

Investigating Endogeneity Effect of Agricultural Commercialization on Household Poverty Status in Oyo State Nigeria: A Cdsimeq Approach

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Abstract – There is an increasing literature on the causal effect of agricultural commercialization on household poverty. However, the empirical evidence regarding the existence of by-causality between commercialization and household poverty is still limited. This study investigated the relationship between them using CDSIMEQ approach. Specifically, the study profiled the respondents based on their poverty status and commercialization level and with respect to their socio-economic characteristics. A multistage sampling techniques was used to collect primary data from 209 smallholder farmers in Oyo state, Nigeria. Data collected were analysed using descriptive statistics, relative poverty measure (RPM) and two stage probit least square regression model (P2SLS). Results reveals that about 40 percent of the smallholder farmers were poor, 33.01 and 16.75 percent of them were in the third and fourth quartile of commercialization level which represented the highest and lowest percentage value for participating in commercialization. The average age of the farmers was about 46 years, with about 17 years farming experience. The mean household size was 7 members which was fairly large. The proximity of the farm to the closest market is an average of 4 kilometers. The findings further revealed the two-way causality between household poverty and commercialization. It was there recommended that smallholder farmers should be encouraged to participate in commercialization to alleviate their poverty and enhance their household well-being.

Keywords – Commercialization, Relative Poverty, Two Stage Probit Least Square, Endogeneity.

I. INTRODUCTION

Agriculture continues to be a strategic sector in the development of most low-income nations. It employs about 40% of the active labour force globally. In sub-Saharan Africa, Asia and the Pacific, the agriculture-dependent population is over 60%, while in Latin America and high income economies, the proportions are estimated at 18% and 4%, respectively. Close to two thirds of the natural wealth in low-income countries is engaged in crop and pasture land. Poverty within Nigeria remains staggeringly high with over 50% and 70% of its general and rural population respectively, living on less than \$2 a day (Adenegan et al, 2013). The high poverty rate persists in rural Nigeria, where farming households continue to depend on agriculture for food and income, despite economic growth.

Research has shown that smallholder farmers comprise 85% of the farming population worldwide (Asuming-Brempong et al, 2013). Majority of the populations in Nigeria live in rural areas and largely depend on small scale agriculture for sustainability. With limited prospects for rural development, smallholder agriculture remains the

major engine of rural growth and livelihood improvement for some time. Meeting the challenge of improving rural welfare in Nigeria will require some form of transition out of the semi - subsistence, low - input, low - productivity farming systems that currently characterizes much of rural Nigeria. Despite Nigeria's abundant agriculture, poverty is widespread in the country and is especially severe in rural areas where up to 80 percent of the population lives below the poverty line, there is a persisting paradox of a rich country inhabited by poor people which has been the subject of great concern for many years, but more especially in the last decade (Edet and Etim, 2014).

The term 'smallholder' usually has embedded in it the connotation of limited land availability. Others sketch a broader view of 'resource-poor' farmers, such as those with limited capital, fragmented holdings, and limited access to inputs (Jayne and Muyanga 2011). Smallholder commercialization may be broadly defined as the situation where farmers of small individual and family farms have greater engagement with markets, either for inputs, outputs, or both (Olwande and Smale 2014). Smallholder farming is key to livelihoods of many rural households in developing economies. Recognition of the potential of market to unlock economic growth and development gave rise to market led rural development paradigm during the 1980s. Small holder farming has proven to be as efficient as larger farms when farmers have received similar support services and inputs (seed, fertilizer, and credit). Many countries and international development agencies give due concern to intensification and commercialization of smallholder farming as a means of achieving poverty reduction and thus have reflected it in their official policies (Ele et al, 2013).

According to Ahmed (2017), in spite of some important successes in reducing poverty, achieving lower-middle income status and increasing agricultural productivity remains a mirage. This is because the smallholders have remained subsistence oriented and their economic contribution has not been properly accounted for. This is attributed to the multiple challenges they faced and which are related to unfavourable historical policies and institutions; transaction costs and access to productive resources, finance, technology, markets availability and information, infrastructure and skills development services. Notwithstanding, the future of smallholder commercialization is not completely bleak as opportunities also emerge in the changing environment especially those related to increased demand driven by population growth, urbanization, income growth and changing consumer tastes and lifestyles. Therefore, smallholders have the opportunity

to commercialize, grow their income and alleviate poverty hence have a better standard of living (Zhou et al, 2013). Commercialization is the outcome of a simultaneous decision-making behaviour of farm households in production and marketing. A characteristic feature of the agricultural production system in Nigeria is that a disproportionately large fraction of the agricultural output is in the hands of these smallholder farmers whose average holding is about 1.0-3.0 hectares (Agwu et al, 2012).

