



Impact assessment of USAID-MARKETS II project on poverty status of rice farming households in Ebonyi State, Nigeria

Nwahia, O.^{1*}, A. Zakari ¹, S. Abdulsalam ¹, A. Sanni ¹ and M. Musa ²

¹ Department of Agricultural Economics, Ahmadu Bello University, Zaria, Ebonyi State, Nigeria.

² Department of Agricultural Extension and Rural Development, Ahmadu Bello University, Zaria, Ebonyi State, Nigeria.

Abstract

Poverty is a major menace in Nigeria. There is an increasing concerns by the government, international and local aid donors for concrete evidence to be supplied on the impact of such public programmes that aims at reducing poverty. This research focused on the impact of USAID-MARKETS II project on poverty status of rice farming households in Ebonyi state, Nigeria. Multi-stage sampling procedure was used to select 239 participants and 252 non- participants of USAID-MARKETS II project for the study. Data were collected from primary source with the aid of structured questionnaire and field observations and analyzed using descriptive statistics (mean and standard error) and inferential statistics (FGT Measures, Propensity Score Matching and LATE Model). The result reveals that participation in USAID-MARKETS II project increased the participants monthly per capita income by ₦5336.9 (45.5% increment) as reveals by PSM (Propensity Score Matching) while the LATE (Local Average Treatment Effect) estimates shows that USAID-MARKETS II significantly, and positively increased per capita income of the participants by ₦1193.86 (5.4% increment). The result further shows that the increment was more on the poor participants' monthly per capita income than on their non-poor counterpart. The study suggested that USAID-MARKET II project should be replicated in other parts of the state that were not initially involved in the project because of its pro-poor nature and positive impact. In addition, future USAID-MARKET project design should incorporate the socio-economic variables, norms, and culture of Ebonyi people for greater impact.

Keywords: USAID-MARKET II project Impact; PSM and LATE approach; Poverty reduction; Rice farming households; Ebonyi state.

1. Introduction

Rice (*Oryza Sativa*) is one of the most important staple foods in most African countries for many decades (Norman and Kebe, 2010; Aliou *et al.*, 2012). Nigeria is blessed with good climatic, vegetation, and soil conditions suitable for rice production. Rice production was estimated at 2.03 million tonnes between 2001 and 2003 in Nigeria while 3.90 million tonnes was consumed within the same time period. Therefore, the balance of 1.90 million tonnes was imported (FAOSTAT, 2007). More Recent, the country was able to

produce about 3.2 million tonnes of paddy annually (Osanyinlusi and Adenegan, 2016). However, compared to the annual consumption level of 5.2 million tonnes, the above estimate is far below the national requirement since an average Nigerian currently consumes 40 kg of rice per year as reported by FUNAI (2016). In Nigeria, 1.7million hectares were cultivated to rice out of 4.6 million hectares available for rice cultivation (Nwachukwu, Agwu and Ezech, 2008), and recently, 2.7 million hectares were put to rice production (Tijjani, and Bakari, 2014). Rice sector development could be a viable tool for economic growth, which can help in poverty reduction, food security, and raising the standard of living of millions of poor people. Rice production create jobs along its value chain, and these, leads to improvement of the

*Corresponding author: Ogechi Nwahia,

Email: godstime_ogefine@yahoo.com

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well-being, and health status of the rural poor. (Africa Rice, 2011, Aliou, *et al.*, 2012).

Nigeria is among the poorest countries in the world. Over 80 million (or over 64%) of Nigerian population are living below poverty line. Poverty is high in rural areas and remote communities where agriculture is the major occupation (United Nation, 2017). Poverty in all ramification has affected the Nigerian society for many generations. Over the years, Nigerian government at all levels have implemented many programmes and projects with poverty reduction mandate, but it appears they have not addressed the root causes of poverty (Mbanasor *et al.*, 2013). Ekong, and Onye (2014), reported that in 2013, the Department for International Development (DFID) report shows that 63% of Nigerian are living below the poverty line of \$1 daily, even with plenty of natural resources such as oil and fertile land for agricultural production. About 69 million Nigerians were poor in 2004 (Omonona, 2009; Diao *et al.*, 2009), and it increased to 112.5 million in 2010 (NBS, 2012), and currently, 119.5million are poor in Nigeria (World Bank, 2017).

