

Original Research Article

Impact of Off-Farm Sector Involvement on Welfare of Rural Households in Nigeria: A Propensity Score Matching Approach

ABSTRACT

This study investigated the impact of off-farm employment on the welfare of households in rural Nigeria employing household data obtained from the RIGA database. A sample of 14,512 rural households was used for the study. Propensity Score Matching (PSM) method was employed to evaluate the impact of participating in both wage and self-employment on the welfare of rural households whose major occupation is farming. Results from analysing socio-economic characteristics showed that majority of the rural households in Nigeria were male headed. These households had very little access to credit especially from formal institutions. Also, most of the households owned land the land they cultivated. The results from the PSM estimations showed that off-farm employment had a positive and robust effect on farm household income. Off-farm participants were observed to have greater consumption expenditure than the non-participating rural households. On average, a rural households involved in off-farm was 8,583 Nigerian naira better-off than a non-participating household. The study therefore recommends relevant policies that will have direct bearing on the rural off-farm sector by enhancing market integration and stimulating the growth of the off-farm sector.

Keywords: Enterprise, expenditure, livelihood, rural development and farm households.

1. INTRODUCTION

In Nigeria, the agricultural sector which used to be the major contributor to the country's Gross Domestic Product (GDP) switched roles with the crude oil sector since the discovery and exploration of oil began in 1958 because of over dependence on revenues from the oil sector ([1]. Consequently, the contribution of agriculture which was over 60 percent of the country's total GDP in the 1960s progressively declined to 48.8 percent in the 1970s and 30.8 percent in the 1980s. The sector's contribution was estimated at about 39 percent in 1990 and further dropped to 35.7 percent in 2000. As reported by the National Bureau of Statistics, the sector's contribution to the real GDP stood at 20.48 percent in 2016 [2, 3]. This has however, not in any way undermined the critical role the agricultural sector play in the economy in rural Nigeria which remains principally agrarian. However, the high incidence of off-farm work by rural households and the dwindling share of income from agriculture suggest that agricultural development alone may not be a reliable pathway out of poverty in rural areas [4].

Evidence from developing countries points towards the growing importance of the rural off farm sector [5, 6, 7]. Rural households view the sector as an avenue to diversify their incomes throughout the year. Hence, the rural off-farm sector has become an important livelihood option for a significant proportion of the rural population accounting for as much as 35-50 percent of the total income of rural households in developing countries [8, 9, 4]. There is, therefore, a growing awareness that rural households' livelihoods are derived from diverse sources and are not as overwhelmingly dependent

on agriculture as previously assumed [10, 11, 12, 13]. The role of the sector as an alternative livelihood avenue for rural households and its contribution to the development of the agricultural sector (through the provision of processing, marketing, and financial services) capable of stimulating and accelerating agricultural growth is well documented [7].

47

The rural off-farm sector in Nigeria is complex and characterized by diverse activities, whose labour and other resource requirements and returns are in no way homogeneous [5]. Rural households may be incapable of maximising the opportunities in the off-farm sector due to personal and institutional constraints like low education levels, high transaction cost and limited access to labour market information [9, 14]. In addition, the presence of entry barriers in the labour market creates difficulty for poor households to maximize the opportunities in the off-farm sector as compared to the non-poor households who have the means to surmount such barriers.

55

There is significant evidence in the literature on the effect of off-farm sector employment on rural household welfare with considerable variations in the findings. A number of previous studies have reported that income obtained from off-farm sector participation contributes to improving the welfare of households and reducing income inequality [see for example, 15, 16, 17]. Other studies have concluded that off-farm income is income inequality increasing [18, 19, 20]. The differences observed in the outcomes of the different studies are possibly attributable to the differences in method employed in the aggregation of different off-farm sector activities with varying returns to labour, the type of household data employed and the definition of what constitutes the rural off-farm sector [21, 22].

