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URBAN FARM-NONFARM DIVERSIFICATION, HOUSEHOLD INCOME AND FOOD EXPENDITURE IN GHANA

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Abstract:

This paper investigates the impact of farm-nonfarm diversification (FND) on household income and food expenditure in urban Ghana using propensity score matching (PSM) technique to account for potential selection bias. We find diversified households to be statistically different from undiversified households in terms of household characteristics. Age, gender, educational attainment of the household head, household size, ownership of livestock and agricultural land, and receipt of miscellaneous and rent incomes are positive and significant determinants of FND in urban Ghana. In addition, we find that participation in both farm and nonfarm activities positively and significantly impacts household income and food expenditure. In the light of growing urbanization, with its implications for unemployment, poverty and food insecurity, we recommend diversification among urban households as a means of smoothing income and consumption.

Key words: *Farm-Nonfarm Diversification, Household Income, Poverty, Food Expenditure, Propensity Score Matching, Urban Ghana*

1. Introduction

Poverty remains a major global challenge. Consequently, the Sustainable Development Goal (SDG) 1 aims at eradicating poverty. Between 1990 and 2015, extreme poverty in the developing world declined from 47% to 14% (United Nations, 2015). The 2015 Millenium Development Goals (MDGs) Report points out that much of

the advancement towards eradicating extreme poverty was achieved in the year 2000 and beyond (United Nations, 2015). This same period saw the intense advocacy of diversification into nonfarm activities by farm households in rural areas of developing countries (*see inter alia*, Barrett & Reardon, 2000; Reardon et al., 2006; Barrett et al., 2001; World Bank, 2003; Davis, 2006; Senadza, 2012; Owoo & Naudé, 2014; Senadza, 2014). In theory, literature reveals that "demand-pull" and "distress-push" factors motivate farm households to diversify into nonfarm activities (Davis, 2006). Among such factors considered as "demand-pull" include; higher returns from nonfarm activities, appeal of urban life, extra incomes to meet household needs (Davis & Pearce, 2000; Barrett et al., 2001). Distress-push diversification, on the other hand, is triggered by factors such as inadequate farm output, failure of farm input markets, population growth, disasters and shocks, risk reduction, absence of financial services, and inadequate resources (Davis & Pearce, 2000; Barrett et al., 2001). Although Davis (2006) discloses that the distinction between the "demand-pull" and "distress-push" factors is not explicit, he emphasizes the need to distinguish between these factors for effective policy.

Empirical analyses of the importance of farm-nonfarm diversification (FND) have been conducted in many rural areas of developing countries. Among these studies, the impact on household food security, agricultural expenditure, and well-being are the most notable (*see inter alia*, Owusu et al., 2010; Jabo et al., 2014; Jabo et al., 2014; Shehu & Siddique, 2014; Dedehouanou et al., 2015; Osarfo et al., 2016). Most of these studies employed econometric techniques which account for selection bias. While Owusu et al. (2010); Jabo et al. (2014a); Jabo et al. (2014b); Shehu and Siddique (2014), and Osarfo et al. (2016) employed propensity score matching (PSM) technique, Dedehouanou et al. (2015) utilized endogenous switching regression (ESR) approach. Although the PSM method is relatively widely used in the literature, it does not account for selection bias due to unobservable characterristics of the household. In this respect, the ESR technique is superior to the PSM method. Nonetheless, both methods are known in the literature to yield consistent results. In general, based on the average treatment effect on treated (ATT), which is employed to estimate the participation effect, participation in nonfarm activities by rural farm households is revealed in the literature to positively and significantly impact rural households' food security, agricultural expenditure, and well-being (Owusu et al., 2010; Jabo et al., 2014a; Jabo et al., 2014b; Dedehouanou et al., 2015; Osarfo et al., 2016). Resultantly, development policies in developing countries are geared towards promoting activity diversification among rural households.

