IMPACT OF INCREASED CASSAVA PRODUCTION AND EXPORT PROGRAMME ON RURAL POVERTY REDUCTION IN NIGERIA.

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ABSTRACT
Globally, Nigeria is the highest producer of cassava, yet they do not participate earnestly in the global market. Hence, the initiation of Increased Cassava Production and Export Programme (ICPEP) to encourage commercialization of cassava and its export to ensure increased income and poverty reduction. This study evaluated the impact of ICPEP on poverty reduction among cassava farmers in Nigeria. Multi-stage sampling technique was used to select three zones from the cassava producing zones, namely: North Central, South East and South South in Nigeria. Benue, Imo and Cross River States were randomly selected from each zone and 4, 3 and 2 Local Government Areas (LGAs) each were randomly selected, respectively from each state for the study. Thereafter, 3 communities were randomly selected from each Local Government Areas (LGAs)and 30 cassava farmers were randomly selected totally 810 cassava farmers. Propensity score matching and Instrumental Variable Estimator were used to evaluate the impact of level of cassava commercialization on poverty reduction. The results from both estimators showed that the Average Treatment effect on the Treated (ATT) for having cassava commercialization index of 0.5 and above is significant and positive resulting to an increase of ₦34, 013.08 – 44, 156.11on monthly cassava income for the farmers. It was therefore recommended that adequate and timely dissemination of agricultural inputs such as fertilizer and credits to farmers should be improved so as to encourage commercialization of cassava production in Nigeria.

Keywords: Increased Cassava Production and Export Programme, Poverty Reduction, Cassava commercialization

INTRODUCTION

For some time now, transforming the subsistence-oriented production system into a market-oriented production system, which reflects a shift towards increased economic opportunities, improving livelihoods of the poor and reducing rural poverty, has been so heavily discussed on the policy spotlight of many developing countries, including Nigeria. The agricultural policy launched in 2001, recognized the roles and potentials of small-scale farmers as the major producers of food in Nigeria (Manyong *et al.*, 2005). Adopting a new lens to smallholder farming through this reformed policy has significantly increased production of agricultural raw materials for industries and exportation as well as improved the welfare of the rural dwellers among its many objectives. Consequently, in 2002, the presidential initiative on agriculture (PIA), later transformed to Agricultural Transformation Agenda (APA) was launched to promote growth in the continuum of various food value chains including production, processing, marketing and utilization of various target crops, livestock and fisheries, and thus boost national food security and poverty reduction (Anyanwu *et al.*, 2011). The PIA constitute of several programmes, one of which is the Increased Cassava Production and Export Programme (ICPEP). ICPEP, among other things, addressed the supply of fertilizer and credit to farmers in order to scale up cassava production from subsistence to commercial level of production.

According to Okezie *et al.* (2012), agricultural production in Nigeria is not subsistence-oriented as only 43.9% of agricultural production is for home consumption. They observed that subsistence food production constituted about 45.8% of total income while value of own-production to total consumption value was 28.5% implying that households were market oriented in consumption. Ele *et al.* (2013) adopted the Household Commercialization Index (HCI) to analyse the extent of commercialization of smallholder farming households in Cross River State, Nigeria and the result showed that the degree of commercialization was moderately high (about 60.40%). Furthermore, Akande *et al.* (2009) reported that utilization of output pointed towards increased commercialization as the proportion of output sold was less than 50% for all crops except for cassava.

Although many academics and practitioners have considered separating myths from facts on the level commercialization of smallholding farms in Nigeria, as seen in the above literatures, these however were done prior to the ICPEP initiative of the reformed Nigerian agricultural sector. Unfortunately, not much has been done to evaluate the outcomes post ICPEP initiative. This study was therefore significant as it assessed the impact of ICPEP on poverty reduction in Nigeria. Specifically, the study was designed to identify the socioeconomic characteristics and ascertain the effect of ICPEP on poverty reduction among rural farming households.

METHODOLOGY

This study was carried out in Nigeria. A multi-stage sampling technique was used to select three zones from the cassava producing zones, namely: North Central, South East and South South in Nigeria. Benue, Imo and Cross River states were randomly selected from each zone and 4, 3 and 2 Local Government Areas (LGAs) each were randomly

selected respectively from each state for the study. Thereafter, 3 communities were randomly selected from each LGA and 30 cassava farmers were randomly selected totally 810 cassava farmers. Descriptive statistics were used to analyse the socioeconomic characteristics of the respondents while Propensity Score Matching (PSM) technique and Instrumental Variable Estimator (IVE) were used to evaluate the effect of ICPEP on poverty reduction among rural farming households. Level of cassava commercialization (LCC) was used as a proxy for participating in ICPEP.

