>E. Benue State is the nation's acclaimed food basket of the nation because of the abundance of its agricultural resources. The State is a major producer of food and cash crops (BNARDA, 2004). Smallholder farmers who are involved in arable crop production like rice, yam, cassava, sweet potato, maize, vegetables, soya bean, as well as livestock like poultry, goat, sheep, piggery, cattle, and fish abound in the State.

**Sampling Technique and Data Collection:** Multi-stage sampling technique was employed to select a sample size of 768 rice farmers consisting of 388 beneficiary and 380 non-beneficiary rice farmers of the Anchor Borrowers' Programme selected from 18 communities and 18 Local Government Areas.

The data for the study were collected using structured questionnaires. Data were collected on the socio-economic characteristics of the respondents; costs and returns of rice production in the study area; farm output, income and productive assets acquired by the respondents; credit demanded and level of utilization of such credit among the respondents; and challenge to credit demand and utilization among respondents.

**Analytical Techniques:** The data collected were subjected to descriptive and econometric analyses. Objective one was realized using independent t-test while objective two was realized using Endogenous Switching Regression Model (ESRM).

### T-test

The t-test is used to assess whether the means of two groups are statistically different from each other. They are tests used on data that are parametric and normally distributed.

There are two major variants of the t-test. They are:

- i. The independent t-test
- ii. The repeated-measures t-test also known as paired-samples or related t-test

The independent t-test is applied in situation where you have two separate groups of individuals or cases in a between-participants design. In other words, the independent samples t-test is used to compare two groups whose means are not dependent on one another.

The dependent samples t-test is used when researchers want to compare two means that are dependent on each other.

This study employed the independent samples t-test in comparing the income, farm output, profit, value of assets of beneficiaries and non-beneficiaries of ABP in the study area.

The independent t-test model for objective one was specified as follow:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \dots\dots\dots (1) \text{ Kim (2015)}$$

Where:

t = calculated t-value

$\bar{X}_1$  = mean value of productive assets, farm output, income and profit of beneficiary rice farmers

$\bar{X}_2$  = mean value of productive assets, farm output, income and profit of non-beneficiary rice farmers

$S_1^2$  = variance of value of productive assets, farm output, income and profit of beneficiary rice farmers

$S_2^2$  = variance of value of productive assets, farm output, income and profit of non-beneficiary rice farmers

$n_1$  = sample size of beneficiary rice farmers

$n_2$  = sample size of non-beneficiary rice farmers

### Endogenous switching regression model

The study adopted endogenous switching regression (ESR) to analyse the effect of ABP access among rice farmers in the study area. ESR is suitable for situations where we are interested in the effect of being in one of two different positions or regimes (e.g. beneficiary versus non-beneficiary) on a desired outcome.

In this study, the two decision states or regimes are whether or not rice farmers accessed ABP, while the outcomes of interest are productive assets acquisition and farm income (measured in Naira). Since the decision to access ABP is voluntary, rice farmers may self-select into ABP, resulting in a biased sample and difficulty in determining causation. For example, beneficiaries in ABP may possess systemically different household attributes from non-beneficiaries as a result of self-selection.

The use of ESR controls for observable as well as unobservable factors that might account for farmers' propensity to access ABP as well as farm performance.

The first step in the application of ESR is to estimate the determinants of access to ABP using Probit model (Lokshin and Sajaia, 2004) as follows:

$$P_i^* = \beta Z_i + \mu_i \dots\dots\dots (2)$$

$$P_i = 1 \text{ if } P_i^* > 0 \dots\dots\dots (3)$$

$$P_i = 0 \text{ if } P_i^* \leq 0 \dots\dots\dots (4)$$

Where  $P_i^*$  is the latent dependent variable for access to ABP, which is observed through the choice to access ABP. The observed dichotomous choice to access ABP is given by  $P_i$  which is equal to 1 for beneficiaries and 0 for non-beneficiaries.  $Z_i$  is a vector of farm and household characteristics affecting access to ABP;  $\beta$  is a vector of unknown parameters; and  $\mu_i$  is a random error term.