At household level, the extent to which smallholder farmers commercialise depends on agro-climatic conditions and risks; access to markets and infrastructure; community and household resource endowments; input and factor markets; laws and institutions; cultural and social factors affecting consumption preferences, production and market opportunities and constraints. There are also exogenous forces that drive commercialization and these include population and demographic change, urbanisation, availability of new technologies, infrastructure and market creation, macroeconomic and trade policies. These factors affect commercialisation by altering the conditions of commodity supply and demand, output and input prices, transaction costs and risks that farmers, traders and others in the agricultural production and marketing system have to cope with. One of the factors that can also affect participation of smallholder farmers in commercialisation of their agricultural activities is their poverty status and this affects their level of **welfare** (Leavy, and Poulton, 2007). Randela, Alemu and Groenewald (2008) also reported that rising market participation can affect smallholder farmers' welfare in two ways through improving the poverty status of most household directly through income effects and indirectly by different linkages.

Commercialization allow households to increase their incomes by producing that which provides the highest returns to land and labour and then use the cash to buy household consumption items rather than be constrained to produce all the goods that the household needs to consume. In the long run, subsistence agriculture may not be a viable activity to ensure improved poverty status and sustainable household welfare. Commercializing smallholder agriculture is an indispensable pathway towards economic growth and development for most developing countries relying on the agricultural sector, therefore there is need to identify the level and driving forces of commercialization of smallholder farming and possible areas of intervention. Such analysis will help to design appropriate instruments, institutions and other interventions for sustainable economic development of small-holder farmers as well as improve their well-being. (Ele et al, 2013).

Despite inconclusive evidence of the impact of agricultural commercialization on smallholder household well-being, many developing countries with majority of their population engaging in smallholder agriculture continues to pursue this agricultural transformation process. Past empirical studies have been criticized for methodological flaws, this study is further justified in its methodological approach to solve endogeneity problem existing between commercialization and household poverty status due to non-linear interaction of commercialization

with unobservable and omitted variables which could bias the estimated structural coefficients using probit two stage least square model (P2SLS). This methodological approach takes care of the continuous index of commercialization and the dichotomous nature of household poverty. In view of this, the study examined the effect of commercialization of small holder's maize crop farmers on poverty status outcomes in specifically, the study; profiled the poverty status and the socio-economic characteristics of the smallholder farmers based on their level of commercialization. It determined the factors influencing commercialization of crops in the study area as well as factors influencing their poverty status and established the bi-causal link between the two.

II. LITERATURE REVIEW

Commercialization aims to bring about a shift from production for solely domestic consumption to production dominantly market oriented. It is usually thought in large scale and the economists usually tend to ignore the fact that even the small farmers and poor households participate in the market either because they produce a little surplus or sell to earn cash income to meet other family necessities (Dil et al, 2010). Commercialization of agriculture as a characteristic of agricultural change is more than whether or not a cash crop is present to a certain extent in a production system. It can take many different forms by either occurring on the output side of production with increased marketed surplus or occur on the input side with increased use of purchased inputs (Agwu et al, 2012). Commercialization could be seen as the strength of the linkage between farm households and markets at a given point in time. This household-to-market linkage could relate to output or input markets either in selling, buying or both. Alternatively, smallholder commercialization could also be seen as a dynamic process: at what speed the proportion of outputs sold and inputs purchased are changing over time at household level (Jaleta Gebremedhin and Hoekstra, 2009). The household asset endowments along with connecting infrastructures are important determinants of commercialization of agriculture. Asset endowments refer to production factors endowments (land, labour and capital) as well as local infrastructure (road, communications, etc.). Household asset endowments shape household strategies to invest its resources for household diversity and welfare goals. Inequalities in asset endowments along with other factors such as seasonality, market, credit and labour markets, generate different asset strategies among households and yield differences in agricultural diversity at household level (Dil et al, 2010). In Agriculture, commercialization has been the bridge between subsistence farming (household farming) and commercial farming, it's the transformation that takes place when household decides to want to sell its output and not produce for its own consumption only. Commercializing smallholder agriculture is an indispensable pathway towards economic growth and development for most developing countries relying on the agricultural sector (Macharia 2014), Commercialization enhances the links between the input and output sides of agricultural markets.

