ANALYSING THE LINKAGE BETWEEN DIVERSIFICATION OF INCOME SOURCES AND ARABLE FARMING INVESTMENT AMONG FARM HOUSEHOLDS IN OGUN STATE, NIGERIA

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ABSTRACT
This study assessed the relationship between smallholder farm households' income diversification and arable farm investment in Nigeria. With the aid of an interview guide, primary data were collected from a cross-sectional section of 180 arable crop farmers in Ogun State, Nigeria, using a multi-stage sampling procedure. Data were collected on the demographic and socio-economic characteristics, as well as the production and investment activities of the sampled arable crop farming households. The collected data were analysed using descriptive statistics, income diversification index, Tobit regression model and Ordinary Least Square multiple linear regression model. The results showed the dominance of three income sources among the sampled farm households. These income sources and their respective proportions were: arable farm enterprise (41.0%), non-farm salary (18.0%) and non-farm self-employment (18.0%). The average share of income earned outside arable farm enterprise to the total households' income was 0.59. The Tobit results revealed that age (p < 0.01), households' head years of schooling (p < 0.1), farm size (p < -0.01), farming experience (p < -0.1), dummy of established school (p < 0.05), electricity grid (p < 0.05), as well as distance to urban/market (p < -0.01), are the determinants of income sources diversification among the sampled agricultural households. Thus, socio-economic and infrastructural variables are established as the key factors determining income sources diversification which can guide policymakers in their efforts to monitor the trends of income diversification among the farming households in the study area. However, regression results showed an insignificant influence of income sources diversification on arable farm investment. Thus, the possibility of significant investment or spillover influence of income sources diversification on arable farm investment is not found in the study area. Agricultural commercialisation in the form of large-scale cultivation is therefore recommended to boost food crop production in the country.
Keywords: Income sources diversification, Arable Farming Investment, Agricultural Households, South-West Nigeria

INTRODUCTION

Income diversification, in its simplest form, refers to the presence of multiple income sources (Minot *et al.*, 2006; Ibrahim *et al.*, 2009; Ijaiya *et al.*, 2009). However, the concept of income diversification goes beyond numerical specification. In agricultural settings, income diversification is defined as a process in which rural agricultural households increase their employment and income from the non-farm sector (Barrett *et al*. 2001; Davis & Bezemer 2003; Ellis 1999; Lanjouw & Feder 2001; Zhao & Barry, 2013). In this regard, either the share of time spent on or the share of earnings from non-farm activities is used to highlight the importance of non-farm income in the household's livelihood. The livelihood of rural households is more often characterised by sophisticated strategies that involve multiple income-generating activities by one

or more household members, as off-farm income sources assume an increasingly important role over time (Kilic *et al.*, 2009; Idowu *et al.*, 2011; Zhao & Barry, 2013). In reality, very few people obtain their income from any one source, hold a single asset portfolio, or use their resources in just one activity (Barrett *et al.*, 2001; Babatunde & Qaim, 2009; Adepoju & Obayelu, 2013). This is especially so for rural agricultural settings where farming, as the primary source of income of the rural dwellers, is failing gradually in providing sufficient livelihood for farm households. In Nigeria, farming as an enterprise is risky in nature. Farm households in the country are often challenged with a series of problems such as depleting soil fertility, declining agricultural productivity, infrastructural inadequacy, risk and uncertainty, seasonality and inefficient agricultural market structures, among others (Adepoju & Obayelu, 2013). This production constraint, especially in terms of unfavourable weather prevalence, as well as imperfect credit and labour market, tend to be more severe for arable farming. Thus, rural farm households are forced to develop coping strategies to the increasing level of vulnerability associated with agricultural production through diversification, intensification and migration or moving out of farming (Ellis, 2000; Adepoju & Obayelu, 2013).

The concept of income sources diversification has generated enormous research interests. The focus has been on why and how households in rural areas diversify their income portfolios and to identify factors driving diversification outside agriculture as well as the examination of equity and food security implications of livelihood diversification (Egyei & Adzovor, 2013). Empirical evidence from different locations suggest that rural households do, indeed engage in multiple activities and rely on diversified income portfolios (Ellis, 1999; Haggblade *et al.* 2007). Haggblade *et al.* (2007) further predicted an increasing share of off-farm income in the coming years, especially in sub-Saharan Africa which is facing increasing population growth and threatened the growth of the agricultural sector due to limited agricultural resources. Subsequently, a range of 30-50 per cent reliance on non-farm income sources has been reported to be a common observation in Sub-Saharan Africa (SSA), (Haggblade *et al.* 2010). Furthermore, observed instances of diversification estimates in terms of off-farm income participation rate, as high as 75% (Adepoju and Obayelu, 2013), 79% (Msoo and Goodness, 2014) and 95% (Idowu *et al.*, 2011) among rural households from different settings in Nigeria has been reported.