The impact of the ICPEP can be defined as the difference between the outcome of those who participated in the ICPEP and the outcome that would have obtained for those same individuals if they had not participated in the programme. PSM estimates a propensity score defined as the conditional probability measure of treatment participation, given observable characteristics that are expected to have an effect on farmers' likelihood of participating in the program and the outcome variables in the construction of an appropriate control group for estimating program effects. According to Heckman *et al.* (1997) comparisons with experimental estimators have shown that PSM provides reliable, low bias estimates of program impact provided that: the same data source is used for participants and nonparticipants, participants and nonparticipants have access to the same markets, and the data include meaningful explanatory variables capable of identifying program participation.

A comprehensive household survey was designed and questionnaires were prepared to meet the requirements of PSM. The variables included in the questionnaires captured many of the determinants of participation, which helped to reduce a potentially significant source of bias in PSM estimators. The use of PSM implies that selection is based solely on observable characteristics and that all variables that influence participation in the ICPEP and potential outcomes simultaneously are observed[1] by the researcher.

Conditional on satisfying the key assumptions of un-confoundedness (i.e. independence, conditional on a set of covariates X, which has been shown to be equivalent for a propensity score based on such covariates, P(X)) and the overlapping (i.e.) common support condition, which ensures that persons with the same X values have a positive probability of being both participants and nonparticipants, Cameron and Trivedi (2009) and Heckman, *et al.* (1999) demonstrated that treatment effect can be estimate thus:

$$ATT(PSM)=E_{P(X)|D=1}\{E[Y\ (1)|D\ =\ 1,\ P(X)]\ -\ E[Y\ (0)|D\ =\ 0,\ P(X)]\}\ .....\ (1)$$

where Y is the monthly income from cassava sales, X the conditioning participant characteristics, $P(X)$ the propensity score based on the observable characteristics (X), and D is the dummy variable equal to 1 if the participant have LCC>= 0.5. Put in words, the propensity score matching estimator is the mean difference in outcomes between treatment and control groups over the common support, appropriately weighted by the propensity score distribution of participants.

This study applied four matching procedures to ensure that the results are not driven by estimation procedure and for comparison. Nearest neighbour matching ensures that each treated observation is matched and compares individuals from the control group to a matching partner closest in propensity score (Caliendo and Kopeinig, 2005). However, it could be affected by poor matches in which the distribution of scores across treated and control individuals are very different. Thus radius matching, which specifies a calliper or maximum propensity score distance by which matches can be made, thus increasing the quality of matching. Matching by stratification is also used to get at potential bias due to the unconfoundedness property's not being satisfied by particular covariates (Caliendo and Kopeinig, 2005; Onur and Arbor, 2006). Here, the common support of the propensity score is partitioned into a set of intervals (strata), and the impact within each interval is calculated by taking the mean difference in outcomes between treated and control observations. Finally, nonparametric Kernel matching[2] was used as it tends to have a lower variance for using more information though possibility of bad matches are bound (Caliendo and Kopeinig, 2005; Heinrich, *et al.*, 2010). To address the possibility of bad matches, this study uses only observations that lie within the common support and compares the results to those of other matching procedures.

Instrumental Variable Estimator (IVE) tries to control for the effects of unobserved characterises in programme participation, which the PSM could not account for. New values were predicted for the

[1]This is a strong assumption, particularly in cases where in the outcome variables are yield (such as cassava output). Ignoring the effect of unobservable characteristics affecting both program participation and these outcome variables could lead to biased estimates of the program effect. In this study, instrumental variable estimator (IVE) was introduced to account for the unobservable characteristics affecting both program participation and the outcome variables.

[2] Nonparametric matching estimators use weighted averages of (nearly) all – depending on the choice of the kernel function – individuals in the control group to construct the counterfactual outcome.

endogenous variable using the exogenous variables in the structural model and adding two more instrumental variables. This is called the first-stage regression. IVs help to triangulate what the average values for the endogenous variable would be, based upon similarities between observations in the sample, without the influence of unobserved characteristics. Instruments used were tested for relevance and exogeneity. Two-stage least squared regression (2SLS) models with exclusion restrictions was used to explain variation in program participation that is independent of LCC. In this analysis, equations 2 and 3 were estimated as function of individual characteristics, household characteristics, and the instrumental variables (i.e. exclusion restrictions).

Treatments= $\alpha + \gamma Zi + \beta Xi + \mu_I$.....equation (2)

$Y_i = \alpha + \beta Treatment + \delta Xi + \varepsilon_I$....equation (3)

Where Y_i = monthly income from cassava sales, treatments is a binary variable equal to 1 if LCC >= 0.5 otherwise 0, Zi is a set of instruments, Xi is a vector of observable variables and μ_1 is the error term.