Many countries and international development agencies give due concern to intensification and commercialization of smallholder farming as a means of achieving poverty reduction and thus have reflected it in their official policies (Ele et al, 2013). Smallholder commercialization is assumed to lead towards more specialized production systems based on comparative advantages in resource use. In turn, specialized production leads to higher productivity through greater learning by doing, scale economies, exposure to new ideas through trade (better knowledge diffusion through exchange), and also better incentives in the form of higher income. Impacts of commercialization can be categorized into first, second and third orders. The first-order are mainly income and employment effects that are directly reflected in household welfare. The second-order effects include health and nutrition aspects usually contingent on the level of income attained through the existing level of commercialization. The third-order (or usually known as higher order) effects are the macro-economic and environmental effects that go beyond household level (Jaleta et al, 2009).

Agricultural commercialization tends to generate more household income due to its comparative advantages over subsistence production. However, unless rural markets are well-integrated and risks are low to influence household decision behaviour, the shift from subsistence to commercial crop production may have an adverse consequence by exposing households to volatile food market prices and food insecurity (Kristien 2013). It produces positive and negative, as well as intended and unintended results at household, societal and global level (Zhou *et al.*, 2013). At household level, studies by IFPRI in Africa credited commercialization for: Increased productivity; family employment; increased household income through market participation and employment; improved consumption diversity; improved nutritional welfare; improved education, health and welfare; and improved household living standards (Boka 2017). This study discovered that at societal level, commercialization contributes to food security; poverty alleviation; rural and urban employment creation; improved livelihoods and social status as well as economic growth through productivity and investment.

Also credited commercialization for creating rural markets for agro-inputs; creating rural supply bases for urban industries and consumers; increased economic investment in agriculture and other sectors; distribution of agricultural products through trade and environmental sustainability. In Nigeria observed increased productivity in food crops due to cotton commercialization as farmers increased use of high productivity inputs purchased with cotton income. Similar effects on income and productivity were also witnessed in Malawi's tobacco production, Botswana's beef production (Timan 2004) and Zambia's maize production (von Braun and Kennedy, 1994). Most of the positive results are income-mediated as increased household income is used to finance household welfare, and investment society and other enterprises. These results confirm commercialization's role in livelihoods, rural development and poverty reduction.

On the other hand, mixed results reported from studies

have caused some questions raised over commercialization's nutritional, welfare and environmental sustainability roles. According to Zhou *et al.*, (2013), commercialization has been criticized for failure to improve household nutrition and livelihoods of the poorest; replacing subsistence risk with more complex market risk; failing to guarantee household food security and welfare; and opposing food self-sufficiency objectives. It has also been criticized for widening regional income inequalities, land degradation through chemicals and being an expensive and risky undertaking especially by the poorest. However, Azametal, Minot and Rashid (2012) argued that the accusations are not comprehensively proven as some of criticisms levelled against commercialization are in fact results of failure in policies, strategies, institutions, attitudes and distribution of benefits and costs within households and communities. Although some negative results have been reported, positive results outweigh the criticisms and strengthen the need for commercialization. However, more empirical research is needed on effects to determine more convincing results (Zhou *et al.*, 2013).

III. METHODOLOGY

The study area is Oyo State, an inland state in south-western Nigeria, with its capital at Ibadan. It is bounded in the north by Kwara State, in the east by Osun State, in the south by Ogun State and in the west partly by Ogun State and partly by the Republic of Benin. Oyo State covers approximately an area of 28,454 square kilometers and is ranked 14th by size. The landscape consists of old hard rocks and dome shaped hills, which rise gently from about 500 meters in the southern part and reaching a height of about 1,219 metre above sea level in the northern part. The Climate is equatorial, notably with dry and wet seasons with relatively high humidity. The dry season lasts from November to March while the wet season starts from April and ends in October. Average daily temperature ranges between 25 °C (77.0 °F) and 35 °C (95.0 °F), almost throughout the year.

Sampling technique: Oyo State is covered by Oyo-State Agricultural Development Programme (ADP) with four zones namely; Shaki, Ogbomoso, Oyo and Ibadan/Ibarapa. A multistage random sampling technique was used to select the studied farmers. Ogbomoso and Oyo zones were purposively selected for they were regarded as the food basket of Oyo state. The membership strength of the farmers was compiled (1190) and twenty percent of the farmers were randomly selected (238). However, 209 farmers were eventually used for the study due to inconsistency in data supplied by the farmers. Data were obtained using structured questionnaires and were analyzed using the descriptive statistics such as frequency counts, percentages, mean and standard deviations, Household Commercialization Index (HCI), Relative Poverty Measure (RPM) and Probit two stage least square regression (P2SLS).