The theoretical explanation provides that farm households diversify outside farming enterprise for many potential reasons (Mendola, 2007; Kilic *et al.*, 2009). Apart from higher returns to labour and or capital, other factors that may drive income sources diversification among farm households include the need to increase farm family income when farm income alone cannot provide sufficient livelihood (Minot *et al.*, 2006); the desire to manage agricultural production and market risks in the face of a missing insurance market (Reardon, 1997; Barrett *et al.*, 2001); as well as the need to earn income to finance farm investment in the absence of a functioning credit market (Reardon, 1997; Ruben & van den Berg, 2001; Kilic *et a.l*, 2009; Oseni & Winter, 2009). However, significant poverty incidence among rural households suggests more of push factors rationale for income sources diversification, as rural poverty appears to be endemic in sub-Saharan Africa (SSA), and has thus attracted much attention. This reflected in the bulk of study on income diversification Ellis (1999) (Barrett *et al.*, 2001) (de Janvry *et al.*, 2005) Babatunde and Qaim (2009) (Idowu *et al.*, 2011) Adepoju and Obayelu (2013) Zhao and Barry (2013) being centred on determinants and or livelihood, poverty or welfare implication for farm households specifically or rural households generally in different settings. For instance, Babatunde and Qaim (2009) (Idowu

et al., 2011) Zhao and Barry (2013) have examined the effect of income diversification directly on household income. Others Kilic *et al.* (2009), Mathijs *et al.* (2012) Babatunde (2013) Egyei and Adzovor (2013) Nasir (2014) Abebe (2014) Ma *et al.* (2017) had examined from a different perspective, the possible influence of income sources diversification as a coping strategy, on agriculture. However, the literature is relatively thin in this regard, specifically from the view of farm investment.

Therefore, with income sources diversification gaining attraction from farming households and rural households in general, its implication on agriculture becomes an essential factor in farm households' welfare policy considerations. Diversifying households may rely on their income sources diversification surplus to overcome liquidity limitations which could enhance agricultural investments as well as efficiency. On the other hand, households may choose to channel the surplus of diversified livelihood portfolios away from agricultural pursuits in the face of deep-rooted sectoral problems that cannot be readily overcome by mere availability of households' income sources diversification surplus. Hence, the net effect of income diversification on agricultural outcomes appears to be too complex to be conceptualised *a priori* expectation.

This research work thus aims at contributing empirically to literature in terms of understanding the nature of rural agricultural households' income sources diversification and its determining factors as well as examining the effect of income sources diversification on arable farming investment. Specifically, this study described the socio-economic characteristics of the arable farm households in the study area; estimated the degree of income sources diversification among the households in the study area; determined the effect of income sources diversification on arable farming investment among the sampled agricultural households in the study area. The hypothesis tested in this study was to determine "if income diversification statistically enhances the investment in arable crop production or otherwise" among the sampled farm households in the study area.

METHODOLOGY
This study was carried out in Ogun State. Ogun State is located in the South-West geo-political zone of Nigeria. Ogun State is bounded by Lagos state at the south, Oyo and Osun State at the north, Ondo State at the east and Republic of Benin at the west. Ogun State was founded in 1976 and named after Ogun River which runs across it from north to south. There are six major ethnic groups in the State namely; the Egba, the Ijebu, the Remo, the Egbado, the Awori and the Egun who speak Yoruba as a language which is however broken down into several dialects. The population of Ogun state based on 2006 Census was 3,751,140, comprising of 1,864,907 males and 1,886,233 females. The State situated between latitude 6.2^0N and 7.8^0N and longitude 3.0^0E and 5.0^0E, has a land area of 16,409.26 square kilometres which is approximately 1.9% of Nigeria's land area of 932,219 square kilometres. It is endowed with a favourable climate and good vegetation for the cultivation of various cash and food crops as well as livestock rearing. As at 1979, Ogun state was classified into four divisions comprising Egba, Ijebu, Egbado (now Yewa), and Remo based on the ethnic groups of its people, this was done in compliance with political dispensation and formed the foundation for the development of agricultural zones in the State. Ogun State Agricultural Development Programme (OGADEP) however, divided the State into four (4) agricultural zones namely: Ilaro, Ijebu-Ode, Abeokuta and Ikenne. These zones are further divided into agricultural blocks, while each block contained different cells within the Local Government Areas.

