

HUMAN CAPITAL AND INCOME DIVERSIFICATION AMONG CROP FARMERS IN RURAL OYO STATE, NIGERIA

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Abstract. This study focused on analyzing the effects of human capital on income diversification among crop farmers in rural Oyo State, Nigeria. The result presented was based on primary data collected from a random sample of 120 households selected from two agricultural zones of Oyo State, Nigeria. Descriptive statistics, Poisson regression and Tobit regression were employed as analytical techniques. Both the Poisson and Tobit regression methods were respectively used to examine the determinants of income diversification. The Poisson regression result showed that educational background, value of productive assets and access to credit were statistically significant and had a positive influence on the number of income sources (NIS). In turn, the Tobit regression results revealed that years of education, years of vocational training etc. were positively significant to income diversification. The recommendations arising from this study were that government should intensify their efforts at enhancing human capital development through formal education, vocational training and extension programs for the farmers so as to make them aware of the benefits of income diversification in improving their welfare. In addition, there is need to improve the participation of poor households in formal credit with low interest rates as credit enables the households to convert their stock into physical capital within a short time to take advantage of income opportunities outside agriculture.

Keywords: human capital, crop farmers, income diversification, households, rural Nigeria

INTRODUCTION

Human capital is the stock of competencies, knowledge and personality attributes embodied in the ability to perform labor so as to produce economic value (Crook et al., 2011). It also refers to the abilities and skills of human resources of a country (Adamu, 2002). This suggests that human capital is a form of resources that can be acquired, built up and developed. It can be acquired through formal education and on the job, through training and experience. Human capital is thus defined by Crook et al. (2011) as the development of human resources concerned with the twofold objective of building skills and providing productive employment for non-utilized and under-utilized workforce. This view is corroborated by Awopegba (2002) who argued that human capital is the knowledge, skills, attitudes, physical and managerial efforts required to manipulate capital, technology, land and materials to produce goods and services for human consumption. Therefore, human capital has positive impacts on productivity, employment, income diversification and generation and standards of living.

Income diversification refers to the allocation of productive resources among different income-generating activities such as on-farm and off-farm/non-farm operations (Abdulai and Crolerees, 2001). Reasons for

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income diversification include declining farm incomes and the farmers' intent to secure themselves against agricultural production risk (Minot et al., 2006). According to Abdulai and Crolerees (2001), rural households are pulled into off-farm activities when the return from non-farm employment is higher and less risky than in agriculture. Adamu (2002) was of the opinion that education is the most crucial way of improving skills and capabilities. He also emphasized that high-quality and market-relevant education is capable of offering a genuine solution to most economic problems. Some researchers (Soderbom and Teal, 2001; Yesufu, 2000) also identified human capital as an important determinant of income diversification. They indicated education and training as the most important direct means of upgrading human intellect and skills for productive employment. Thus, human capital is both an entry barrier to, and an important determinant of, income diversification.

PROBLEM STATEMENT

Poverty levels in Sub-Saharan Africa are remarkably high, especially in rural areas (Newman and Canagarajah, 2001). Rural areas in Nigeria are plagued with poverty more in terms of incidence, depth and severity (World Bank, 2001). Agricultural production in the country relies heavily on rural farmers who constituted about 90% of food producers for the nation (Rahji, 2000). World Bank (2001) described these rural farmers as small-scale operators, tenants or landless, characterized by low income and nutritional deficiencies, limited assets, large families and high dependency ratios. One characteristic of the rural farming households is their low level of education. Consequently, the managerial ability of the farmers is low and this may have a negative effect on their tendency to diversify into other non-farm activities which could enhance their farming income and improve the overall farming household's welfare.

