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## Impact of Livelihood Diversification on the Economic Performance of Rural Households in Nasarawa State, Nigeria

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### Abstract

This study examined the impact of livelihood diversification on the economic performance of rural households in Nasarawa state, Nigeria. Multistage sampling procedure was used to select 390 respondents. Endogenous switching regression model was employed to carry out the impact analysis of diversified agricultural and non-agricultural activities on rural households' economic performance of which income, poverty gap, and severity were indicators. The empirical findings revealed that rural household's age, gender, level of education, access to market, membership of cooperatives, access to public transport and rural-urban seasonal migration significantly influenced income, while gender, level of education, household size, access to farmland, access to market, membership of cooperative and entrepreneurial skills significantly influenced rural households' poverty gap and severity. Improved income of rural households in the study area promotes agricultural activities which is the mainstay of their economy. In conclusion, livelihood diversification improves living standard and reduces poverty for rural families and their communities.

### Keywords

Livelihood diversification, economic performance, rural households.

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### Introduction

Agriculture is the mainstay of the economy of the rural households in the study area as it plays a great role in the development of the area. Diversifying agriculture results to enhancing the welfare and income of the rural households. But exacerbating climatic conditions such as erratic rainfall, rising temperatures (Cooke and Jonathan, 2016), over grazing in the far north, desertification, incessant violent clashes between herdsmen and farmers and prevailing Boko Haram insurgency in the North-Central and North East (International Crisis Group, 2017) pushes poorer smallholders to seek alternative incomes in the non/off farm sector. These alternative incomes are used to revive the fallen agricultural activities in the study area. It was reported that coping with the changing situation, smallholder farmers in the North Central and North East in Nigeria are adopting both on-farm (planting drought-tolerant crops and mixed

farming) and off/non-farm diversification strategies. According to Baird and Hartter (2017), households across the developing countries are trying to diversify their livelihood activities to secure from risks and cope with the economic and environmental shocks. Diversified livelihood combines both agricultural and non-agricultural activities to survive and improve the standard of living. Livelihood diversification plays a crucial role in promoting economic growth and reducing rural poverty in developing countries (Loison, 2019). It is the process of providing alternative job. It marks a vital role in sustainable ecological development and rural poverty reduction (Liu and Lan, 2015).

Rural livelihood diversification is the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living (Khatun and Roy 2012). The rural livelihood

diversification into farming, off-farming and non-farming is one of the rural households' strategies for boosting agricultural activities and for survival in the study area. The rural people diversify into farm and non-farm activities to explore opportunities through which they increase and stabilize their incomes or to supplement farming in order to improve the welfare or living standard of their household (Wondim, 2019). Rural people have diversified their livelihood means and income earning portfolio across farm, non-farm and off-farm activities. Thus, non-farm income generating activities have become an essential component of livelihood strategies among rural households ((Bezu, Barret and Holden, 2012; Khatun and Roy 2012; Agyeman, Asuming-Brempong and Onumah, (2014). According to Ovwigho (2014), the rural farm families usually engage in different non-farm income generating activities apparently to balance the shortfall of income due to the seasonality of primary agricultural production and create a continuous stream of income to cater for the various household needs. The rural households in the study area survive farm productivity crisis by engaging in a variety of activities, thus generating income and other consumption goods to meet the needs of the family. The Nigerian rural households may have enough reasons to diversify their income. Firstly, factors such as inconsistent government policies, poor processing techniques, poor storage facilities, bad road networks and natural disasters which negatively impact on farmers' productivity, drives income diversification in Nigeria so as to boost agriculture (Msoo and Goodness, 2014). Secondly, Cooke and Jonathan (2016) argued that Nigerian farmers finds it very difficult to access quality agricultural inputs, such as seeds, pesticides, fertilizer and credit needed to scale up their farm operations. Thirdly, the Nigerian labour productivity per worker is about three times higher in the non-farm sector than the farm sector and the non-farm sector boast of higher average income than incomes from the farm sector (Djido and Shiferaw, 2018).

To the best of my knowledge, empirical studies on the impact of livelihood diversification on rural households' economic performance using income, poverty gap and severity appear to be infrequent in the North central area of Nigeria. Therefore, there was the need to carry out this study in Nasarawa State, which developed a structure that measured the impact of diversified farming, off-farming and non-farming activities looking at improving income which will help support the mainstay of their economy. Endogenous switching Regression model approach (Lokshin

and Sajaia, 2004) was used in this study to examine the impact. Also examined were the determinants of livelihood diversification where the parameters for economic performance considered in this study were income, poverty gap and severity. This paper adds to the literature by giving recent information on the impact of livelihood diversification on economic performance in North Central part of Nigeria using income, poverty gap and severity as measurement. There has not been detailed impact analysis of livelihood diversification on economic performance of rural households of recent using parameters like income, poverty gap and severity as measurement which this study has given proper attention.