The  $Z_i$  variables include sex, age, marital status, household size, educational level, farming experience, farm size, dependent ratio, and membership of cooperative.

The second step in executing the ESR model is to derive separate productive assets acquisition and farm income functions for the two farmers' group. The productive assets acquisition and farm income models are specified as follows

$$\text{Beneficiaries (if } P_i = 1): Y_{1i} = \beta_1 X_{1i} + \epsilon_{1i} \dots\dots\dots (5)$$

$$\text{Non-beneficiaries (if } P_i = 0): Y_{2i} = \beta_2 X_{2i} + \epsilon_{2i} \dots\dots\dots (6)$$

$Y_{1i}$  and  $Y_{2i}$  are the dependent variables (log of value of productive assets and farm income) in the productive assets acquisition and farm income equations for beneficiaries and non-beneficiaries

respectively;  $X_{1i}$  and  $X_{2i}$  represent vectors of exogenous variables, while  $\beta_1$  and  $\beta_2$  are vectors of parameters; and  $\epsilon_{1i}$  and  $\epsilon_{2i}$  are random disturbance terms.

In order to address the sample selectivity bias, the ESR technique relies on joint normality of the error terms in the access to ABP, productive assets acquisition, and farm income equations. The error terms  $\mu_i$ ,  $\epsilon_{1i}$ , and  $\epsilon_{2i}$  are assumed to have a trivariate normal distribution with mean zero and covariance matrix.

According to Lokshin and Sajaia (2004), full information maximum likelihood (FIML) is an efficient way to estimate ESR models. This study adopted FIML to analyse the ESRM. The FIML estimates of the parameters of the ESR model for this study were obtained using Stata command *movestay* (Lokshin and Sajaia, 2004).

In order to ensure that the model is properly identified, at least one independent variable in the first stage Probit access to ABP regression is not included in the second stage productive assets and farm income regression (Maddala, 1983). A requirement for the selection instrument is that it must have a direct effect on access to ABP but not on the outcome of interest (i.e. productive assets acquisition and farm income). The study used membership of cooperative society as the selection instrument (or identification restriction) because it directly affects the access to ABP but not productive assets acquisition and farm income.

## RESULTS AND DISCUSSION

### COMPARISON OF THE VALUE OF PRODUCTIVE ASSETS, FARM OUTPUT, INCOME, AND PROFIT OF BENEFICIARY AND NON-BENEFICIARY RICE FARMERS

The estimated Average Treatment Effect (ATE) and t-test analysis of variables used to determine the effect of the ABP are presented in Table 1 below.

The findings in Table 1 indicates that rice farmers' productive assets acquisition improved more for ABP beneficiaries (₦111,325.88) than for non-beneficiaries (₦97,075.50). The estimated average treatment effect (ATE) was positive (₦14,250.37) indicating increase.

**Table 1: Estimated ATE and t-test analysis of variables used to determine effect of ABP**

Variable	Beneficiaries	Non-beneficiaries	ATE	t-test	p-value
<b>Productive assets (₦)</b>	111,325.88 (76678.670)	97075.50 (128780.45)	14250.37	1.516	0.130 <sup>NS</sup>
<b>Income (₦)</b>	357342.13 (276401.29)	286567.91 (237130.54)	70774.22	3.152	0.002 <sup>***</sup>
<b>Profit (₦)</b>	164001.16 (170838.76)	159455.03 (190063.16)	4546.13	0.299	0.765 <sup>NS</sup>

<b>Farm output (Bag)</b>	29.90 (21.65)	19.67 (9.95)	10.23	6.483	0.000***
<b>Cost (₦)</b>	191925.34 (139485.19)	126639.74 (65623.28)	65285.61	6.521	0.000***

**Source: Field survey data, 2018. \*\*\*= significant at 1% level; NS = Not Significant; values in bracket are standard deviation of the corresponding mean; 1bag = 50 kg.**

