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Determinants of participation in non-farm activities and its effect on household income: An empirical study in Ethiopia

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Undertaking non-agrarian income-generating activities to reduce overreliance on agriculture, production failures, and income fluctuations is a household-amenable, self-insurance mechanism, which provides employment opportunities and capital investment. This article examines the determinants of participation in non-farm activities and effect on household income. Heckman two-step procedure was used to analyze a three-wave survey data set captured from 3866 households. Crop failures, insufficient intake of food, household consumption expenditure, gender, family size, literacy, health status, farm animals holding, access to credit, total hired labor, cooperative membership and agricultural extension services were factors influencing household involvement in non-farm work. Furthermore, the findings establish that there is a decline in the likelihood of households headed by aged people, who tend to rely on subsistence farming to engage in alternative non-agrarian activities. The results of the analyses support the non-separability hypothesis of non-farm activities and household income; this implies that engaging in non-agricultural activities has a direct positive effect on household income. The omnipresence of non-agrarian income generating activities in agro-ecoregions requires inclusive rural development policies that focus beyond agriculture based on the recognition of the rural economic heterogeneity.

Key words: Rural development, non-farm activities, household income, Heckman Two-Step model, Ethiopia.

INTRODUCTION

The United Nations' Millennium Development Goals (MDGs) of eradicating extreme poverty and making assuage hunger by 2015 represent global mobilization to attain Sustainable Development in a short run. Hitherto, many countries like Ethiopia are still far from actualizing both "No Poverty" and "Zero Hunger" objectives. Ethiopia is one of the low-income countries in the world. The country's Human Development Index is 0.424 and 0.501 for female and male, respectively. Poverty is substantially a rural phenomenon in Ethiopia. However, it declined to

23.5% from 2015 to 2016, albeit, 61.8% of inhabitants live under severe multidimensional poverty (IMF, 2018; UNDP Ethiopia, 2018; FAO, 2019a). That notwithstanding, within the past decade, the country is one of the rapidly developing economies. Economic growth averaged 10.9% per year since 2004 with 8.3% as annual per capita growth (Paul et al., 2016; Negassa et al., 2017; Medhin and Mekonnen, 2019; UNDP Ethiopia, 2018). More than 80.04% of Ethiopia's population live in rural areas and are predominantly in the

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agricultural sector which provides 95% of food production, 85% of total employment, 90% of exports, 42% of aggregate GDP, and 90% of foreign exchange (Gebreyesus, 2016; Chanie et al., 2018; FAO, 2019a). Agriculture in Ethiopia is essentially small-scale, largely rain-fed, low-input with low productivity (NPC, 2015; USDS, 2016). In Ethiopia, commercial farmers produce only 5% of food crops whilst small-scale and rural farmers produce the remaining. Poorer households with fewer non-agrarian skills rely on staple crops for their subsistence and semi-subsistence farming systems with average farm size between 0.5 and 2 ha (Baye, 2017). Smallholder farmers use 96% of total farmland and practice either crop production or mixed farming (Taffesse et al., 2012; Sibhatu and Qaim, 2017). In the crop production system, major crops cultivated include cereals, roots, tubers, fruits, cash crops which represent 54, 13, 7 and 5%, respectively and account for 29% of agricultural GDP (Diao, 2010; Taffesse et al., 2012; CSA, 2015; ATA, 2016). These crops are produced using traditional farming techniques that predominantly rely on animal traction with the dominant type mainly supported by family labor (Sisay, 2010; Tabe-Ojong et al., 2018). Only 9% of farmers practice mechanized farming (Berhane et al., 2016).

With respect to animal production, about 48% of people in agro pastoral areas and 90% of peasants are engaged in animal husbandry practices. The national livestock herd also promotes the economic development of Ethiopia. Herd growth output contributes to 47% of agricultural GDP, 85% of farm income, 16.5% to national GDP, 16% of foreign exchange and 10% of export income (MoFED and MoA, 2011; MoA, 2012; Bachewe et al., 2018). Majority of inhabitants are nomad herdsmen who face severe global warming and its effects (Kebede and Adane, 2011; Rettberg et al., 2017). Predominance of unmechanized agriculture, climate crisis, subsistence farming systems, crop failures and low agricultural productivity in Ethiopia result in cereal importation and food-aid dependence of 10% of the population. During the dry season of 2015 up to 2016, one-fifth of Ethiopians required food-aid (Endalew et al., 2015; Wakeyo et al., 2016; Cochrane, 2017; UNDP Ethiopia, 2018). Droughts engender over 84% of the damage and losses in agriculture (FAO, 2015). Post-harvest food loss contributes to high incidence of chronic food insecurity, malnutrition and poverty in the country. In spite of the dwindling productivity, annual post-harvest losses range from 30 to 50% for food crop shortage, 40 to 50% for fresh produce, 30% for cereals and 20% for oilseed. Furthermore, drought and land degradation elicited 12% decrease in crop productivity and 4% decline in GDP (Ayenew and Kopainsky, 2014; WFP, 2014; FDRE, 2015; USAID, 2016). Peasants lack purchasing capacity, adoption of production technologies, assets for adaptation, and strategies for risk mitigation. These pressures exhaust savings, provoke the sale of essential resource and threaten livelihoods (de Schutter, 2011).

Agriculture alone cannot overcome the state of deprivation and chronic food insecurity and guarantee broad-based economic development. Enhancing and protecting productivity potential and strengthening the resource utilization constitute the foremost challenges (Anand and Khetarpal, 2015). Poorer households with fewer non-agrarian skills trapped in subsistence farming systems and exposed to climate-related risks are forced into precarious and low-paid non-farm activities. This justifies the reinforcement of non-farm livelihood diversification strategies in mitigating the detrimental effects of global warming and ensuring food security (Demeke and Zeller, 2012; Dorosh and Rashid, 2013; Yizengaw et al., 2015).

In Ethiopia, non-farm activities are pro-cyclical with farming operations. The percentage of households' participation in non-farm employment is 34% at national level. The extent of involvement in non-farm activities is markedly driven by necessity due to land degradation and insufficient income from agriculture (Van den Broeck and Kilic, 2019; Fentahun et al., 2018). This approach is a defensive survival strategy especially in rural areas where most of the households are already vulnerable undertaking livelihood diversification to attain food security. In Ethiopia, the key constraints for launching non-farm business activities are lack of access to credit (35%), marketing facilities to sell goods (30%) and poor roads (14%) (Zerai and Gebreegziabher, 2011; CSA, 2017; Fentahun et al., 2018). Lack of assets and limited access to financial services constrain participation in high return non-farm activities. Thus, the alternative opportunities for vulnerable peasant producers, which are unskilled and low return non-farm activities are coping mechanism rather than a pathway for emancipation from poverty. Meanwhile, families, which depend exclusively on farm activities, are more likely to be among the poorest. The three primary groups of non-farm activities comprise of non-agricultural businesses or services from home (10%), selling of processed agricultural products including food and local beverages (6%) and trading businesses such as selling goods on a street or in a market (4%) (CSA, 2017). However, the trend of household adoption of diversification strategies in Ethiopia varies with regions. The proportion of rural households who participate in non-farm activities ranges from 61.18% in Moyale district, Oromia Regional state, Southern Ethiopia to 73.44% in Northern Ethiopia (Damena and Habte, 2017; Kassie et al., 2017). Between 80 and 90% of these non-farm business activities depend essentially on family labor and 70% of non-farm enterprises are exclusively self-employment (World Bank, 2008; Filmer and Fox, 2014). Engaging in income-earning activities significantly rises households' income in rural Ethiopia (Block and Webb, 2001). In Ethiopia, 20 to 35% of total income is obtained from non-farm activities (Gebru and Beyene, 2012; Demie and Zeray, 2016). In

addition to farm and household chores, 36.6% of rural women undertake wage and self-employment activities on the average in Ethiopia (Beyene, 2008).