This study employed a multi-stage sampling procedure. In the first stage of the sampling procedure, Abeokuta, Ikene and Ilaro zones were randomly selected from the four agricultural zones in the State. The second stage involved the selection of three (3) blocks randomly across the selected zones giving a total of 9 blocks. This was followed by the random selection of 2 cells from each of the chosen blocks to give 18 cells. The final stage followed a more random/convenient technique of sampling ten arable farm households from farming communities within the earlier sampled cells. In the absence of a comprehensive sample frame of the arable farm households in the communities, an effort was tailored towards improvising for a useful sample frame with the help of the village heads and extension officers. However, the inconsistency challenge in the part of some households' availability weakened the achievement of efficient randomness. Since it is not a pure fallacy, that consistency in the availability and readiness of respondents on the field, in reality, is a key factor in achieving efficient randomness in sampling. This challenge, therefore, given the research time frame and resources, restricted the degree of effective random sampling in the final stage. Hence, some unavailable sampled respondents were replaced conveniently with the available ones. This gave a total of 180 arable crop farm households sampled in the State.

A structured questionnaire was used in collecting the required data from the selected arable farm households in the study area. However, out of the sampled 180, it was responses obtained from 174 administered questionnaire that gave meaningful information relevant for analysis, narrowing the sample size down to 174. Data were collected on; the households' arable cultivation enterprise and other income sources beside arable cultivation, socio-economic (individual, household and community) characteristics. It is important to note that in this study, households' income sources diversification was conceptualised based on earnings obtained by the sampled agricultural households outside arable crop production farm gate; which is the primary target occupation of the sampled households.

In addition to the primary income of concern (arable farm income), the following categories of income sources were identified. These included: other farming activities (subdivided into plantation farming and livestock/aquaculture farming), off-farm activities (classified into agricultural-related income generating sources and non-farm generated income sources. The agricultural generated income sources include the agricultural wage income from labour supply on another household's farm, and the agricultural-related self-employment income such as income from agro-processing and value addition, sales and marketing of agricultural products.

On the other hand, the non-farm income-generating activities are classified into the non-farm wage or salary income sources (this include both unskilled and skilled labour supply such as teaching, health services, night guard, messenger, labourer), the non-farm self-employment income sources (from carpentry, bricklaying, welding, transport, craftwork, blacksmithing, trading, food selling, hunting, forest gathering, traditional medicine and clergy work, etc.), and the other sources of livelihood; which may include remittances from household relatives (transfer earning), income from the household asset (income-earning assets) and or pension earning.

The above categorisation of income sources was based on relevant empirical literature. Idowu *et al*., 2011 used categories of non-farm income sources in estimating diversification among farm

households in southwest Nigeria. Also, Babatunde and Qaim (2009) went further by identifying income diversification as an activity beyond households own farm enterprise and therefore recognised earnings from labour supply to another household farm.

Data collected were analysed using descriptive statistics such as mean, frequency, percentage, diversification index and inferential statistics like Tobit, Ordinary Least Square Multiple regression and Two-Stage Least Square regressions.

Measurement of Income Diversification
The income sources diversification in terms of farm and off-farm activities were expressed as an index specified in equation (1), building on previous research (Babatunde &Qaim, 2009; Malek & Usami, 2010; Idowu *et al.*, 2011; Adebayo *et al.*, 2012).
$$D_i = \frac{y_i}{Y_i} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$
Where D_i= the income sources diversification index (score) for i^{th} household,
y_i = the income earned by the ith household from activities aside arable farming in monetary (₦) value
Y_i = total income of an ith household in monetary (₦) value from arable farming and other livelihood enterprises the households engage (Akamo *et al.*, 2017).
Therefore, D_i= income sources diversity, which takes a value between 0 and 1. For a household with a single income source (i.e. arable cultivation), $D_i = 0$, and the larger the value of the income diversification index, the greater the diversification of income (Babatunde & Qaim, 2009; Zhao & Barry, 2013).