The t-test reveals that there was no significant difference in the value of productive assets of beneficiaries and non-beneficiaries in the ABP ( $t = 1.516, p > 0.05$ ). This is attributed to the high cost incurred by the beneficiaries (₦191,925.34) compared to that incurred by the non-beneficiaries (₦126,639.74) in their farm enterprise. The t-test analysis reveals there was significant difference in the cost of production of beneficiaries and non-beneficiaries in the ABP ( $t = 6.521, p < 0.01$ ). This finding is in agreement with Madu *et al.* (2016) who in a study on the effect of a community-driven development project (Fadama II) on rural farming communities in Adamawa State, Nigeria, reported a positive significant increase in the value of productive assets among the project participants.

Analysis of Table 1 reveals that rice farmers' income improved significantly more for ABP beneficiaries (₦375,342.13) than for non-beneficiaries (₦286,567.91). The estimated average treatment effect (ATE) was positive (₦70,774.22) indicating significant increase. The t-test analysis indicates there was a significant difference in the income of beneficiaries and non-beneficiaries in the ABP ( $t = 3.152, p < 0.01$ ). The implication is that ABP has enhanced the capacity of the beneficiaries to realize significant increase in their income. This finding is in agreement with Adesiji *et al.* (2011) who in a study on the effects of credit utilization on youth farmers' rice output in Patigi Local Government Area of Kwara State, Nigeria, revealed an increase in the average annual income of majority of youth rice farmers that received credit.

The results in Table 1 shows that rice farmers' profit improved more for ABP beneficiaries (₦164,001.16) than for non-beneficiaries (₦159,455.03). The estimated average treatment effect (ATE) was positive (₦4,546.13) indicating increase. The t-test analysis reveals there was no significant difference in the profit of beneficiaries and non-beneficiaries in the ABP ( $t = 0.299, p > 0.05$ ). The insignificant difference in the profit of beneficiaries and non-beneficiaries in the ABP was due to the high cost incurred by the beneficiaries (₦191,925.34) when compared to that incurred by the non-beneficiaries (₦126,639.74) in their rice production business. The implication is that ABP has enhanced the capacity of the beneficiaries to realize increase in their profit which could be attributed to increase in their farm output. This finding is in consonance with Javed *et al.* (2006) who posited that micro credit contributes to improved crop production, income and thus farmers' livelihood.

Furthermore, analysis of Table 1 indicates that rice farmer farm output improved more for ABP beneficiaries (29.90 bags) than for non-beneficiaries (19.67 bags). The estimated average treatment effect (ATE) was positive (10.23 bags) indicating significant increase. The t-test result

shows that there was significant difference in the farm output of beneficiaries and non-beneficiaries in the ABP ( $t = 6.483$ ,  $p < 0.01$ ). The implication is that ABP has enhanced the capacity of the beneficiary rice farmers to realize significant increase in their farm output. This finding agrees with Adebayo and Adeola (2008) who observed that agricultural credit enhances productivity and promotes standard of living by breaking the vicious cycle of poverty of the resource poor farmers.

### EFFECT OF ANCHOR BORROWERS' PROGRAMME (ABP) ON FARM INCOME

The effect of ABP on the income of rice farmer is presented in Table 2 below.

Table 2 shows that the likelihood ratio test for joint independence of the three equations was statistically significant at 1%. The implication is that these three models are not jointly independent and should not be estimated separately. In other words, the three equations are dependent.

**Table 2: Full Information Maximum Likelihood (FIML) estimates of the endogenous switching regression model for farm income**