Diversification of rural non-farm activities associated with shocks that affect farm activities forms the most shared features of agrarian economies. Across sub-Saharan African countries, income diversification is increasing and consist of non-farm business, intensive cropping system and sale of non-conventional goods and animal husbandry (Assan and Beyene, 2013; Bryceson, 2004). Non-farming postharvest activities of the food economy stand at 40% of the sector's value added (Allen and Heinrigs, 2016). Earning income directly from one's own business, trade, or profession versus wage labor are among livelihood diversification strategies (Ellis, 2000; Barret et al., 2001). Nonagricultural rural incomes enable households to improve their consumption and expenditure, stabilize and capitalize their earnings and attain families' goals. Poorer farm households that participate in non-farm activities expand their assets required for children education, agricultural land ownership, purchase inputs, adoption of productivity-enhancing technologies, boost agricultural production and yields (Whitehead and Kabeer, 2001; Babatunde, 2015; Anang, 2017). In Mozambique, non-farm sector contributed to upward mobility and better consumption of low-educated households (Fox and Sohnesen, 2016). Rural non-farm sector is forecasted to employ 38% of workforce between 2010 and 2020, and provide millions of jobs opportunities in rural Africa over the next decade (Fox and Pimhidzai, 2013; Fox and Sohnesen, 2016). Most enterprises in the continent are small and informal business where 42% of households own non-farm business that generates between 40 and 50% of household total income (Haggblade et al., 2010; Rijkers and Costa, 2012; Nagler and Naude, 2014). In Asia, the proportion of non-farm activities varies from over 70% for the Philippines and Sri Lanka to below 40% for China, India and Nepal (Thapa et al., 2013). In Latin America and the Caribbean, the average contribution of non-farm activities is over 50% (Dirven, 2011). The proportion of non-farm economy in full-time rural employment is about 30% in Asia and Latin America, 20% in West Asia and North Africa and 10% in sub-Saharan Africa (Haggblade et al., 2010; Boto et al., 2012). Growth in non-agrarian earnings sector and micro-enterprises stimulates overall GDP and a decline in the Gini index of total income thereby helping to deter social tensions and political instability. Non-agrarian income generating activities are also drivers of reduction of ecosystem-wide risks from human activities, thus acting as catalysts of biodiversity preservation through degraded farmland restoration and decrease of over exploitation of natural resources (Ahmed, 1996; Reardon et al., 2000; Kassie, 2017).

Growing demand for higher-value added farm products amongst emerging middle-class consumers in Africa is making the non-farm business employment increasingly vital for livelihoods and stability (de Janvry and Sadoulet,

2010; Rijkers and Costa, 2012; de Brauw et al., 2013). Such transition in demand is reflected in the development of modern system of production, processing, transport, and dietary pattern (Anríquez and Stamoulis, 2007). Promoting household income streams has the potential to set the challenge of climate adaptation in the context of changes in land productivity and food insecurity in agrarian societies. Non-farm labor is 6 times more productive than agricultural labor in Africa as against 4.5, 3.4, 2.2 manifolds obtainable in other developing, middle-income and high-income countries respectively (Gollin et al., 2014). The prevalence of rural diversification activities implies that development policies aimed at promoting poverty alleviation and food security must recognize the heterogeneity of rural poverty and look beyond agriculture. Economic opportunities outside agriculture increase income, shape farm activities, strengthen households' purchasing power and lessen the risk associated with intra-year food production (Barrett et al., 2001; Kuiper et al., 2007; Haggblade et al., 2007). Growth in non-farm sector and agriculture both create aggregate complex strategies that involve multiple income-generating opportunities for farm households. Thus, rural non-farm sector appears to be an indispensable complement to agriculture or additional source of income to stabilize food consumption and expenditure in agro-ecoregions (Gladwin et al., 2001; Akaakohol and Aye, 2014; Seng, 2015).

Although there is growth in non-farm activities in household livelihood in Ethiopia, there is paucity of documented information regarding the contribution of these activities to household income. Available studies on non-farm activities are limited to socio-economic factors that determine household decision to undertake non-farm business activities and to some geographical areas. The data used in previous types of research were regional or village-specific, not nationally representative hence limit broader applicability. These calls for empirical research to better understand the aforementioned situation in specific settings as rural development programs disregard the role of non-farm activities and their link with household total income in Ethiopia. The lack of adequate intersectoral growth agenda makes it difficult for government to set clear rural development policies. Hence, a national representative household level panel data that covers all Ethiopian agro-ecosystems was used in the current study aimed at investigating the factors influencing participation in non-farm activities and the consequential effect of such endeavor on household income.

MATERIALS AND METHODS

Study area

Located between latitudes 5°N and 15°N and longitudes 35°E and 45°E, Ethiopia is a landlocked country geographically sited in the east of Africa (Awulachew et al., 2007; Yazew, 2005), sharing

borders with Eritrea (North), Djibouti and Somalia (East), Kenya and Somalia (South), Sudan and South Sudan (West). The map of Ethiopia is as shown in Figure 1. With nearly 105 million inhabitants (World Bank, 2019), Ethiopia is the 2nd most populous country in Africa after Nigeria and the 10th largest in the world. It spans a landmass of 1,126,829 km^2 (WFP and CSA, 2019). Farming households, representing the majority of the population (FAO, 2019a) rely on agriculture for their subsistence (Awulachew et al., 2007; MoA, 2011; Bekele et al., 2012). These rural people appear to be concentrated primarily in Oromia or northern SNNPR (Southern Nations, Nationalities, and Peoples' Region). The seasonality of rainfall varies in different regions of Ethiopia (Funk et al., 2012). Uplands receive more rainfall and are suitable for farming with higher population densities than low arid areas. Lowland inhabitants generally practice animal production. Agro-pastoralists rely on a mixture of the two livelihood strategies (Livelihoods Integration Unit, 2010). Due to variation in altitude, 4,620 m above to 110 m below sea level in the Amhara National Regional State and the Afar National Regional State, respectively, the temperature varies from 39°C to the very cool Afro-monatane climate at high altitudes (The Federal Democratic Republic of Ethiopia Environmental Protection Authority, 2011).

Sources and type of data used for the empirical analysis

Empirically, factors influencing household decision to diversify into non-farm activities in Ethiopia were documented using a dataset obtained from three waves of surveys: 2011-2012, 2013-2014 and 2015-2016. Ethiopia's Central Statistics Agency (CSA) and the World Bank collected the household panel datasets. 3,969 households were interviewed in 2011-2012 out of which 3,776 were re-interviewed in 2013-2014 representing less than 5% of the attrition rate. During the third wave of the survey, 4,954 households were interviewed in 2015-2016. However, to create a balance data for econometric analysis, the total sample used in this analysis were 3866 due to supplementary restrictions imposed on the sample. The research focused on households that undertake both farm and non-farming activities.

Data analysis tools and econometric model specification

For dataset analysis, descriptive statistics and econometric analysis were applied using STATA software.

Descriptive analysis

Descriptive analysis was done with tools such as mean and standard deviation. The explanatory variables are dichotomized taking (1) for households engage in non-farm activities and (0) for those who do not practice non-farm income diversification.

Econometrics analysis

In addition to the descriptive analysis, maximum likelihood estimation with probit model was used to ascertain the determinants of household diversification towards rural non-farm activities. The consequential effect of participation in non-farm activities on household income was estimated by using Heckman's two-step procedure.

Theoretical background: Probit regression was employed to model binary outcome variables (0/1). In the model, the inverse

standard normal distribution is shown as a linear combination of the predictors. Econometrically, the model can be expressed as:

$$\Pr(Y = 1|X) = \phi(X^T \beta) \tag{1}$$

where Pr represents the probability, ϕ denotes the Distribution Function of the standard normal distribution, β stands for unknown parameters that are estimated by maximum likelihood.

Assuming there is an auxiliary random variable, the probit regression can be regarded as a latent variable model:

$$Y^* = X^T \beta + \varepsilon \tag{2}$$

where $\varepsilon \sim N(0,1)$. Y indicates if the latent variable is positive:

$$Y = \left\{ \begin{array}{l} 1 \ Y^* > 0 \\ 0 \ \text{otherwise} \end{array} \right\} = \left\{ \begin{array}{l} 1 \ \varepsilon < X^T \beta \\ 0 \ \text{otherwise} \end{array} \right\} \tag{3}$$

By symmetry of the normal distribution, the equivalence of both models above can be presented as follow:

$$\Pr(Y = 1|X) = Pr = Y^* > 0 = Pr(Y^T\beta + \varepsilon > 0) = Pr(\varepsilon > -X^T\beta) = Pr\left(\varepsilon < X^T\beta = \phi(X^T\beta)\right) \tag{4}$$

Model estimation: Considering dataset $\{y_i, x_i\}_{i=1}^n$ comprises n independent units conforming with the Equation 4, for each observation, conditional on the vector of inputs is:

$$\Pr(y_i = 1|x_i) = \phi(x_i'\beta)$$
$$\Pr(y_i = 0|x_i) = 1 - \phi(x_i'\beta) \tag{5}$$

where x_i represents a vector of K×1.