65

This study is aimed at examining the welfare effects of participation in off-farm activities by households in rural Nigeria. Off-farm sector activities undertaken by households are disaggregated here to account for the heterogeneity of the rural off-farm sector. This is pertinent as the key to understanding the link between the rural non-agricultural sector and rural welfare is based on the heterogeneity of the sector [5]. It is assumed that rural households have differential access to the various activities in the rural off-farm sector with varying rate of returns, hence the need to pay attention to the differences in the effect of alternative off-farm employment opportunities.

73

74 MATERIALS AND METHODS

The data used in this study was obtained from the Rural Income Generating Activities (RIGA) database of the Food and Agriculture Organization. The database is a product of selected national surveys across several countries. Data obtained for Nigeria consist of 14,512 rural households.

78 2.1 Data Analysis

The propensity score matching technique was employed here to determine the impact of off-farm work on welfare of rural households. Suppose the expenditure of an off-farm participating household is Y_{it} , and say the pre-entry expenditure of the same household is Y_{i0} , and $D_i = (0, 1)$ represents participation status. Then the gain from participation in the off-farm sector is given by:

$$\Delta_i = Y_{i1} - Y_{i0} \quad (1)$$

where Δ_i denotes the welfare impact of off-farm sector participation.

However, while Y_{i1} is observable, Y_{i0} is not. The score matching technique is therefore aimed at trying to obtain an estimate of this missing information. The focus is therefore on the average effect in the population rather than Δ_i , the effect of participation for any off-farm participant [23]. It becomes possible to estimate Y_{i0} in equation 1 from the sub-sample of nonparticipants in the population, and obtain an estimate of the average effect of off-farm participation as:

$$\Delta_s = E(Y_{i1}/D_i = 1) - E(Y_{i0}/D_i = 0) \quad (2)$$

The above matching technique is based on the propensity scores. Propensity score involves estimating the probability of participating in the off-farm sector conditional on the pre-treatment characteristics, X . Obtaining a single-index variable (the propensity score) to make the matching feasible is given by:

$$p(X_i) = Pr(D_i = 1/X_i) \quad (3)$$

In this study, the propensity score was estimated using a standard probit model with the binary dependent variable representing the two alternatives that are being compared. Having obtained the propensity scores, participants and non-participants with similar propensity scores were matched employing matching estimators: nearest neighbour, kernel, and radius matching. Finally, the difference in expenditure between the matched participants and non-participants is summed over all the differences to obtain the Δ^s shown in equation 2. Three treatment effects were estimated to show the effect of off-farm sector participation on welfare of rural households: Average Treatment Effect on the Treated (ATT), the Average Treatment Effect (ATE) and the Average Treatment Effect on the Untreated (ATU). These treatment effects are computed as follows:

$$ATT = E[E(Y_1|D = 1) - E(Y_0|D = 0) | D = 1] \quad (4)$$

ATT denotes the effect of participation in the off-farm sector on the expenditure profile of off-farm sector participating households.

$$ATU = E[E(Y_1|D = 1) - E(Y_0|D = 0) | D = 0] \quad (5)$$

ATU implies the potential welfare gains for rural households not involved in off-farm work if they were to undertake off-farm work.

$$ATE = E[E(Y_1|D = 1) - E(Y_0|D = 0)] \quad (6)$$

ATE measures the average effect of off-farm sector participation outcome on a household randomly selected from the rural population.