Determinants of Income Diversification
The determinants of income diversification were estimated using the Tobit regression analysis following Babatunde and Qaim, (2009); Idowu *et al.*, (2011). The Tobit models expression (equation 2) was censored between zero and one for the diversification index (D_i) given the minimum and maximum possible index score 0 and 1, respectively.
$$D_i^* = \beta X_i +$$
$$\mu_i \qquad \mu_i \sim N(0, \sigma^2) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$
$$D_i = \max (0, D_i^*), \qquad D_i = D_i^* \; if \; D_i^* > 0$$
$$D_i = 0$$
Where D_i^*= Income diversification index obtained based on equation 1 specified above
$\qquad$ X_1 = Age of household head (HH) in years
$\qquad$ X_2 = Gender of HH (D:1 if male, 0 if female)
$\qquad$ X_3 = Marital Status of the HH (D:1 if married, 0 if otherwise)
$\qquad$ X_4 = Education of HH (in years of formal schooling period)
$\qquad$ X_5 = Household size (in number of persons)
$\qquad$ X_6 = Farm size (in hectare)
$\qquad$ X_7 = Farming experience of HH (in years)
$\qquad$ X_8 = Presence of public electricity grid (D:1 if yes, 0 if no)
$\qquad$ X_9 = Presence to established school (D:1 if yes, 0 if no)
$\qquad$ X_{10} = Distance to the nearest urban center or market (in kilometer)

Evaluating the Effect of Income Sources Diversification on Arable Production Investment
A linear regression model was specified in line with Kilic et al., (2009); Babatunde, (2013) as follows:

$$Y_i = \beta_0 + \beta_1 D_i + \beta_2 X_i + \varepsilon_i \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (3)$$

Where; Y_i = total value of arable farm investment ('000 Naira)

β_0= the constant term

X_i= is the vector of explanatory variables for i^{th} households, specifically the variables are given as;

X_1 = Age of household heads (HH) in years

X_2 = Gender of HH (D:1 if male, 0 if female)

X_3 = Marital Status of HH (1 if married, 0 otherwise)

X_4 = Household size (in number of person)

X_5 = Education of HH (in years of formal schooling period)

X_6 = Farm size (in hectare)

X_7 = Farming experience HH (years)

X_8 = Extension contact (D:1 if yes, 0 if no)

X_9 = Access to credit D:(1 if yes, 0 if no)

X_{10} = Total arable farm labour (in man-days)

D_i = Income Sources Diversification Index obtained based on equation 1 specified above

Testing for possible endogeneity problem associated with income diversification, the instrumental variables (IV) used for estimating the two-stage least square regression are:

IV_1 = Average education of households' income earners (in years of formal school attended)

IV_2 = Dummy of the public electricity grid (1 if available, 0 if not)

IV_3 = Average distance of the household location from nearest urban centre/market (km)

It is believed that the chosen instrumental variables are highly correlated with income source diversification, hence influence the households' total value of arable farm investment only through their effects on income source diversification.

RESULTS AND DISCUSSION

Socio-economic characteristics of arable farm households in the study area

The result of the socio-economic characteristics of the sampled households and households' head are presented in Table 1.

Table 1: Distribution of households and household heads by socio-economic characteristics

Characteristics	Frequency	Percent	Mean
Age of Household Head (HH)			
Less than 31 years	1	0.6	49
31 – 60 years	156	89.6	
Above 60 years	17	9.8	
Gender of HH			
Male	161	92.5	
Female	13	7.5	
Marital status of the HH			
Married	154	88.5	
Others (divorced/widowed)	20	11.5	
Educational status of HH			
No formal education	38	21.8	
Primary school education	57	32.8	
Secondary school education	51	29.3	
Tertiary school education	28	16.1	
Years of formal school attended			