Accordingly, the probability of each observation (y_i, x_i) is:

$$\mathcal{L}(\beta; y_i, x_i) = \phi(x_i'\beta)y^i \left[1 - \phi(x_i'\beta)\right]^{(1-y_i)} \tag{6}$$

If $y_i = 1$ then $L(\beta; y_i, x_i) = \phi(x_i'\beta)$ and if $y_i = 0$, then $L(\beta; y_i, x_i) = 1 - \phi(x_i'\beta) \tag{7}$

Since observations are not related, the probability of the whole sample is equal to the total of the probabilities of each observation:

$$\mathcal{L}(\beta; Y, X) = \prod_{i=1}^n (\phi(x_i'\beta)^{y_i} [1 - \phi(x_i'\beta)]^{1-y_i}) \tag{8}$$

Therefore, the joint log-likelihood function is specified as:

$$\ln\mathcal{L}(\beta; Y, X) = \sum_{i=1}^n y_i \ln\phi(x_i'\beta) + (1 - y_i)\ln(1 - \phi(x_i'\beta))) \tag{9}$$

Asymptotic distribution for $\hat{\beta}$ can be stated as:

$$\sqrt{n}(\hat{\beta} - \beta) \xrightarrow{d} = N(0, \Omega^{-1}), \tag{10}$$
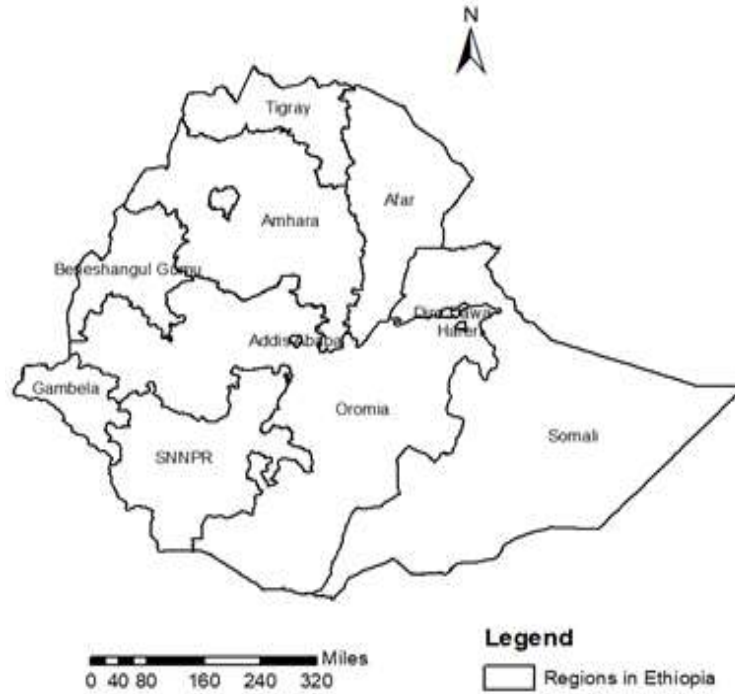
where

Figure 1. Map of study area.

$$\Omega = E\left[\frac{\varphi^2(x'\beta)}{\phi(x'\beta)\left(1-\phi(x'\beta)\right)}XX'\right], \hat{\Omega} = \frac{1}{n}\sum_{i=1}^{n}\frac{\varphi^2\left(x_i'\hat{\beta}\right)}{\Omega\left(x_i'\hat{\beta}\right)\left(1-\phi(x_i')\right)}x_i x_i',$$

(11)

Moreover, $\varphi = \phi'$ is the likelihood of standard normal distribution. Therefore, participating in non-farm business activities by household can be expressed as:

$$NFP = \phi(\beta_1 GEND + \beta_2 AGE + \beta_3 AGE^2 + \beta_4 HHZ + \beta_5 LITSTATUS + \beta_6 HEALT + \beta_7 TLU + \beta_8 ACCESSCRED + \beta_9 TTLHIREDLBOR +$$
$$\beta_{10} TTLCROPROD + \beta_{11} ANNFOODCONSUM + \beta_{12} ANNCONSUMPEXP + \beta_{13} COOPMEMB + \beta_{14} EXTSERV + \beta_{15} DISTROAD +$$
$$\beta_{16} DISTMARK)$$

(12)

Besides, to determine the percentage likelihood of non-farm business participation, the marginal effects of independent variables were calculated. As the probability of non-farm business activities shown:

$P(Y = 1/X = X)$, given that all other variables are constant, the marginal effects are:

$$\frac{\partial P(Y_i=1/X_i)}{\partial X_i} = \frac{\partial E(Y_i/X_i)}{\partial X_i} = \emptyset(X_i'\beta)\beta$$

(13)

Heckman two-step selection model for the analysis of effect of non-farm activities on household income: The estimation of the influence of non-farm activities on household income based on regression analysis could be biased if the factors that influence the participation in non-farm activities are not integrated in the empirical framework. Due to some unobservable characteristics, the impact of non-farm activities could be over (or under) estimated if households who undertake non-farm business activities have more (less) earnings compared to eligible non-participants (Astatike and Gazuma, 2019). Hence, the need to use Heckman model to estimate the income equations, which has been used in similar contexts (Hagos and Holden, 2003; Sisay, 2010; Haile, 2012). Heckman two-step selection method is a two-stage estimation method. The first stage performs a probit analysis on a selection equation while the second stage analyzes an outcome equation based on the first-stage binary probit model. Rural non-farm income diversification index and households total income can be equally associated with the same household socioeconomic variables (Gebreyesus, 2016). Thus, household total income is given as:

The regression equation is:

$$Y_j = X_j\beta + u_{1j}$$

(14)

The selection equation is:

$$Z_{j\gamma} + u_{2j} > 0$$

(15)

where $u_1 \sim N(0,\sigma)$, $u_2 \sim N(0,1)$, and $Corr(u_1, u_2) = \rho$

The log likelihood for observation j, $\ln L_j = l_j$, is:

$$l_j = \begin{cases} w_j \ln \Phi\left\{\frac{(Z_{j\gamma} + (y_j - Y_j\beta)\rho/\sigma)}{\sqrt{1-\rho^2}}\right\} - \frac{w_j}{2}\left(\frac{y_j - X_j\beta}{\sigma}\right) - w_j \ln(\sqrt{2\pi}\sigma) & y_j \quad \text{observed} \\ w_j \ln \Phi\left(-Z_{j\gamma}\right) & y_j \quad \text{is not observed} \end{cases}$$

(16)

where Φ (.) is the standard cumulative normal and w_j is an optional weight for observation j. ln the maximum likelihood estimation, ρ and σ are not directly estimated. Directly estimated are $\ln \sigma$ and antah ρ.

$$\text{antah } \rho = \frac{1}{2}\ln\left(\frac{1+\rho}{1-\rho}\right) \tag{17}$$

The standard error of $\lambda = \rho\sigma$ is approximated through the propagation of error (delta) method, that is,

$$Var(\lambda) \approx \mathbf{D} \, Var\left\{(\text{atanh}\rho \ln \sigma)\right\} \mathbf{D}'$$.

where $\mathbf{D}$ is the Jacobian λ with respect to $\text{atanh } \rho$ and $\ln \sigma$. Based on probit analysis, the mills ratio is determined as follows:

$$\lambda_i(c) = \frac{\emptyset(C)}{1 - \Phi(C)} \tag{18}$$

where

$$C = \frac{x_i\beta}{\sigma} \tag{19}$$

λ_i is the Mills ratio, $\emptyset$ represents the density function of a standard normal variable, Φ is the cumulative distribution function of a standard normal distribution. Therefore, the income equation could be written as:

$$Y_i = \gamma_0 + \gamma_1 W_i + \gamma_2 Z_i + \gamma_3 \lambda_i + \varepsilon_i \tag{20}$$

where Y_i represents household income, W_i is factors influencing households' income; γ_i represents coefficients of explanatory variables and ε_i the error term.

Variables description and hypothesis

Based on the background of the study, the predictors that can influence participation in rural non-farm activities and its effect on household income are summarized in the Table 1.

RESULTS AND DISCUSSION

Summary statistics of the principal explanatory variables

The descriptive statistics provided in Table 2 show that 76% of male-headed agricultural households were involved in rural non-farm activities while 72% of women were non-participants of non-farm business. The mean age of the sample households' head who participated in non-agricultural income diversification activities was 41 years. Households with an average size of about five people were more likely to participate in income diversification strategies since agricultural income or

activity is seasonal and not sufficient to meet their needs. An average of 42.18% of the farmers involved in non-farm business activities had formal education while 57.82% of non-participants had no formal education. Among the participants in non-farm activities, 69% have had health issues while only 31% reportedly had stable health. The total crop production was lower for participants (314.9613 Kg) than non-participants (449.1158 Kg) suggesting that in the face of low crop productivity, non-farm activities may enable farm households to maintain food security (income and consumption). The descriptive statistics further indicate that, 40% of agricultural households had income from non-agrarian income-earning activities whereas agriculture was the only source of income for 60% of respondents. The average total livestock owned in tropical livestock unit (TLU) by the participants in non-farm sector earnings was 1.82 contrary to 2.53 for non-participants. Agricultural households who did not pursue non-agrarian income-earning activities owned extra herds of livestock than those who participated in income diversification. Few rural households (42%) had access to business start-ups capital; however, 58% did not get access to working capital that allows relaxing liquidity constraints in launching and unlocking the growth of business activities. Annual value of food consumption was higher (5497.238 Birr) for participants than non-participants (4543.355 Birr).