Variables	Access to ABP (1/0)	Benefited = 1	Did not benefit = 0
constant	1.879*** (0.544)	12.463*** (0.300)	11.911*** (0.145)
Sex	0.222 <sup>NS</sup> (0.160)	0.560*** (0.115)	0.001 <sup>NS</sup> (0.039)
Age	-0.045*** (0.011)	-0.030*** (0.007)	-0.014*** (0.003)
Marital status	0.331 <sup>NS</sup> (0.234)	1.114*** (0.178)	0.168*** (0.053)
Household size	0.126*** (0.024)	0.072*** (0.016)	0.035*** (0.008)
Educational level	-0.173*** (0.023)	-0.045*** (0.017)	0.009 <sup>NS</sup> (0.007)
Farming experience	0.092*** (0.018)	-0.002 <sup>NS</sup> (0.007)	0.004 <sup>NS</sup> (0.004)
Farm size	0.320*** (0.052)	0.124*** (0.033)	0.206*** (0.018)
Dependent ratio	-0.061 <sup>NS</sup> (0.216)	0.031 <sup>NS</sup> (0.120)	0.166*** (0.053)
Membership of cooperative	-0.089*** (0.019)		
/ln <sub>1</sub>		-0.427*** (0.045)	
/ln <sub>2</sub>			-1.386*** (0.053)
/r <sup>1</sup>		-0.009 <sup>NS</sup> (0.175)	

$/r^2$		-0.279 <sup>NS</sup> (0.214)
<b>Sigma_1</b>	0.652*** (0.030)	
<b>Sigma_2</b>		0.250*** (0.013)
<b>rho_1</b>	-0.009 <sup>NS</sup> (0.175)	
<b>rho_2</b>		-0.272 <sup>NS</sup> (0.198)
<b>LR test of indep.eqns</b> 414.15***		

**Source: Field survey data, 2018. Standard errors in parentheses. \*\*\* = significant at 1%; NS = not significant**

The covariance terms (rho\_1 and rho\_2) are non-zero indicating that the model shows endogenous switching (Maddala, 1986). This therefore justifies the use of the Endogenous Switching Regression (ESR) model.

The correlation coefficient rho\_1 which shows the correlation between the ABP access equation and the beneficiaries' farm income equation was negative and not statistically different from zero. This implies that rice farmers who accessed ABP were not better or worse than a random rice farmer in terms of farm income improvement. In order words, the beneficiaries in the ABP did not better or worse than a random rice farmer in terms of farm income improvement.

The correlation coefficient rho\_2 which shows the correlation between the ABP access equation and the non-beneficiaries farm income equation was negative and not statistically different from zero. This implies that rice farmers who did not accessed ABP were not better or worse than a random rice farmer in terms of farm income improvement.

The result of the estimates in Table 2 and Table 3 are in three parts. One part consists of the Probit model for the determinants of ABP access. The estimates of the coefficient for the Probit model are shown in the first column of Table 2 and Table 3.

The coefficient of sex was significant at 1% and positively related to ABP access. The positive sign of the coefficient is in congruent with the *a priori* expectation, implying that male rice farmers were more likely to have accessed the ABP. The different economic activities engaged by men and women have impact on their probability of access to credit. Since women lack control and ownership of productive resources, they lack the required collateral to secure loans from formal financial lenders. This finding conforms to Owusu (2017a) who revealed that formal financial lenders feel pessimistic on women ability to repay credit as they lack the required collateral such as land that are mostly owned and controlled by male farmers.

The coefficient of marital status was significant at 1% and positively related to ABP access. The positive sign of the coefficient agrees with the *a priori* expectation implying that married rice farmers were more likely to have accessed the ABP. Farmers who are widows, divorcees, and



unmarried tend to face difficulties in accessing credit owing to their high level of mobility which discourages formal financial institutions in extending credit to them. This finding agrees with Owusu (2017a) who revealed that married farmers are likely to access credit from formal financial institutions as they are less mobile to be located and their loan repayment easier as it is jointly made.

The coefficient of dependent ratio was significant at 1% and negatively related to ABP access. The negative sign of the coefficient agrees with the *a priori* expectation, implying that rice farmers with large number of dependents were less likely to have accessed the ABP. Farmers with lower dependent ratio are more likely to access credit from formal financial sources as they consider such farmers more reliable in repaying the borrowed fund. This finding is in congruent with Kosgey (2013) who reported that households with lesser dependents accessed agricultural credit than those with higher dependents as formal credit institutions consider them as capable of utilizing their loans on the intended purpose as opposed to bigger ones.