2. RESULTS AND DISCUSSION

3.1 Socio-demographic Characteristics of Rural Households

Descriptive analysis of selected socio-demographic characteristics of rural households is presented in Table 1. It is evident from the results that majority of the households in rural Nigeria (86.6 percent) are male headed with female headed households making up just about 13.4 percent of the sample. Most of the households (69 percent) have not been successful in accessing any form of credit and only 11.2 percent have had access to credit facilities regularly. The major source of this credit is from public financial institutions which generally put in place stringent conditions rural households must fulfill to access credit. Most of the households fail to meet such requirements based on their poverty status. A significant proportion of the rural households (50.2 percent) had access to land which is available for both farm and off-farm activities. The land tenure system which is still quite traditional provides the opportunity for households to own and operate land passed down as heritage. However a good number of these households (48.9 percent) have for reasons of poverty leased or sold out their lands leaving them landless. In the case of access to electricity, it is evident that only 17.9 percent of rural households reported having electricity supply as against a significant 82.1 percent who are without electricity. The issue of electricity in the study area has been a huge challenge spanning over several years and various attempts by successive government through the power sector road maps have produced little results with majority of households even in the urban centres without power. Despite the huge resources that Nigeria is been blessed with, poverty especially in the rural areas has been on the rise. This has been attributed to huge corruption and mismanagement by the political class. The self assessment by the households of their poverty status further confirms the degree of poverty in the area. Over half of the rural households (52.1 per cent) reported that they are very poor with another 29.5 per cent claiming they are “averagely” poor. Only 18.3 per cent of the households submitted that they were not poor. This result however only reflects self assessment. This is possibly quite close to the situation on the ground, which may be worse than what is revealed here.

Table 1: Distribution Based on Descriptive Statistics of the Selected Sample

Characteristics	Percentage
Gender of household head	
Male	86.6
Female	13.4
Credit access outside home	
Never	69.0
Sometimes	9.5
Always	11.2
Land ownership	
Own land	50.2
Landless	49.8
Access to electricity	
Yes	82.1
No	17.9
Self assessment of poverty	

Very poor	52.1
Averagely poor	29.5
Not poor	18.3

Source: Authors' Computation (2017)

3.2 Welfare Implication of Off-farm Sector Involvement

The result of the probit model employed in predicting the propensity scores is presented in Table 2. A detailed interpretation of the result is not undertaken since as observed by a number of studies such as Lee [24], the propensity scores are only a means to an end. The scores are used for balancing the observed distribution of the covariates across the treated and control groups preparatory for the computation of the treatment effects. It is obvious from the result that the majority of the variables included in the equation returned signs as expected. As observed by Rosenbaum and Rubin [25], that conditional on the propensity score there would be no systematic pre-treatment difference between the treatment and control groups, it is imperative to examine whether the propensity score passes as an adequate balancing score. A balancing test which involves checking that each value of the propensity score has the same distribution for the treatment and control groups was conducted. The common support condition was imposed for all the propensity score estimates and the balancing property was satisfied at the 1 percent level of significance.

With the success of the matching procedure, it is possible to examine the differences in the expenditures between off-farm participating and non-participating households. This difference in expenditure (which is the outcome of the "treatment effects") denotes the effect of off-farm participation. The estimators employed to select the non-participants to act as matches for the participants are nearest-neighbour, radius and kernel matching estimators. The results of the nearest neighbour and radius matching estimators alongside the treatments effects are presented in Table 3. The estimates obtained from the kernel matching were very similar to those from the radius matching, hence the result are not presented here.

Table 2: Probit estimates of propensity score for off-farm sector participation

Variable	Coefficient	Z-value
Gender	0.311**	1.50
Age	0.109***	1.22
Education	0.294***	1.12
Household size	0.309**	2.46
Dependants	-0.411	1.84
Credit	0.308*	1.49
Association	0.147**	1.35
Infrastructure	0.082	1.34
Land cultivated	0.194***	1.13
Agric asset	-1.298***	-2.55
Non-agric asset	-0.109*	-1.21
North east	0.409*	1.63
North west	0.212	1.21
South west	0.197	1.30
South east	0.228*	1.17

Source: Author's computation (2017). Note: ***, **, and * refer to significance at the 1, 5 and 10 per cent levels, respectively.