USAID-MARKETS II is one of the efforts made by the Nigerian government to improve the rice sector and reduce poverty. USAID is an international agency that provides foreign aids to needy countries. The agency's intervention in agricultural production is known as Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites (MARKETS). MARKETS is working along the value chain of rice in order to improve productivity, income, sales, and jobs at firm and farm levels (USAID, 2013). USAID MARKETS was initiated in 2005, and designed to expand economic opportunities in Nigeria's agricultural sector. Over time, USAID-MARKETS have grown to provide farmers with assistance such as fertilizer supply and technology development; seed development, and farmers training (USAID-MARKETS, 2010). USAID MARKETS II project was initiated to assist rice producers with adequate knowledge and skills to enhance rice productivity, income, and their

well-being (USAID-MARKETS, 2010; USAID-MARKETS, 2014). After years of USAID MARKETS II project operation, the project assessment in terms of its impact on poverty becomes pertinent, and the following questions become necessary. What are the socio-economic profile of participants and non-participants rice farming households in USAID-MARKETS II project in Ebonyi State? What is the poverty status of participants and non-participants rice farming households in USAID-MARKETS II project in Ebonyi State? What is the impact of USAID-MARKETS II project on the poverty status of rice farming households?

2. Methodology

The study was conducted in Ebonyi State. Ebonyi State was created in 1996, making it one of the youngest states in Nigeria. Agriculture is among the major occupation in Ebonyi State; with 85% of Ebonyians earn their living from agriculture. Ebonyi state is blessed with good land for growing cash and food crops, such as rice, yam, cassava, maize and cocoyam, cash crop like cashew, cocoa and oil palm with a total land area of 5,935 km² (Obasi, Agbo and Onyenekwe, 2015). It is located within latitude 7^o 30E, and 8^o 30E, and longitude 6^o 40N, and 6^o 45N of South East zone of Nigeria. Ebonyi state comprises of thirteen local government areas, with a total population of 3.1 million people.

Multi-stage sampling procedures was used for this study. In the first stage, 4 Local Government Areas (LGA) out of 12 that participated in USAID-MARKETS II project were randomly selected. In the second stage, 3 villages each were randomly selected from the 4 LGAs making a total of 12 villages. The 3 villages (selected on equal proportion basis) captured about 10% of the total villages in each of the Local Government Areas. In the third stage, 239 participating rice-farming households were selected from the list of USAID-MARKETS II participants in 12 sampled villages, using a scientific formula developed by Yemen (1967) for calculating

sample size, and adopted by Okpe *et al.* (2014). The 12 sampled villages, and their respective selected numbers includes Onu-ebonyi = 24, Agelegu = 9, Ogbuchie =10, Ufueseni =17, Ndikpo = 25, Owutu = 61, Agbaugo Okpo = 8, Enuogurugu = 18, Uchechi-Okposi =11, Amoffia = 23, Umuakpu = 8, and Ngbo = 25.

Yemen (1967) scientific formula is given as $n = \frac{N}{1+N(\alpha^2)}$, 5% room for error was given and 95 percent confidence level in selecting the sample size. Where n is the sample size, N is the sample frame and α^2 is the precision level (0.05). In order to control for spill-over effect, 6 villages (>10%) were randomly selected from one LGA that did not participate in USAID-MARKETS II project in Ebonyi state to serve as the control group. Also, from the list of non-participants of USAID-MARKETS II, using the Yemen scientific formula, 252 non- participating rice-farming households were selected from the 6 sampled villages which includes oriuzor = 52, Amuda = 34, Umuogharu = 54, Ogboji = 22, umuezeakaoha = 58, and umuezeoka = 32. In all, a total sample size of 491 rice-farming households were selected for the study. Data were collected from primary source with the aid of structured questionnaire and field observations. The questionnaire were administered to both participants and non-participants rice-farming households in the selected villages in Ebonyi State. Data collected were analyzed using descriptive statistics, Foster, Greer and Thorbeecke (FGT) Index, Propensity Score Matching (PSM), and Local Average Treatment Effect (LATE).