The United Nations (2014) projects that by 2050, 66 percent of the world's population will be living in urban areas, with lower-middle-income countries urbanizing faster than the other regions. Accordingly, unified policies to improve both rural and urban livelihoods are required (United Nations, 2014). Addo (2010) reports that urban farming, ubiquitous globally, and recognized as a sustainable livelihood strategy among urban and peri-urban poor in developing countries, significantly and positively impacts food security. In addition, the following have been identified in the literature as

potential benefits of urban farming: 1) employment creation and livelihood support; 2) waste and nutrient recycling; 3) conservation of urban soil; 4) water management; and 5) reduction of global warming and atmospheric pollution (*see inter alia*, Deelstra & Girardet, 2000; Mougeot, 2001; Mkwambisi et al., 2011; Arku et al., 2012). Despite the fact that urban farming has positive implications for economic development, as of 2005, there was no specific policy on urban farming in Ghana (Cofie, et al., 2005). Nonetheless, in recent times, Gyasi et al. (2014) report that Ghana's Food and Agricultural Sector Development Policy (FASDEP II) and Medium Term Agriculture Sector Investment Plan (METASIP) 2011–2015, have some components promoting urban and peri-urban agriculture. While urban agriculture is constrained by a number of factors including, limited availability of land for farming, health risks, insufficient water for irrigation, inadequate governing policies, lack of ready markets for perishable produce, and limited storage facilities (Cofie, et al., 2005; Gyasi, et al., 2014), its contribution to the Ghanaian economy is quite significant. For instance, Cofie, et al. (2005) postulate that urban farming accounts for 80 percent of vegetable supply to Accra.[1] Furthermore, urban farming is revealed to be an important source of food, income, and employment in Tamale[2] (Gyasi, et al., 2014).

Agriculture remains the predominant economic activity in Ghana, particularly in the rural part of the country. The Ghana Statistical Service (2014) report based on the Ghana Living Standards Survey (GLSS) conducted in 2012/2013 indicates that 51.5% of households in Ghana are employed in the agriculture sector. The corresponding figures for rural and urban Ghana are 82.2% and 26.6%, respectively. Although secondary to agriculture, the nonfarm sector employs 44.3% of households in Ghana (Ghana Statistical Service, 2014). However, relative to rural households, a greater proportion of urban households are involved in nonfarm activities either as wage-employed or self-employed. Generally, rural households do combine nonfarm activities with their farming activities, while some urban households also simultaneously engage in farming and nonfarm activities. Analysis of the GLSS data for 2012/2013 reveals that although on a lower scale, about 16 percent of urban households in Ghana engage in FND (See Figure 1).[3]

While previous studies exist on farm-nonfarm diversification in Ghana, they have all focused on the rural setting. Even though on a lesser scale, Figure 1 indicates that quite a significant proportion of households in urban Ghana combine farming with their nonfarm income activities. Thus, it is important to investigate the motives behind such diversification pattern and what impact it has on household well-being. More so, in spite of the fact that the urban population in Africa is projected to outgrow the rural population by the year 2050 (United Nations, 2014), coupled with poor households

[1] Accra is the capital city of Ghana, with an estimated population of 2.27 million as of 2012, and urbanizing at a rate of about 6 percent per annum, largely on account of rural-urban migration.
[2] Tamale is the capital of the Northern region of Ghana. It is Ghana's fourth-largest city, with a 2013 projected population of *360,579* according to the 2010 Ghana Population and Housing Census, and the fastest-growing city in West Africa.
[3] *Diversified* means household engages in both farm and nonfarm activity, while *Not Diversified* implies household engages solely in either farm or nonfarm activity.

urbanizing at a faster rate than the entire population growth (Ravallion et al., 2007), literature on urban development and urban FND is scant. Ghana is among the developing countries that are urbanizaing at very fast rates in recent years (Todaro and Smith, 2012). This demographic transformation is likely to have profound adverse effects on urban livelihoods and consequently requires studies on urban household livelihood strategies. The paper therefore investigates the impact of urban FND[1] on household income and food expenditure in Ghana. The paper is guided by the following research questions: 1) What are the determinants of FND decisions in urban Ghana? 2) What is the impact of FND on household income and food expenditure?