Less than 7 years	95	54.6	8		
7 – 12 years	51	29.3			
13 – 17 years	27	15.5			
Above 17 years	1	0.6			
Household size (Number of people)					
Less than 5 people	48	27.6	6		
5 – 9 people	108	62.1			
Above 9 people	18	10.3			
Farm size (Hectares)					
Less than 1 hectare	35	20.1	2.03		
1 – 3 hectares	114	65.5			
Above 3 hectares	25	14.4			
Farming Experience of HH					
Less than 10 years	14	8.0	22		
10 – 20 years	81	46.6			
21 – 30 years	51	29.3			
Above 30 years	28	16.1			
Access to extension service					
Yes	106	61.0			
No	68	39.0			
Income earning members of the household					
1 person	14	8		73	3
2 – 3 persons	127	19			
Above 3 persons	33				

Source: Field Survey, 2015, N = 174

The results showed that most (92.5%) of the household heads were males. The mean age of household heads is 49 years, an indication of productive age bracket, which is in tandem with the estimate of Ambali (2012) in his research involving a sample of respondents in the same study area as this. Similarly, most (88.5%) of the household's head expectedly are married, which indicates additional responsibility for family maintenance, and the possibility of having more income earners within the households. The majority (62.5%) of the households have a size of 5 to 9 persons while the mean household size was six persons. This could imply relatively abundant human resources given the households' dependency ratio. The table shows the distribution of household heads educational status as 21.8%, 32.8%, 29.3%, and 16.1% for no formal education, primary, secondary and tertiary respectively. Converting the educational status to years of formal schooling attendance, about half (54.6%) of the household heads, have less than seven years of formal schooling, with a mean of 8 years formal schooling. This reflects on the average, a relatively low literacy achievement among the household heads. A more substantial proportion (73%) of the households has 2 to 3 persons of her members working, with a mean of 3 persons as income earners. This is expected in a rural setting with a low level of academic pursuit, favouring early engagement of in livelihood activities. Approximately (65.5%) of the sampled households cultivated one to three hectares of arable farmland, with a mean size of 2 hectares. This is reasonable because the study focuses on arable farm households as opposes to individual arable crop farmer. Besides, consideration for multiple arable crops supports the possibility of increasing the scale of cultivation. The mean farming experience of the household heads is 22 years, with 42.6% of the household heads having 10 to 20 years of experience in farming. This indicates that the household heads are somewhat experienced in farming. Lastly, the majority (61.0%) of the

households' heads had contact with extension agents, implying a relatively fair chance of benefiting in extension services and agricultural development programs.

Analysis of income diversification estimates

Table 2 presents summary statistics of income sources diversification index, alongside the distribution of households based on their income sources diversification scores.

Table 2: Distribution of farm households by income sources diversification estimates

Diversification index *(D)*	Frequency	Percent (%)
Less than 0.201	5	2.9
0.201 – 0.4	28	16.1
0.401 – 0.6	58	33.3
Above 0.6	83	47.7
Total	174	100.0
Minimum	0.136	
Maximum	0.984	
Mean	0.590	
Standard deviation	0.218	

Source: Field survey, 2015

The approach used for estimating income sources diversification in this study was based on the share of income earned by households outside arable crop production in line with Akamo *et al*., 2017. The result showed that the mean estimate of income sources diversification index was 0.59 (± 0.218) which could be as low as 0.136 and as high as 0.984, with the value in parenthesis is the standard deviation of the estimate. This implies that none of the households depends solely on arable cultivation as a source of income and that on the average, the share of income earned outside the arable enterprise is relatively high with a value of 59%. This could be related with the 30 to 50 percent estimate reported by Ellis (1999); Haggblade *et al.* (2010), indicating the percentage of reliance on non-farm income among farm households in Sub-Saharan Africa (SSA). Babatunde and Qaim (2009) reported an off-farm share index of 0.497 among farm households in their study of income diversification pattern in Nigeria. Meanwhile, the observed slightly higher diversification index obtained in this study could be adduced to the choice of target enterprise (arable farm) of the households, as well as the identification of income diversification at the food crop production at the farm gate. Furthermore, distribution of the income sources diversification scores reflects that about half (47.7%) of the households were above 0.6 score of income sources diversification.

The distribution of the respondents by the categories of their recorded income sources is presented in Table 3.

Table 3: Distribution of households by the categories of their recorded income sources

Category of income sources	Frequency	Percent (%)
Arable farm income	174	100
Tree crop income	86	49.4
Livestock income	52	29.9
Agricultural wage income	25	14.4
Agricultural self-employment income	84	48.3
Non-farm wage/salary income	61	35.1
Non-farm self-employment income	131	75.3
Others (e.g. Remittance)	69	39.7

Source: Field survey, 2015

Considering the pattern of earning from the various categories of income sources, table 3 reveals that majority 75.0% earn income from non-farm self-employment, followed by plantation farming (49.4%) and agricultural self-employment (48.3%) respectively. This suggests more of push factor which drives households into less risky enterprise with little entry barrier that could enhance smooth earnings, even if the expected revenue is low.