The interesting research topic examined livelihood diversification as a survival strategy and a means to improve economic performance of rural households with the following research questions. Firstly, what are the determinants responsible for livelihood diversification amongst rural households in Nasarawa State, Nigeria? What is the impact of livelihood diversification on rural households' income, poverty gap and poverty severity in the study area? The specific objectives of this research are to analyse the impact estimate of determinants on livelihood diversification, also, impact estimate of livelihood diversification on income, poverty gap and poverty severity using Endogenous Switching Regression (ESR) model. The remaining sections of this paper include materials and methods, results and discussion, and conclusions

## **Materials and methods**

### **Study area**

The study was carried out in Nasarawa State, North Central Nigeria. The State has Latitude 80° - 90°30'N (approx.) and longitude 70° - 90°30'E (approx) and covers a land area of about 32,500 km<sup>2</sup> (Nasarawa State Ministry of Information, 2012) with a population of about 2.13 million (National Population Commission, 2016) with average growth rate of 2.5%. Agriculture is the mainstay of its economy with the production of varieties of cash crops throughout the year. Some of the inhabitants of the State are fish farmers while most of them cultivate food crops such as grains and legumes, root and tubers, vegetables and fruits.

### **Data collection and sampling procedure**

Data used for this study were collected from primary source through administration of a well-structured questionnaire on rural households in the study

area. A multistage sampling technique was adopted for the study. The thirteen (13) Local Government Areas (LGAs) of the state were selected. At the first stage, three (3) communities were randomly selected from each of the LGAs in the state, making a total of thirty nine (39) communities. Thereafter, at the second stage, a random sampling technique was used to select eleven (11) rural households from each community to give a sample size of four hundred and twenty nine (429) rural households. Out of the 429 responses, 390 were valid and complete.

### Data analytical procedure

Endogenous Switching Regression Model was used for the analysis of the data.

### Empirical specifications

#### Endogenous Switching Regression (ESR) model

In the process of estimating the impact of livelihood diversification on the economic performance of rural households using ESR framework, a two-stage estimation procedure is involved. In the first stage, the model for the determinants of livelihood diversification is estimated that is the adoption decision to diversify is estimated in order to determine the factors that influenced diversification. The second stage involved the estimation of relationship between the outcome variables and a set of explanatory variables specified for two regimes of diversified and non-diversified rural households. The diversified and non-diversified rural households are represented by  $y_{1i}$  and  $y_{2i}$  respectively, while the unobserved is denoted by  $I_i^* = y_{1i} - y_{2i}$ . The function that specifies the households is:

$$I_i^* = \begin{cases} 1 & \text{if } I_i^* > 1 \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

The basic relationship used is income, poverty gap and poverty severity from diversification status and it is stated in relation to a vector of household independent variables ( $Z_i$ ) in a latent variable framework. The relationship, which is the determinants of livelihood diversification in the first stage, is expressed as follows;

$$I_i^* = \alpha Z_i + \mu_i \quad (2)$$

where  $I_i^*$  is a dichotomous variable with 1= diversified rural households and 0 otherwise,  $Z$  represents all observable determinants rural households, for example, household characteristics,  $\alpha$  is a vector of parameters to be estimated,  $\mu$  is the error term with mean zero. The relationship being

considered in examining the impact of livelihood diversification on income, poverty gap and poverty severity assumes that vector of outcome variable is a linear function of a vector of explanatory variables ( $Z_i$ ) and diversification status which is a dichotomous variable explanatory variables ( $I_i$ ). The relationship can be expressed as follows;

$$y_i = k\beta + l_i\gamma + \mu_i \quad (3)$$

where variable  $y_i$  is a vector of outcome variable,  $K_i$  is a vector of farm and household characteristics,  $l_i$  is the diversification status,  $\mu_i$  is a random error term while  $\beta$  and  $\gamma$  are vector of parameters estimated.

In the course of carrying out impact evaluation, the study was only aware of the observed attributes declared by the respondents, while other unobservable factors are known to only the respondents. In view of this, selection bias ensues if error terms of the outcome equation, ( $\mu$ ) in the Equation 2 and selection equation ( $\varepsilon$ ) in the Equation 1 are influenced by unobservable factors. Endogenous Switching Regression model approach which was developed by Lokshin and Sajaia (2004) was employed in order to concurrently estimate the determinants and impact of livelihood diversification with consideration being given to observable and unobservable factors. The specifications for the two regimes in the second stage are as follows;

Regime 1 (Diversification):

$$y_{1i} = \beta_1 x_{1i} + \varepsilon_{1i} \quad (4a)$$

Regime 2 (Non-Diversification):

$$y_{2i} = \beta_2 x_{2i} + \varepsilon_{2i} \quad (4b)$$

where  $y_{1i}$  and  $y_{2i}$  are outcome variables for rural households that diversified and did not diversify respectively;  $x$  is a vector of household characteristics;  $\beta$  is a vector of parameters to be estimated and  $\varepsilon$  is the error term.