First-stage results of determinants of participation in non-farm activities and marginal effects

The estimation of the binary probit model and marginal effects of associated explanatory variables (Tables 3 and 4) revealed that fourteen of the sixteen explanatory variables used for the regression analysis had significant effect on engagement in income diversification into non-agricultural business by Ethiopian households. Specifically, these variables are crop production, annual value of food consumption, household consumption expenditure, gender, family size, literacy, health status, farm animals holding, access to credit, total hired labor, cooperative membership cum agricultural extension services.

Gender has mixed influences on non-farm activities of rural household as mentioned in rural diversification literatures. Several findings indicate that being male largely affects participation in non-agrarian income-earning activities. The motive is that since men are normally family heads, they have a prominent role to support households with food and other basic needs. Women are more likely to be involved in unskilled wage labor and represented in low-return activities (Bezabih et al., 2010; Bezu and Barrett, 2010; Larson et al., 2015). As shown in Table 3, being a woman is significantly (P ≤ 0.05) and negatively associated with income diversification into non-farm activities. The large

Table 1. Description of the principal variables used in the study, units of measurement and hypothesized relationships.

Variable	Type of variable	Unit of measurement	Expected signs
Dependent variable			
Participation in non-farm economic activities	Binary	Yes = 1; No = 0	+
Independent variable			
Gender	Dummy	Male = 1; Female = 0	-
Age	continuous	Years	+/-
Family size	Continuous	Number of household members	+
Literacy status	Categorical	1 if Literate, 0 Otherwise	+
Health status	Categorical	1 if Health issues, 0 Otherwise)	+
Total number of farm animals	Continuous	Livestock unit (TLU)	-
Access to loan	Dummy	Yes=1; No=0	+
Total hired labor	Continuous	Birr	+
Total crop production	Continuous	Kg	-
Annual value of food consumption	Continuous	Birr	+
Total annual household consumption expenditure**s**	Continuous	Birr	+
Farmers' cooperative membership	Dummy	Yes=1; No=0	+
Agricultural extension services	Dummy	Yes=1; No=0	+
Distance to nearest major road	Continuous	Km	+
Distance to nearest major market	Continuous	Km	+

Table 2. Summary statistics of the principal variables used in the study.

Variable	Participants (yes=1)		Non-participants (no = 0)	
	Mean	Standard deviation	Mean	Standard deviation
Participation in non-farm economic activities	0.40	0.49	0.60	0.37
Gender	0.76	0.68	0.72	0.71
Age	41.35	13.87	47.52	16.22
Family size	4.69	2.36	4.49	2.43
Literacy status	42.18	0.49	57.82	0.48
Health status	69	0.43	31	0.58
Total number of farm animals	1.82	7.01	2.53	4.32
Access to loan	0.42	0.006	0.58	0.004
Total hired labor	78.378	564.3896	61.43625	312.4944
Total crop production	314.9613	843.3081	449.1158	1220.313
Annual value of food consumption	5497.238	9554.14	4543.355	6977.374
Total annual household consumption expenditures	23225.76	26996.32	21372.93	21792.66
Farmers' cooperative membership	0.65	0.52	0.35	0.24
Agricultural extension services	0.71	0.44	0.29	0.41
Distance to nearest major road	13.51	22.85	13.16	20.56
Distance to nearest market	60.41	0.45	60.14	0.59

Source: Computed based on the data from Living Standards Measurement Study (LSMS)-Integrated Surveys on Agriculture Ethiopia Socioeconomic Survey (ESS) 2011/2012-2013/2014-2015/2016.

proportion of males involved in non-farm activities as compared to women revealed the unequal access between men and women to nonagricultural business practices. The marginal effects result indicated that the likelihood of women engagement in non-agricultural activities decreased by 0.0365. Engaging in lucrative non-agricultural business creates more inequality among female households, where owning individual businesses is vital and non-agricultural income diversification activities are more constrained (Canagarajah et al., 2001).

Table 3. First-stage regression results of determinants of non-farm business participation.

Variable	Coefficient	Robust Std Err
Gender	-0.0967	0.0440**
Age	0.0167	0.00273***
Age^2	-0.000258	3.31***
Family size	0.0222	0.00640***
Literacy status	-0.152	0.0255***
Health status	0.0697	0.0312**
Total number of farm animals	-0.00698	0.00208***
Access to loan	-0.189	0.0296***
Total hired labor	8.51	4.10**
Total crop production	-8.35	1.44***
Annual value of food consumption	-7.70	2.77***
Total annual household consumption expenditure	6.98	2.43***
Farmers' cooperative membership	0.0183	0.00754***
Agricultural extension services	1.34	1.61***
Distance to the nearest major road	-1.97	0.000718
Distance to the nearest market	0.000255	0.000333
LR Chi^2(16)	274.42	-
Prob > Chi^2	0.0000	-
Pseudo R^2	0.0235	-
Number of observation	11598	-
Number of round	3	-

***, ** and * represent 1, 5 and 10% significance level, respectively.

Evidence from Latin America showed that non-farm wage employment is gender segregated by sector with female headed-households more represented in low-productivity and low-return activities, this is what Lanjouw (2001) indicated as "safety net" employment. The results of the present study agree with the findings of Datt et al., (1998) conducted in Egypt where poverty level is higher amongst women than men in the remote rural communities, and the unemployment ratio for female-headed households is four times higher than for male-headed households. Although, there is a worthwhile contribution of rural women to rural economy and rural development, their lack of basic skills, inadequate ownership, unequal access to physical and financial assets restrain their participation in high remunerative business activities as it is the case in Ethiopia. They are recurrently engaged in self-employment businesses such as trading, pottery making, beer brewing, oil pressing and others low rewarding business activities (Ruben and Van den Berg, 2001; Canagarajah et al., 2001; Haggblade et al., 2002). Exclusion based on gender, and or social status leads to social and economic marginalization, which create barriers to upward mobility, confining women capabilities to participate in economic opportunities and to benefit from growth and development. In the context of access to remunerative non-farm activities, closing the exclusion gap in agrarian societies could help female headed-households to enhance their agricultural yields, increase their market portfolio and allow them to make better and productive choices.

Age is a key demographic variable whose measurements are of particular interest in understanding changes in behaviors, beliefs, and lifestyles that coincide with age. As shown in Figure 2, adding the age squared to age, allows more accurate modeling of the effect of differing ages, rather than assuming that the effect is linear for all ages. This is known as a quadratic effect, which is an interaction term where a factor interacts with itself. In this case, we are not comparing one age-group with another age-group but exploring how the nexus between age and the dependent variable changes at different values of the age variable (or in other words, at different ages). A positive effect of age with a negative effect of age squared means that as people get older the effect of age is lessened. Used as predictors, age and age^2 have a positive and negative significant influence at $P \leq 0.01$, respectively on rural income diversification. The marginal effect of age^2 indicates that the likelihood of engaging in nonagricultural activities for each additional year decreases by 9.75 units. These findings concur with study by Kassie et al. (2017) in Northern Ethiopia that supported the view that non-farm work requires vigor and that younger farmers are stronger than older ones. Young farmers are more attracted to non-farm business than older households who tend to be more engaged in on-

Table 4. Marginal effect (dy/dx).

Variable	Marginal effect	
	dy/dx	Robust Std Err
Gender	-0.0365	0.0166**
Age	0.00629	0.00103***
Age^2	-9.75	1.25***
Family size	0.00838	0.00241***
Literacy status	-0.0575	0.00963***
Health status	0.0263	0.0118**
Total number of farm animals	-0.00263	0.000784***
Access to loan	-0.0715	0.0112***
Total hired labor	3.21	1.55**
Total crop production	-3.15	5.43***
Annual value of food consumption	-2.91	1.05***
Total annual household consumption expenditure	2.63	9.18***
Farmers' cooperative membership	0.00580	0.00288***
Agricultural extension services	-1.06	4.82***
Distance to the nearest major road	7.43	0.000271
Distance to the nearest market	9.62	0.000126
LR Chi^2(16)	274.42	-
Prob > Chi^2	0.0000	-
Pseudo R^2	0.0235	-
Number of observation	11598	-
Number of round	3	-

***, ** and * represent 1, 5 and 10% significance level, respectively

farm agricultural activities merely for their survival. However, informal and/or vulnerable employment opportunities are pervasive for the vast majority of the youth in sub-Saharan Africa. For instance, 67% of youth who work in the informal economy live in poverty. Poor governance, lack of development schemes focused on the promotion of human resources as youth, and lack of prospect of having a secure job, create frustration among unemployed youth. They often suffer from under-employment and lack of decent working conditions. This is reflected in rural exodus, social and political instability and emigration. Meanwhile, youth represents one of the utmost human resources that can stimulate Africa's economy. Agriculture and non-farm economy can contribute to absorb the 10 million of young people who join the labor market per annum (FAO and ECA, 2018; AGRA, 2015). However, they are two times less likely to be jobless compared to adults. The unemployment rate was 11.8% in 2012 amongst the Africa's youth (The Montpellier Panel, 2014; ILO, 2013). Moreover, roughly, 20.1% of young people who are working earn below or about USD 1.25 per day, implying that they are salaried workers as a necessity instead of by choice (AGRA, 2015). Limited access to education or trainings is an obstacle to get stable and well-paid employment. Rural youth in the continent face the challenges of low levels of literacy, poor numeracy, high dropout rate in higher education and low levels of tertiary recruitments. Promoting education and youth empowerment can strengthen their innovative and technical abilities as a tool for food security, poverty alleviation and African green revolution. Likewise, the development of transportation and storage systems, markets, telecommunication and modern technologies is strategic and vital to attain the potential of young people along the agricultural value chain.