Despite the persistent image of Africa as a continent of "subsistence farmers," non-farm income already accounts for as much as 40–45% of average household incomes (Little et al., 2001). Usually, it is positively correlated with income and wealth in rural Africa, and thus seems to offer a pathway out of poverty if the opportunities can be seized by the rural farming households. Hence promoting diversification is equivalent to assisting the poor. Human capital plays an important role in

income diversification as indicated by some scholars (Soderbom and Teal, 2001; Yesufu, 2000). They indicated education and training as the most important direct means of upgrading human intellect and skills for productive employment. Education also facilitates access to a number of different economic activities, either as a formal requirement for wage earning jobs or because it helps setting up and managing own small businesses (Minot et al., 2006).

The above makes this study important in Nigeria as it will be useful for economic decision makers in formulating policies for poverty reduction. Although several studies exist on income diversification in Nigeria, including Oluwatayo (2009), Babatunde and Qaim (2009), Ibekwe et al. (2010), there is dearth of study on the effects of human capital on income diversification, particularly among Nigerian crop farmers. Thus, this study is introducing an interesting dimension to the concept of income diversification by probing the contribution of human capital to it in rural Oyo State. In terms of methodology, instead of the common approach of using binary models such as Probit or Logit to assess the determinants of income diversification, this study adopted the Tobit regression to assess the intensity of diversification and Poisson regression to examine the determinants of the number of income sources available to a farming household in the study area.

METHODOLOGY

The study was carried out in Oyo state, Nigeria, with a total land area of 28,454 square kilometers and a population of 5,580,894 (2006 population census). The landscape consists of old hard rocks and dome-shaped hills which rise gently from 500 meters in the southern part and reach a height of about 1,219 meters above sea level in the northern part. Primary data used for the study was collected through the administration of a well-structured questionnaire tailored to the objectives of the study. The multistage sampling technique was employed to select the respondents from the study area. In the first stage, two (Ibadan-Ibarapa and Ogbomoso) out of four zones were randomly selected.

The second stage involved the random selection of two local government areas from each zone. These are Ido and Ibarapa Central local government areas from the Ibadan-Ibarapa zone, and Surulere and Ogo-Oluwa local government areas from the Ogbomoso zone. Then,

two villages were randomly selected from each local government to make a total of eight villages, namely: Bakatari and Araro from Ido, Shekere and Aba Alabi from Ibarapa Central, Arolu and Ilajue from Surulere and Ahoro-dada and Tewure from Ogo-Oluwa local government areas, respectively. Finally, fifteen food crop farmers were randomly selected from each of the villages, making a total of 120 respondents. The descriptive statistics, Poisson regression model and Tobit regression were used to analyze the data collected.

Model specification

An income-based approach was used which focused on three measures of income diversification:

- the number of income sources (NIS),
- the share of off-farm income in total income (OFS),
- the Herfindahl diversification index (HDI).

Used by Minot et al. (2006) and Ersado (2005), NIS is relatively easy to measure, though it has been criticized for its arbitrariness. But since it was used in connection with other measures, this was not considered to be a major problem. The OFS indicates the importance of off-farm income, while HDI is a measure of overall diversification taking into account not only the number of income sources but also the magnitude of income derived from them. The HDI originates from the industrial literature where it is used to measure the degree of industry concentration. It can also be used to measure the degree of concentration of income from various sources at individual household level. It is then calculated as the sums of squares of income shares from each income source (Ersado, 2006). The Herfindahl index as such increases in line with concentration, and therefore households with perfect specialization (i.e. having only one source of income) have a value of one. As this study is interested in diversification, which is the opposite of concentration, HDI (which is defined as one minus the Herfindahl index) was used. Thus, households with most diversified income sources had the largest HDI, and vice versa (Barrett and Reardon, 2000).

The Herfindahl diversification index is given by (Ersado, 2006):

$$d = 1 - \sum_i^n P_i^2$$

Where:

d = Herfindahl diversification index.

i = number of income sources indexed by i .

P_i = Proportion or share of income generated from income source i .

$\sum P_i^2$ = Herfindahl index (HI)

Note: $1 - HI = HD$

Determinants of income diversification

The three measures of diversification (NIS, OFS and HDI) were regressed on a set of household and contextual characteristics.