2.1. Analytical Framework

2.1.1. Foster, Greer and Thorbeecke (FGT)

Foster, Greer, and Thorbeecke (FGT) (1984) poverty measures was used to determine poverty status among rice-farming households. The model is generally given as:

$$P_\alpha = \frac{1}{N} \sum_{i=1}^q \left(\frac{Z-Y_i}{Z}\right)^\alpha \dots\dots\dots (1)$$

Where: P = Foster, Greer, and Thorbeecke poverty measure

N = total number of rice-farming households

q = number of rice-farming households that are below the poverty line

Y_i = per capita household income of the rice farming households.

z = poverty line. α is a non-negative poverty aversion parameter (0, 1,2). The poverty status of the rice-farming households were decomposed into three indicators: - poverty incidence (P₀), The depth of poverty (P₁), and the severity of poverty (P₂). If $\alpha = 0$, the model becomes

$$P_0 = \frac{q}{N} \dots\dots\dots (2)$$

This formula gives the head count ratio, which is the percentage of rice-farming households that are living in poverty, that is, those whose per capita income is below the poverty line. In the Model, q is the number of the poor in the population and N is the entire population. If $\alpha = 1$, it gives the depth of poverty which is written thus:-

$$p_1 = \frac{1}{N} \sum_{i=1}^q \left(\frac{Z-Y_i}{Z}\right) \dots\dots\dots (3)$$

If $\alpha = 2$, it measures poverty severity and this is the mean of square proportion of the depth of poverty. It is written thus:-

$$p_2 = \frac{1}{N} \sum_{i=1}^q \left(\frac{Z-Y_i}{Z}\right)^2 \dots\dots\dots (4)$$

2.1.2. Poverty Line

In line with studies on poverty, per capita household income was adopted by this study as a measure for determining the poverty line. The total income of each household was calculated, and then corrected for each household size by dividing the household total monthly income by the number of people within the household.

Per capita income (monthly)
 = $\frac{\text{total household monthly income}}{\text{adjusted household size}} \dots\dots\dots (5)$

Mean per capita household income = $\frac{\text{total per capita income for all households}}{\text{total number of household}} \dots\dots\dots (6)$

Poverty lines were drawn as two thirds of the mean per capita household income.

Organization for Economic Cooperation and Development (OECD) equivalence scale were used to adjust the household size.

2.1.3. *The Propensity Score Matching Model*

The propensity score is the conditional probability of receiving a treatment given pretreatment characteristics (Rosenbaum and Rubin, 1983; Adebayo and Olagunju, 2015). The binary logit regression was used to compute the propensity scores. The model is given as:

$$p(x_i) = P(d=1|X_i) \dots\dots\dots (7)$$

Where $p(x_i)$ is the estimate of the propensity score evaluated at X_i while X_i were the socio-economic variables used for the matching. Pscore were estimated at the first stage, and computed for each farming household, the actual matching was carried out after pscore was computed using nearest neighbor matching method. Average Treatment Effect (ATE), Average Treatment Effect on the Untreated (ATU), and Average Treatment Effects on the Treated (ATT) were estimated in the second stage. ATT was estimated by computing the differences across both groups (treated and untreated). Thus, the formula is

$$ATT = E[Y_1 | d = 1, P(X)] - E[Y_0 | d = 0, P(X)] \dots (8)$$

Where ATT = Average impact of Treatment on the treated, $d = 1$, if the households participated in USAID-MARKETS II and $d = 0$ if otherwise, Y_1 is the outcome (household per capita income) of the project after participation; Y_0 = outcome of the same beneficiary if he/she had not participated and X is the socio-economic variables on which the subjects were matched.

2.2. *Local Average Treatment Effect (LATE) Model*

LATE is an instrumental variables (IV) estimate that uses treatment assignment as an instrument for treatment received, The propensity score matching method lacks the

power to deal with the problem of selection on unobservable, which may be solved by the double difference approach if the unobservable are time invariant. Moreover, neither of the two approaches deals appropriately with the problem of non-compliance. In this regard, LATE model were employed.

Considering how USAID-MARKETS II was carried out in Ebonyi state, rice-farming households exposed to USAID-MARKETS II have the total control over their decision to participate or not to participate (i.e. the receipt of the treatment is endogenous). When subjects fails to receive the treatment to which they were assigned, the process experiences noncompliance. Noncompliance usually makes it impossible to estimate the actual impact of a project, but LATE (Local Average Treatment Effect) which was first discussed by Imbens, and Angrist, (1994), can handle these. This study also adopted LATE Model to complement PSM in order to capture the impact of USAID-MARKETS II project on poverty status of rice-farming households in Ebonyi State.

$$\text{LATE Model is given as } LATE = \frac{\text{cov}(y,z)}{\text{cov}(d,z)} \dots\dots(9)$$

$$= \frac{E(y|z = 1) - E(y|z = 0)}{E(d|z = 1) - E(d|z = 0)} \dots\dots (10)$$

Where y is the treatment status variables, z is the instrument variable (which in this case, is the awareness of USAID-MARKETS II project), and d is the outcomes variable. This equation is known as *Wald* estimator and it is estimated using two-stage least squares.