Data analysis. The household commercialization index (HCI) was used to determine household specific level of commercialization. The model specification is



$$HCI = \frac{\text{gross value of crop sales}}{\text{gross value of all crop yield}} \times 100$$

Relative Poverty Measure (RPM) was used to categories the respondents based on a measure of per capita expenditure (PCE) of households on food and non-food expenditure. Households spending less than two third of the mean PCE were categorized as poor, while those spending it were categorized as non-poor. Also, the P2SLS model used was based on Maddala (1983) where estimates for simultaneous equations such as household poverty and commercialization behavior were obtained. The command `cdsimeq` is written to fit a simultaneous equation model in which one of the variables is continuous and the other is dichotomous in nature. In order to attain partial equilibrium between the variables, an iterative process was adopted. A joint sub-system incorporating commercialization and household poverty was formulated, this presents various estimation challenges as the former is an observed continuous variable while the latter is dichotomous. Invariably, the commonly adopted two stage least square regression model is obviously not applicable here because both endogenous variables considered were not continuous. As suggested by Maddala (1983), further illustrated by Keshk (2003) and used by Felsentein and Ashbel (2010), the estimation strategy involves creating instruments for the potential endogenous variable in the first stage and substituting them into the structural equations in the second stage.

In order to estimate this CDSIMEQ two stage programmed in STATA (Keshk 2003) was used. The Stage 1 involves the estimation by OLS and probit models which were fitted using all the exogenous variables and the predicted values obtained. The reduced-form estimates, predicted values from each model were obtained for use in the second stage. In Stage 2, the original endogenous variables from stage 1 were replaced by their fitted values. Finally, correction for standard errors was done. This is the adjustment of the variance-covariance matrices as the models were based on predicted values and not on the appropriate observed values. In this case the two-equation system consists of a commercialization model (y_1 , continuous variable) estimated by OLS and a household poverty model (y_2 , dichotomous variable) estimated by probit, as follows:

$$y_1 = \gamma_1 y_2^* + \beta_1 X_1 + \mu_1 \quad \dots 1$$

$$y_2^* = \gamma_2 y_1 + \beta_2 X_2 + \mu_2 \quad \dots 2$$

Note that while $y_1 = y_1^*, y_2^*$ is observed as a dichotomous endogenous variable i.e. it is equal to 1 if $y_2^* > 0$ and equal to 0 otherwise. As y_2^* is not observed (i.e., only observed as a dichotomous variable), the structural equations (1) and (2) are re-written dividing through by standard errors:

$$y_1 = \gamma_1 \sigma_2 y_2^{**} + \beta_1' X_1 + \mu_1 \quad \dots 3$$

$$y_2^{**} = \frac{\gamma_2}{\sigma_2} y_1 + \frac{\beta_2'}{\sigma_2} + X_2 \frac{\mu_2}{\sigma_2} \quad \dots 4$$

The two-stage estimation then proceeds with the estimation of reduced-form OLS and probit models for commercialization and household poverty status respectively:

$$y_1 = \Pi_1 X_1 + v_1 \quad \dots 5$$

$$y_2^{**} = \Pi_2 X_2 + v_2 \quad \dots 6$$

where X is the matrix of all exogenous variables and Π_1, Π_2 are vectors of parameters to be estimated. The predicted values from equations (5) and (6), $\widehat{y}_1, \widehat{y}_2^{**}$, are plugged back into the model for the second-stage estimation. Thus, the original endogenous variables in (1) and (2) are replaced by their fitted values from (5) and (6):

$$y_1 = \gamma_1 \widehat{y}_2^{**} + \beta_1 X_1 + \mu_1 \quad \dots 7$$

$$y_2^{**} = \gamma_2 \widehat{y}_1 + \beta_2 X_2 + \mu_2 \quad \dots 8$$

On a final note, a correction for the estimated standard errors is needed. These corrections are based on $\widehat{y}_2^{**}, \widehat{y}_1$ and not on y_2^{**}, y_1 . The CDSIQEM procedure adjusts the variance-covariance matrices and produces corrected variances for use in equations (3) and (4).