Table 4 presents the distribution of the different categories of income by their share of contribution to the total households' income.

Table 4: Distribution of income categories by their share of the total household income

Income category	Percent (%)
Arable farm income	41.0
Tree crop income	9.0
Livestock income	1.7
Agricultural wage income	1.5
Agricultural self-employment income	7.4
Non-farm wage/salary income	18.0
Non-farm self-employment income	18.0
Others (e.g. Remittance/transfer)	3.2
Total Income	100.0

Source: Field survey, 2015

In this regard, the outcome of the distribution showed that arable farming still holds a significant share of the total income among the household, indicating the potential of the enterprise yet to support the livelihood of the farm household to a more considerable extent. However, this could be associated with the enterprise being the primary source of income target by the study. This was in tandem with studies of similar context (Babatunde and Qaim, 2009; Shittu, 2014) who also reported arable crop enterprise as an essential contributor of income among farm households in different study area within the country. Meanwhile, non-farm wage income, non-farm self-employment and plantation farming are next in the share of total income with a value of 18.0%, 18.0% and 9.0% respectively.

Identifying the Determinants of Income Sources Diversification among Households

Tobit model was used to determine factors that influence the diversification of income among arable farm households as presented in Table 5.

Table 5: Tobit Regression Parameter Estimates of Households' Income Sources Diversification Determinants in the study area

Variables	Coefficients	t-value
Age HH	0.007***	3.50
Gender HH	0.011	0.16
Marital Status HH	0.062	0.95
Education HH	0.005*	1.65
Household Size	-0.002	-0.22
Farm Size	-0.064***	-4.65
Farming Experience HH	-0.004*	-1.69
Public Electricity	0.096**	2.26
Public School	0.010**	0.32

Urban Distance	-0.009***	-2.91
Constant	0.205**	2.14
Log-likelihood	-44.46	
F-statistic	6.69***	
Prob. > F	0.000	

Source; Computed from survey data, 2015; N = 174; *, **, *** coefficients are significant at the p<0.1, p<0.05, and p<0.01, respectively.

The variables; age, households' head years of schooling, farm size, farming experience, presence of established school (dummy), presence of electricity grid (dummy), and distance to urban market/centre were all found to be significant determinants of income diversification. The age of household heads was found to be positive and significant (p<0.01) with income diversification. It implies that arable farm households with older head earn more income outside the arable enterprise and that on the average an increase in age of household head raises the likelihood of increasing income diversification. This challenge Awoniyi and Salman (2011); Bekelu and Abdi-Khalil, (2013); Ogbanje *et al.*, (2014); who reported an inverse age-income diversification interaction. And also Babatunde and Qaim (2009); Alobo, (2012); Alobo & Bignebat, (2017); who found age to have insignificant influence on diversification of income. A possible explanation is that the financial responsibility of household heads more often than not increases with age, especially for those in the productive age, which arable farm enterprise may not sufficiently meet. Also, it could be related to reducing energy and vigour to engage in the rigorous arable crop enterprise effectively. At the same time, the possibility of having a larger volume of production resources and more mature household with a higher number of income earners could also be a rationale.

The households' head years of formal schooling is also significant (p<0.1) in the positive direction with the diversification of income. That is, an increase in the year of schooling would raise the likelihood of income diversification other things been equal. Expectedly given the adopted approach of estimating income diversification, increased educational achievement could stimulate salary income-earning which contribute significantly to the volume of income earned by household beyond arable farming in line with Ogbanje *et al.*, (2014). It also follows the findings of (Babatunde & Qaim, 2009). Arable farm size (p<0.01) and farming experience (p<0.1) decreases households' income diversification. The implication is that the larger the arable farm sizes the lower the likelihood of income diversification; also households with a head who has higher experience in farming will diversify less. The negative correlation presented by these variables follow *a priori* expectation, as farm size and farming experience could enhance arable farm income which may oppose the likelihood of increasing diversification of income among the households (Awoniyi & Salman, 2011; Tasie *et al.*, 2012; Ogbanje *et al.*, 2014). This challenges the suggestion of Alobo, 2012; Alobo & Bignebat, (2017) that more massive farm may support the diversification of income because of the wealth accrued to larger farm size, especially in the core rural settings with low agricultural revenues.

