

Impact of participation in producer organisation on the welfare of smallholding farming households in selected states of Northern Nigeria

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Abstract - Lack of access to specialized market leave numerous under-capitalized, high-cost individual smallholder farmers with low economies of scale in transaction cost or market intelligence, leaving most with unstable incomes. Sampling 604 smallholder farmers, this study evaluated the impact of agricultural producer organization membership on the welfare of smallholder farmers using cross-sectional data collected from the northern part of Nigeria. Using crop income as a welfare indicator, we measured the impact of agricultural cooperative membership by implementing the endogenous switching regression estimation technique. The estimation method indicates that joining producer organizations has a positive impact on the welfare of smallholder farmers. Furthermore, the analysis also indicates that agricultural producer organization membership has a heterogeneous impact on welfare among its members.

Keywords: Producer organization, welfare, Multinomial Endogenous Switching Regression, Smallholder farmers, Nigeria.

INTRODUCTION

Several of the developing countries, especially in the rural areas, were unable to achieve the Millennium Development Goal of reducing poverty by half between 1990 and 2015 (Aziz et al., 2021), and the achievement of most of the SDGs are also stalling (Liu, et al., 2024). Because most rural dwellers depend largely on agriculture for their livelihoods (Mukaila et al., 2021), improving productivity and market access and increased income, and by extension their welfare, is argued to be the main pathway out of poverty (Ma et al., 2024). Therefore, approaches to link farmers to markets through the producer organization are increasingly becoming a major pathway towards inclusiveness in the agricultural sector (Vorley, Fearne and Ray, 2016). Producer organizations help small-scale farmers to consolidate as a group, and develop shared comparative advantage in terms of quantity, quality, innovation, cost, and farm management, and securing supply. Thus becoming a lifeline in the current difficult entry within the global food value chains (Kale et al, 2025), especially in the presence of the inadequacies of conventional cooperatives (Fabusoro *et al.*, 2017). It enables contractual links to input and output markets (Simmons, Winters, and Patrick, 2005). For the farmers, the net benefit of selling through this market is higher as they have more income and low transaction costs (Aku, Mshenga, Afari-Sefa, and Ochieng 2018). But numerous under-capitalized, high-cost individual smallholder farmers are unable to explore the economies of scale in transaction cost or market intelligence (Poulton *et al.*, 2006), leaving most smallholder farmers with unstable incomes (Uduji et al., 2021).

Several agricultural policies in Nigeria are aimed at the development of the agricultural sector and improving the welfare of farmers (Abubakar et al., 2021), however, they have not been able to

bridge the gap in the growth of producer organizations and their attendant benefits as a link between smallholder farmers and the rapidly evolving modern market. The root cause often lies in policy designs that emphasize production technology improvement while overlooking the need for improved market participation, limiting the competitiveness of smallholders in markets. It is imperative to provide scientific evidence that will inform agricultural policies around producer organization to ensure inclusive participation and ultimately improve the household welfare- by increasing net income of smallholder farmers. Therefore, this study accesses the impact of participation in producer organization on the welfare of smallholder farmers. Several studies have been carried out in Africa on the impact of producer organization (Aku et al., 2018; Ahmed and Mesfin, 2017; Kizito, 2018; Verhofstadt and Maertens, 2014; Mutonyi, 2019 and Fischer and Qaim, 2012; Bachke, 2009). However, limited documentation exists on the impact of producer organizations on the income of smallholder farmers in Nigeria. Also, this study adopted the Multinomial Endogenous Switching Regression (MESR), accounting for selection bias and endogeneity originating from observed and unobserved heterogeneity, to analyze the impacts of participation in organization combinations on welfare