RESULTS AND DISCUSSION

Table 1 shows the mean age of participants is above 45years for all the treated and control groups while sex is approximately 0.50 implying equal number of male and female participants. Mean values for household size is above 8, years of schooling and planting of cassava are approximately 8 and 20 respectively. This implies that the level of literacy among participants is low being that most participants finished primary education and less secondary and tertiary education. Estimated cassava plot has a mean range of 1.84 and 3.52 hectares. A mean value of above 0.70 indicates that most of the participants are full time farmers and this corresponds with farming as a major source of income that has a mean value of 1.00. Participants' membership of associations is less than 0.5 except for being a member of a village meeting, which is common in the study areas. Monthly cassava income for all the treatments is on average for the treated group U$278.38[3] and U$66.49 for the control group.

[3] US 1 = ₦199.00

Table 1: Descriptive statistics of variables based on treatments

	Control (N = 481)		Treated (N = 329)	
Variable	**Mean**	**S.D.**	**Mean**	**S.D.**
Age	45.83	10.61	46.50	10.59
Sex (male = 1 otherwise 0)	0.54	0.50	0.56	0.50
Household size	9.11	3.45	8.37	3.53
Years of schooling	8.86	5.03	8.42	4.98
Years of planting cassava	19.76	10.85	19.54	10.65
Occupation (full time farmer =1 or otherwise)	0.70	0.46	0.78	0.42
Major source of income (income from farm activities = 1 otherwise 0)	0.99	0.08	0.99	0.10
Off-farm income (income from nonfarm activities =1 otherwise 0)	0.41	0.49	0.30	0.46
Member of a cooperative society= 1 otherwise 0	0.33	0.47	0.21	0.41
Member of a village meeting = 1 otherwise 0	0.47	0.50	0.56	0.50
Member of cassava farmers association = 1 otherwise 0	0.20	0.40	0.13	0.34
Member of Farmers Association of Nigeria= 1 otherwise 0	0.18	0.38	0.15	0.36
Estimated cassava plot (ha)	1.84	0.68	3.52	2.58
Monthly cassava income (U$)	66.49	56.78	278.38	184.06

Source: Field Survey, 2014

Table 2 reports the results of the PSM. The Average Treatment effect on the Treated (ATT) of LCC on monthly cassava income is significantly positive. At 1% significance level, monthly cassava income increase by U$212 for nearest neighbour, radius and kernel matching techniques and U$171 for stratification techniques.

Table 2: Effect of ICPEP on Participants

Treatment	**Outcome variable**	**Matching technique**	**Number treated**	**Number Controlled**	**ATT**	**Std. Err.**	**t-test**
Effect of LCC >=0.5	Monthly cassava Income (U$)	NN	329	481	211.89	10.472	20.233***
		radius	329	481	211.89	10.472	20.233***
		stratification	298	512	170.92	11.032	15.493***
		kernel	329	481	211.89	12.223	17.336***

Note: * ** Significant at 1%; + significant at 20%

Table 3 reports the results for the standard econometric analysis of the effect of program participation on monthly cassava income where IV's are implemented to correct for the endogeneity of program participation. For the purpose of comparing the relevance of unobserved factors, the table show the OLS and IV estimates of ICPEP effect on the outcome variables, the exclusion restrictions used in regression and the statistical test for the exogeneity and relevance of instruments.

The LCC increases income of cassava farmers by U$181.88 (₦36194.12). Household size and price of fertilizer at 1% significant level were used as instruments for LCC with monthly cassava income as the outcome variable. The partial R^2 shows that the instruments are 17.71% correlated with the instrument. The Wooldbridge score and Regression based test statistics are 49.10 and 58.42 respectively at 1% significant level suggesting that the instruments can be considered exogenous for LCC. Moreover, the test of over identification has a value, 0.0205 with p-value of 0.8861 indicating the failure to reject the null hypothesis. The robust F-statistic is 56.795 > 10 as suggested by Kriby and Bollen, (2009) and value of MES is 46.006 > 19.93 critical values at 10% indicating that the null hypothesis that the instruments are weak is rejected. Therefore, the instruments are valid.