The coefficient of age was significant at 1% and negatively related to ABP access. The negative sign of the coefficient agrees with the *a priori* expectation, implying that older rice farmers were less likely to have accessed the ABP. Older farmers are less likely to access credit from credit institutions as these institutions prefer giving credit to younger farmers who can easily repay the borrowed fund. This finding conforms to Akudugu (2012) who revealed that banks are more inclined to supplying credit to farmers within the economically active age group as they tend to use age as a proxy for maturity and ability to use credit and to repay.

The coefficient of household size was significant at 1% and positively related to ABP access. The positive sign of the coefficient differs with the *a priori* expectation, implying that rice farmers with large household size were more likely to have accessed the ABP. Large household size that consist of more adult members positively influences access to credit from formal financial sources as it improves the family business through the provision of more labour. This finding agrees with Bendig *et al.* (2009) who reported a positive relationship between household size and access to credit.

The coefficient of educational level was significant at 1% and negatively related to ABP access. The negative sign of the coefficient differs with the *a priori* expectation implying that rice farmers with higher educational level were less likely to have accessed the ABP. Farmers with formal education have the capacity to understand credit scheme and its terms and conditions compared to farmers with low level of education. However, educated rice farmers who did not access the ABP were the older rice farmers as credit institutions prefer giving credit to younger farmers who can easily repay the borrowed fund. This finding conforms to Akudugu (2012) who revealed that banks are more inclined to supplying credit to farmers within the economically active age group as they tend to use age as a proxy for maturity and ability to use credit and to repay.

The coefficient of experience was significant at 1% and positively related to ABP access. The positive sign of the coefficient is in congruent with the *a priori* expectation, implying that experienced rice farmers were more likely to have accessed the ABP. Improvement in the managerial ability of the farmer achieved through years of continuous farming makes the farmer

a better manager in terms of efficiently utilizing and repaying borrowed fund and hence, more likely to access credit from financial institutions. This finding conforms to Owusu (2017b) who reported a positive relationship between farming experience and access to credit.

The coefficient of farm size was significant at 1% and positively related to ABP access. The positive sign of the coefficient agrees with the *a priori* expectation, implying that rice farmers with large farm size were more likely to have accessed the ABP. Large farm sizes have positive effect on financial credit access due to their ability to benefit from economies of scale and the ability to repay back credit received. Also, land constitutes an important asset to serve as collateral in order to access credit from formal lending sources. Thus, farmers with large farm land are more likely to access credit from formal financial sources than farmers without land or small farm holdings. This finding is in congruent with Owusu (2017a) who revealed that households with more land are more likely to access credit and vice versa.

The coefficient of membership of cooperative society was significant at 1% and negatively related to ABP access. The negative sign of the coefficient disagrees with the *a priori* expectation, implying that rice farmers who are members of cooperatives were less likely to have accessed the ABP. Membership of cooperative is a fundamental requirement to become beneficiary of the ABP. However, rice farmers who are members of cooperatives and did not access the ABP were the older rice farmers as credit institutions prefer giving credit to younger farmers who can easily repay the borrowed fund. This finding conforms to Akudugu (2012) who revealed that banks are more inclined to supplying credit to farmers within the economically active age group as they tend to use age as a proxy for maturity and ability to use credit and to repay.

The coefficient estimates of the second stage switching regression model for farm income are shown in the second and third column of Table 2. The results of the determinants for farm income among rice farmers that accessed the ABP is reported in the beneficiaries column, and the determinants of farm income among rice farmers that did not access ABP is presented in the non-beneficiaries column.

The coefficient of sex was significant at 1% and positively related to farm income among rice farmers that accessed the ABP. The positive sign of the coefficient conforms to the *a priori* expectation, implying that male beneficiary rice farmers had more farm income. Male farmers tend to invest most of their earnings in their farm enterprises which translates to more farm income than their female counterpart who devote most of their earnings in the upkeep of their households. This finding agrees with Adenuga *et al.* (2014) who observed that total household income was higher for male-headed households than female-headed ones.

