

*Original Research Article*

## Off-farm income diversification among rural farm households in Nigeria

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### Abstract

This paper aims to analyze the extent of off-farm income diversification of farm households in rural areas of Nigeria by age, gender, educational qualification, farm size, household size and across the different regions in the country. The determinants of such diversification were also identified. Data for this study were obtained from 836 rural farm households using the Nigeria General Household Survey, 2013. The Herfindahl Index was employed to analyze the share of income from different income generating activities, extent of off-farm income diversification. Tobit Regression Model was used to identify the determinants of such diversification.

An estimate of 0.28 was observed for the Nigerian rural farm households with a higher extent of diversification in the Northern regions. Males, older farmers, and farmers without formal education had a higher extent of diversification. The results show that having higher landholdings, post-primary education, access to electricity and location are major factors. Identifying the extent of diversification into the different off-farm sectors is relevant to inform policy and provide opportunities for promoting the different off-farm sectors with an ultimate goal of improving rural farm households' livelihoods. This has its resultant effect on development of the entire rural space.

**Keywords:** off-farm; income diversification; farm households; Herfindahl Index; Tobit model.

### INTRODUCTION

In Nigeria, agricultural production is largely dependent on smallholder farmers who are mainly rural dwellers. Despite the enormous limitations they are confronted with in terms of inadequate access to land, new technologies and output market opportunities, they produce about 80% of the total food requirement (Liverpool-Tasie et al., 2011). Low yields and income variability have caused farmers to diversify into different activities to improve their living standard.

Diversifying income has become the norm especially in rural areas (Dimova and Sen, 2010; Dzanku, 2015; Davis et al., 2010). This is, however, a practice not confined to developing countries but is current also in advanced countries (Bhandari, 2013; Bhaumik, 2007; Chang and Mishra, 2008) and their role in economic development has become of keen interest to policymakers. The advantages of off-farm diversification for rural livelihood are becoming unveiled. In developing countries, about 35-50% of rural income and one-third of rural employment is accounted for by rural off-farm sector (Haggblade et al., 2010; Rijkers and Costa, 2012).

Off-farm activities are viewed as a means for reducing rural-urban income gap, poverty reduction, slowing down rural-urban migration, building local industry, improvement of food security status, provision of off-season income, reducing risk at the advent of declining agricultural output, absorbing surplus labour for youths and women (Davis and Pearce, 2001); augment farm production in the face of credit and liquidity constraints; increasing farm households' income (Bezu et al., 2012; Haggblade et al., 2010).

Much attention has not been given to off-farm income diversification of rural farm households at a national level in Nigeria. Amongst the few studies conducted on this subject at a national level (Oluwatayo, 2009; Awoyemi, 2011; Corral and Radchenko, 2017), none of them paid particular attention to the patterns and extent of off-farm income diversification of rural farm households across the regions. Having established that farm households diversify out of the farm, it is imperative to understand the extent of this diversification by different characteristics and in addition, explore the resources which influence such extent. This is important to understand various opportunities and limitations farmers are exposed to, and their ability to explore

such opportunities. Since rural farm households are seen as being the backbone of agricultural and rural development (Alasia et al., 2009), policy initiatives should therefore focus more on relevant issues pertaining to this group which on the long run has its positive implications on the entire rural space. This study contributes to existing literature by considering the effect of location characteristics and deviates from most studies which focus on the determinants of participation by identifying the factors which influence the extent to which farmers diversify off the farm at a national level. This is crucial in providing information on how to enhance farmers' capacity and promote an enabling environment for rural income diversification.

Rural activities are broadly classified as on-farm, non-farm, and off-farm. On-farm activities include agricultural activities carried out on the farm (Senadza, 2014); crop and livestock activities (Ellis and Freeman, 2004; Idowu et al., 2011). The non-farm includes all economic activities (including trade, production, service, and agro-processing) undertaken outside farming (Rijkers and Costa, 2012; Haggblade et al., 2010). In this paper, we regard on-farm as comprising crop and livestock production; the non-farm as comprising non-farm self-employment, non-farm wage, other income (remittances, savings, interest); and the off-farm as the combination of all activities in the non-farm and the agricultural wage sectors: wage from working on other people's farm. Rural household incomes are grouped into two: income from agriculture (crop and livestock production) and off-farm income comprising non-farm wage, non-farm self-employment, agricultural wage, remittances and other incomes such as pensions (Babatunde and Qaim 2009; Davis et al., 2017; Senadza, 2012). Total farm household income is the sum of income from the farm (net farm income from crop and livestock production: value obtained by deducting total cash outlays excluding family labour from total revenue); non-farm self-employment (value obtained from the deduction of total cost incurred from total enterprise earnings); non-farm wage (income from salaried jobs in the non-farm sector); agricultural wage (income from salaried jobs on other people's farms) and others which include remittance income (value of income received in cash and in-kind gifts received (converted into cash: Naira). The last four categories are referred to as off-farm income.