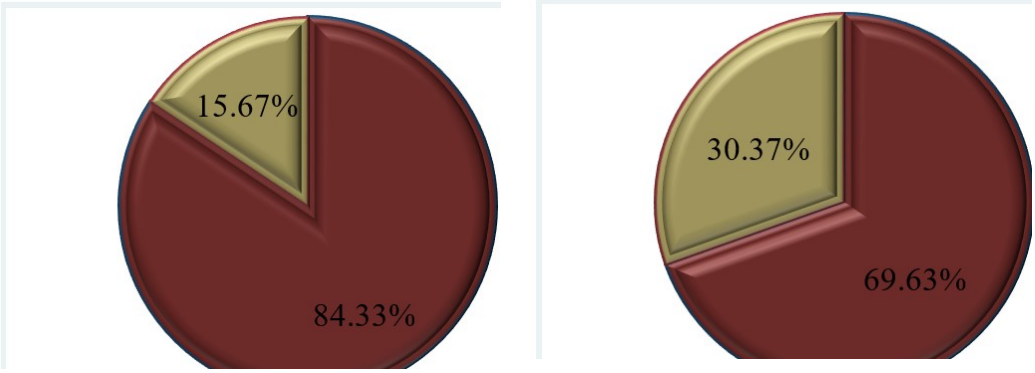

Figure 1. Distribution of Households by FND Decision, 2012/2013
Source: Computed by authors from GLSS6 data, 2012/2013.

The rest of the paper is organized as follows. The next section discusses the theoretical framework that relates to participation in farm and nonfarm activities. The data and empirical methodology adopted by the study are presented in section three. Section four presents and discusses the study results. Section five concludes the study.

1. Theoretical Framework Relating to Farm-Nonfarm Participation

Following Owusu et al. (2010), the paper draws from Huffman's (1991) specification of the Agricultural Household Model **(**AHM). The model is based on the theory of utility maximization; where households maximize utility subject to time, budget, production and non-negativity constraints. The goal of this section is to provide theoretical basis for farm and nonfarm diversification. A caveat worth noting is that this model assumes that the household is primarily agrarian.

[1] For the purpose of the paper, a farm-nonfarm diversified household is defined as any household which simultaneously operates farm and nonfarm businesses.

In the model, a farm household is assumed to maximize a utility function {U = U (Q, H)} defined over consumption of goods (Q) and leisure (H). The time constraint is represented as follows T = L_1 + L_2 + H, where T is total time endowment, L_1 and L_2 are time allocated to farm work and nonfarm work, respectively, and H represents leisure. The household is faced with budget constraint expressed as $PQ = p_1y_1 + w_1L_1 + w_2L_2 + R$, where P represents the price of consumption goods purchased, w_1 and w_2 are returns to labor from farm work and nonfarm work, respectively, y_1 denotes annual quantity of farm output produced and sold, p_1 is price of farm output, and R represent non-labor income.

The first order condition (FOC) for optimal time allocation for farm and nonfarm works, and leisure is given as $\frac{\delta U}{\delta L_I} = \left(\frac{w_i \delta U}{\delta Q}\right) - \left(\frac{\delta U}{\delta L}\right) = 0$. From this, the earnings from participation in farm and nonfarm activities is derived as $w_i = (\delta U/\delta Q)(\delta U/\delta L)$. The determinants of farm and nonfarm activities participation are, respectively, given as $L_1 = L_1(w_1, w_2, p_1, p_2; Z)$ and $L_2 = L_2(w_1, w_2, p_1, p_2, R; Z)$, where Z represents household and locational characteristics that affect the individual's reservation and nonfarm wages. By extension, a household participates in both farm and nonfarm work if the potential market wage (w_i^m) is greater than the reservation wage (w_i^r) for both activities (i.e. $L_i^* = 1$, otherwise $L_i^* = 0$). The wage differentials are only observed by the household's decision to participate, or not participate, in both activities. This decision is represented as:

$$L_i = \beta Z_i' + \mu_i \qquad \text{(Participation/diversification equation)}$$

where Z_i' represents the vector of household characteristics and μ_i is the stochastic error term.