The benefits of participation in producer organization on welfare indicators (farm income, yields, prices received by producers, asset holdings, consumption expenditure, and other livelihood dimensions) have been extensively studied. Using Difference-in-difference, Buchke (2009) and Anirban (2019) found that participation in producer organizations contribute significantly to higher income, and thereby welfare among small-scale farmers. The effect of membership on income is stable and around 30% when the results are

significant. Using Propensity Score Matching (PSM), Aku *et al.*, (2018) shows that farmers who had access to the market provided by farmer organization have more income per season (USD 220.11) than vegetable farmers who do not belong to the group membership (USD 177.90). Although not crop specific Verhofstadt *et al.*, (2014) shows that cooperatives are most effective in increasing the income of smallholder farmers who are less likely to join the cooperative due to the entry requirements yet found no income effect for very low landholders of less than 0.15 hectares and it is not effective for improving the welfare of land poor or near-landless farmers although, farm income increased with landownership of 0.5 hectares and above. Similar findings are reported by Mutonyi (2019) who also found that the effect is only significant for farmers with a total farm size of 6 acres. Smallholder farmer participation is low. This is stated to be due to initial capital outlay of joining the organization. This is contrary to the findings of Ito *et al.*, (2012) in China who also used PSM but found that the treatment effect for smallholder farmers is 40-41 Yuan/day compared to 23 Yuan/day for large scale farmer. Although, continent specific difference may not be explained but this finding may be due to the fact that unobservable characteristics are not included in the model. Again, using endogenous switching regression Adjin, (2020) and Ma and Awudu, (2016) suggest that farmer organizations are effective at enhancing farmers' land productivity and welfare. Mojo *et al.*, (2017) shows that cooperatives have significant positive economic impacts on members, and direct and positive spill-over effects on non-members although, cooperative provide similar marketing and non-marketing services to both members and non-members (due to a vaguely defined property right problem). Jimenez *et al.*, (2018) in Philippines shows that cooperative membership significantly increases household welfare measured in terms of household consumption expenditure.

METHODOLOGY

The study area is Plateau and Kano states. Quantitative data was collected using a semi-

$$\pi_j = p(y = j) = \frac{1}{1 + \sum_{j=1}^{J-1} \exp[\sum_{k=1}^K \beta_{jk} x_k]} \quad j=1,2,\dots,J-1 \quad \dots\dots\dots (1)$$

The probability of lying within the baseline category will be calculated as:

$$\pi_J = P(y = J) = 1 - [(P(y = 1 + P(y=2) + \dots + P(y = J - 1))] \quad \dots\dots\dots (2)$$

In a multinomial logistic regression model, the logit transformation was obtained by taking the logarithms of the odd ratios after selecting the baseline category (Kienbaun and Klein, 2010). This is given as

$$\ln \left[\frac{P(y=1|x_1)}{P(y=0|x_1)} \right] = \beta_1 + \beta_{11} x_1$$

$$\ln \left[\frac{P(y=1|x_2)}{P(y=0|x_1)} \right] = \beta_2 + \beta_{21} x_1 \quad \dots\dots\dots (3)$$

structured questionnaire. The population for the study were tomato and potato farmers consisting of participants and non-participants in producer organizations. Tomato and potato producer organizations in the study area were well established for sufficient period to ensure meaningful assessment their impact on the welfare of their members. A multi-stage sampling procedure was adopted for respondent selection. Plateau and Kano states were purposively selected because of the successful establishment of the activities of producer organizations (Plaisier *et al.*, 2019). Based on high farming activities and the presence of established producer organizations, two local government areas was selected from each state and four communities was selected from each local government area making a total of sixteen communities for the study. Participants were systematically selected from the list of producer organizations members while non-participants with similar characteristics were selected. A total of 604 respondents consisting of 289 participants and 315 non-participants were utilised for this study.

Descriptive statistics was analysed using frequencies, and cross tabs while the Multinomial Endogenous Switching Regression (MESR) was used to analyse the impact of participation in producer organizations on the welfare of smallholder farmers.

The first stage of the MESR employed the use of multinomial logistic regression model. This model allows dependent variables to be more than two, discrete, non-ordered categories and have nominal properties, exhibiting multinomial distribution category (Liao, 1994; Long and Greese, 2006). The model for this study has three dependent variables categories; a baseline category was determined in order to make comparisons or analyses. The baseline category (*J*) can be selected arbitrarily by the package software (Hosmer and Rodney, 2000). If *J* is selected as the baseline category, the probability of the dependent variable to lie within the baseline category is defined as given as:

Variables in the model include Age, Education, Age square, Access to extension agent, access to credit, ownership of land, access to phone, distance to farm, farm income, participation in non-farm activities, entrepreneurial experience

organization and buttresses the notion that all services, opportunities, and establishments are open to all people and that male and female stereotypes should not define societal roles and expectations. Majority of the male respondents, 92.20%, participating in the producer organization are married while the lowest percentage of non-participants, 0.6% are widowed or separated and 78.87% of the female are married. The result shows that 10.14% of the respondents are single while a higher of respondents that are widowed, divorced or separated are female. This status has a way of influencing women ability to make autonomous choices in life, which includes participation in producer organizations. Women’s participation in producer organization itself reveals agency in itself, mirroring women’s physical mobility and freedom to participate in collective action (Meier zu Selhausen, 2016).