Finally, the significant outcome of electricity dummy (p<0.05), school dummy (p<0.05), and urban centre distance from farming community (p<0.01) on income diversification indicate at enhancing the quality of rural non-farm economy development on farm households diversification of income. The dummy of the public electricity grid and schools increases the likelihood of income diversification, while the distance of the farming community to an urban centre reduces diversification of income. Possible justification is the increasing tendency of households to overcome small businesses entry barrier in the presence of a rural economy which supports

diversification of income. This is in tandem with findings of (Idowu *et al.*, 2011) as well as Babatunde (2013) and Alobo (2012) in Nigeria and Kenya, respectively.

Effect of Income Sources Diversification on Arable Farming Investment
The effect of income diversification on arable farm investment is presented in Table 6. The Ordinary Least Square (OLS) regression result is presented alongside 2 Stage Least Square (2SLS) regression estimate.

Table 6: Regression Estimates of Income Diversification Effect on Arable Farm Investment

Variables	OLS Coefficients	t-value	2SLS Coefficient	t-value
Age HH	-1.252**	-2.22	-1.148	-1.60
Gender HH	-14.721	-1.60	-14.534	-1.57
Marital Status HH	-5.271	-0.56	-4.536	-0.49
Education HH	1.196*	1.94	1.302*	1.74
Household Size	3.777**	2.38	3.816**	2.45
Farm Size	58.385***	5.67	57.781***	6.08
Farm Experience HH	1.067*	1.68	1.004	1.31
Extension Contact	1.411	0.13	0.938	0.08
Credit	0.617	0.08	1.936	0.21
Total Labour	0.467***	3.50	0.463***	3.53
Diversification index (D_i)	10.435	0.58	-3.325	-0.07
Constant	17.519	1.08	21.508	1.10
R-squared	0.88		0.88	
F-statistics	131.37***			
Probability.> F	0.000			
Wald Chi-square			1576.03***	
Probability.> Chi-square			0.000	
Endogeneity test				
Wu-Hausman statistic			0.067	
Probability.> Wu-Hausman statistic			(0.795)	
Sagan Chi-square			1.154	
Probability.> Sagan Chi-square			(0.562)	

Source: Computed from survey data, 2015. N = 174 *, **, *** coefficients are significant at the p<0.1, p<0.05, and p<0.01, respectively

However, the possibility of endogeneity issue between income diversification and arable farm investment was empirically assessed with Durbin Wu-Hausman test. The presence of endogeneity in the arable farm investment model was rejected based on the statistical insignificance of the Durbin Wu-Hausman endogeneity test statistics. While endogeneity issue has been reported in most income diversification studies (Kilic *et al.*, 2009; Babatunde 2013; Egyei and Adzovor, 2013; Abebe 2014), the observed opposition in this study could be attached to the estimation procedure adopted in this study. While estimating the households' income diversification in this study, we considered all income earners within the households, however, households' agricultural production decisions depends more on the households' head or the significant decision-making members of the households for arable farming as an enterprise. The exogenous report on income sources diversification meanwhile, gains the support of Zhao and Barry (2013) in their analysis of income diversification among rural households in China. Therefore, the OLS result, which also gives more significant variables, was reported.

The robust standard error was used in estimating the t-values to correct for the possibility of heteroscedasticity in the estimated model. In the regression, the dependent variable is the total arable farm investment value in Naira for the 2014/15 farming season, which includes the value of land rent, hired labour, fertiliser, pesticides, seeds/planting materials, farming tools. The explanatory variables used are predominantly socio-economic, alongside farm size and total labour; this is done to accommodate the socio-economic nature of the variable of concern "income sources diversification". These variables included: age of households head, the gender of households head, marital status of the households head, household size, schooling years of households' head, farm size, farming experience and extension contact. From the result presented in Table 6, age of household heads has a significant ($p<0.05$) decreasing effect on farming investment, indicating that increase in age of households' head will decrease investment in arable farming. The explanation for this could be linked with the inverse situation of the observed positive age-income diversification interaction discussed earlier, coupled with reduced physical strength associated with ageing in the extreme, which could decrease arable production scale and subsequently farming investment. Household size ($p<0.05$), households' head years of schooling ($p<0.1$), arable farm size ($p<0.01$), farming experience ($p<0.1$) and farming labour ($p<0.01$) all have increasing effect on arable farm investment, in line with Babatunde (2013). This implies that an increase in any of these variables will raise the value of the investment in arable crop enterprise, *ceteris paribus*. For instance, an increase in household size by one person will increase investment by ₦3,777.00 on the average. In contrast, a year increase in farming experience will lead to ₦1,067.00 increase in investment all things being equal.