2. Data and Empirical Approach

Data

The paper is based on the sixth round of the Ghana Living Standards Survey (GLSS 6). This most recent nationally representative dataset on Ghana, collected in 2012/13 by the Ghana Statistical Service, contains information on education, health, migration and tourism, employment and time use, housing, agriculture, financial services and asset ownership from households. To collect these socioeconomic and demographic information, household questionnaire; non-farm household questionnaire; community questionnaire; governance, peace and security questionnaire; and prices of food and non-food items questionnaire were employed. The survey covered 72,372 individuals in 16,772 households; out of which 7,445 households were resident in urban areas. Table 1 presents the variables used.

Table 1: Description and Measurements of Variables

Description	Measurement
Participation in both farm and nonfarm activities by household	Diversified=1, undiversified=0, (treatment variable)
Log of total household income	Sum of all incomes received in GH¢
Log of total household food expenditure	Sum of all food expenditures in GH¢
Age of HH head	In number of years
Age of HH head squared	Square of age of HH
Gender of HH head	Male = 1 and female = 0
Educational attainment of HH head	1= none, 2= basic, 3= secondary, 4= vocational, 5= tertiary (reference)
Marital status of HH head	Married=1, unmarried=0
Household size	Number of household members
Household size squared	Square of number of household members
Ownership of farm land	Yes=1, no=0
Ownership of livestock	Yes=1, no= 0
Electricity consumption	Yes=1, no=0
Wealth quintile	1= first (reference), 2= second, 3= third, 4= fourth, 5= fifth
Receipt of remittance	Yes=1, no=0
Receipt of miscellaneous income	Yes=1, no=0
Receipt of rent income	Yes= 1, no=0

Propensity Score Matching (PSM)

Propensity score matching is commonly used for non-experimental impact studies. This is because it is known to account for selection bias. It achieves this by simply employing matching algorithms to match treatment and control units on the basis of similar propensity scores (Rubin, 2001). While the treatment unit is made up of households which participate in both farm and nonfarm activities, the control unit constitutes those households which participate in either farm or nonfarm work. The propensity score is defined as the conditional probability that an urban household would diversify income portfolio given pre-participation characteristics. This is denoted as:

$$p(Z_i) \equiv prob\,(L_i = 1|Z_i) = E(L_i|Z),$$

where $L_i(0,1)$ represents the participation equation and Z_i is the vector of pre-participation characteristics of the household.

Literature reveals that two basic assumptions are required for the use of PSM technique. The first assumption, termed un-confoundedness assumption (Rosenbaum & Rubin, 1983), proposes that treatment assignment and potential outcomes are not concurrently influenced by unobserved characteristics which are not found in Z (Becker & Caliendo, 2007). That is, it is unlikely for unobserved variables not captured by the vector Z to affect the decisions of households to participate in both farm and nonfarm activities, and their respective outcomes. This is represented as $(Y_1, Y_2) \mid L \perp Z$. When

this assumption breaks down, the matching estimators would not be robust (Rosenbaum, 2002 cited in Becker & Caliendo, 2007). Therefore, to test the validity of the un-confounded assumption, a sensitivity analysis is undertaken to ascertain the presence, or otherwise, of hidden biases. The second assumption is the common support assumption. This assumption postulates that all diversified households have undiversified counterparts for each covariate. It is represented as $1 < Pr(L=1|Z) < 0$.

Studies reveal a number of matching algorithms to match treated and untreated units based on the propensity scores. These include nearest neighbor matching (NNM), radius matching (RM), and kernel matching (KM) methods. Others are stratification matching (SM) and Mahalanobis matching (MM) methods. For robustness, NNM and RM methods are adopted for the study. The NNM method matches diversified households with their closest undiversified neighbors with similar observed characteristics. This thus minimizes the selectivity associated with the study. The radius matching on the other hand pairs each "treated household with a control household whose propensity score falls in a predefined neighbourhood of the propensity score of the treated household" (Kousar and Abdulai, 2013).

To estimate the impact of FND on household income and food expenditure, the average treatment effect on treated (ATT) is computed as:

$$ATT = E\{E[Y_{1i} - Y_{0i} \mid L_i = 1, p(Z_i)]\} = E\{E[Y_{1i} \mid L_i=1, p(Z_i)] - E[Y_{0i} \mid L_i= 0, p(Z_i)] \mid L_i = 1\},$$

where L_i denotes the indicator of exposure to treatment, Z_i is the vector for pre-participation characteristics, Y_{1i}represents the observed potential outcome and $Y_{0i}$is the counterfactual potential outcome. The ATT is utilized to estimate the mean difference between diversified (treated unit) and undiversified (control unit) households with similar characteristics because it captures the participation effect (Owusu et al., 2010).