The treatment effects of off-farm sector participation with the exception of the slight reduction in the value between the nearest neighbour and radius matching produced consistent estimates. Results of both matching estimators shows that participation in the off-farm sector has a significant and positive effect on the per adult equivalent expenditure of rural households. The estimates of the ATT shows that off-farm participating households have significantly greater welfare gains, as measured by adult equivalent household expenditures, than rural households not involved in off-farm work. The results reveal that on average, a rural household involved in off-farm work has 8,583 naira per adult equivalent expenditure higher than a non-participating household. In terms of individual off-farm work, rural households involved in off-farm self employment and wage employment activities in comparison to the non-participating households are observed to have greater welfare gains. Specifically, self employed households have an average of 3,480 naira higher adult equivalent expenditure than the non-participants, while the wage employed households had on average 4,222 naira higher expenditure.

The estimates of ATU correspond to the potential welfare outcome for the non-participating rural households if they had undertaken off-farm work. The results shows that on average, the adult equivalent expenditure of rural households not involved in off-farm work would have been higher by 5,383 naira if they had undertaken off-farm work. In other words, the welfare of households involved in farming only would have been significantly enhanced if they had off-farm sector ventures. Similarly, the decision to participate in either self or wage employment activities would have significantly improved the welfare of the non-participants. Similar results are obtained in the case of the ATE, where participation in off-farm sector activities by a household randomly drawn from the rural population is capable of raising the expenditure of such household by an average of 6,935 naira. The implication of this result is that participation in off-farm sector activities contributes in raising the expenditure profile of households in rural Nigeria. Based on the kind of off-farm sector activities, participation in self employment and wage employment is observed to increase the expenditure profile of rural households on average by 2,502 naira and 3,348 naira, respectively.

Table 3: Outcomes of rural households according to off-farm sector involvement

Status	Matching estimator	Effect of Participation		
		ATT	ATU	ATE
Off-farm sector participation	NNM	8042.70**	5056.99**	6474.11**
	Radius	9125.22**	5709.29**	7397.94**
Self employment participation	NNM	3121.61***	1102.22**	2094.22**
	Radius	3839.81***	1992.07**	2911.50**

Wage employment participation	NNM	4147.10 ^{***}	2491.02 [*]	3296.50 [*]
	Radius	4298.76 ^{***}	2568.99 [*]	3401.21 [*]

Source: Authors' computation (2017). Note: ***, **, and * refer to significance at the 1, 5 and 10 per cent levels, respectively.

Welfare indicator: household expenditures was divided by the number of equivalent adults in the households, therefore the result as presented implies the difference in expenditure per adult equivalent.

3. CONCLUSION

Results of the propensity score matching confirm that participation in off-farm activities significantly increases the welfare outcome of rural households. The results revealed that off-farm participants were observed to have greater consumption expenditure than the non-participating rural households. On average, a rural households involved in off-farm work had 8,583 naira in terms per adult equivalent expenditure more than a non-participant household. In terms of individual off-farm work, rural households involved in off-farm self and wage employment activities in comparison to the non-participating households are observed to have greater welfare gains. The outcome of this study affirms that the off-farm sector has potentials to significantly enhance the welfare of the rural population. Hence any effort aimed at the development of the rural economy and supporting the rural population to undertake off-farm work will be towards achieving the goal of rural poverty reduction.