3. Results and discussion

The socio-economic variables of the rice-farming households such as age, years in formal education, sex, extension visit, years of experience in rice farming, household and farm sizes were analyzed using mean and standard error, and the result are presented in Table 1.

Table 1. Socio-economics characteristics of the respondents

Variables	Participants		Non-participants	
	Mean	Std Error	Mean	Std error
Sex (Male, Female)	(70.94%,29.06%)	0.46	(70.25%, 29.75%)	0.48
Age (years)	47	10.49	46	10.04
Household size	7	2.83	6	2.47
Years in education	9	4.52	8	4.81
Extension visits	2	0.86	0.13	0.37
Years in rice farming	21	9.37	23.38	9.60
Rice farm size (ha)	1.28	0.83	1.12	0.61

Source: Field survey, 2018.

Table 1 shows that majority (70.94%, and 70.25%) of participants and non-participants of USAID-MARKETS II households respectively were headed by male while less than 30% of both participants and non-participants households were headed by female. This implies that male-headed households participated in USAID-MARKETS II more than their female counterpart did. This validates Olaolu *et al.* (2013) who found that male participated in FADAMA project more than their female counterpart did. The average age of USAID-MARKETS II participants were 47 while the non-participants were 46 years. This reveals that majority of both participants and non-participants are within their productive stage. This is in line with Osondu *et al.* (2015) who found an average age of 42 and 45 years for Fadama III participants and non-participants respectively. Table 1 reveals that the average size of the households of the participants and non-participants of USAID-MARKETS II in Ebonyi state were 7 and 6 respectively. This shows that the participants and non-participants households have high household sizes. Thus, rice-farming households have a good source of family labour. This agrees with Osondu *et al.* (2015).

Education can enhance farmer's ability to make accurate and meaningful management decisions. Table 1 reveals that the average years spent in formal education by the participants and non-participants were 9 and 8 respectively. This shows that majority of the USAID-MARKETS II participants and non-participants had some level of formal education. This agrees with Folorunso (2015) but against Awotide *et*

al. (2013). Table 1 reveals that the average extension visit to the participants was 2 times per farming period, which is inadequate. Extension visit was negligible for non-participants (0.13 almost non-existent for the entire production season).

The average years of rice farming experience of the participants and non-participants were 21 and 23.38 respectively, which is long enough for the rice-farming households to improve their performance in rice operation. This is in line Girei *et al.* (2017) but against Okwoche, and Asogwa (2012). The average of rice farm size of participants were 1.28 hectares, and that of non-participants were 1.12 hectares. This shows that both participants and non-participants were smallholders farmers.

3.1. Impact of USAID-MARKETS II on Poverty

Due to selection bias, non-compliance or problem of endogeneity, this study used two methods to assess the impact of USAID-MARKETS II on poverty. Local Average Treatment Effect (LATE) model and Propensity Score Matching (PSM) were the two methods employed. Nearest neighbor matching method were used as the matching method in propensity score. Nearest neighbor method, uses the propensity score of individuals that are similar to each other in the treated, and control group to construct the counterfactual outcome. The major advantage of nearest neighbor matching method is its lower variance. To obtain the propensity score-matching estimator through the logit regression, individual socio-economic

variables were used to form matched pairs of observational similar individual characteristics.