The coefficient of age was significant at 1% and negatively related to farm income among rice farmers that accessed the ABP. The negative sign of the coefficient differs with the *a priori* expectation, implying that older beneficiary rice farmers achieved lower farm income. As farmers advance in age, their ability to perform farm tasks reduces and thus, making them to depend more

on hired labour which reduces net farm income. This finding is in agreement with Ibekwe *et al.* (2010) who observed a negative relationship between age and farm income.

The coefficient of marital status was significant at 1% and positively related to farm income among rice farmers that accessed the ABP. The positive sign of the coefficient is not in congruent with the *a priori* expectation, implying that married beneficiary rice farmers achieved higher farm income. The stability and improved managerial ability in farm households that come with marriage translates to increased farm income. This finding agrees with Chauke *et al.* (2014) that observed a positive relationship between marital status and average gross margin from crop production and attributed this to the stability marriage accords to head of farm households.

The coefficient of household size was significant at 1% and positively related to farm income among rice farmers that accessed the ABP. The positive sign of the coefficient differs with the *a priori* expectation, implying that beneficiary rice farmers with larger household size achieved higher farm income. Rice farm households that consist of adult members will experience increased farm income due to reduction in the cost of hired labour. This finding contrasts Adenuga *et al.* (2014) who reported a negative relationship between household size and household income.

The coefficient of educational level was significant at 1% and negatively related to farm income among rice farmers that accessed the ABP. The negative sign of the coefficient differs with the *a priori* expectation, implying that beneficiary rice farmers with higher educational level achieved lower farm income. Education affects productivity and hence farm income through a choice of better inputs and better utilization of existing inputs. However, educated beneficiary rice farmers whose farm income decreased are those that consist of dependents that are too young to contribute to the household's total income. This finding agrees with Adenuga *et al.* (2014) who observed a negative relationship between household size and household income.

The coefficient of farm size was significant at 1% and positively related to farm income among rice farmers that accessed the ABP. The positive sign of the coefficient agrees with the *a priori* expectation, implying that beneficiary rice farmers with larger farm size achieved higher farm income. Increased farm size will motivate farmers to increase their farm output which translates to increased farm income. This finding conforms to Osanyinlusi and Adenegan (2016) who revealed that the bigger the size of a farm, the higher the productivity and hence, increased farm income.

Similarly, the coefficient of age was significant at 1% and negatively related to farm income among rice farmers that did not accessed the ABP. The negative sign of the coefficient differs with the *a priori* expectation, implying that older non-beneficiary rice farmers achieved lower farm income. As farmers advance in age, their ability to perform farm tasks reduces and thus, making them to depend more on hired labour which reduces net farm income. This finding is in agreement with Ibekwe *et al.* (2010) who observed a negative relationship between age and farm income.

The coefficient of marital status was significant at 1% and positively related to farm income among rice farmers that did not accessed the ABP. The positive sign of the coefficient disagrees with the *a priori* expectation, implying that married non-beneficiary rice farmers achieved higher farm

income. The stability and improved managerial ability in farm households that come with marriage translates to increased farm income. This finding agrees with Chauke *et al.* (2014) that observed a positive relationship between marital status and average gross margin from crop production and attributed this to the stability marriage accords to head of farm households.

The coefficient of household size was significant at 1% and positively related to farm income among rice farmers that did not accessed the ABP. The positive sign of the coefficient varies with the *a priori* expectation, implying that non-beneficiary rice farmers with larger household size achieved higher farm income. Rice farm households that consist of adult members will experience increased farm income due to reduction in the cost of hired labour. This finding contrasts Adenuga *et al.* (2014) who reported a negative relationship between household size and household income.

The coefficient of farm size was significant at 1% and positively related to farm income among rice farmers that did not accessed the ABP. The positive sign of the coefficient concurs with the *a priori* expectation, implying that non-beneficiary rice farmers with larger farm size achieved higher farm income. Increased farm size will motivate farmers to increase their farm output which translates to increased farm income. This finding conforms to Osanyinlusi and Adenegan (2016) who revealed that the bigger the size of a farm, the higher the productivity and hence, increased farm income.