Poisson regression model

Following the lead of Omotayo (2016), since the determinants of NIS (number of income sources) which is the dependent variable is expressed in count outcome form. Therefore, a Poisson regression model is the best and adopted model for this objective. This has also been used by Minot et al. (2006), Ersado (2005) and Babatunde and Qaim (2009). The probability distribution function of the Poisson distribution is given by:

$$f(Y_i) = N^Y e^{-\mu}$$

The model may be written as:

$$Y_i = e(Y) + \mu_i = \mu_i = \mu_i + \mu_i$$

$$\mu = e(Y_i) = x^i \beta$$

Where: Y_i = dependent variable (NIS)

X = matrix of explanatory variables which are: X_1 = household size of the farm head; X_2 = gender of the farm head (dummy); X_3 = age of the farm head (years); X_4 = educational level of the farm head (years); X_5 = farm size of the farm head (ha); X_6 = productive assets of the farm head (NGN); X_7 = access to electricity by the farm head (dummy); X_8 = access to pipe-borne water by the farm head (dummy); X_9 = presence of tarred road to the farm (dummy); X_{10} = distance to market (km); X_{11} = access to credit facility by the farm head (dummy); X_{12} = ownership of farmland by the farm head; X_{13} = dependency ratio = number of adults aged above 60 and children aged below 14.

Tobit regression model

To assess the determinants of off-farm share in total household income and HDI, the Tobit regression model (censored between 0 and 1) was adopted. Schwarze and Zeller (2005), in Central Sulawesi and Indonesia, as well as Dejanvry and Sadoulet (2001), Adelekan and Omotayo (2017) and Woldenhanna and Oskan (2001) in Mexico, also used the Tobit model in the same context. It can be expressed as $Y_i^* = X_i \beta + \varepsilon_i$

where:

- ε_i is normally distributed with zero mean and constant variance,
- Y^* = dependent variables (OFS and HDI, respectively),
- β^i = regression parameters/coefficients,
- ε_i = error term,
- X_1 = vector of explanatory variables listed/mentioned above.

RESULT AND DISCUSSION

Socioeconomic characteristics of food crop farmers in the study area

The result of socioeconomic distribution of the respondents is presented in Table 1. The result revealed that

Table 1. Socioeconomic characteristics of the respondents ($n = 120$)

Variables	Frequency Percentage	
	1	2 3
Age in years		
<30	17	14.17
31–40	24	20.01
41–50	45	37.49
51–60	34	28.33
Gender distribution		
female	20	16.67
male	100	83.33
Marital status		
married	111	92.50
not married	9	7.50
Household size		
1–5	36	30
6–10	53	44.17
11–15	21	17.50
16–20	9	7.50
>20	1	0.83
Number of adults		
0	84	70.0
1	14	11.67
2	22	18.33

Table 1 – cont.

	1	2	3
Number of children < 14			
<5		99	82.50
6–10		18	15.0
>10		33	2.5
Years of education			
0		5	4.17
5–10		71	59.17
11–15		32	26.67
16–20		12	10.0
Years of training			
0		37	30.83
1		9	7.
2		68	56.67
3		6	5.0
Contact with extension agents per year			
0		14	11.67
1–3		87	72.50
4–6		19	15.84
Farm size in hectares			
<5		74	61.47
6–10.5		44	36.67
above 10.5		2	1.67
Farming experience			
<10		39	32.50
11–20		28	23.33
21–30		36	30.0
31–40		16	13.33
>40		1	0.83
Average income per annum in NGN			
farming income		350,966	
commerce income		106,791.00	
livestock income		66,875.00	
processing income		46,666.00	
labor income		10,416	
fishing		73,333	
salary		112,916	
hunting		19,583	
Land ownership			
own land		67	55.83
otherwise		53	44.17

Table 1 – cont.