3. Results

Determinants of Urban Farm-Nonfarm Diversification

Table 2 presents summary statistics of the variables, and shows that diversified and undiversified households in urban Ghana are significantly differentiated on the basis of socioeconomic factors. This affirms the presence of self-selection bias and justifies the use of PSM. The t-test statistics suggest that relative to undiversified households, diversified households in urban Ghana earn higher incomes and also expend more on food. The differences are statistically significant at the 1 percent level.

Table 2: Descriptive Statistics of Variables

Explanatory Variable	Full Sample Mean (SE) (n = 7,201)	Sub-samples Mean (SE) U (n = 6,051)	Mean (SE) D (n = 1,150)	Mean Difference (t-test)
Log of household income	8.191 (0.018)	8.117 (0.020)	8.586 (0.040)	-0.470***
Log of food expenditure	8.180 (0.008)	8.157 (0.009)	8.297 (0.017)	-0.140***
Age of HH head	44.054 (0.177)	43.27 (0.194)	48.16 (0.402)	-4.889***
Age of HH head squared	2,165.05 (17.62)	2,100.44 (19.25)	2,505.029 (42.44)	-404.593***
Gender of HH head	0.661 (0.006)	0.644 (0.006)	0.752 (0.013)	-0.108***
Educational attainment of HH head				
None	0.252 (0.005)	0.236 (0.006)	0.336 (0.014)	-0.099***
Basic	0.454 (0.006)	0.448 (0.006)	0.485 (0.015)	-0.037**
Secondary	0.126 (0.004)	0.132 (0.004)	0.096 (0.009)	0.037***
Vocational	0.074 (0.003)	0.079 (0.004)	0.047 (0.006)	0.032***
Tertiary	0.093 (0.003)	0.104 (0.004)	0.037 (0.006)	0.068***
Marital Status of HH head	0.529 (0.006)	0.496 (0.006)	0.706 (0.013)	-0.211***
Household size	3.670 (0.028)	3.408 (0.029)	5.050 (0.076)	-1.642***
Household size squared	19.058 (0.300)	16.584 (0.288)	32.077 (1.033)	-15.493***
Ownership of farm land	0.050 (0.003)	0.031 (0.002)	0.152 (0.011)	-0.122***
Ownership of livestock	0.101 (0.004)	0.056 (0.003)	0.336 (0.014)	-0.279***
Electricity consumption	0.832 (0.004)	0.836 (0.005)	0.814 (0.012)	0.022*
Wealth quintile				
First quintile	0.139 (0.004)	0.143 (0.005)	0.113 (0.009)	0.030***
Second quintile	0.155 (0.004)	0.157 (0.005)	0.145 (0.010)	0.012
Third quintile	0.148 (0.004)	0.146 (0.005)	0.161 (0.011)	-0.015
Fourth quintile	0.318 (0.006)	0.0327 (0.006)	0.271 (0.013)	0.056***
Fifth quintile	0.240 (0.005)	0.227 (0.005)	0.310 (0.014)	-0.082***
Receipt of remittance	0.322 (0.006)	0.312 (0.006)	0.374 (0.014)	-0.062***
Receipt of miscellaneous income	0.051(0.003)	0.047 (0.003)	0.075 (0.008)	-0.028***
Receipt of rent income	0.661 (0.006)	0.630 (0.006)	0.820 (0.011)	-0.190***

D= Diversified U= Undiversified

Source: Computed by authors from GLSS 6 data, 2012/2013.