The coefficient of dependent ratio was significant at 1% and positively related to farm income among rice farmers that did not accessed the ABP. The positive sign of the coefficient differs with the *a priori* expectation, implying that non-beneficiary rice farmers with larger number of dependents achieved higher farm income. Farm households that consist of adult members that can be engaged in the farm enterprise will experience increased farm income owing to reduction in hired labour cost. This finding contrasts Adenuga *et al.* (2014) who reported a negative relationship between household size and household income.

### **EFFECT OF ANCHOR BORROWERS' PROGRAMME (ABP) ON PRODUCTIVE ASSETS ACQUISITION**

The effect of ABP on the productive assets acquisition among rice farmers is presented in Table 3 below.

The likelihood ratio test for joint independence of the three equations was statistically significant at 1%. The implication is that these three models are not jointly independent and should not be estimated separately.

The correlation coefficient rho\_1 which shows the correlation between the ABP access equation and the beneficiaries' productive assets acquisition equation was positive and significant at 5%. This implies that the rice farmers who benefited from the ABP earned lower value of productive assets than what a random rice farmer from the sample would have earned.

### **Table 3: Full Information Maximum Likelihood (FIML) estimates of the endogenous switching regression model for productive assets acquisition**

Variables	Access to ABP (1/0)	Benefited = 1	Did not benefit = 0
<b>constant</b>	3.321*** (0.723)	10.518*** (0.390)	10.744*** (0.222)
<b>Sex</b>	0.685*** (0.227)	-0.116 <sup>NS</sup> (0.119)	-0.088 <sup>NS</sup> (0.066)
<b>Age</b>	-0.121*** (0.018)	0.008 <sup>NS</sup> (0.009)	-0.005 <sup>NS</sup> (0.004)
<b>Marital status</b>	1.584*** (0.347)	0.317 <sup>NS</sup> (0.219)	-0.053 <sup>NS</sup> (0.089)
<b>Household size</b>	0.154*** (0.031)	0.004 <sup>NS</sup> (0.016)	-0.004 <sup>NS</sup> (0.012)
<b>Educational level</b>	-0.152*** (0.032)	0.010 <sup>NS</sup> (0.021)	0.016* (0.010)
<b>Farming experience</b>	0.233*** (0.032)	-0.002 <sup>NS</sup> (0.008)	0.021*** (0.007)
<b>Farm size</b>	0.144 <sup>NS</sup> (0.102)	0.214*** (0.049)	0.234*** (0.028)
<b>Dependent ratio</b>	-1.701*** (0.486)	-0.830*** (0.249)	-0.020 <sup>NS</sup> (0.089)
<b>Membership of cooperative</b>	-0.255*** (0.048)		
<b>/ln<sub>1</sub></b>		-0.753*** (0.070)	
<b>/ln<sub>2</sub></b>			-0.864*** (0.054)
<b>/r<sup>1</sup></b>		0.470** (0.204)	
<b>/r<sup>2</sup></b>			-0.816*** (0.271)
<b>Sigma_1</b>		0.471*** (0.033)	
<b>Sigma_2</b>			0.421*** (0.023)
<b>rho_1</b>		0.438** (0.165)	
<b>rho_2</b>			-0.673*** (0.148)

**LR test of indep.eqns** 297.02\*\*\*

**Source: Field survey data, 2018. Standard errors in parentheses. \*\*\* = significant at 1%; \*\* = significant at 5%; \* = significant at 10%; NS = not significant**

The correlation coefficient rho\_2 which shows the correlation between the ABP access equation and the non-beneficiaries' productive assets acquisition equation was negative and significant at

1%. The implication is that the rice farmers who did not benefit from the ABP earned higher value of productive assets than what a random rice farmer from the sample would have earned.