The study hypothesizes a positive influence of location on off-farm income diversification. Socio-economic and farm characteristics are also expected to influence off-farm income diversification.

Approaches to measuring the extent of income diversification include: Number of income sources (Minot et al., 2006); Vector of income share from

income source (Barrett et al., 2001; Bhaumik, 2007); Inverse of the Herfindahl Index (Ersado, 2003; Idowu et al. 2011); Simpson Index (S.I) (Dzanku, 2015; Agyeman et al., 2014); The Herfindahl Hirshman Index (H.H.I) also referred to as the Herfindahl Index (Dimova and Sen, 2010; Tong et al., 2013).

**MATERIALS AND METHODS**

The study employs the Nigeria General Household Survey 2013 on 836 farm households across the country at rural level. We consider rural farm households as farmers who earn at least 50% of their total household income from the farm (crop and livestock). Information from respondents at household level is justified due to the tendency that the activities of any member of the household would be determined jointly as part of the entire household income generating activity (Adeoye et al., 2019). STATA 12 software was used for the analysis.

**Herfindahl Index**

The extent of income diversification is measured using the Herfindahl Index. The Herfindahl Index is reported to produce similar result as the Simpson Index (Barrett et al., 2000). The Herfindahl Index considers both the income sources and the magnitude of income source. It is the square of the share of the off-farm income sources in total income of the household. The value is between zero and one. A value approaching one indicates low extent of diversification and extent of diversification increases as the value approaches zero. Analysis of the extent of income diversification is by describing the distributions by region, age, sex, educational qualification, farm size and household size.

$$H.I = \sum_i^N P_i^2 \tag{1}$$

Where, H.I = Herfindahl Index; *P* is the share of each income activity in total household income.

**Tobit Model**

The Tobit model (Tobin, 1958), also referred to as the censored regression model is a model where the dependent variable (Herfindahl Index) is observed in only a given range of values and has some values clustered at a certain limit, usually zero. All the negative values are mapped to zero implying censoring of observations from the lower limit, zero. According to Greene (2012), the mathematical expression is stated as:

$$Y_i^* = x_i\beta + \epsilon_i \tag{2}$$

$$Y_i^* = \beta_0 + \beta x_i, \quad \epsilon_i \sim Normal(0, \sigma^2) \tag{3}$$

$$Y_i = \max(0, Y_i^*) \tag{4}$$

$$Y_i = 0 \text{ if } Y_i^* \leq 0 \tag{5}$$

$$Y_i = Y_i^* \text{ if } Y_i^* > 0 \tag{6}$$

**Table 1.** Share of income sources in total household income by region

Region	Sector's Share in Total Income					Mean Herfindahl Index
	Farm Income	Non-farm wage share	NF Self Employment	Agric. Wage	Other	
North Central	0.602	0.015	0.323	0.058	0.001	0.234
North East	0.545	0.009	0.404	0.037	0.002	0.258
North West	0.623	0.012	0.314	0.046	0.003	0.211
South East	0.265	0.020	0.528	0.177	0.005	0.561
South South	0.276	0.024	0.444	0.19	0.004	0.449
South West	0.285	0.007	0.299	0.404	0.002	0.492
<b>Sector's share</b>	<b>52.9</b>	<b>1.3</b>	<b>36.7</b>	<b>8.2</b>	<b>0.9</b>	<b>0.28</b>
<b>Off-farm share</b>	<b>47.1%</b>					

Source: Author's computation

NF self-employment refers to non-farm self-employment; Agric. Wage refers to agricultural wage.

The Tobit model in line with Idowu et al. (2011), Woldenhanna and Oskam (2001), Janvry and Soudoulet (2001), Oluwatayo (2009), Van Leeuwen and Dekkers (2013) is appropriate since the dependent variable is continuous. It can take cognizance of non-negative observations which is a special case of censored regression models and the presence of a number of observations with zero values, implying that households do not participate in off-farm activities.

## RESULTS AND DISCUSSION

### Patterns of income diversification

Table 1 shows the share of income obtained from each income source in total income and the mean Herfindahl Index of diversification off the farm amongst rural farm households in Nigeria. The mean Herfindahl Index estimate is 0.28, revealing high extent of diversification in the country. This implies that farm households tend to source for income from many other activities in rural areas. This estimate is quite lower than estimates reported by Dzanku (2015) and Dimova and Sen (2010). Farm income constitutes 52.9%. Across regions, the highest off-farm income share is from the non-farm self-employment sector (36.7%) which shows that the sector has great prospects in contributing to livelihoods of rural farm households. Very few (1.3%) actively engage in the non-farm wage sector. This contradicts the findings of Babatunde and Qaim (2010) who report a 6% contribution in Kwara State. In total, the entire off-farm income constitutes about 47.1% of total income. Similar estimate of 43% is reported in Ghana (Senadza, 2012), and a mean of about 44% non-farm participation share for African countries (Davis et al., 2017).