The result of the family size was positively significant at (P ≤ 0.01) probability level. Each additional increase in household size increases the likelihood of engagement in income diversification by 0.838 percent significance level. As reported in previous empirical researches, family size stimulates non-agricultural income diversification activities. Large households allocate extra labor into non-farm entrepreneurship (Nagler and Naude, 2014). This implies that having an additional adult member in the household creates additional labor force. It is an opportunity for allocating the workforce for agricultural and non-agricultural activities (Demie and Zeray, 2016). According to Zerai and Gebreegziabher (2011), large family size in a limited and marginalized land has its benefits since farmers tend to get involved in activities that bring additional income. Family size in agro-ecoregions involves generally many people and high dependency ratios, consequence of fastest-growing
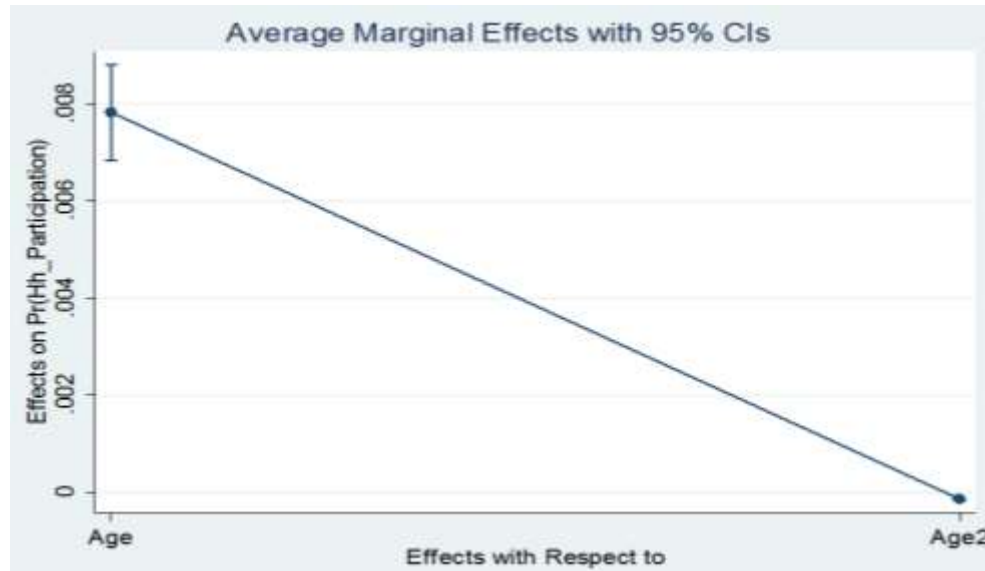
Figure 2. Margins' plot of age effects with respect to age[2].

human population. Vulnerable households with limited resources depend exclusively on human assets to generate income (Khan, 2000).

Education is one of the core proxies of livelihood diversification into non-farm activities and self-employment (Fuje, 2017). As expected, the result of the regression revealed that less or lack of formal education negatively influenced participation in non-agricultural rural labor markets at less than a (P ≤ 0.01) probability level. This can be interpreted as the penchant of engaging in higher pay-offs or high paying self-business activities decreased by 5.75% percent for the households with less formal education. This result is consistent with the studies conducted by Bryceson (2002), Kassie (2013) and Kassie et al. (2017). The authors demonstrated that low literacy status negatively affected non-farm work. In Ethiopia, the majority of farm families are recurrently prone to food crisis aggravated by the impacts of climate related-shocks, rain-fed and small-scale agricultural production (Cornia and Martorano, 2016). Such a situation results in widespread of undernutrition particularly in rural areas where 52% of people are food insecure (FAO, 2012a; Girmay et al., 2016; Sibhatu and Qaim, 2017); this force farm families to seek extra labor usually unskilled nonagricultural employment as a coping mechanism for weather shocks during the off-season. These vulnerable farm families develop 'distress-push' or 'defensive' survival strategies. Therefore, their involvement in non-agrarian activities is to fill the food gap that agriculture was unable to do. Consequently, most of the non-farm activities practiced by vulnerable households usually are not high return opportunities. Such low-income activities are selling local food and drinks, collecting and selling firewood, farm wage work, community work and unskilled

wage work (Sisay, 2010). The disposition of human capital assets defines people's livelihood options. Evidence shows that in China, investment in education has led to decline in rural poverty (Fan et al., 2000). Promotion of literacy raises the level of productivity, shapes entrepreneurship, and technological progresses. It is very fundamental for economic performance and improving income distribution and lifts the labor market earnings. Moreover, number of years of education can influence people's understanding and improve their lifestyle. Female headed-households, especially in rural societies, are disadvantaged with regard to access to education and labor markets. Their likelihood of getting "decent" activities could be compromised, when it comes to jobs requiring a minimum level of literacy. Thus, the unemployment rate for women is higher than that for men. Education brings positive returns in terms of wages and access to "better" job opportunities.

The health status of the family head is undeniably vital in pursuing non-agricultural business activities and for risk mitigation. The result of the regression showed that being in good health positively influenced household engagement in non-farm income streams at (P ≤ 0.05) significance level. The marginal effects from the probit model result corroborate the fact that other factors being constant, the probability of diversification increased by 0.0263 for the households who are in good health. Poor health status handicaps productivity and access to better economic opportunities. Intensive resources and extra time needed to pursue nonagricultural labor employment will make it difficult for unhealthy or physically challenged people to practice it (Bowen et al., 2012). The prevalence of AIDS, malaria, tuberculosis and other health problems in a number of Sub-Saharan African countries reduces

investment in human capital and leads to loss of labor, productive time, and material assets particularly in agro-ecoregions. For example, over two-thirds of people affected by HIV/AIDS in the continent are rural residents (Meijerink and Roza, 2007). These people are usually unable to cope with HIV/AIDS given the inadequate and inaccessible health facilities. These challenges extremely undermine their resilience and development prospects. Health issues of a member within the household may have a prejudicial impact on the rest of the family, children being particularly vulnerable. The detrimental long-term effect, for example, depriving children from education to assist with domestic chores and to save financial expenses. To cover the costs of health care, individuals or households may have to sell out their productive assets or contract debts. Health care costs exacerbate household poverty due to few or lack of health insurance mechanisms. This negatively affects their potential to undertake non-farm livelihood activities (Asfaw et al., 2017). Preventing such exhaustion of assets through the promotion of better health will help rural households live above the poverty line. This will further enable them to use their assets efficiently to raise their income and sustain their livelihood. Most sub-Saharan African countries have underinvested in health facilities and are characterized by weak and fragmented health systems that do not entitle the necessary capacity to face health crisis. Adequate health systems and facilities ensure well-being, which is vital for sustainable development.

Total livestock per unit (TLU) was calculated to measure livestock holding of the farming households. Results indicate that livestock husbandry of households in Ethiopia is on a small-scale, mostly free-range system. Proportionally, those farmers depending exclusively on farming for their livelihood have higher livestock holding than the participants of non-farm activities due to the negative influence of livestock size on the propensity of engaging in non-farm work at less than a (P ≤ 0.01) probability level. For farm families who have large number of livestock, the likelihood of seeking for non-farming employment decreased by 0.00263 with every increase in one herd of livestock. The income generated from livestock helps farmers fulfill family requirements including food and non-food consumption expenditure. Wealthier families who can afford family needs through earning from livestock may not engage in other income-generating business unless their objective is to increase their asset holding. However, households with fewer livestock had to stabilize and increase their portfolio by engaging in non-farm business and this accelerates the rate of diversification. This result is consistent with findings of Demeke and Zeller (2012) who inferred that larger livestock size reduces the participation in high pay-off jobs. In Ethiopia, animal husbandry provides an opportunity for agricultural settings. It serves as source of food for consumption, animal traction, provides organic fertilizer to enrich soils and serves as source of income to support farmer's livelihood. The livestock subsector production system generates about 1.128 metric tons (MT) of meat, 174 million eggs, 5.2 billion liters of milk, nearly 68 million tons of manure annually, and roughly 617 million days in animal traction (Shapiro et al., 2017). Around 80% of rural residents depend on livestock assets, which account for 80% of agricultural incomes. Meanwhile, poor market access, lack of infrastructure, animal genetic, water scarcity, poor nutrition and animal health care, over grazing and endemic animal diseases, inhibit animal settlements in Ethiopia (ILRI, 2011; Shapiro et al., 2017; Awoke et al., 2015; Tekle and Abebe, 2001).