The structure of the ESR model gives room for an intersection (overlap) of  $Z$  in the Equation 2 and  $\beta$  of the Equations (4a) and (4b). However, it is important that at least one variable in  $Z$  does not appear in  $\beta$  for the purpose of identification. Therefore, this suggests that the same set of variables are used to estimate selection and outcome equation but with additional one variable in the former. Access to non-farm and off-farm job information is used as a valid instrument as it is expected to affect diversification status and not the outcomes.

As explained by Heckman (1979), the selectivity terms used in the selection equation which represent  $\lambda_1$  and  $\lambda_2$  for rural household that diversified and did not diversify respectively, covariance terms  $\sigma_{12}$  and  $\sigma_{1e}$  are included in the Equation 4a and 4b which resulted to equation 5a and 5b below;

$$y_{1i} = x_i\beta + \sigma_{1e}\lambda_1 + \Phi_{i1} \text{ if } l_i = 1 \quad (5a)$$

$$y_{2i} = x_i\beta + \sigma_{2e}\lambda_2 + \Phi_{i2} \text{ if } l_i = 0 \quad (5b)$$

The ESR model was used to examine the impact of livelihood diversification on rural households' outcome variables (income, poverty severity and poverty gap) by comparing the expected outcomes of rural households who are diversified with the expected outcomes of the counterfactual hypothetical cases that rural households who were diversified are not diversified. The expected values of the outcome  $Y$  on diversified and non-diversified can be expressed as follows:

$$E(Y_{i1}/l = 1) = x_i\beta_{i1} + \sigma_{1e}\lambda_1 - \Phi_{i1} \quad (6a)$$

$$E(Y_{i2}/l = 0) = x_i\beta_{i2} + \sigma_{2e}\lambda_2 - \Phi_{i2} \quad (6b)$$

According to Lokshin and Sajaia (2004), Average Treatment effect on the Treated (ATT) is a change in the outcome due to diversification adoption. In this case, ATT is expressed in terms of livelihood diversification status, which is expressed as follows in the Equation 7 as the difference in the expected outcomes from equations 6a and 6b.

$$ATT = E(Y_{i1}/l = 1) - E(Y_{i2}/l = 0) = x(\beta_{i1} - \beta_{i2}) + \lambda(\sigma_{1e} - \sigma_{2e}) \quad (7)$$

Table 1 shows the list of variables in the Econometric Analysis.

## Results and discussion

The Full Information Maximum Likelihood (FIML) results of the Endogenous Switching Regression Model (ESRM) for income, poverty gap and poverty severity are presented

Variable	Description	Measurement
<b>Dependent variables</b>		
Livelihood Diversification (LD)	If household engages in livelihood diversification	(Yes =1; No= 0)
Income	Income per household	Naira
Poverty gap	Poverty gap per household	Number
Poverty severity	Poverty severity per household	Number
<b>Independent variables</b>		
<i>Personal characteristics</i>		
Gender	Gender of household head	(Male=1, Female=2)
Age	Age of respondents	Years
Level of education	Education of respondents	Years
Membership of cooperative societies	Household membership of cooperatives	(Yes =1; No= 0)
Household size members	Number of household members working	Number
Access to farmland	If had access to farmland	(Yes=1; No= 0)
<i>Institutional Variables</i>		
Access to credit	If had received informal credits	(Yes =1; No= 0)
Access to market	If had access to market	(Yes =1; No= 0)
Access to public transport	If had access to public transport	(Yes=1; No=0)
Access entrepreneurial skills	If had received entrepreneurial skills	(Yes =1; No= 0)
Access to jobs information.	If had access to jobs information	(Yes =1; No= 0)
Rural-urban seasonal migration opportunity	If had experienced seasonal migration	(Yes =1; No= 0)
<i>Environmental factors</i>		
Bad weather occurrence	Weather shock experience such as late onset of rains, rises in temperature, heavy rainfall and other unseasonable weather which are as a result of the consequences of climate change experienced in the previous year	(Yes=1, No=0)

Source: Own processing

Table 1: List of variables in the Econometric Analysis.



in Table 2, 3 and 4. The Wald tests confirmed joint significance of the error correlation coefficients in both selection and outcome equations. The significant correlation coefficients of the selection equation and the outcome equations (Income, Poverty gap and Poverty severity) for participants in livelihood diversification indicated the presence of self-selection in engaging in livelihood diversification. Table 5 presents expected values of various outcomes under actual and counterfactual conditions and resulting treatment effects.