	1	2	3
Land cost in NGN			
0		68	56.67
11,000–30,000		24	20.0
31,000–50,000		17	14.17
51,000–70,000		10	8.33
71,000–90,000		1	0.83
Cost of productive assets			
<10,500		68	56.67
10,600–20,500		35	29.17
20,600–30,500		10	8.33
30,600–40,500		4	3.33
40,600–50,500		1	0.83
Distance in kilometers			
0		1	0.83
3		28	23.33
4		46	38.33
5		15	12.50
5.5		15	12.50
6		15	12.50
Membership in an organization			
member		65	54.17
non member		55	45.83
Access to credit			
have access		65	54.17
otherwise		55	45.85
Source of credit			
formal		65	54.17
informal		55	45.83
Credit obtained in NGN			
0		55	45.83
60,000–200,000		22	18.33
201,000–400,000		14	11.67
301,000–400,000		5	4.17
401,000–500,000		4	11.67
>500,000		10	8.33
Total		120	100

Source: own elaboration based on field survey data.

about 17.0% of the farmers were female while about 83.0% of them were male in the sample population. This implies that more men engage in farming activities than women (Ganiyu and Omotayo, 2016; Adeniyi et al., 2016). Most of them (92.5%) were married with a mean household size of 8. Therefore, they may rely on family labor which results in reduced production costs. Also, this was in conformity with Ibekwe et al. (2010), who reported that a large household size has a positive impact on income diversification because farmers with large households need additional income to meet their family needs. The mean age of farmers in the study area was 44 years; most farmers (70.5%) had 5 to 10 years of formal education. This inferred that most of the interviewed farmers were still in their productive age; this could have had a positive effect on income diversification which is in line with (Huffman, 1999). The distribution of respondents by number of adults aged above 60 and children aged below 14 in their households revealed that the majority (70.0%) had no adult aged over 60 living with them while about 20.0% of them had about 6 to 10 children living with them. This suggests that the dependency ratio within the family is very low, and this could have a positive effect on household income.

Determinants of the Number of Income Sources (NIS model) of crop farmers

Factors affecting the NIS in the study area are presented in Table 2. The socioeconomic characteristics of farmers in the study area that have effect on the NIS were identified using the Poisson regression. The result shows that the household's educational background, productive assets and access to credit are statistically significant and have a positive influence on the number of income sources. This implies that the number of income sources tends to increase with educational background, productive asset value and access to credit. The better the household's educational background (years of vocational training), the higher the number of income sources. This is not surprising because education plays a positive and significant role in income diversification as it has been emphasized in most studies on income diversification; this report is in line with these previous studies (Minot et al., 2006; Babatunde and Qaim, 2009). Similarly, an increase in the value of productive assets owned by farming households would entail an increase in the number of income sources. Years of farming experience is a variable negatively significant

Table 2. Poisson regression for the determinants of income diversification (NIS model)

Variables	Coefficient	Standard error	Z	P > Z/
Age of the farm head	0.0176369	0.056427	0.31	0.755
Age ²	-0.0000807	0.0006889	-0.12	0.907
Gender of the farm head	0.0591221	0.213182	0.28	0.782
Marital status of the farm head	0.0955337	0.2043001	0.47	0.640
Dependency ratio	0.1967916	0.3941799	0.50	0.618
Household size of the farm head	-0.0068183	0.0200614	-0.34	0.734
Educational background of the farm head	0.1028645	0.0623356	1.65*	0.099
Land cost	0.0011153	0.0030399	0.37	0.714
Years of farming experience of the farm head	-0.0182297	0.0097199	-1.88*	0.061
Productive assets of the farm head	0.0000174	5.54e-06	3.13***	0.002
Distance to market	-0.0807855	0.0512013	-1.58	0.115
Access to electricity	-0.1471619	0.173084	-0.85	0.395
Access to credit facility	0.29966849	0.1286526	2.33**	0.020
Constant	0.4957191	1.212055	0.41	0.683
Number of observations	120			
L R Chi ² (13)	77.39			
Prob > Chi ²	0.0000			
Pseudo R ²	0.1693			
Log likelihood	-189.80586			

*, **, *** coefficients are significant at 10%, 5% and 1%, respectively.