REFERENCES

- Ugwu, D.S. and Kanu, I.O. (2012). Effects of Agricultural Reforms on the Agricultural Sector in Nigeria. *Journal of African Studies and Development* 4(2); 51 – 59.
- National Bureau of Statistics (2016). Nigeria Gross Domestic Product. Issue 09 (Quarter one).
- National Bureau of Statistics (2012). *The Nigeria Poverty Profile Report*. Federal Republic of Nigeria, Abuja, Nigeria.
- Haggblade, S., Hazell, P.B. and Reardon, T. (2010). The rural non-farm economy: prospects for growth and poverty reduction. *World development*, 38(10).
- Lanjouw, J. O. and Lanjouw, P. (2001) The rural non-farm sector: Issues and evidence from developing countries. *Agricultural Economics Journal*, 26, 1-23.
- Oseni G. and Winters, P. (2009). Rural non-farm activities and agricultural crop production in Nigeria. *Agricultural Economics*, 40(2).
- Babatunde, R.O. and Qaim, M. (2009). The role of off-farm income diversification in rural Nigeria: driving forces and household access. *Quarterly Journal of International Agriculture* 48(4), 305-320.
- Islam, N. (1997). The nonfarm sector and rural development: The review of issues and evidence. *Food, Agriculture and the Environment Discussion Papers*, 22, IFPRI.
- Reardon, T., Stamoulis, K., Balisacan, A., Cruz, M.E., Berdegue, J., and Banks, B. (1998). Rural nonfarm income in developing countries. In: FAO, *The State of Food and Agriculture 1998*. FAO, Rome.
- Benjamin, D., Reardon, T., Stamoulis, K. and Winters, P. (2002). Promoting farm/nonfarm linkages for rural development - Case studies from Africa and Latin America. FAO, Rome.
- Abdulai, A. and CroleRees, A. (2001). Determinants of income diversification amongst rural households in southern Mali. *Food Policy Volume* 26, 437-452.
- Matshe I. and Young, T. (2004). Off-farm labour allocation decisions in small-scale rural households in Zimbabwe. *Agricultural Economics*, 30(3).
- Haggblade, S., Hazell, P.B. and Reardon, T. (2007). *Transforming the rural non-farm economy*. Johns Hopkins University Press, Baltimore, MD.
- Beyene (2008). Determinants of off-farm participation decisions of farm households in Ethiopia. *Agrekon*, 47(1)
- de Janvry, A. and Sadoulet, E. (2001). Income strategies among rural households in Mexico: the role of off-farm activities. *World Development* 29(3).

- 250 16. Rahut, D.B. (2006). *Rural non-farm employment in the lower Himalayas of eastern India: A*
251 *micro-econometric analysis*. Cuvillier Verlag, Gottingen.
- 252 17. Zhu, N. and Luo, X. (2006). Non-farm activity and rural income inequality: A case study of two
253 provinces in China. *Policy Research Working Paper Series No. 3811*. World Bank.
- 254 18. Canagarajah, S., Newman, C. and Bhattamishra, R. (2001). Non-farm income, gender, and
255 inequality: evidence from rural Ghana and Uganda. *Food Policy* 26:4, 405-420.
- 256 19. Kung, J.K., and Lee, Y.F. (2001). So what if there is income inequality? The distributive
257 consequence of nonfarm employment in rural China. *Economic Development and Cultural*
258 *Change*, 50(1), 19-46.
- 259 20. Woldenhanna, T. and Oskam, A. (2001). Income diversification and entry barriers: Evidence
260 from the Tigary region of northern Ethiopia. *Food Policy* 26, 351-365.
- 261 21. Dercon. S. and Krishnan, P. (1996). Income portfolios in rural Ethiopia and Tanzania: choices
262 and constraints. *Journal of Development Studies*, 32 (6): 850-875.
- 263 22. Davis, B., Winters, P., Carletto, G., Covarrubias, K., Quinones, E., Zezza, A., Stamoulis, K.,
264 Azzarri, C., and Di Giuseppe, S. (2010). A cross-country comparison of rural income generating
265 activities. *World Development* 38 (1), 48–63.
- 266 23. Heckman, J., LaLonde, R. and Smith, J. (1999). The economies and econometrics of active
267 labour market programs In: Ashenfelter, O., Card, D. *Handbook of Labour Economics Vol. 3A*.
268 North-Holland, Amsterdam.
- 269 24. Lee, J.E. (1965). Allocating farm resources between farm and nonfarm uses. *Journal of Farm*
270 *Economics*, 47(1), 83-92.
- 271 25. Rosenbaum, P.R. and Rubin, D. (1983). The central role of the propensity score in
272 observational studies for causal effects. *Biometrika* 70, 41-55.