Low crop production or crop failure is among the factors that push Ethiopian farm households to undertake non-farm business activities, and the empirical result is negative and significant at (P ≤ 0.01) probability level. In the face of production failures, non-farm business activities generate residual income or subsistence food production for poor folks. The assets generated from these activities complement the resource base and represent vital coping mechanism. Ethiopia's agriculture is characterized by low productivity, small-scale and vulnerable to global price fluctuations, weather patterns, soil erosion and compaction. Consequently, the annual farm per capita income decreased at the rate of 1.2% over the last 4 decades (Taddesse, 2001; Hamza and Anderson, 2005; Dagnaw, 2007). Intensifying and boosting agricultural yields is imperative to maintain household income, food security (Taffesse et al., 2012) and transform the economy. Agricultural development could stimulate assets protection, control inflation and establish connectivity to cities and markets, promote the upstream and downstream operations and sustain the value chains and development of agro-based industries. This will result in the shift toward varied structure of domestic production and trade with more job opportunities and sustained poverty-reduction growth (Abro et al., 2014; Losch, 2016).

Crop failures tend to decrease the amount of food available for consumption and the result is significant at (P ≤ 0.01) probability level. Low or insufficient intake of food pushes households with fewer assets to seek non-agrarian business activities as a risk smoothing mechanism and the only available solution to (sustain income and consumption) the vicious circle of food insecurity particularly in agro-ecoregions (Anang, 2017). Approximately, 40 to 50% of people are food insecure and food deficiency affects 40% of farm families in Ethiopia (Shone et al., 2017; CSA, 2014). Rural 'purchasing power is very low in Ethiopia and 70% of humanitarian aid allocated to the country is merely food aid (Donnenfeld et al., 2019).

Total hired labor is positively associated with household engagement in non-farm business at (P ≤ 0.05) significance level. The marginal effects results showed that when households undertake nonagricultural activities,

the probability to hire additional labor for farming operations increased by 3.21. Stampini and Davis (2009) in their study reported an increase in agriculture investment as consequential effect of non-farm work. In high potential areas with high culture of entrepreneurship, high level of diversification at the agrarian household level does not habitually detract from agricultural work. Usually, it is a key decision, which has implications for farm output and productivity. Profits from non-farm sector allow farm households to mitigate risks among different activities and finance agricultural activities by hiring additional labor, purchasing production inputs or adopting higher-yielding technologies (Davis et al., 2010). Assessing the effect of non-agrarian income generating activities on farm productivity would contribute to implement rural development policies that address the dwindling agricultural productivity among peasants (Anang, 2017).

Agricultural cooperatives are vital channels to share and disseminate information and knowledge. Cooperative membership positively influenced household engagement in non-farm income streams at (P ≤ 0.01) significance level. The marginal effects from the probit model result corroborate the fact that other factors being constant, the likelihood of diversification increased by 0.580% for households who are members of farmers' organization. The results concur with findings of other studies that support the view that households who engaged in cooperatives are involved more in the non-farm enterprise sector (Alemu and Adesina, 2017).

Getting access to technical advice and information had negative influence on household engagement in nonagricultural business activities at (P ≤ 0.01) significance level. The result of the marginal effect suggested that the likelihood to undertake non-farm business decreases by 1.06 for households who had access to agricultural advisory services. Rural extension and trainings provide useful information that enables rural population to increase the efficiency of the family farm, and specifically to improve production and their livelihood. Given the importance of food security in agrarian societies, both cooperative membership and access to rural extension services coupled with information and training related to agricultural production must provide alternative solutions to production failures, market imperfections including non-agrarian generating business. As well as allow agricultural households to take the initiative which produce change for better rural society when farmers put recommendations into practice. Through extension service delivery, farmers are able to practice good agronomic practices (GAP) that foster productivity and food security. Farm households may tend to achieve food security and generate more income that can help them save more money. Peasants tend to easily learn from their colleague farmers particularly when they notice good results from each other. These cooperatives tend to unite farmers with common interest

and hence the continuous growth of these cooperatives translates into rural economic development from diverse areas such as education, agriculture, social infrastructure, health and poverty alleviation. Cooperatives may aggregate their produce, sell in bulk and this can help them get good value for their produce, and this makes marketing of produce more convenient. Women in cooperatives tend to be more empowered and are able to take up leadership positions in society. It tends to make women more financially independent.

Total annual consumption expenditure over the past 12 months, is positively associated with farm families decision of pursuing non-farm work at (P ≤ 0.01) significance level. The marginal effects from the probit model result support the hypothesis that other factors being constant, the likelihood of making adequate profits to actualize family consumption expenditure increased by 2.63 when households endeared to seeking extra incomes from non-fam activities. Adequate returns from non-agrarian generating activities allow household heads to meet basic needs, finance crop production, invest in goods and services as well as stabilize income and consumption.

As a liquidity factor, the possibility to get loan or business start-ups capital is one of the best options for households to overcome liquidity constraints to practice non-farm business. Business start-ups capital negatively affected non-agrarian earnings activities at (P ≤ 0.01) significance level.

The marginal effects results support the hypothesis that the likelihood of engaging in non-farm activities decreased by 0.0715 with business loans and credit. In Ethiopia, the financial assets disposition is among the key challenges for either agricultural production or launching remunerative business activities. Thus, the alternative opportunities for vulnerable farming families are unskilled and low-return non-farm activities as coping mechanism rather than a pathway for escaping out of poverty. Exclusive reliance of households on farm activities or a single source of income contributes to the prevalence of rural poverty and food insecurity. Generally, assets ownership like land is a prerequisite to guarantee loan repayment. This situation leads to the inequality associated to the participation in non-farm businesses.

Furthermore, lack of insurance mechanisms that protect farmers, high transaction costs and repayment rates; illiteracy and lack of information related to financial institutions contribute to failure in credit markets. However, a number of empirical research suggested the positive correlation between access to credit and rural non-farm agricultural activities. This implies that when agricultural households have access to credit, their propensity to own non-farm businesses increase due to their entitlement to overcome financial constraints and capitalize the gains from non-farm business (Adebiyi and Okunlola, 2013; Beyene, 2008; Zerai and Gebreegziabher, 2011; Bedemo et al., 2013; Zewdie and

Sivakumar, 2017).

Second-stage results: Effect of participation in non-farm activities on household income

In this research, Heckman two-step selection procedure was employed to investigate the effect of non-farm activities on household total income. The first stage is the estimation of binary probit model and marginal effects for participation in non-farm activities. The second stage estimation outcomes based on heckman two-stage selection procedure are reported in Table 5. As expected, the results of the analyses support the non-separability assumption of non-farming business activities and household income; this implies that the involvement decision in non-farm activities by households has a direct positive effect on their income. Keeping other factors constant, this implies that income of households who undertake non-farm business increased by 947.7 Ethiopian Birr than that of non-participants. This outcome is in line with findings of Gebreyesus, (2016), Astatike and Gazuma (2019) who suggested that, families that participate in non-farm employment have higher total income as compared to those with one source of income. Farm households pursue non-farm work for multiple reasons, such as raising income, mitigating exposure, improving well-being and consumption. Evidence from Egypt has suggested that non-farm activities amount to nearly 60% of total income and play an essential role in the livelihoods of vulnerable households. These rural diversification strategies have contributed meaningfully to reduce income disparities. In Ghana, poverty alleviation is linked to growth in non-farm sectors that absorbed the extra agricultural labor from the farming sector (Canagarajah et al., 1998; Adams, 1999).

On the human capital side, educational attainment shapes employment opportunities, earnings and sustainable livelihood. The coefficient of households' educational status is negative and statistically significant at (P ≤ 0.01) probability level. This shows that the likelihood of participating in non-farm livelihood activities decreases for rural people who have any or less school background, and this leads to a loss of 118.9 Ethiopian Birr in their income. Fundamentally, the higher the education level, the higher the income. Better-educated employees have higher earnings compared to those with low levels of literacy. Evidence from Mexico has shown that, the level of formal education positively correlates with household total income (de Janvry and Sadoulet, 2000). This study further suggested that high level of education facilitates the access to higher pay-offs of non-farm employment. Education determines people's earning potential and resource accumulation that can improve their livelihoods (Suryadarma and Suryahadi, 2009). Low level of formal education leads to high incidence of poverty (Barnes and Lord, 2013; Connelly et al., 2014). Despite progress in access to education, nearly 60% of people from the age of 15 to 24 years in sub-Saharan Africa do not go beyond primary school education and they work in the agricultural sector. They experience challenges associated to their socioeconomic status. Besides, the 10% with secondary school education are in household enterprises whilst the better-educated are employed in the wage sector (Betcherman and Khan, 2015; Filmer and Fox, 2014).