The probit estimates of the determinants of FND in urban Ghana are presented in Table 3, where the marginal effects are also reported. Age, gender, educational attainment of the household head, household size, ownership of livestock

and agricultural land, and receipt of miscellaneous and rent incomes are all positively correlated with FND. There is a positive association between the age of the household head and the probability that a household will diversify, albeit marginally. It reveals that if the age of the household head increases by one year, households are 0.94 percentage points more likely to diversify. The negative coefficient for the square of the age of household head indicates a rise in the likelihood that a household would diversify with additional years to the household head's age until after 55 years after which the likelihood of diversification reduces by 0.010 percentage points for each additional year. Relative to female headed households, male headed households in urban Ghana were found to be 2.80 percentage points more likely to diversify. Although with caution here is that this relates to the gender of the household head only, this outcome could plausibly relate to the fact that most females in urban Ghana are revealed to participate in nonfarm activities mainly as self-employed, hence limiting their diversification abilities.

Relative to households headed by persons with tertiary education, households headed by persons with no education, basic education, secondary education or vocational education, are 9.4 percentage points, 9.62 percentage points, 8.95 percentage points and 4.59 percentage points respectively, more likely to diversify. This suggests that households headed by individuals with less education are more likely to participate in both farm and non-farm activities simultaneously. This is plausibly because, positively associated with higher incomes from non-farm wage employments, households headed by individuals with higher education are less motivated to diversify into agriculture. Except for vocational education, the educational attainment variables were all significant at 1 percent level. Furthermore, likelihood of FND increases with household size. One addition to household membership results in the household being 3.46 percentage points more likely to diversify. Households in Ghana mainly depend on its members for labour supply. This possibly accounts for the fact that households with more members are more likely to participate in both farm and non-farm activities. However, household size beyond 9 persons results in urban households being 0.20 percentage points less likely to diversify.

Table 3: Determinants of Urban FND Decisions in Ghana (Probit)

Explanatory Variable	Coefficient	Marginal Effect
Age of HH head	0.0563***	0.0094
Age of HH head squared	-0.0005***	-0.0001
Gender of HH head (male=1)	0.1680***	0.0280
Educational attainment of HH (Tertiary=ref)		
None	0.5660***	0.0944
Basic	0.5770***	0.0962
Secondary	0.5370***	0.0895
Vocational	0.2750*	0.0459
Marital Status of HH head (married=1)	0.0860	0.0143

Household size	0.2070***	0.0346
Household size squared	-0.0110***	-0.0018
Ownership of farm land (yes=1)	0.6460***	0.1080
Ownership of livestock (yes=1)	0.7960***	0.1330
Electricity consumption (yes=1)	0.0981	0.0164
Wealth quintile (First quintile=ref)		
Second quintile	-0.0671	-0.0112
Third quintile	-0.1120	-0.0187
Fourth quintile	-0.0913	-0.0152
Fifth quintile	-0.1260	-0.0210
Receipt of remittance (yes=1)	0.0670	0.0112
Receipt of miscellaneous income (yes=1)	0.2480**	0.0414
Receipt of rent income (yes=1)	0.2990***	0.0499
Constant	-4.9380***	
Number of observation	7,201	7,201
Log pseudo likelihood	-2,191.64	
Pseudo R2	0.2556	
Wald chi2	911.44	
Prob > chi2	0.0000	

Regional differences have been controlled for.
*** p<0.01, ** p<0.05, * p<0.1
Source: Computed by authors from GLSS 6 data, 2012/2013.

Farm asset ownership promotes FND in urban Ghana. While households which owned at least one medium-size livestock were reported to be 13.30 percentage points more likely to participate in both farm and non-farm activities, households which owned farm lands were reported to be 10.80 percentage points more likely to diversify into farm and non-farm activities. The finding proposes that access to farm assets encourage FND by urban households in Ghana. Aside from receipt of remittance which was found to be insignificant, receipt of rent and miscellaneous incomes by urban households were found to significantly and positively influence FND. Most importantly, households which received rent incomes are reported to be 4.99% more likely to diversify. Also, households which received miscellaneous incomes were reported to be 4.14 percentage points more likely to embark on FND.

Impact of FND on Household Income and Food Expenditure

Results of the impact of FND on household income and food expenditure is presented in Table 4. The ATT technique proposed by Becker and Ichino (2002) is used to estimate the impact of FND on household income and food expenditure. The propensity scores were calculated from a probit regression. Based on the propensity score values, diversified and undiversified households were paired employing nearest neighbor matching (NNM) and radius matching (RM) methods. In computing the

propensity scores, the common support property was imposed while the balancing property was satisfied.