The variable of concern income sources diversification surprisingly has an insignificant effect on arable farming investment against the *apriori* expectation (Oseni & Winter, 2009; Joachim, 2011; Babatunde, 2013). Although showing a positive tendency on arable farming investment, the insignificant income source diversification effect suggests that the motive of diversification among the farm households is beyond the goal of relaxing liquidity constraints, especially with arable farming. That increase diversification of income sources does not necessarily translate to a significant increase in arable farming investment. However, the evidence from the literature mentioned above challenges the findings of this research. This could be associated with the sampled farmers' aggregated nature of farming practices (arable, livestock and plantation) investment concern of income sources diversification, which may have shadowed its specific implication on the food crop sub-sector. Another explanation could also be offered in terms of the ageing population of farming members of the households. The drudgery associated with arable cultivation may work against the will to invest income from livelihood diversification into arable farming. At the same time, significant numbers of the interviewed farming members also identified climatic and unstable food crop market price, as challenges to profitable arable enterprise.

The first stage regression estimates of the 2 SLS regression are presented in Table 7. This is necessary to assess the validity of the chosen instrumental variables. The statistical significance of the selected instrumental variables indicates the validity of the instrumental variables to proxy for income source diversification.

Table 7: First Stage Estimates of Income Sources Diversification in the 2SLS Regression

Variables	Coefficients	t-value
Age HH	0.007***	3.22
Gender HH	0.043	0.58
Marital Status HH	0.019	0.30

Education HH	0.0005	0.11
Household Size	-0.004	-0.54
Farm Size	-0.042	-1.22
Farming Experience HH	-0.004*	-1.72
Extension Contact	-0.016	-0.45
Credit	0.081**	2.46
Total Labour	-0.0002	-0.43
Instruments		
Education of Income Earners	0.008*	2.33
Public Electricity	0.075*	1.75
Urban Distance	-0.008**	-2.47
Constant	0.209***	2.10
R-squared	0.30	
F-statistics	7.85***	
Prob> F	0.000	

Source: Computed from survey data, 2015. N = 174; *, **, *** coefficients are significant at the 10%, 5%, and 1%, respectively.

CONCLUSION

From the research findings, the study concluded that diversification of income sources is an established livelihood practice among arable farming households. None of the households depends solely on arable farming as a source of livelihood. Arable farming households in the study area have an average of 0.59 income sources diversification index and could be as high as 0.98 based on income earned outside arable crop enterprise. That is, up to 98% of the arable farming households' income could be earned from sources outside arable crop production. The non-farm self-employment is the most common source of income besides arable crop production among the households, with plantation farming and agricultural related self-employment coming next to it in that other. However, the three dominant income source categories in term of the households' annual income share are arable crop enterprise, non-farm salary job and non-farm self-employment. Furthermore, while income sources diversification appears to be desirable for livelihood purpose given its contribution to the overall households' income, it exerted an insignificant influence on arable farming investment among the households in the study area. The critical observable determinants of income sources diversification are socio-economic and community characteristics such as the age of household head, education of household head and income earners, farm size, urban distance and so on.

RECOMMENDATIONS

Based on the conclusions, the study offers the following policy recommendations to expand arable crop production, a significant source of domestic food crop supply in Nigeria.
1. The significant effect **of** cultivated farm size on income diversification and farm investment imply that farm expansion should be encouraged among the arable crop farmers. This is necessary to allow increasing crop production and incomes; thus, the share of households' income from crop enterprise, against increasing the diversification of income.
2. Furthermore, households' head years of schooling should be considered in achieving an overall improvement in the livelihood and production benefits among the arable crop farming households. Therefore, the pursue of formal education is recommended for farm households while educated individuals are also encouraged to take up arable crop enterprise as a business.

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