The likelihood ratio tests for joint independence of the equations in endogenous switching regression model revealed that the equations are dependent. This implies that the models were not jointly independent and not estimated differently, which explains the empirical approach applied in this study. Therefore, the use of ESR model, which accounts for both observable and unobservable factors, was suitable for this study as explained by (Lokshin and Sajaia, 2004). The estimated coefficients of the correlation term ( $r_1$  and  $r_2$ ) were statistically significant in all the regimes. The result showed that there was selection bias due to unobservable factors in livelihood diversification. The negative and significant sign for 'r' implies that there was a positive selection bias which suggests that rural households that diversified have higher probability of having increased income and reduced poverty gap and severity.

### **Determinants of adoption**

The results from the selection equation are presented in Tables 2, 3 and 4 together due to the fact that the empirical results in the selection equation can be interpreted as normal probit coefficients. It is worthy of note that estimates for variables with the same name in the selection equation (probability of adopting livelihood diversification) have similar effects on the dependent variable. Results of the estimation of the determinants of livelihood diversification in the study area suggest that level of education, membership of cooperatives and rural to urban seasonal migration are the main drivers behind rural households' engagement in livelihood diversification. The factors are positive and statistically significant at 1% which shows that, the claim of these factors promoting livelihood diversification cannot be rejected. It was also observed that gender and access to market were found to be significantly positive at 5%. Other factors such as access to farmland, entrepreneurial skills and bad weather were observed to have positive correlation

with engagement with livelihood diversification. 1% (highly statistically significant) and 5% (statistically significant) significance level do not have enough evidence to reject the claim that determinants of rural households improve livelihood diversification.

As shown in the results, level of education implies that the probability of being diversified tends to increase as level of education increases. This means that increase in the level of education by 1% enables the rural dwellers to have improved agricultural practices and also engage in various livelihood activities as some non-farm and off-farm jobs demand a minimal level of education. This is in line with Amare and Shiferaw (2017), that said empirical literature shows that education allows households to overcome barriers to diversification and provides incentives for expansion of livelihood options both within and outside agriculture. Membership of cooperative indicates that being a member of cooperative society increases the probability of diversifying livelihood amongst the households. This is possible because cooperative societies in the rural areas help to enhance and establish livelihood activities. Cooperative societies distribute farming inputs and also, introduce their members to sustainable agricultural practices and business opportunities and gives loan to start-up businesses. This is supported by Oloyede (2008) who said the recognition of cooperatives as self-help organizations with capacity to improve livelihood is global and wide spread. Rural to urban seasonal migration exposes rural households' farmers to different technology which helps to improve agricultural practices and also influence diversification into off-farm and non-farm activities. This seasonal migration is mostly during the dry season, off farming season. This is in line with Barrett et al. (2001), who said rural households in Nigeria engage in economic activities when migrated. However, gender was found to significantly and positively influence the decision of livelihood diversification in the study area at 5% level. The implication of this scenario is that being a male rural household's head increases the probability of having livelihood diversification. This may be as a result of the cultural practices among the respondents that give men power over and access to productive resources. This confirms the report of Mulwa et al. (2017) that gender variable is a positive and significant factor in rural household decision making in the adoption innovative practices, such as household income improvement. Also, access to market was found to be positive and significant to influence the decision to diversify livelihood

in the study area at 5%. The implication of the result is that access to market increases the likelihood of being diversified. However, improved market accessibility will enhance diversification into production of different crops, rearing of animals and involvement in various economic activities by the respondents. Prowse (2015) asserted that distance to markets determines and influences income diversification in rural areas.

Age is a major negative driver in engaging in livelihood diversification as increase in age significantly reduces the likelihood to engage in livelihood diversification by 1%. Age of the household's head had a negative and significant coefficient with rural households' decisions to livelihood diversification, suggesting that increase in age of the respondent decreases the probability of choosing diversified livelihood. This concurs with Asfir (2016) who reported the effect of age of the rural farmers on diversification and pointed out that as the farmers get older, they become more resistant to new ideas, information and technology to better farming activities. Job information about livelihood diversification into on-farm, off-farm and non-farm by rural households tends to increase the likelihood of having diversified livelihood. However, it is worthy to note that the aim of the selection equation is not to perfectly explain diversified livelihood but to account for unobserved heterogeneity that could cause bias. It is for this reason that one or more valid instruments must be included in the selection equation and the instrument used in his study is job information about livelihood diversification. The instrument variable, access to job information was found to be positive and influenced the choice of diversification significantly. Job information about livelihood diversification in farming, off-farm and non-farm by rural households tends to increase the likelihood of having diversified livelihood. This implies that having access to job information on farming and non/off farm activities increases the likelihood of livelihood diversification as there are job opportunities. This is in line with Shujaat Farooq and Zunaira Younais (2018) who said access to employment information are provided for more than half of the rural population, contributing to reduction in poverty and equity.