The results show that relative to undiversified urban households, diversified households earn higher income and also expend more on food (see Table 4). Aside from the insignificance of the NNM for food expenditure, the matching algorithms reveal positive and highly significant ATTs for both outcome variables. To check the sensitivity of the RM results to changes in radius, the ATTs were estimated at radius 0.1 and 0.5. The results reported in Table 4 for the two RM estimates do not vary much.

Table 4: Impact of FND on Household Income and Food Expenditure

Matching Algorithms	Number of Treated Units	Number of Control Units	ATT	Standard Error	T-Statistics
	Total	***Household***	***Income***		
Nearest Neighbor	1,150	813	0.293***	0.074	3. 954
Radius (0.1)	1,150	5,993	0.440***	0.045	9.786
Radius (0.5)	1,150	5,993	0.459***	0.044	10.339
	Total	***Food***	***Expenditure***		
Nearest Neighbor	1,150	813	0.004	0.034	0.107
Radius (0.1)	1,150	5,993	0.133***	0.020	6.746
Radius (0.5)	1,150	5,993	0.134***	0.019	6.896

Source: Computed by authors from GLSS 6 data, 2012/2013.

Both the NNM and RM methods utilized 1,150 diversified households. However, whereas the NNM method utilized 813 undiversified households, the RM method used 5,993 undiversified households. As indicated by Jabo et al. (2014a), the RM method is expected to yield the most appropriate result since it exploits more control units to be compared with treated units. On the impact of FND on household income, the paper obtains positive and significant ATTs of 0.293, 0.440 and 0.459 utilizing the NNM, RM (0.1) and RM (0.5) algorithms respectively. Similarly for food expenditure, but for the NNM method which is also positive but insignificant, ATTs of 0.133 and 0.134 for radii of 0.1 and 0.5, respectively, were obtained based on RM. These findings are similar to Owusu et al. (2010); Jabo et al. (2014a); Dedehouanou et al. (2015); and Osarfo et al. (2016).

To ascertain the validity of the un-confoundedness assumption, a sensitivity analysis was undertaken to test the presence, or otherwise, of hidden biases. Given that the simulated ATT of the RM algorithm of radius 0.1 was same as the baseline ATT after simulating the former with a confounder, the sensitivity analysis proposed by Becker and Ichino (2002) could not provide enough evidence to suggest the presence of hidden biases in the PSM approach.

4. Conclusion

Employing the PSM technique, the paper sought to explore the impact of urban farm-nonfarm diversification on household income and food expenditure in Ghana. The propensity score values were obtained from a probit regression. The nearest neighbor matching and radius matching methods were utilized to pair treatment and control units with similar propensity scores. The ATTs were then computed following Becker and Ichino (2002). The correlates of urban FND include age, gender, and educational attainment of the household head, household size, ownership of livestock and agricultural land, and receipt of miscellaneous and rent incomes. Whereas FND was found to positively and significantly impact household income by 0.293, 0.440 and 0.459 using the NNM, RM (0.1) and RM (0.5) methods, respectively, the impact on food expenditure was positive and significant by 0.133 and 0.134 employing the RM method with radii 0.1 and 0.5, respectively. The paper, therefore, concludes that participation in both farm and nonfarm activities by urban households in Ghana positively and significantly impacts household income and food expenditure.

As a policy measure, it is recommended that, in the light of the growing urbanization in developing countries, with implications for unemployment, poverty and food security, measures to mitigate these challenges should focus on encouraging participation in both farm and non-farm activities. This can be done by paying attention to the factors that promote FND among urban households. As an example, in attempt to encouraging FND in developing countries, the evidence provided suggests that ownership of agricultural assets by urban household matters greatly. And so, in-kind subsidies on agricultural assets can be made available to urban households, most of which are predominantly into non-farm activities. Likewise, these households can be educated on the benefits of investing in both farm and non-farm activities concurrently, taking cognizance of the other influencing factors revealed by the paper.

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