IV. RESULTS AND DISCUSSION

The level of commercialization is presented in Table 1 in relation to the farmers' poverty profile. Results revealed that 39.71 percent of the respondents fall under the poor category while the remaining 60.29 percent were non-poor. About 33 percent of the respondents which accounted for the highest percentage were in the 3rd quartile that is, the farmers who sell between 50 and 75 percent their farm produce to generate income. The mean percentage for this category of people 68.63 percent. The least percentage value for the level of commercialization (16.75%) are farmers who sell more than 75 percent of their farm produce for income generation. An average farmer in this category sells about 86 percent of what is produced on their farm.

About 23 percent of the farmers in the poor category sold only 12.94 percent of what they produced on farm to generate income while an average farmer in the non-poor category sold less than poor category (6.55%). Expectedly, for both poor and non-poor categories, the mean percentage of farm products sold by farmers relatively increased from the first to the forth quartile with increase in the level of commercialization. However, the non-poor category had a higher mean percentage when compared to their poor counterpart. It is worthy to note that there is a minimal difference in the mean percentage of farm produced sold between the poor and non-poor categories for the second quartile group. The result established that farmers in the study area engaged in commercialization in the area of study at different levels.

Table 1. Respondents level of commercialization.

Commercialization level	Poor		Non-poor		Pooled	
	*Freq.	**Mean	*Freq.	**Mean	*Freq.	**Mean
1 st quartile (≤ 25%)	19.00 (22.89)	12.94 (8.35)	25.00 (19.84)	15.77 (6.55)	44.00 (21.05)	14.55 (7.42)
2 nd quartile (25.1 -50%)	26.00 (31.33)	38.36 (5.95)	35.00 (27.78)	38.96 (6.84)	61.00 (29.19)	38.70 (6.43)
3 rd quartile (50.1- 75%)	25.00 (30.12)	67.98 (5.71)	44.00 (34.92)	69.00 (5.76)	69.00 (33.01)	68.63 (5.72)
4 th quartile (> 75%)	13.00 (15.66)	85.44 (3.63)	22.00 (17.46)	85.62 (3.62)	35.00 (16.75)	85.56 (3.57)
Total	83.00 (100.00)	43.58 (26.05)	126.00 (100.00)	56.46 (24.41)	209.00 (100.00)	51.35 (25.80)

* Figures in parenthesis are percentages

** Figures in parenthesis are standard error

Source: field survey 2017

V. PROFILED SOCIO ECONOMIC CHARACTERISTICS RELATIVE TO LEVEL OF COMMERCIALIZATION

The profiled farmers' socio economic characteristics are presented in Table 2. There is decrease in the percentage of farmers' participation in commercialization as the level of commercialization increases for farmers under 30 years and those between 31 and 40 years. An exception to this are farmers under 30 years' old who were in the fourth quartile and those between 31 and 40 years under the first quartile. The mean age of the respondent is about 46 years. This indicated that an average farmer is still in his active years, hence energetic enough to withstand the rigours of producing and selling of farm produce. On the other hand, there is percentage increase in female participants with increase in level of commercialization from first to fourth quarter while the male counterparts experience a decrease in participation with increasing commercialization level. The married respondents had the greatest representation relative to other categories. Hence, they recorded the highest percentage for all the levels of commercialization considered. The respondents had 88.52 and 88.41 percent of participation for the second and third quartiles. There is decrease in the percentage of the singles with increasing commercialization level.

The percentage of farmers that participated in commercialization increased with increase in quartile for farmers with three household members or less while it decreased with increase in quartiles for respondents with 4 to 6 household members. None of the farmers with more than 9 members have a representation in the first quartile while it has the highest percentage for the fourth quarter (40%). The farm size result revealed that for farmers with hectares and below there is increase in participation with increasing level of commercialization. Farmers with more than four hectares of farmland had the highest percentage in the first quartile and this decrease across the table with the least percentage of 14.29 in the fourth quartile. The mean farm size is 3.18 hectares which confirms that the farmers were smallholders who engage in commercialization of their farm produce.