#### **Impact estimate of determinants on rural households' income**

The estimates in the outcome equation in the columns for diversified and non-diversified in Table 2 generally show the impact of livelihood

diversification on rural household income. The impact estimates showed that the key variables behind rural households' increased income for diversified rural households are gender, level of education and rural to urban seasonal migrations which are significantly positive at 1% while access to market and membership of cooperative are significantly positive at 5%. Age was found to be the major negative driver that reduces income in the study area. The key variables for increased income of non-diversified rural households is access to market which is significantly positive at 1% while age is at 5% and gender at 10%. The negative main driver for income of non-diversified rural households' is rural to urban seasonal migration, found negative at 1% and significant. 1% (highly statistically significant) and 5% (statistically significant) significance level do not have enough evidence to reject the claim that the determinants increase income of rural households. 10% significance level has enough evidence to reject the claim that determinants increase income.

The result of the impact estimates states that age had negative but significant relationship with the income of the diversified respondents while the income of non-diversified respondents was positive and significantly influenced by age. This implies that, as the age of the rural households' increases, the income of diversified respondents falls while the income of non-diversified respondents rises. This finding concurs with Roslan and Siti (2011) and Ike (2015) who separately noted that the older the farmer, the less the probability for him/her to participate in any employment. The positive and statistically significant coefficients of gender of both diversified and non-diversified respectively showed that male household heads in the study had more income than their female counterparts in the two groups (diversified and non-diversified livelihoods). Level of education of diversified rural households tends to increase income. This showed that the more educated the rural households the better they participate in employment opportunities. This is in accordance with McMichael (2008) who stated that the new agriculture for development replaces smallholder knowledge with corporate inputs for development. Also, households with higher education are more likely to participate in wider employment opportunities offered by the non-farm and urban sectors. The positive and statistically significant coefficients of access to market increases income for diversified and non-diversified households.

Variables	Selection		Income of Diversified Households		Income of Non-Diversified Households	
	Coefficient	Z-Value	Coefficient	Z-Value	Coefficient	Z-Value
Age	-0.055***	2.91	-0.010*	1.95	0.019**	2.27
Gender	0.294**	2.15	0.688***	6.7	0.009*	1.89
Level of Education	0.797***	3.34	0.034***	3.15	-0.042	0.33
Household Size	-0.001	0.02	0.012	0.73	-0.015	0.67
Access to farmland	0.004	1.12	0.187	0.84	0.003	0.23
Access to Market	0.123**	2.07	0.354**	2.23	0.938***	4.52
Membership of Cooperatives	0.714***	2.56	0.147**	2.01	-0.114	0.93
Access to Credit	-0.229	0.53	0	0	0.034	0.16
Access to Public transport	-0.043	0.09	0.043	0.26	-0.005	1.82
Rural- Urban Seasonal Migration	4.097***	6.31	1.059***	6.09	-0.059***	2.45
Entrepreneurial Skills	0.246	0.57	0.012	0.08	-0.294	1.26
Bad Weather	0.45	1.04	0.233	1.39	-0.079	0.3
Access to Job Information	0.296**	2.02				
Constant	-0.411	0.33	10.899	36.7	10.121	23.19
Ins1			-0.652***	14.92		
Ri			-0.311***	4.98		
Ins2					-0.569***	9
r2					0.15	0.48
LR test of independent: $\chi^2(1) = 30.49***$						
Log likelihood = -115.681						

Note: \*\*\*, \*\*, \* means significant at 1%, 5% and 10% respectively  
 Source: Own processing

Table 2: Full information maximum likelihood estimates of endogenous switching regression model for livelihood diversification and impact on rural households' income.

Abdiassa (2017) reported a similar result that rural household heads having access to market centres has higher involvement in livelihood diversification and could diversify their sources of income.

However, being a member of the cooperative increases the income of the respondents that diversified livelihood. This is in accordance with ILO (2014) who reported that the services of cooperatives help pull members out of poverty. While rural-urban seasonal migration increases income of diversified respondents and increases the likelihood of non-diversified income to fall. It can be interpreted that the more the respondents migrate the higher the income and the lower the income of non-diversified households. The results show that migration is a source of income to the rural households because seasonal migration to urban areas is driven by search for work to earn cash as they see no visible options for moving out poverty within their locality.. This is in agreement with Clement and Timothy (2014) that said migration is one of the households' sources of income used to alleviate unforeseen shocks.