3.2. Poverty Status of Participants and Non-Participants of USAID-MARKETS II

The households' poverty status among the USAID-MARKETS II participants and non-participants were analyzed using three indicators, which includes poverty incidence (Po), the depth of poverty (P1), and poverty severity (P2) from FGT Index, and presented in Table 2. The result shows that the poverty incidence for USAID-MARKETS II participants and non-participants were 0.38 and 0.57. This shows that 38 percent and 57 percent of the participants, and non-participants rice-farming households respectively were poor while 62 percent, and 43 percent of the participants and non-participants respectively were non-poor. The poverty depth were 0.15 and 0.22 representing 15 percent and 22 percent

respectively for participants and non-participants whose average monthly per capita income was below the poverty line. This gap represents the percentage of income required to bring poor households up to the poverty line. This result can be compared with Mbanasor *et al.* (2013), and Omonona (2009) but against Tsue *et al.* (2013). The severity of poverty were 0.05 and 0.12 representing 5 percent and 12 percent respectively of the participants and non-participants households were poorest of the poor rice-farming households. They are vulnerable to poverty, and require the attention of the government to come out of poverty. All these three poverty measures shows that poverty were more prevalent and severe among non-participants than participants of USAID-MARKETS II. This could be as a result of increased yield and income realized by the participants of USAID-MARKETS II due to employment of better rice practices.

Table 2. Poverty Status of Participants, and Non-Participants of USAID-MARKETS II

Poverty categories	participants	Non-participants
Non- poor	0.62	0.43
Poor	0.38	0.57
Poverty indices		
Poverty incidence(p _o)	0.38	0.57
Poverty depth (p ₁)	0.15	0.22
Poverty severity (p ₂)	0.05	0.12
Mean per capita income(MPI)	11112.6	
Poverty line 2/3 of MPI	7408.40	

Source: Field survey, 2018.

3.3. Estimates of the Impact of USAID-MARKETS II on Poverty.

The result of the estimates of the impact of USAID-MARKETS II on poverty were presented in Table 3. Household monthly per capita income were used as a proxy for poverty. Income shows the capability of the rice-farming households to purchase their basic needs. The result shows that Average Treatment Effect on the Treated (ATT) had a positive and significant impact on participants' poverty reduction by increasing their monthly per capita income by ₦5336.9 (45.5% increment). This implies that without USAID-MARKETS II, the monthly per capita income of the participants would have been 45.5% less than its present level. This

could be as a result of more income realized from rice production due to better practices adopted by them. The Average Treatment Effect (ATE) for the sampled rice farming household had a value of ₦4828.1 (41.2%) increase in monthly per capita income. The result shows that Average Treatment Effect on the Untreated had a positive and significant impact on poverty of rice farming households with a value of ₦1064.2. This value is the counterfactual outcome of the treated if they were not treated. This is in line with Adenuga *et al.* (2016).

The LATE estimate result were presented in Table 3. The mean difference

results reveals that there was a significant difference of ₦1192.57 (5.4% difference) in per capita income of participants and non-participants of USAID-MARKETS II. The LATE estimates shows that USAID-MARKETS II significantly and positively increased per capita income of participants by ₦1193.86 (10.2% increment). This is the average change in total monthly per capita income brought about by participation in

USAID-MARKETS II. The LATE result further revealed that the impact (increment in per capita income) were more (₦1585.52, that is 13.5% increment) on the poor participants households than on their non-poor counterpart (₦1144.94, that is 9.8% increment). This shows that USAID-MARKETS II programme is pro-poor in nature. This validates Osondu *et al.* (2015).

Table 3. Impact of USAID-MARKETS II on Poverty

sample	Treated	Control	Difference	Std. err	t-stat
Per capita unmatched	11717.90	10525.30	1192.60	467.20	2.55***
Income					
ATT	13331.70	7994.80	5336.90	1534.10	3.48***
ATU	8532.20	9596.40	1064.20		
ATE			4828.10		
Estimation	Parameter		Robust std err		Z-value
LATE by WALD	1193.86		262.68		4.54***
Estimation by mean diff					
Participants	11717.90		390.03		30.04***
Non-participants	10525.33		262.34		40.12***
Observed difference	1192.57		470.05		2.54***
Impact on poverty status					
Non-poor	1144.94		762.87		1.50
poor	1585.52		197.99		8.01***

Source: Field Survey, 2018. Note: *** = P < 001.

4. Conclusion and recommendation

The study establishes that participation in USAID-MARKETS II project had a positive impact on poverty alleviation. USAID-MARKETS II project increased the participants monthly per capita income by ₦5336.9 (45.5% increment) by PSM, and ₦1193.86 (5.4% increment) by LATE model. The increment were more on the poor participants' monthly per capita income than on their non-poor counterpart. The study therefore suggested that USAID-MARKET II project should be replicated in other parts of the state that were not initially involved in the project.

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