Also, the farmers with 10 years of farming activities or

less recorded an increasing percentage of participation in commercialization with increase in commercialization activities from first to fourth quartile. Respondents with eleven to twenty years farming experience recorded the highest percentage in the first quarter (38.64%) and the least in the fourth quartile (17.14%). Farmers with more than forty years farming experience recorded the least in all the levels of commercialization considered. It is noteworthy that they have no representation whatsoever in the fourth quartile of the commercialization groups. Proximity to the market can go a long way in encouraging farmers to participate in commercialization. The result revealed that percentage of farmers participating in commercialization decrease with increasing level of commercialization for farmers with one kilometer or less to their farmland. Reason for this may be due to the fact that some farmers sell their produce at the farm gate to avoid transportation cost which may lower their income. On the contrary, farmers with over four kilometers away from the farmland recorded the highest percentage of participation in all the considered quartiles except the third. This may be done to encourage buyers who may be unwilling to buy at farm gate due to distance.

All the farmers in the first quartile realized ₦100,000 or less but not more than that from their commercialization activities unlike others in the second, third and fourth quartiles. Noteworthy is the fact that respondents with income of ₦100,000 or less recorded the highest percentage for the four quartiles considered in this work. The least percentage however are farmers who earn more than ₦300,000. The average income for the farmers was ₦117,756 which is relatively low relative the average farmland cultivated. Over average of the respondents in all the quartiles testified they had access to credit facilities which may be from different sources, while majority of the farmers in the first quartile (93%) claimed they had access to extension agent activities, 62.30 percent of respondents in the second quarter belongs to one association or the other where they can access information, training and exchange technology to improve their farming activities. Majority of the farmers were involved in secondary income generating activities to increase income hence have the ability to improve their family well-being.

Table 2. Respondents profile relative to their level of commercialization.

Commercial level	<= 25% Freq (%)	25.1.-50% Freq (%)	51.1 -75% Freq (%)	>75% Freq (%)
		Mean ± Std dev. =		45.64± 11.41
Age				
<=30	6 (13.64)	4 (6.56)	3 (4.35)	3 (8.57)
31-40	12 (27.27)	20 (32.79)	22 (31.88)	9 (25.71)
41-50	17 (38.64)	19 (31.15)	25 (36.23)	13 (37.14)
51-60	7 (15.91)	13 (21.31)	14 (20.29)	7 (20.00)
>60	2 (4.55)	5 (8.2)	5 (7.25)	3 (8.57)
Sex				
Female	9 (20.45)	14 (22.95)	17 (24.64)	13 (37.14)
Male	35 (79.55)	47 (77.05)	52 (75.36)	22 (62.86)
Marital Status				
Married	32 (72.73)	54 (88.52)	61 (88.41)	30 (85.71)
single	7 (15.91)	4 (6.56)	3 (4.35)	1 (2.86)
widowed	3 (6.82)	2 (3.28)	4 (5.80)	3 (8.57)
seperated	2 (4.55)	1 (1.64)	1 (1.45)	1 (2.86)
Household size		Mean ±Std dev. =		7.43 ± 4.74
<=3	6 (13.64)	4 (6.56)	7 (10.14)	5 (14.29)
4 – 6	30 (68.18)	28 (45.9)	30 (43.48)	9 (25.71)
7 - 9	8 (18.18)	10 (16.39)	12 (17.39)	7 (20.00)
>9	(0 0.00)	19 (31.15)	20 (28.99)	14 (40.00)
Farm size		Mean ±Std dev. =		3.18 ± 2.05
<=1	6 (13.64)	6 (9.84)	11 (15.94)	7 (20.00)
1.1-2.0	3 (6.82)	13 (21.31)	28 (40.58)	14 (40.00)
2.1-3.0	14 (31.82)	21 (34.43)	9 (13.04)	7 (20.00)
3.1-4.0	3 (6.82)	6 (9.84)	8 (11.59)	2 (5.71)
>4.0	18 (40.91)	15 (24.59)	13 (18.84)	5 (14.29)
Farming Experience		Mean ±Std dev. =		17.04 ± 10.68
<=10	5 (11.36)	20 (32.79)	38 (55.07)	22 (62.86)
11-20	17 (38.64)	21 (34.43)	20 (28.99)	6 (17.14)
21-30	13 (29.55)	9 (14.75)	7 (10.14)	5 (14.29)
31-40	8 (18.18)	7 (11.48)	3 (4.35)	2 (5.71)
>40	(1 2.27)	4 (6.56)	1 (1.45)	
Distance to market (km)		Mean ±Std dev. =		4.00 ± 3.17
<=1	7 (15.91)	7 (11.48)	5 (7.25)	2 (5.71)
1.1-2	(11 25)	13 (21.31)	32 (46.38)	14 (40.00)
2.1-3	2 (4.55)	1 (1.64)	4 (5.8)	2 (5.71)
3.1-4	2 (4.55)	4 (6.56)	1 (1.45)	2 (5.71)
>4	22 (50.00)	36 (59.02)	27 (39.13)	15 (42.86)
		Mean ±Std dev. =		117,756.00 ± 120,914.40
Income				
<=100000	44 (100.00)	38 (62.30)	33 (47.83)	17 (48.57)
100001-150000		10 (16.39)	15 (21.74)	6 (17.14)
150001-300000		9 (14.75)	15 (21.74)	8 (22.86)
300000-450000		1 (1.64)	3 (4.35)	2 (5.71)
>450000		3 (4.92)	3 (4.35)	2 (5.71)
Access to credit	28 (63.64)	39 (63.93)	40 (57.97)	20 (57.14)
Access to Ex.agent	41 (93.18)	44 (72.13)	30 (43.48)	19 (54.29)
Assoc.Membership	29 (65.91)	38 (62.30)	29 (42.03)	18 (51.43)
Sec. occupation	41 (93.18)	55 (90.16)	50 (72.46)	24 (68.57)
Total	44 (100.00)	61 (100.00)	69 (100.00)	35 100.00)