### **Impact estimate of determinants on rural households' poverty gap**

As indicated in Table 3, the impact estimate of determinants on rural households' poverty gap shows that the main drivers of the diversified rural households are level of education and rural to urban seasonal migration which increases the probability of reducing poverty gap at 1% while membership of cooperative increases the probability of reducing poverty gap by at 5% and access to farmland at 10%. The main drivers for non-diversified rural households that increase the probability of reducing poverty gap at 1% are gender and level of education while access to farmland is at 5% and access to market at 10% respectively. Household size was found to be positive and significant at 1% and a main driver which reduces the probability of poverty severity. 1% and 5% significance level do not have enough evidence to reject the claim that the determinants increase the reduction of poverty gap amongst the rural households. 10% significance level has enough evidence to reject the claim that



Variables	Selection		Poverty Gap of Diversified Households		Poverty Gap of Non-Diversified Households	
	Coefficient	Z-Value	Coefficient	Z-Value	Coefficient	Z-Value
Age	-0.055***	2.91	0.004	0.91	-0.005	1.28
Gender	0.294**	2.15	0.023	0.65	0.763***	3.64
Level of Education	0.797***	3.34	0.173***	3.38	-0.056***	2.42
Household Size	-0.001	0.02	0.008	0.74	0.030***	2.65
Access to farmland	0.004	1.12	-0.101*	1.82	-0.583**	2.25
Access to Market	0.123**	2.07	-0.648	1.44	-0.038*	1.91
Membership of Cooperatives	0.714***	2.56	0.104**	2.19	0.085	1.40
Access to Credit	-0.229	0.53	0.021	0.20	-0.128	1.22
Access to Public transport	-0.043	0.09	0.144	1.34	-0.159	0.86
Rural- Urban Seasonal Migration	4.097***	6.31	-3.302***	6.63	0.034	0.14
Entrepreneurial Skills	0.246	0.57	-0.004	0.04	-0.194*	1.84
Bad Weather	0.450	1.04	0.114	1.05	-0.027	0.21
Access to Job Information	0.296**	2.02				
Constant	-0.411	0.33	3.377***	6.39	0.359	1.65
Insl			-0.081***	3.70		
Ri			0.792***	2.39		
Ins2					-0.071**	2.17
r2					-0.128**	2.18
LR test of independent: $\chi^2(1) = 15***$						
Log likelihood = -137.872						

Note: \*\*\*, \*\*, \* means significant at 1%, 5% and 10% respectively  
 Source: Own processing

Table 3: Full information maximum likelihood estimates of endogenous switching regression model for livelihood diversification and impact on rural households' poverty gap.

determinants reduce poverty gap.

The impact estimate of determinants on rural households' poverty gap shows that gender disparity amongst the non-diversified rural household negatively affects the household economic success to a significant degree. This shows that gender differences in access to resources and status usually favour men and often institutionalized through tradition and social norms. This is in agreement with Joe-Ukamuke (2019) who reported that promoting gender equality is widely recognised globally in contributing to agricultural productivity and food security. The level of education increases the probability of reducing poverty gap. This implies that the fall in the level of education widens the poverty gap of the respondents as rural farmers find it difficult to accept new technology. The results denote that education is an important factor to reduce poverty in the study area. This is in accordance with Omodero and Azubike (2016) who said education is way out of economic problem in the rural areas. Also, increase in household size increases poverty gap for the non-diversified in the study area. The result explains that poverty

levels increases with larger size of households that have not diversified farming, off-farm and non-farm activities. This study is in accordance with Anyanwu (2014) who said there is a positive correlation between the levels of poverty and the size of the household. Poverty is lowest among single-person households and increases with the number of members of the households.

Farmland increases the likelihood of reducing poverty. The reason for this could be attributed to inherited farmland or farmland owned by the family as essential means of livelihood for rural households but is also one of the most important assets that can be the principal source of poverty reduction. This is in accordance with Akinyemi, B.E., Mushunje, A., and Sinnett, D. (2019) who explained that land availability is fundamentally crucial to efficient agricultural production, food security and poverty alleviation in Sub-Saharan Africa where rural households have limited access to productive land. Access to farmland is essential to improving the rural farming households in Nigeria. Market accessibility increases the likelihood of reducing poverty gap

for the non-diversified in the study. The result explains that non-diversified respondents who are into farming need to be able to access markets to sell their products. Unavailability of this market increases the poverty gap for the non-diversified respondents in the study area. According to Akaakohol and Aye (2014), distance to market is negatively related to diversification. Reliable market access boosts farm productivity, increases incomes and strengthens food security. It can contribute to reducing poverty and hunger for rural families and their communities.