Source: own elaboration based on field survey data.

to the number of income sources. The longer the farming experience period, the lower the number of income sources. A long farming experience helps the farmers improve their farming methods and may lead to higher productivity and income, thus discouraging diversification into another gainful activity.

Determinants of off-farm share in total income (OFS Model)

The result of the Tobit regression for OFS determinants is presented in Table 3. As shown by the analysis, some socioeconomic characteristics of the farmers significantly affect the share of off-farm income in total incomes. The number of years of education, number of years of vocational training, number of contacts with extension agents, access to credit and value of productive assets all

have a positive and significant effect on off-farm share in total income. This implies that as these variables increase, so does the share of off-farm income in total household incomes. For instance, the share of off-farm income in total incomes tends to increase with the level of education, training and extension agent contacts. In other words, accumulated experience contributes to skills needed for off-farm income generating activities.

As expected, years of education of the household head have a positive and significant influence on OFS. This is in line with previous studies which highlighted the important role of education for off-farm income diversification (Lanjouw, 2001; Adelekan and Omotayo, 2017). Also, years of vocational training and extension agent contacts have a positive and significant impact on OFS. Some previous studies also identified 5 ways of

Table 3. Tobit Regression for the determinants of income diversification (OFS model)

OFS	Coefficient	Standard error	T	P>/t/
Age of the farm head	-0.0007854	0.0134978	-0.06	0.954
Age ²	-8.2189234	0.0001648	-0.05	0.960
Gender of the farm head	-0.1986852	0.0583075	-3.41**	0.001
Marital status of the farm head	0.0537667	0.053201	1.01	0.315
Dependency ratio	0.0096186	0.1022861	0.09	0.925
Household size of the farm head	0.0025076	0.0052219	0.48	0.632
Years of education	0.0212255	0.0059617	3.56**	0.001
Years of vocational training	0.0829428	0.0152853	5.43***	0.000
Extension agent contacts	0.036186	0.0159435	2.27**	0.025
Farm size in hectares	-0.019515	0.0128105	-1.52	0.131
Years of farming experience	-0.0027875	0.002563	-1.09	0.279
Land ownership	-0.1025522	0.0766626	-1.34	0.184
Distance to market	-0.0127745	0.0136755	-0.93	0.352
Access to electricity	-0.042287	0.0427225	-0.99	0.325
Access to credit	0.0599728	0.0329046	1.82*	0.071
Land cost	-0.0031104	0.0017987	-1.73*	0.087
Productive assets	0.0041818	0.0021358	1.96*	0.053
Constant	0.1422703	0.0096723	1.60	0.113
Number of observations	120			
LR Chi ² (17)	145.44			
Prob > Chi ²	0.0000			
Pseudo R ²	3.2798			
Log likelihood	50.546716			

*, **, *** coefficients are significant at 10%, 5% and 1%, respectively.

Source: own elaboration based on field survey data from 2011.

developing human resources, including vocational training; formal education at the elementary, secondary and higher levels; and study programs for adults that are organized by firms, including extension programs (notably in farms). Likewise, access to credit and a growing value of productive assets increase the OFS according to Babatunde and Qaim (2009); these factors facilitate the establishment of self-employed businesses. The result also revealed that the higher the value of the households' productive assets, the more income the households are likely to earn from diversifying into other economic activities.