Source: field survey 2017

VI. DETERMINANTS OF COMMERCIALIZATION AND HOUSEHOLD POVERTY

The results of the factors influencing commercialization and household poverty is as presented in Table 3 with the OLS and the Probit regression results for stage one estimates. The results revealed that sex, access to extension agent activities and secondary occupation significantly influence level of commercialization negatively while marital status, ownership of land and household income positively influence it. Sex influence the level of commercialization of crops grown at 10% level of significance. This is an indication that increase in the number of households headed by females farmers will increase the level of commercialization in the study area. Reasons for this cannot be far-fetched as the female folk are known to be more involved in agricultural marketing relative to their male counterpart.

Access to extension agent and engaging in secondary occupation were statistically significant at 5%. This indicates that increase in the access to extension agent services and secondary means of income will reduce the level of commercialization of the smallholder farmers in the study area. The result implies that excess of this activities will reduce the attention given to commercialization hence reduction in participation. On the other hand, increase in the number of married respondents will increase the rate of smallholder farmers' participation in commercialization. Having more responsibility at the household level may encourage more involvement in commercialization in order to generate more income for the well-being of the family.

Household income and land ownership significantly infl-

uence commercialization level at 10%. This implies that as the total land owned by a farmer increases, the level of participation will also increase. As expected, more land cultivated will increase farm output which invariably will be sold for income generation. Also, as income increases, the tendency to expand farmland increases hence increased commercialization level of the smallholder farmers.

The factors influencing farming household poverty status in the area includes, household size, marital status and household income at 1% level of significance while sex, level of education and land ownership influence poverty at 10% level of significance. The sex estimates as shown on the table favours the female smallholder farmers which implies that an increase in the number of female smallholder farmers will increase the probability of the household having an improved poverty status and vice versa for the male folks. Also, an increase in the number of household members will reduce the probability of the household moving out of poverty. This is consistent with a priori expectations as increased household size will lead to increase household demand for resources that may go round hence, reduction in standard of living for the household.

Being married had a positive influence on household poverty status. This is an indication that as the number of married smallholder farmers increases there will be increase in the probability that the household will have an improved poverty status relative to the unmarried respondents. Land ownership, and household income positively affect poverty level of the smallholder farmers. An indication that increase in ownership of land and income generated will increase will increase the tendency of the farming household to have improved poverty status.

Table 3. Results of First stage regression estimates.

comindex	Coef.	SE	t	Povtcat 2	Coef.	SE	z
age	0.32	0.22	1.46	age	0.02	0.02	0.93
sex	-6.72*	3.84	-1.75	Sex	-0.51*	0.27	-1.86
Hhdsiz	0.26	0.45	0.59	Hhdsiz	-0.29***	0.05	-5.56
ms_dummy	10.13**	4.81	2.11	ms_dummy	0.95***	0.33	2.88
Yearsinsch	0.12	0.38	0.33	Yearsinsch	0.05*	0.03	1.95
Farmsize	-0.65	1.09	-0.59	Farmsize	0.03	0.07	0.42
experience	-0.29	0.28	-1.06	experience	-0.01	0.02	-0.47
Creditaccess	0.59	3.53	0.17	Creditaccess	-0.02	0.24	-0.06
Ext.Agent	-10.11**	4.46	-2.21	Ext.Agent	-0.30	0.33	-0.88
Association	-6.79*	3.92	-1.73	Association	0.25	0.26	0.93
Mkt dist	0.47	0.62	0.77	Mkt dist	0.01	0.04	0.34
Own land	6.42*	3.43	1.87	Own land	0.41*	0.23	1.79
income	0.00*	0.00	1.68	income	0.00***	0.00	2.88
sec0ccup	-10.31**	4.35	-2.37	sec0ccup	-0.39	0.31	-1.26
_cons	45.92***	10.73	4.28	_cons	0.31**	0.12	2.51
No.of obs	=		209	No of obs	=		209
Prob > F	=		0.0000	LR chi2(14)	=		88.9
R-squared	=		0.2998	Prob > chi2	=		0.0000
Adj R-sqrd	=		0.2492	Pseudo R2	=		0.3166