Diversification across regions (Table 1) shows that the level of diversification is higher in the Northern Regions compared to the Southern Regions. The North West Region has the highest

value with a mean Herfindahl Index of 0.211. Among the Southern Regions, the highest level of diversification is in the South South Region. This may be due to pollution in the area arising from mining activities which might have affected the natural resource base for agricultural production. The least level of diversification (0.561) is in the South East Region. Although South East Region is known for business activities, the rural areas in this region are characterized by agricultural production and some trading activities.

### Extent of off-farm income diversification

Table 2 shows the extent of off-farm income diversification by sex, age-range, educational qualification, farm size and household size. The results reveal that males have the lowest index of diversification of about 0.28 while females have an index of approximately 0.49, implying that females are less diversified than the males probably because females are care givers at home and could be more engrossed with household chores than males. Farm household heads below 35 years of age have the least level of diversification with an index of about 0.29. Farmers between 35 and 50 years have a higher level of diversification compared to farmers below 35 years. The level of diversification for farmers beyond 50 years is a bit higher; perhaps their asset base provides more opportunity to engage in other off-farm sectors. Liu and Lan (2015), in China; Abdulai and CroleRees (2001), in Mali also backed this view.

The extent of diversification decreases as educational qualification improves. The highest level of diversification (0.233) is observed for farmers without formal education, compared to those with primary and secondary education having diversification values of 0.365 and 0.358, respectively. This could indicate concentration of educated farmers on some income activities with better opportunities rather than extensively diversifying into different off-farm jobs.

**Table 2.** Extent of off-farm income diversification by sex, age-range, educational qualification, farm size and household size

Variables	Herfindahl Index	F-stat
<b>Sex</b>		
Male	0.28	3.43***
Female	0.49	
<b>Age-range</b>		
<35years	0.296	0.26
35–50 years	0.288	
51–65 years	0.278	
65 years	0.283	
<b>Educational qualification</b>		
Uneducated	0.233	23.52***
Primary	0.365	
Post-Primary	0.358	
<b>Farm size</b>		
Small	0.292	5.77***
Medium	0.245	
Large	0.171	
<b>Household size</b>		
1–5	0.337	3.04**
6–10	0.282	
11–15	0.253	
>15	0.181	

Source: Authors' computation

**Determinants of extent of off-farm income diversification**

Table 3 represents the estimates of the Tobit model. The F-statistic is significant ( $P < 0.01$ ), indicating a good fit of the model and that all the variables have a joint influence on the dependent variable (Herfindahl Index). Post-primary education is significant ( $P < 0.05$ ) and positively related with Herfindahl Index. This reveals that having extra educational qualification beyond primary school is likely to increase income concentration and decrease the extent to which farmers diversify their income sources. This could indicate that the more educated specialize in some activities and are less likely to involve in other off-farm activities such as low remuneration jobs. Although education could provide better opportunities in some wage activities which could provide additional income for the farmers, it is also possible to be educated and unable to actively engage in some activities due to other constraints asides skills such as financial constraint.

Liu and Lan (2015) observe a negative association for low income farmers in China. Canagarajah et al. (2001) opine that poor reward for education in rural areas in Ghana could be a reason for this outcome. Similar finding is observed in Ghana and Ethiopia where education reduces engagement in non-farm activities with low remuneration (Demeke and Zeller, 2012). However, Barrett et al. (2001) in Côte

d'Ivoire and Kenya, report that education is seen to have positive impact on the off-farm work decision. Winters et al. (2009) state that a higher share of non-farm income is from those with post primary education in Malawi, Madagascar, Ghana, Nepal, Guatemala and Nicaragua.

Farm size is significant ( $P < 0.1$ ) and negatively correlates with the Herfindahl Index. This implies that as farm size increases, concentration level reduces and the extent of diversification increases. The implication of this is that farmers with larger farm sizes are more likely to diversify income sources. Results are mixed in this regard. Abdulai and CroleRees (2001) discover that higher landholding promote diversification into non-farm activities in Mali. Demeke and Zeller (2012) hypothesize the existence of a positive relationship in Ethiopia, since having more land, which is a measure of wealth, could provide more opportunity for diversifying into some activities in the off-farm sector. However, Liu and Lan (2015); Meraner et al. (2015) and Bhaumik (2007) find a negative correlation between farm size and diversification and that the latter is common among small holder farmers. Farm size is not significant in some studies (Oseni and Winters, 2009; Idowu et al., 2011; Babatunde and Qaim, 2009; Corral and Radchenko, 2017) in Nigeria; (Abdulai and Delgado, 1999), in Ghana; Prowse (2015), in Ethiopia.