The results from second stage estimation indicated that being a female contributed to loss of 286.3 Ethiopian Birr and the result is significant at (P ≤ 0.01). Female headed-households in Ethiopia generally do not have access to higher payoff activities that could enable them sustain their livelihoods. Lanjouw (2001) reported that women are more employed in "residual" activities with earnings below the market rate in El Salvador. Thus, women's earnings from non-farm activities are one-third lower than men. Some regions in sub-Saharan Africa dominated by a patriarchal system and providing small or no place for women in the society, have rural women who cannot inherit because of the interpretation of customary inheritance rules. Typically, these women are "pushed" to negotiate or even pay to access productive resources like land, water and forest, often owned or controlled by men. In many cases, this leads to losses because they are obliged to make payments in kind with part of their crops. In addition, landowners can cancel their access rights at any time. Generally, these rural women are less likely to undertake well-paid rural diversification activities. This adversarial gender-based effect suggests labor market and income inequalities between men and women. Young women are further marginalized as a result of social norms that restrict them and their employment choices (Filmer and Fox, 2014). Pregnancy, parenting, including sets of behaviors and beliefs shared by members of a society or group of people prevent young women from building up their technical know-how and abilities. These social values impose occupational segregation that limit the number of possibilities, and resources for young women (Filmer and Fox, 2014). Young men in SSA tend to have higher chances of participating in jobs with low numbers of joblessness compared to young women (Betcherman and Khan, 2015). The sexualization of socio-cultural identities that impose roles dishearten rural women from participating actively in economic activities. Female headed-households need to be coached and supported with financial facilities to own their economic businesses that can empower them to participate in more lucrative non-farm activities. To promote female headed-household's role in rural non-farm business activities, their meaningful contribution must be recognized since the percentage of women unable to read and write is very high. Free and better-quality education can reduce wage gap and, empower women to diversify by widening the opportunities available to them. In the Philippines, women

Table 5. The outcome equation estimation result.

Variable	Coefficients	Std. Err.
Non-farm activities	947.7	128***
Gender	-286.3	596.9***
Age	556	509.1***
Age^2	-223	413***
Family size	486.9	707.2
Literacy status	-118.9	437.1***
Health status	185.7	668.4***
Total number of farm animals	-284.5	341.9**
Access to loan	588.2	434.7
Total hired labor	452.5	256.8**
Total crop production	-380.5	150.3***
Annual value of food consumption	498	280***
Total annual consumption expenditure	689	635***
Farmers' cooperative membership	191	298
Agricultural extension services	-163	367
Distance to nearest major road	48.68	13.05
Distance to nearest market	81.29	63.71
Inverse Mills Ratio	1.092	135.9***
Constant	-1.105	0.0719***
Rho	0.16637	-
Sigma_u	6564.7567	-
Prob > Chi^2	0.0000	-
Number of observations	11598	-
Number of round	3	-

***, ** and * represent 1, 5 and 10% significance level, respectively.

are more likely to obtain non-farm employment than men and this partly explains the higher educational attainment of girls (Quisumbing et al., 2004). Conditional transfer programs set for women in the household is a successful means to improve the livelihood of children and women (Quisumbing and Pandolfelli, 2010).

Age^2 has a negative and significant influence (P ≤ 0.01) on household income. Most youth in sub-Saharan African countries reside in rural areas and small towns. They are vulnerable, less educated and experience many challenges, particularly for stable and lucrative work that can enable them to achieve a standard of living. They often work either in farming sectors, or are self-employed but with low earnings. Those with basic educational attainment are underemployed and, earn survival incomes with no profits or security (Betcherman and Khan, 2015). Moreover, in most countries, there are no financial services and innovations in rural finance designed exclusively for the youth which can encourage investment in both farm and non-farm sectors (Filmer and Fox, 2014). Meanwhile, sub-Saharan Africa is witnessing youth bulges. Its annual growth forecast stands at 3.9 million of young people over several decades with further expansion in a year by 5.2 million inhabitants from 2025 to 2030 in the continent (Lam, 2014). Thus, the size of

youth cohorts translates into disappointing prospects in a competitive job market, rise of part-time work and increasing unemployment rates. Failures in hours worked and in wage rates both trigger the slump in young people's wage income. Youth in Sub-Saharan Africa are twice marginalized due to its passive links with the labor market than the general population (Filmer and Fox, 2014). Youth who are not able to secure their preferred jobs end up working in the informal economic sector with lower wages and limited savings or usually depend on their families for survival. Deferred entry into the labor market shrinks the period income streams of young unqualified workforces. This situation causes income inequality and social exclusion. Africa's expanding workforce can be a crucial resource in the worldwide marketplace. Over the next decade, the vast majority of young population will work on family farms and Household Corporation. With a low dependency ratio, Africa's youth bulge can create the space for savings, investment, and stimulate sustainable economic growth. Promoting the efficiency and productivity of youth and household non-farm business activities in rural regions may be a catalyst for growth and development of the formal sector (Filmer and Fox, 2014). Youth participation in agriculture will depend on the sustainability and

profitability of family farming. The lack of enforced social welfare system in addition to the correlation between high growth rates of the youth population and unemployment is a call for development actors to improve the youth labor market and promote the distribution of dynamic resource, labor and productivity growth.

The negative correlation between total livestock ownership and household income implies that, herd size is central in rural non-agricultural activities. Each increase in one head of livestock reduces the propensity of seeking additional source of income, thus leading to loss of 284.5 Ethiopian Birr in household income. The promotion of animal husbandry practice and development of livestock sector may accelerate the eradication of hunger and poverty in agropasto state societies. Better access of cattle breeders' to the market is pivotal for growth in livestock sector. Market is a determinant for poverty eradication in transitioning economies. In low and middle-income countries (LMIC), increase in demand for the livestock sector from 2007-2030 is forecasted to amount to 2.2 and 2.1% for meat and milk respectively (FAO, 2012a, 2012b; Alexandratos and Bruinsma, 2012). Rapid urbanization and income growth trigger higher demand for livestock and more sustainable commodities due to stabilization of total consumption (McDermott et al., 2010; FAO, 2017). The rising recognition of the patrimonial value of livestock is a pathway for local commodities development (Gandini and Villa, 2003). Livestock products are a substantial source of protein, micro minerals and vitamins required for maintaining health. However, animal products are pricey unlike crops, and high consumption of animal source food (ASF) is associated with sustainable growth. The viable Value Chain Development' (VCD) for stock-farmers may foster production efficiency, and stimulate the preservation of breeds and livestock genetic diversity. The sustainability of the Value Chain would enhance efficient rural-urban linkages, accelerate rural poverty eradication and strengthen the resilience of producers to the increase in the average temperature of the Earth. This strategy is in line with numerous objectives of United Nations' Sustainable Development Goals (SDGs), such as SDG1 (No poverty), SDG2 (Zero hunger and food security), SDG8 (Decent work, inclusive and sustainable economic growth), SDG12 (Sustainable consumption and production patterns), and SDG17 (Global partnership to achieve the goal) (FAO, 2019b).

The positive correlation at (P ≤ 0.05) significance level of total hired labor with household income concurs the investment, production and consumption linkages between agriculture and rural non-farm economy throughout the rural economy, and both are complex livelihood strategies for farm families in agrarian societies. The agricultural investment effect of non-farm income streams is particularly important for peasants. Profits from non-farm business enable them to hire labor to undertake timely cultivation practices, and contribute positively to better yields, production input expenditures and technical efficiency (Ellis and Freeman, 2004). In areas where agriculture is the backbone of the economy, when farm households partake in non-farm work, they may invest more in agriculture, which helps to increase productivity and income level of farmers.

Household's economic vulnerability and asset inequalities can be assessed based on annual value of food consumption and expenditures. The fact that households cannot actualize food security and fulfill consumption expenditures from their income is an evidence of financial stress. The coefficient of annual value of household food consumption and expense over the past 12 months are positively associated with household's earnings and this is significant at (P ≤ 0.01). Agriculture as a primary source of income has failed to guarantee adequate livelihood for rural masses and agricultural development policies have largely produced little improvement in Sub-Saharan Africa. About two-thirds of Ethiopian earn less than $2 per day. In the country, poverty is predominantly a rural phenomenon with high dependency rate. In 2016, about 90% of the poor were rural residents, with a share of 80% of the rural population (Bundervoet et al., 2020). Rural income diversification facilitates consumption smoothing, that is, the continuous actualization of the peasants' households' purchased needs. The multi-occupational nature of rural households enables them to supplement on-farm income, thus contributing to household welfare and food security. Participating in rural households' non-agricultural activities enhances consumption expenditure (Akaakohol and Aye, 2014).