RESULTS AND DISCUSSION

Socioeconomic

The result in table 1 shows that 56.62% of the male respondents are participating in producer organizations compared to 32.42% for female respondents (Table 1). This is in line with the finding of Adefris and Woldeyohannes (2021) who opined that more males than females are involved in producer organization. However, more female-heads (69.51%) are involved in producer organizations than male-headed (50.57%). This is also like the result found for the male headed household. This shows gender inclusion in participation in formal

Table 1: Socioeconomic distribution based on membership of producer organization

Variables	Participants(n=289)	Non-participants(n=315)	Test of Difference
Sex of respondents			
Male	218 (56.62)	167 (43.38)	
Female	71 (32.42)	148(67.58)	
Head of household			
Male headed	264 (50.57)	258 (49.43)	
Female headed	57 (69.51)	25 (30.49)	
Marital status			
Single	10 (17.24)	48 (82.76)	
Married	257 (52.77)	221 (46.23)	
Widowed	17 (41.46)	24 (58.54)	
Divorced	2 (10.53)	17 (89/47)	
Separated	3 (37.50)	5 (62.50)	
Age (years)			
Less than 20	2 (13.33)	13 (86.67)	
21-40	132 (39.29)	204 (60.71)	
41-60	134 (60.91)	86 (39.09)	
Above 60 years	21 (63.64)	12 (36.36)	
Mean	43.04 (11.13)	37.46 (12.07)	5.89***
Household size			
Less than 5	49 (62.02)	80 (62.02)	
5-10	210 (52.63)	210 (52.63)	
Greater than 10	51 (67.11)	25 (32.89)	
Mean	7.8 (3.68)	6.5 (3.13)	4.72***
Educational status			
No education	58 (41.43)	82 (58.57)	
Primary education	55 (41.04)	79 (58.96)	
Secondary education	85 (43.81)	109 (56.19)	
Tertiary education	91 (66.91)	45 (33.09)	
Mean	9.36 (5.79)	7.55 (5.58)	
Farming experience (years)			
Less than 10	58(29.74)	137 (70.26)	
11-20	93 (48.95)	97 (51.05)	
21-30	50 (41.67)	70 (58.33)	
Greater than 30	35 (35.35)	64 (64.65)	
Mean	22.90 (11.68)	16.89 (11.65)	6.29***

Source: Data Analysis, 2025

There was found to be a significantly high disparity in the educational status of participants and non-participants in the study area. The average year of education is 9 and 7 years respectively and majority of the participants are more educated than the non-participants. Again, the result shows that the highest proportion of male and female participants have a tertiary and secondary education respectively while majority of the non-participant that are female have no formal education. This implies that the male respondents are more formally educated than the female. Majority of the female farmer, 35.21%, who are participants of the producer organization have less than 10 years farming experience with 19 years mean experience while most of the male participants, 35.32% have between 11 and 20 years farming experience with mean experience of slightly above 24 years.

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Average treatment effect on the treated

Conditional average effects

The first panel of table 2 shows the average effect of participation in organizations on household

income. Results in column (3) of Table 2 show that participation in organizations is highly associated with significant increment in household income. In all cases, households who participated in organizations would have obtained lower benefits had they not participated. Farmers who participated in producer organization only had the highest income gain (₦24,203), followed by those who participated in producer organization and cooperative (₦9,318) and those who are in cooperative only (₦2912). The impact of participation in cooperatives facilitating increase household income has over time been established (Zou and Wang, 2022), participation in producer organization has been shown to increase in household income over eight times of what will be achieved if only in cooperatives and over three times of what will be gotten if producer organization is combined with cooperative. This implies that participation in producer organization helps farmers to have access to reliable markets, have higher bargaining power, more stable prices due to consistent market and lower post-harvest losses as they are able to mitigate against risk due to market instabilities that can cause income fluctuations.