Being a member of the cooperative increases the likelihood of reducing poverty gap. The results showed that, rural households whose livelihoods are diversified or not diversified should be members of the cooperatives so as to have access to financial support to secure farming inputs and also to do other businesses. This is in accordance with Ma and Abdulai (2016) who said existing studies suggest that cooperatives can help reduce market failures and improve access to financial resources without stringent interest rates or harsh conditions. Rural-urban seasonal migration tends to increase the likelihood of reducing poverty gap in the study area if they diversify on-farm, off-farm and non-farm activities. The results show that to have diversified livelihoods may be as a result of migration from rural to urban in search of job when there is low agricultural productivity. Amrevurayire and Ojeh (2016) contrary reported that migration reduces the availability of skilled professionals to work on developmental projects aimed at developing rural areas, furthermore, the notion that better working conditions are only found in major cities, entices unskilled people to leave rural areas, hence prominent rural sector industries such as agriculture and extraction may find it cumbersome to attract the required labour, especially with the notion that rural salaries are not in line with those of urban areas. Having acquired skills for other kinds of job reduces poverty gap of non-diversified respondents when faced with challenges on farm. This is in line with Naudes (2008) who said that the role of rural entrepreneurship in the development process is an effective entrepreneurship venture which fosters the production of wealth for a nation, creates jobs that utilise human resources and also reduces economic waste.

#### **Impact estimate of determinants on rural households' poverty severity**

As indicated in Table 4, the impact estimate of determinants on rural households' poverty severity shows the negative main drivers that

decrease the probability of reducing poverty severity of diversified rural households by 1% which are level of education and rural to urban seasonal migration while access to farmland and membership of cooperative negatively and significantly reduce poverty level by 5%. Household size and membership of cooperative from non-diversified rural households on poverty severity was found significant and positive at 5% while the main driver which is unavailability of market increases the probability of poverty severity at 5%. However, gender and level of education were found to be 10% significant. 1% and 5% significance level do not have enough evidence to reject the claim that the determinants increase the reduction of poverty severity amongst the rural households. 10% significance level has enough evidence to reject the claim that determinants reduce poverty severity.

The impact estimates of determinants on rural households' poverty severity showed that gender outcome equation of the non-diversified respondents was found to be significant but negative which means that, male non-diversified respondents experienced less poverty severity than their female colleagues. This is in accordance with Beyene (2008) that stated male headed households have more access to opportunities than female headed households. The probability of diversifying is expected to be positive for the former. The level of education was seen to be negative and significant for the diversified and non-diversified respondents. This implies that increase in the level of education reduces poverty severity of the respondents. This is in accordance with Yizengaw et al., (2015) who said the more educated households' heads are the more diversified activities they would have. The positive and significant effect of household size on poverty severity for non-diversified indicates that increase in household size increases poverty severity for the non-diversified respondents. The result explains that the more the household size, the more likely is the burden of the jobless household members on those employed and hence poverty increases with increased household size. This is in accordance with a study by Orbeta (2005) who revealed that extra children have a negative impact on the welfare of household, especially in the case of poor households. Another result indicates that access to farmland was significant but negative for diversified and undiversified rural households. This implies that, poverty severity increases for respondents that do not acquire farmland. This result explains that, availability of farmland is also a source of income distribution

Variables	Selection		Poverty Severity of Diversified Households		Poverty Severity of Non-Diversified Households	
	Coefficient	Z-Value	Coefficient	Z-Value	Coefficient	Z-Value
Age	-0.055***	2.91	0.001	0.17	-0.006	1.68
Gender	0.294**	2.15	-0.012	0.72	-0.338*	2.00
Level of Education	0.797***	3.34	-0.155***	3.10	-0.020*	1.88
Household Size	-0.001	0.02	-0.015	1.47	0.019**	2.00
Access to farmland	0.004	1.12	-0.009**	2.12	-0.065	0.87
Access to Market	0.123**	2.07	-0.083	2.10	-0.012**	2.16
Membership of Cooperatives	0.714***	2.56	-0.101**	2.19	0.074**	2.46
Access to Credit	-0.229	0.53	-0.026	0.26	-0.095	1.10
Access to Public transport	-0.043	0.09	0.154	1.48	-0.188	1.25
Rural- Urban Seasonal Migration	4.097***	6.31	-2.491***	6.21	0.129	0.71
Entrepreneurial Skills	0.246	0.57	0.016	0.16	0.138	1.49
Bad Weather	0.450	1.04	0.093	0.88	-0.021	0.19
Access to Job Information	0.296**	2.02				
Constant	-0.411	0.33	2.709***	6.42	0.357*	1.99
Insl			-0.111***	2.11		
Ri			0.209***	9.20		
Ins2					-0.456***	2.17
r2					-0.012***	3.28
LR test of independent: chi2 (1) = 68.87***						
Log likelihood = -161.365						

Note: \*\*\*, \*\*, \* means significant at 1%, 5% and 10% respectively

Source: Own processing

Table 4: Full information maximum likelihood estimates of endogenous switching regression model for livelihood diversification and impact on rural households' poverty severity.

and very necessary for the diversified respondents who solely rely on non-farm. The results show that farmland is not only for farming but can be used for other economic activities. Meanwhile, Ali and Deininger (2015) stated that empirical research suggests that land availability and tenure security are important factors in the growth of rural economies. Land ownership motivates investments labour and other resources in land so as to diversify sustain productivity and maintain the value of that land.