Source: Regression Estimates

VII. ENDOGENEITY EFFECTS OF AGRICULTURAL COMMERCIALIZATION ON HOUSEHOLD POVERTY

The commercialization of agricultural produce is at a cost when time and other resources are considered. It is therefore imperative to set apart the exogenous impact of commercialization on household poverty. The study tested for the existence of causality effect with the aid of instrumental variable using CDSIMEQ program for implementing two stage probit least square. Earlier studies have always used methods such as endogenous switching regression (Olwande and Smale, 2014) and (Muricho et al., 2017), double hurdle regression model (Boka, 2017) among others. This study, however, used a different model. That is, P2SLS which fit a simultaneous equation model in which one of the variables is continuous (household commercialization index) and the other is dichotomous (household poverty status).

Table 4 presents the second stage estimates of the OLS and the Probit regression with the corrected standard error. The stage two estimates results confirmed the existence of a bi-causal relationship between household poverty status and the smallholders level of commercialization. The result suggests a positive relationship between household poverty and commercialization level at 5% significance level. This indicates that households with high level of commercialization will increase the probability of a household having an improved poverty status.

It is worthy to note that at the second stage, regression estimate reveals that household size positively influence commercialization at 1% significance level contrary to the first stage regression estimates where household had no effect on commercialization. This suggest that the larger households will enhance will higher level of commercialization. That is, increase in household size will increase level of commercialization.

Table 4. Second stage regression estimates with corrected standard errors.

comindex	Coef.	SE	t	povtcat2	Coef.	SE	z
I_povtcat2	9.04***	4.46	3.46	I_comindex	0.05**	0.03	2.49
age	0.12	0.36	0.51	age	0.01	0.02	0.74
sex	-1.64	6.13	-0.42	sex	-0.51*	0.30	-1.7
Hhdsiz	2.79***	1.37	3.27	hhdsiz	-0.27***	0.05	-5.63
ms_dummy	1.28	8.19	0.25	ms_dummy	1.01**	0.42	2.43
Yearsinsch	-0.42	0.61	-1.06	Yearsinsch	0.05**	0.03	2.03
Farmsize	-1.04	1.68	-0.95	Farmsize	0.03	0.02	0.42
experience	-0.06	0.43	-0.22	experience	-0.01	0.07	-0.39
Creditaccess	2.17	5.29	0.63	Creditaccess	-0.07	0.23	-0.32
Ext.Agent	-9.16*	7.23	-1.96	Ext.Agent			
Association	-9.65**	6.24	-2.37	Association			
Mkt dist	0.09	0.95	0.14	Mkt dist			
Own land				Own land	0.42	0.29	1.46
Income				income	0.00***	0.00	3.07
sec0ccup				sec0ccupdu~y	-0.42	0.40	-1.04
cons	39.96***	14.71	4.17	cons	0.29**	0.14	2.44
No of obs	=		209.00	No of obs	=		209.00
Prob > F	=		0.00	LR chi2(14)	=		87.63
R-squared	=		0.2859	Prob > chi2	=		0.00
Adj R-sqrd	=		0.2422	Pseudo R2	=		0.312

Source: Regression Estimates 2017.

VIII. CONCLUSION

The study contributed to literatures on poverty reduction through the attempt to overcome the endogeneity problem in the estimation of the effect of commercialization on household poverty. Findings from the study established the existence of two-way causality between them. It also identified the factors that influenced commercialization of farm produce as well as the factors determining smallholder farmers' poverty status. It is recommended that smallholder farmers should be encouraged to participate in marketing of the excesses from their farmland as this will enhance their poverty status which consequently improve their well-being and living standard.

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