Determinants of income diversification among the farmers (HDI model)

The results of the Tobit regression for the determinants of HDI are presented in Table 4. As seen above, the years of education, years of vocational training and access to credit have a significant and positive impact on income diversification. This implies that an increase in these variables would lead to an increase in income. In addition, access to credit has a positive influence on income diversification. This is because credit can reduce liquidity constraints and increase the households'

Table 4. Tobit regression for the determinants of income diversification (HDI model)

Variables	Coefficient	Standard error	T	P>/t/
Age of the farm head	-0.0058465	0.0128891	-0.45	0.651
Age ²	0.0000896	0.0001574	0.57	0.571
Gender of the farm head	-0.1064675	0.0557093	-2.88***	0.005
Marital status of the farm head	0.0466089	0.0503862	0.93	0.357
Dependency ratio	0.1285764	0.0976686	1.32	0.191
Household size of the farm head	0.0025336	0.0049834	0.51	0.612
Years of education	0.0205242	0.0056886	3.61***	0.000
Years of vocational training	0.0791404	0.0145762	5.43***	0.000
Extension agent contacts	0.0167569	0.0152019	1.10	0.273
Farm size in hectares	-0.002669	0.0122388	-0.22	0.828
Years of farming experience	-0.0048916	0.0024468	-2.00**	0.048
Land ownership	-0.0635603	0.072958	-0.87	0.386
Distance to market	-0.0133496	0.0130814	-1.02	0.310
Access to electricity	-0.0205286	0.0408857	-0.50	0.617
Access to credit	0.0724727	0.0314659	2.30**	0.023
Land cost	-0.0025974	0.0016975	-1.53	0.129
Productive assets	0.0009485	0.0020426	0.46	0.643
Constant	0.474245	0.2795023	1.70	0.093
Number of observations	120			
LR Chi ² (17)	118.21			
Prob > Chi ²	0.000			
Pseudo R ²	11.1861			
Log likelihood	53.820974			

*, **, *** coefficients are significant at 10%, 5% and 1%, respectively.

Source: own elaboration based on field survey data.

capacity to start an off-farm business. Other variables that have a significant, though negative, impact on income diversification are the household head's gender and years of farming experience. A negative relationship exists between the household head's gender and income diversification. This means female households diversify their income sources to a greater extent than their male counterparts. Contrary to *a priori* expectations, the years of farming experience also have a negative significant effect.

CONCLUSION AND RECOMMENDATIONS

This study examined human capital and income diversification in rural farming households in Oyo State. As revealed by the results, most of the households in the study area have fairly diversified income sources. While farming remains the dominant income source for those with lower levels of (or without) human capital, i.e. poorer households, off-farm activities are the main source for

those at higher levels of human capital (wealthier households). They tend to be more diversified, as shown by using different measures of income diversification. The econometric analysis confirmed that diversification has a significant and positive impact on total household income. Yet the regression models also showed that the households differed in their abilities to diversify their income sources. Years of education, years of vocational training, extension agent contacts, access to credit and productive assets increase the level of income diversification. In other words, resource-poor households in the study area are constrained in diversifying their income sources. Hence, human capital plays an important role in income diversification.

Having established from the study that respondents with high levels of human capital were able to diversify their income sources more effectively than those with low levels, the following recommendations were made:

Credit enables households to convert their stock into physical capital within a short time to take advantage of income opportunities outside agriculture. Therefore, a possible policy measure is to improve the participation of poor households in formal credit with low interest rates.

The findings also highlighted the influence of physical infrastructure on income diversification. Poorer households are constrained in terms of these facilities (decent roads, network, electricity and pipe-borne water). Therefore, the rural development policy could improve the rural households' access to infrastructure.

Finally, the fact that wealthier households are more diversified in rural Nigeria suggests that other mechanisms, which could not be captured in this study, are active. Therefore, income diversification should not be considered just as a policy objective. Instead, it should be understood as the households' response to various market imperfections. Hence, the objective of the policy should be to reduce these imperfections and make markets work better. While this would facilitate income diversification both among the poorest and the richer, it would also have a positive impact on their incomes.

SOURCE OF FINANCING

Financial resources and support from the Food Security and Safety Niche Area, Faculty of Natural and Agricultural Sciences, North West University, are deeply appreciated.

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