The estimate of market accessibility was found to be significant but negative for the non-diversified rural households. The result explains that non-diversified respondents who are into farming need to be able to access markets to sell their products. Unavailability of this market increases the poverty severity for the non-diversified. This is in agreement with Frelat et al., (2016) who said greater market access through better quality road infrastructure is central to advancing the well-being of rural farming populations in many developing countries. Also, the coefficient of membership of cooperatives was found to be statistically significant but negative for both the diversified and non-diversified

respondents. This implies that membership of cooperatives tends to reduce poverty severity. The results showed that, member of cooperatives experience the ease of funding their businesses and obtaining inputs for farming. This is in accordance with Sugden et al., (2021) who said cooperative facilitate collective purchase of inputs and marketing of produce, which lower the cost of production, enhance bargaining power for favourable prices and build resilience. While rural-urban seasonal migration was found to be significant to poverty severity of the diversified respondents. This means that migration was identified as a survival strategy utilized by the rural dwellers. This is in agreement with Ajaero and Onokala (2013) who stated that the regression analysis carried out showed that rural-urban migration contributes significantly towards the development of rural communities.

#### **Endogenous Switching Regression: Average Treatment Effects (ATT)**

In Table 5, the case of the impact of livelihood diversification on income showed that livelihood diversification increased income for both diversified

Variables	Diversified	Non-diversified	ATT
<b>Income</b>			
Diversified Households	8.430	4.410	ATT = 4.02***
Non- Diversified Households	6.538	3.202	ATU = 3.33
<b>Poverty Gap</b>			
Diversified Households	0.440	0.615	ATT = -0.175**
Non- Diversified Households	0.386	0.461	ATU = -0.075
<b>Poverty Severity</b>			
Diversified Households	0.283	0.489	ATT = - 0.206**
Non- Diversified Households	0.123	0.298	ATU = -0.175

Source: Own processing

Table 5: Expected Outcome, Treatment and Heterogeneity Effects.

and non-diversified rural households. For instance, diversification of livelihood increased the income of the respondents as indicated by the positive and significant value of ATT. This shows how important livelihood diversification is among the respondents.

In the case of poverty gap, the results show that being diversified is capable of reducing the poverty gap. The ATT was negatively significant which implies that diversification of livelihood would reduce poverty gap among the respondents that diversified their livelihood. The positive value of base heterogeneity implies that there is the existence of some sources of heterogeneity that make diversified respondents less productive than non-diversified respondents.

While in the case of poverty severity, the results show that being diversified is capable of reducing the poverty severity. The ATT was negatively significant, which implies that diversification of livelihood would reduce poverty severity among the respondents that diversified their livelihood. The positive value of base heterogeneity implies that there is the existence of some sources of heterogeneity that makes diversified respondents less productive than non-diversified respondents.

## Conclusion

Endogenous Switching Regression model was used to estimate livelihood diversification and impact of diversification on rural households' economic performance. It is indicated in this study that livelihood diversification strategies had positive and statically significant influence on the rural households' economic performance. The empirical findings revealed that rural household's age, gender, level of education, access to market, membership of cooperatives, access to public transport

and rural urban-migration significantly influenced income of rural households while gender, level of education, household size, access to farmland, access to market, membership of cooperative and entrepreneurial skills significantly influenced rural households poverty gap and severity.

Following the empirical findings from this study, the following conclusions are made:

1. Livelihood diversification should be encouraged among rural households in Nasarawa State of Nigeria because of its positive effect on household income, poverty gap and severity.
2. Government and NGOs should give more support in protecting the rural households' life and properties and also support the development of formal and informal capacity building at the local level to enhance human assets of rural households and make them adopt new technology in agriculture which will promote Climate Smart Agriculture, off-farm and non-farm opportunities;
3. Government should ensure that rural development programmes are effectively implemented, monitored and evaluated. This will go a long way in ensuring an enabling rural environment in terms of provision of adequate rural infrastructure that is very important for livelihood diversification;
4. Private investors and development partners should be encouraged to invest in rural areas. This will help tremendously in the fight against unemployment among rural households during off-season of agriculture and;
5. Enabling rural environment should also

be provided by the government and NGOs in terms of extension worker services, establishment of cooperative society, access to other livelihood assets, reduction in vulnerability, training, provision of infrastructural facilities such as good

roads, electricity, communication networks and farm inputs, marketing facilities, agrometeorological services as well as other programmes that will enable rural households to sustain their livelihoods at both seasons of the year.

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