Table 3: OLS and Instrumental Variable Estimates (IVE) of Program Participation on LCC

	OLS			IV		
	Coeff	Robust S.E.	T stat	Coeff	Robust S.E.	Z stat
LCC				181.876	20.451	8.89***
Household size ###	-0.034	0.004	-7.61***			
price of fertilizer ###	0.001	0.000	5.77***			
Sex	-0.019	0.029	-0.65	5.949	5.690	1.05
Age	-0.000	0.001	-0.34	-0.118	0.234	-0.5
Marriage	-0.011	0.016	-0.68	2.632	3.112	0.85
years of schooling	-0.003	0.003	-1.23	-0.367	0.537	-0.68
use of improve cassava varieties	0.009	0.014	0.61	4.273	2.636	1.62*
years of planting cassava	0.001	0.001	0.46	0.195	0.251	0.78
length of cassava cutting (m)	-0.436	0.191	-2.28**	12.765	35.328	0.36
source of land: renting	0.059	0.034	1.72*	2.983	6.705	0.44
Landowner	0.014	0.007	1.97**	0.579	1.042	0.56
Major source of income	-0.174	0.112	-1.55	37.180	21.927	1.70*
Motorcycle	0.003	0.004	0.73	-1.178	0.724	-1.63*
Off-farm income	-0.036	0.015	-2.47***	3.508	2.748	1.28
member of a cooperative society	-0.009	0.011	-0.82	-0.947	2.091	-0.45
Value of loan (U$)	-0.000	0.000	-2.26**	0.002	0.011	0.18
Distance to market	-0.001	0.002	-1.78*	-0.001	0.319	0.00
Method of planting	-0.055	0.032	-1.72*	1.962	6.461	0.30
market participation	0.035	0.016	2.18**	-1.492	2.759	-0.54
log of cost of transporting fertilizer	0.021	0.007	3.07***	2.984	1.234	2.42**
cassava plot	0.123	0.021	5.86***	54.417	4.433	12.28***
Information on credit	0.011	0.004	2.7***	-0.367	0.829	-0.44
Used credit in 2014	0.201	0.101	1.99**	18.310	18.619	0.98
Constant	0.361	0.303	1.19	-157.411	56.701	-2.78***
number of observation	810			810		
Wald chi2(37)						34.12***
F(35, 774)			34.12***			
R-squared			0.4759			0.8195
Adjusted R-Squared			0.4522			
Partial R-squared			0.1771			
Robust F(2, 774)			56.7953***			
Root MSE			0.4096			0.9001
Robust Score chi2 (1)						49.1000***
Robust regression F (2, 771)						58.4237***
Score chi2						0.0205
P – value						0.8861
Minimum eigenvalue statistics					46.006	
2SLS size of nominal 5% Wald test						
10%					19.93	
15%					11.59	
20%					8.75	
25%					7.25	

Note: ***, ** and * implies statistically significance at 1, 5, and 10% level respectively
Instruments
Source: Field Survey, 2015

This study revealed that the ATT from both estimates, of a farmer that have LCC >= 0.5 ranges from U$211.89 - 170.92 (₦34, 013.08 – 44, 156.11) on average from cassava sales. This asserts that high LCC increases income of cassava farmers thus, improving poverty. It also shows on average that participants with LCC of more than 0.5 earn more than $1 poverty line per day adopted internationally[4]. This conforms to Onwudiwe *et al.*, (2014) that extent of commercialization alleviates poverty. Fakoya *et al.*, (2010) further revealed that farmers' perceived income realized from cassava sales as source of improved livelihood and poverty alleviation. Farmers used the income realized for food, clothing,

[4] Sachs, Jeffrey D. (2005) *The End of Poverty* 2005, p. 20

education, health care and shelter, which are major indicators for poverty reduction. Corresponding with other studies Tufa *et al.*, (2014), Ele *et al.*, (2013), Okezie *et al.*, (2012), and Martey *et al.*, (2012), cassava plot, fertilizer use, mobile phone, information on credit, market participation, landowner, renting land, transaction cost and use of credit positively affect LCC while distance to market, length of cutting, method of planting, value of loan, off-farm income and household size negatively affects LCC. The effect of these factors on LCC also determines poverty reduction among participants.

CONCLUSION

Commercialization of agriculture has been in the front line of many developing countries as a tool for increasing income, improving livelihood and poverty reduction. No doubt of the potentials of agriculture to reduce poverty particularly in Africa where net income of the major population comes from agriculture. Subsequently, the Nigeria government initiated the Increase Cassava Production and Export programme to promote growth in the production, processing, marketing and utilization of cassava, and thus boost national food security and poverty reduction. Therefore, this study assessed the impact of ICPEP on livelihood and poverty reduction via monthly cassava income of participants. ATT for having cassava commercialization index of 0.5 and above is significant and positive resulting to an increase of ₦34, 013.08 – 44, 156.11on monthly cassava income. The effect of LCC will further reduce poverty if factors such as supply and distribution of fertilizer and credit are properly addressed in the ICPEP. Finally, there is need to discover the synergies between credit/fertilizer supply and farmers as to develop an efficient distribution channel to enhance ICPEP impact on farm households as well as identifying the potentials of farmer clusters for market development.

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