Table 2: MESR based treatment effects of participating in organizations on household welfare

Outcome variables	Organization choice	Participating	Non-participating	Average Treatment effects
	(j)	(j=2,3,4) (2)	(j=1) (1)	3=2-1
Conditional average effects				
Income (₦)	Cooperative only	51544.92	48632.41	2912.501***
	Producer organization with cooperative	56190.62	46871.66	9318.961***
	Producer organization only	123841.5	99637	24203***
Unconditional average effects				
Income	Cooperative only	73510.47	66400.52	7109.95***
	Producer organization with cooperative	79259.28	66400.52	12858.76***
	Producer organization only	108671.7	66400.52	42271.21***
Heterogeneity effects				
Income	E(4 2) vs. R(3 2)	85948.26	51544.92	34403.34
	E(4 3) vs. R(2 3)	86318.37	46871.66	39446.71
	E(3 4) vs. R(2 4)	96380.1	82315.53	14064.57

Source: Data Analysis, 2025

Unconditional average effects

Unconditional average effects of adoption on income summarize the causal effects of participation for the entire population. Results show that for all the categories of organizations considered, on average, participants realize more income compared to non-participants. Farmers who participated in cooperative only were found to have ₦7109 more than non-adopters, those who participated in producer organization and

cooperative have ₦12,858 more while those who participated in producer organization have ₦42,271 more than those who do not participate in organization. This implies that participation in cooperative, cooperative and producer organization and producer organization only was found to increase income. However, these results are only indicative of the effects of participating in organizations and could be misleading due to

selection bias from both observed and unobserved factors.

Heterogeneity Effects

We also estimated average treatment effects for participants in organizations only. Participants heterogeneity effect results presented in table 18 shows that maximum gain would be obtained from both producer organization only vs. cooperative only followed by producer organization only vs producer organization cum cooperative and the producer organization cum cooperative vs cooperative only for all outcome indicators.

Average Treatment effect on the Untreated

Furthermore, table 3 shows the estimation of the average treatment effects on the untreated (ATU). If non-adopters have participated in cooperative, their income will increased by ₦2912 naira; if non adopters have participated in producer organization and cooperative, their income will have increased by ₦37,315 naira but they have participated in producer organization only, their income will have increased by ₦106,575 naira. It is worth noting that non-adopters would have benefited in terms of higher incomes had they participated in organization with highest payoff been realized from participation in producer organization only.

Table 3: MESR based average treatment effects of participating in organizations on household welfare: ATU

Outcome variables	Organization choice	Participating	Non-participating	Average Treatment effects on the untreated (ATU)
	(j)	(j=2,3,4) (2)	(j=1) (1)	3=2-1
Income	Cooperative only	51544.92	48632.41	2912.501
	Cooperative and producer organization	85948.26	48632.41	37315.84*** (5305.555)
	Producer organization only	155207.7	48632.41	106575.3** (58102.61)

Source: Data Analysis, 2025

Values in parenthesis are the standard error.

CONCLUSION

The findings of this study underscore the significant positive impact of participation in producer organization on the welfare of farming households in Northern Nigeria. To assess the impact of participation on the welfare of diverse household head structures, multinomial endogenous switching regression was employed. Estimating the impact of participating in producer organization on household welfare by correcting for selection bias and endogeneity originating from observed and unobserved heterogeneity, participation in organizations significantly increases the tomato/potato yield and household income. Notably, households who engaged in any of the organization individually or simultaneously would have obtained lower benefit had they not participated. However, maximum benefits are achieved when farmers adopt producer organizations only.

Based on these findings, it is recommended that policy makers prioritize the promotion of producer organizations as a key component of welfare improvement for farming households. Specifically, interventions should focus on:

1. Raising awareness on the benefits of producer organization membership and participation especially among smallholder farmers.

2. Facilitating and institutionalizing producer organizations to ensure larger coverage, access and inclusivity.

By implementing the targeted policies to increase awareness, and effectiveness of producer organizations, stakeholders can substantially enhance the welfare of smallholder farming households and boost the goals of rural development in Nigeria.

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