Household's access to electricity is positively associated ( $P < 0.01$ ) with Herfindahl Index, pointing

**Table 3.** Determinants of extent of income diversification: Tobit regression

<b>Dependent variable: Herfindahl Index</b>	
<b>Variables</b>	<b>Coefficient</b>
Sex	-0.0610 (0.066)
Age	-0.0041 (0.005)
Age square	0.0000253 (0.000046)
Primary education	0.0329 (0.0272)
Post-primary education	0.0507** (0.0255)
Adult worker	0.00192 (0.0058)
Farm size	-0.0101* (0.0058)
Livestock value	-3.21e-08* (1.69e-08)
Formal credit	-0.01036 (0.0448)
Membership in organization	0.03409 (0.0298)
Access to electricity	0.0593*** (0.0239)
Distance to market	-0.000565 (0.0011)
North Central	-0.1207*** (0.0422)
North East	-0.0764* (0.0416)
North West	-0.138*** (0.039)
South East	0.156*** (0.048)
South West	0.135* (0.070)
Constant	0.518*** (0.149)
F-statistics	10.01***
Pseudo R-square	0.405
Observations	836
Log likelihood	-119.5

Author's computation  
 Robust standard errors in parentheses \*\*\* P < 0.01, \*\* P < 0.05, \* P < 0.1  
 Figures in brackets are Standard Errors

to a decrease in the extent to which farmers diversify. This does not negate the relevance of electricity in providing opportunities for rural farm households to diversify. It only implies that access to electricity may not extensively lead to high diversification levels

but could promote concentration in some income sources. This is possible if electricity becomes stable and the businesses that are driven by electric power such as tailoring, milling, carpentry, hairdressing, constitute the dominant source of household income

on a sustainable basis. Sustained access to stable electricity could lead to concentration of households on the fewer businesses since sustained access to stable electricity would imply steady income flow. Idowu et al. (2013) note that the absence of electricity could force farm households into jobs that are not power driven such as petty trading and crafts. Electricity access invariably lowers operational cost for enterprise owners whose operation depends on electricity. This result is slightly different in other findings where it was shown that farm households with electricity access could engage in diverse activities to generate income (Sundaram-Stukel et al., 2006; Stifel, 2010; Senadza, 2012).

Regional differences significantly relate with the extent to which farm households diversify. Different regions have different opportunities and endowments which causes variations in the degree of diversifying income. From the results, compared to the South South Region (the reference group), farmers in the South East and South South Regions are less likely to have higher extent of diversification and the extent is more likely to increase for farmers in the North Central, North West and North East Regions. This could be due to the adverse weather condition in the northern areas of Nigeria coupled with the state of unrest in the Northern Regions which could have affected several farmers. In search of means to better secure their livelihoods, they could move into other activities outside agriculture.

Concentration in off-farm work may be higher for farmers in Southern Regions compared to Northern residents. The disparity between the Southern and Northern Regions may stem from the fact that the Southern Regions have more opportunities including higher educational levels, infrastructure and proximity to cities and could easily find job opportunities in urban areas. This corroborates the findings of Beyene (2008), who reports a higher probability of working off the farm in high drought-affected and food deficit regions and low off-farm participation in food surplus areas. Weltin et al. (2017) in their study in Europe state that off-farm diversification of farm households relate to the regional and institutional environment in which the farms are embedded. They find that small-scale livestock farmers who predominate in Noord-Holland region with more alternatives to income generation have higher tendency to diversify off-farm due to proximity to labour markets and low unemployment rate. Canagarajah et al. (2001) in Ghana, observe positive non-farm earnings premium in the Central, Eastern and Western Regions relative to the Northern Region.

## CONCLUSION AND RECOMMENDATIONS

From the findings of this study, high extent of diversification is observed amongst rural farm households in Nigeria. The highest off-farm share is from the non-farm self-employment sector, indicating that this sector has its prospects for rural farm households. Policies should focus on improving performance of the off-farm sector through provision of productive inputs, functional institutions and markets. More off-farm jobs could be made available and necessary qualifications for entry and continuity should be provided. There is need for location specific policies to address key issues in specific regions of the country since variations exist. More institutions relevant to rural development should be provided especially in the Northern Regions. Capacities of farmers to increase their off-farm income earnings should be improved and constraints to entry by small scale farmers should be removed to provide adequate opportunity for small scale farmers to engage productively in the off-farm sector.

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