The coefficient estimates of the second stage switching regression model for productive assets acquisition are shown in the second and third column of Table 3. The result of the determinants of productive assets acquisition among the rice farmers that had access to ABP is reported in the beneficiaries column, and the determinants of productive assets acquisition among rice farmers that did not have access to ABP is presented in the non-beneficiaries column.

The coefficient of farm size was significant at 1% and positively related to productive assets acquisition among rice farmers that accessed the ABP. The positive sign of the coefficient agrees with the *a priori* expectation, implying that rice farmers with larger farm size had more productive assets. Increase in farm size will result to increased farm inputs which translate to increased profit and hence, more production resources acquisition. This finding conforms to Ijioma and Osondu (2015) who revealed a positive relationship between farm size and farm inputs.

The coefficient of dependent ratio was significant at 1% and negatively related to productive assets acquisition among rice farmers that accessed the ABP. The negative sign of the coefficient conforms to the *a priori* expectation, implying that beneficiary rice farmers with higher dependent ratio had lesser productive assets. Increase in the number of dependents leads to increase in a farmer's non-farm expenses and hence, diverts the farmer's attention from farm expenditure to dependents' welfare which translates to less productive assets acquired. This finding conforms to Adenuga *et al.* (2014) who reported a negative relationship between household size and household income.

Similarly, the coefficient of educational level was significant at 10% and positively related to productive assets acquisition among rice farmers that did not accessed the ABP. The positive sign of the coefficient agrees with the *a priori* expectation, implying that non-beneficiary rice farmers with higher level of education had more productive assets. Educated farmers have better tendency for resources management and adoption of improved farm practices which translates to increased farm income and hence, more production resources acquisition. This finding agrees with Mwangi and Kariuki (2015) who reported that education level of a farmer increases his ability to obtain, process and use information relevant to adoption of a new farm technology and hence, more likely to invest his income on such farm technology.

The coefficient of experience was significant at 1% and positively related to productive assets acquisition among rice farmers that did not accessed the ABP. The positive sign of the coefficient is in congruent with the *a priori* expectation, implying that non-beneficiary rice farmers with more years in rice farming had more productive assets. Improvement in the managerial ability of the farmer achieved through continuous years in farming makes the farmer a better manager which translates to increased income and more productive assets acquisition. This finding conforms to Mwangi and Kariuki (2015) who revealed that experienced farmer are better able to evaluate improved farm technologies than younger farmers and hence, more likely to invest their income on these improved farm inputs.

The coefficient of farm size was significant at 1% and positively related to productive assets acquisition among rice farmers that did not accessed the ABP. The positive sign of the coefficient concurs with the *a priori* expectation, implying that non-beneficiary rice farmers with larger farm size had more productive assets. Increase in farm size will result to increased farm inputs which translate to increased profit and hence, more production resources acquisition. This finding conforms to Ijioma and Osondu (2015) who revealed a positive relationship between farm size and farm inputs.

## CONCLUSION

The findings revealed that Anchor Borrowers' Programme (ABP) has enhanced the income and farm output of rice farmers in the study area. Rice farmers' access to ABP was significantly influenced by their socio-economic characteristics. Beneficiary and non-beneficiary rice farmers were not better or worse in terms of farm income than a random rice farmer from the samples. Beneficiary rice farmers acquired lesser productive assets than what a random rice farmer from the sample would have earned while non-beneficiary rice farmers acquired more productive assets than what a random rice farmer from the sample would have earned.

Based on these findings, it was recommended that The Federal Government should consolidate on the gains of the Anchor Borrowers' Programme in the State by increasing funding for the programme and making sure more rice farmers benefit from the programme given that the programme has enhanced income and farm output of beneficiaries in the State.

Also, the Bank of Agriculture (BOA) and other agricultural credit institutions in the State should streamline their procedures for securing loans from them in order to make it simple for farmers and also ensure timely disbursement of the loan to beneficiaries for timely purchase of the required inputs; and the actual amount of loan applied for should be given to the rice farmers so as to enable them embark on project as planned. When this is done, the right and improved farming tools and productive assets will be acquired on time thereby increasing their farm output.

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