The regression estimates showed that crop production negatively affect farmers' income at (P ≤ 0.1) significance level. In many sub-Saharan African countries like Ethiopia, farming is the primary source of income and food production. The sector employs up to 65% of workforce and represents nearly 32% of gross domestic product (GDP). This situation suggests the low yields of the sector that inhibit small-scale producers' pathways out of poverty (Chauvin et al., 2012). The large share of agriculture in GDP is reflected in the limited diversification of Africa's economy (OECD and FAO, 2016). In the continent, labor productivity has increased by a factor of only 1.6 over the last three decades, while it is 2.5 in Asia (NEPAD, 2014). Failures of growth over the long run lead to increasing imports of food commodities, high incidence of hunger and poverty particularly in rural regions. Food price shocks threaten food security of poorest households who are net buyers and who rely on agriculture and related activities. Across sub-Saharan Africa, income inequality restricts food consumption and the emergence of a number of middle to higher income consumers (OECD and FAO, 2016). More than 70% of people in the continent are self-employed and a great majority work in the informal sector with very low returns (Fields, 2019). Poverty and income disparities are high among women

who represent 60 to 80% of the workforce in many sub-Saharan African countries. They are mostly involved in low return, seasonal and part-time activities (FAO, 2015).

They are locked out of agricultural inputs, production technologies, land tenure and are often neglected in accessing agricultural extension services, which set back their attempt to escape out of poverty. Coherent and integrated strategies that foster changes to farm structure and higher rate of productivity growth can prompt rural structural transformation and make the agricultural sector more attractive. Appropriate change in upstream and downstream food sectors has the potential to accelerate the development of non-farm income streams. This will enable peasant producers to accumulate the resources required to switch from small-scale and subsistence farming into large-scale and more commercialized level (OECD and FAO, 2016).

CONCLUSION AND POLICY RECOMMENDATIONS

In developing countries like Ethiopia, rapid population growth, degradation of biodiversity, climatic emergency, remoteness of rural areas, poor infrastructure, inadequate access to production inputs, and lack of mechanization accelerate loss of productive assets, exacerbate spikes in food prices and confine agriculture potential to provide sustainable livelihoods. This situation further handicaps the attainment of the Sustainable Development Goals (SDGs) to eradicate poverty and hunger. Given the heterogeneity in the assets disposition and the roots of poverty, households adopt a number of self-insurance mechanisms to mitigate income fluctuations. The productivity-induced non-farm economy growth can drag other sectors with it, faster economic transformation and job opportunities. Evidence from China positions the power of diversification of income streams as drivers of rural poverty alleviation and consequential food security. Unless coherent inclusive development programs are implemented to support and shape productivity, there is a risk that the slump of agriculture will further engender poverty. Likewise, approaches and strategies that strengthen the human capital and promote the expansion of lucrative labor markets are effective tools to guarantee a shift of people out of agriculture without high poverty rates.

This paper presents evidence and discusses in support of the recommendation that sustainable expansion of non-farm sector may propel economic transformation, hunger and poverty eradication in Ethiopia. Efforts to develop the small-scale and subsistence stature of agriculture into commercial stature and enduing households with skills and infrastructures for modern post-harvest processing to sell value added commodities would be a powerful tool for non-farm business that guarantee sustainable livelihood. In addition, sustainable development policies and programs must promote inclusive growth because fostering exclusively agriculture dominated by farm families further trap marginalized subpopulations into more poverty. In Ethiopia, in the face of stagnant or declining income and productivity, migration of poor peasants into cities in search of better economic opportunities is not an alternative for everyone. Successful implementation of the post-2015 development agenda implies an understanding of different dimensions of poverty and inequality across countries and population groups.

Weak agricultural performance, which affects the livelihood of majority of population is a clarion call on policymakers and governments to promote remunerative non-farm opportunities and attractive rural business. Such diversification strategies are essential for households' well-being during the agricultural off-season, and constitute certain means of economic and social security for more people that are vulnerable. Thus, a range of policy recommendations emerges to support livelihood diversification for nutrition and resilient outcomes.

(1) Bridging gender gaps and empowering women: The predominance of males in the adoption of livelihood strategies choice is a call for government and policy makers to promote gender equality in all development activities. Improving the chances of women to be involved and benefit as much as men from development activities through the integration of the gender approach into policies and development strategies must become a development priority goal. Making education free and compulsory is the cornerstone of any national program to eradicate gender disparities in education and to achieve the goal of universal education. This will allow young mothers to return to school and improve their schooling rate successfully since many women make up a disproportionate share of people in poverty. This is a prerequisite for the full participation of women in social life and the global economy.

(2) Awareness creation on non-farm activities among younger farmers: The negative effect of age on the income diversification into non-farm work suggests creating awareness among younger farmers and strengthening their skill to exploit sustainable economic development opportunities. Youth are the country's greatest asset. Addressing the multi-faceted causes of youth unemployment will help turn a countries' demographic dividend into an economic one. In addition, rural transformation policies, which promote secure profit-making job for rural youth must emphasize on both farm and rural non-farm agricultural business, institutional and infrastructure system development. The expansion of nonagricultural enterprises through the promotion of downstream agriculture and food value chain development in areas with high potential agricultural productivity fosters rural-urban poverty reduction, and food insecurity.

(3) Promotion of access to higher and quality education: The negative influence of literacy status on participation in non-agrarian income generating activities suggests that access to higher education needs to be strengthened. Hence, the government needs to encourage compulsory education for children and improve upon the educational infrastructure by renovating school buildings, empowering existing teaching work force and employing additional qualified ones, and constant monitoring so that all children can enjoy their right to quality education.

(4) Encourage and assist farmers to go into livestock production, processing and value addition as a business: The negative significant role of livestock holding in livelihood security suggests designing and adoption of development policies for animal production via improving veterinary services, marketing, and management of livestock production that aims at improving household livelihood status. Small-scale stock-farmers play key role in food production and, subsequently, in health and landscape management. The connectivity of cattle breeders to market is substantial based on the rising demand, both current and predicted, for animal products. A sustainable value chain is fundamental for viable food system development given the substantial sizeable employment opportunities for farmers aspiring nonagricultural labor activities and may reduce health costs and result in better health outcomes. Shifts in food demand, rural production and agri-support settings are growth patterns and development pathways that induce food security, productivity and income growth. Thus, fostering small-scale producers' connectivity to market is in line with making agricultural and food systems more inclusive and efficient, eradicating rural poverty, hunger and malnutrition.

(5) Promotion of the culture of entrepreneurship: The government needs to promote, vulgarize and emphasize among population the culture of entrepreneurship, including the advantage of being more and efficiently involved in nonagricultural activities since relying on farm activities alone cannot alleviate poverty and ensure food security. Besides, the government needs to liaise with financial institutions to ensure farmers get access to credit facilities at possibly no-interest rates.

(6) Decentralization of markets and transportation networks: The relationship between distances to the nearest major road emphasizes the need for access to better roads and markets. Ease access to connect with urban areas can be a pathway to promote rural enterprises. This will strengthen the supply of competing products, promotes the rural-urban linkages and contribute to a change in rural tastes and penchants towards more urban products. This increases the gain of non-farm activities. The development of e-business can be powerful for economic and job opportunity for rural people in developing countries. In China, the rise of e-commerce has boosted the income of many rural households, protected them against economic shocks, contributed to women's empowerment, stimulated

employment, served as means of bringing young migrant workers back to their home villages to start businesses and to diversify their incomes. Low barriers of entry to e-commerce have brought a number of women into the industry, who benefited from self-reliant source of earnings, and the flexibility of running their businesses from home at their own convenience. E-business has a significant impact on market access because it drives connectivity. Information and communication technologies facilitate interconnection within the value chain, access to reliable information and prices. Policies and interventions should therefore support communication services in rural regions and e-commerce so that small farmers and non-farm workers can produce and deliver their products to market.

(7) Modernization and industrialization of agriculture: This can be done through households' easy access to mechanization, fertilizer, improved seeds, and development of irrigation systems. Compared with rainfed farming, irrigation technologies are essential for sustainable agricultural production, lucrative non-farm business, inputs for food security and rural structural change thus, stable agrarian societies. Rainfed agriculture is often much low output and less security of production particularly in drought-stricken areas. Irrigation services stimulate diversification in cropping patterns and a shift from low-value subsistence production to high-value commercial agriculture. Food security and agriculturally self-sufficiency require the combination of intensification of cropping systems and large-scale irrigation infrastructure. These can be effective measures in mitigating climate-related shocks.

Biodiversity loss and harmful changes in the world's weather destroy resources and particularly limit food production in agropasto state societies. However, if sustainable non-agrarian business activities are promoted, the challenges presented by unstable agriculture will not hinder food security and poverty alleviation. Expanding economic opportunities for poorest people will empower them, improve their living standards and have a strong positive effect on growth. It will further hasten the eradication of hunger and widespread poverty among youths and adults alike. Hence, an imperative change in mode and trends of production and consumption is key to inclusive rural development.

CONFLICT OF INTERESTS

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