
Household participation in livelihood diversification choices and its effects on household income of smallholder farmers in Boloso Sore District of Wolaita zone, Ethiopia

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Received: 18 March 2019; Revised: 02 April 2019; Accepted: 09 October 2019

Abstract

Rural households in many different contexts have been found to diversify their income sources allowing them to spread their risks and to ease consumption. Generating diversified incomes for a majority of the rural poor is an essential component of a successful rural development strategy. This study examined participation in livelihood diversification choice and its effect on household income in Boloso Sore District of Wolaita Zone, Ethiopia. Multistage sampling technique was employed and 270 households were selected for the study. Data analyses were carried out by using descriptive statistics and econometric model. Multinomial logit model was used to identify factors influencing households' participation in livelihood diversification choices while effects on the household income were analysed by using two-limit Tobit model. The result showed that agricultural activities were the most important source of income for rural households in contributing 72% of total household income with the remaining 28% originating from non-agricultural activities. Multinomial logit model output revealed that age of household head, market distance, members in cooperatives determined participation in livelihood choices significantly and negatively while educational level, economically active members at home, sex, training, owning mobile phone had positively determined participation in livelihood choices. Besides, two-limit Tobit result revealed that age, family size and farm size determined level of income diversification significantly and negatively while educational level, economically active members at home, sex, frequency of extension visit and credit access had positively determined level of income diversification. The findings imply that these factors need to be considered by policy makers in the planning of agricultural and non-agricultural initiatives in the study area.

Keywords: Household Revenue, Multinomial Logit Model, Participation Decision, Two-Limit Tobit Model, Wolaita Sodo

Introduction

As the rural economy is diversified to have an independent income earning options by the household and individual livelihood portfolios will help them to sustain their lives (Diao et al., 2006).The agriculture sector in Sub-Saharan Africa (SSA) remains the backbone of national economies, rural and urban livelihoods sustainability, food and income provision for the majority of households (FAO et al., 2015). The vast majority (about 80%) of farming households in SSA are small (World Bank, 2016). However, studies examining agricultural dynamism in Africa reveals that only a small proportion of farms exhibit any dynamism in terms of intensification, extensification or expansion (Dilruba and Roy, 2012). Gebrehiwot and Fekadu (2012) reveals agriculture sector is characterized by decreasing farm sizes, low levels of output per farm, a high degree of subsistence farming, with increases in production being driven mainly by area and not yield growth.

The Ethiopian economy is largely dependent on the agricultural sector. The small-scale farming dominates the agricultural sector and accounts for 95 percent of the total area under crop and more than 90 percent of crop output. About 84% of the citizens depend on various agricultural productions (Fikremarkos, 2012). Even though there are various measures taken by the government to lead the economy to industrialization, the country's economy still relies mainly on agriculture sector. But the sector has a lot of limitations such as a decreasing farm size, low productivity of labour, high soil degradation, farming for survival (subsistence farming), imperfect agricultural markets and poor infrastructure, seasonal and inadequate rainfall and tenure insecurity (EEA, 2009). Furthermore, diversification may also develop as a coping response to the loss of capital assets needed for undertaking conventional on farm production. Decreased availability of arable land, increased producer/consumer ratio, credit delinquency, malnutrition and health problems, have little or no literacy and environmental deterioration can be indeed important drives towards diversification. Specially the government has been formulating and implementing various policy interventions and programs that are in one way or another related to the reduction of rural household livelihoods (Yishak, 2017; Godfray et al., 2010).

In the study area of Wolaita Zone, outside of agriculture, the rural households generate income from non/off-farm wage, trading and remittance from relatives and friends. In this zone, distant migration as a way to maximize income across seasons and cope with food shortage has been a

long history. However, the majority (more than 50%) of the population lives on subsistence margin with little or no land and livestock and dependent on marginal non-farm income sources (i.e., casual labor, petty trade) (Ayana and Ermias, 2019). The very poor are often without working labor, with no assets (i.e., land, livestock) and dependent on income transfers (Yishak, 2017). The speed of labor movement out of agriculture has been slow. Pressure of labor on land resource is still not reduced and hence the small-scale farms with low labor productivity are main features in the study area. Consequently, the rural households adapt the situation by reallocating their scarce resources into diversified non-agricultural economic activities to search additional income and comprehending the driving factors of each livelihood strategy is crucial to improve the response mechanisms related to poverty, food security and livelihoods improvement in the study area (Ayana and Ermias, 2019). However, there are a number of features which make the present study different from the existing empirical studies (Yishak, 2017; Yenesew et al., 2015; Mathewos, 2013; Woldehanna and Oskam, 2001) in that it might fill the gap that exists in terms of livelihood diversification and its effect on household income in an integrated and comprehensive manner are scarce.

Considering the growing importance of non-farm activities, it is worthy of note, that the rural non-farm sector in study area, as it is in other parts of the country, is complex and characterized by diverse activities, whose labour and other resource requirements and returns are in no way homogenous. The findings of the study are also expected to indicate the policy interventions that might improve rural livelihoods to raise incomes and curb widespread poverty. The objectives of this study were to describe the socioeconomic characteristics of the farm households, and analyse the household participation in livelihood diversification choices and its effects on household income among the farm households in the study area.

Research methodology

Description of the study area

The study was conducted at Boloso Sore District, Wolaita Zone; Ethiopia. The area has a bimodal rainfall pattern with two distinct rainy and cropping seasons. The total number of households in the District is 38,935. Among them, 89.87% are men while 10.13% are women. The total population of the District was estimated to be 196,582. Among them, 49.27% were

male and 50.73% were female. The population density of the District is 636 persons per Km². The average household size is 5.1. The total size of the District is 24,286 hectares. Out of the total size of the District, 65.80% is used to grow annual crops, whilst 13.3% is used for perennial crops. The rest of the land is used for grazing and a small portion of land for other communal purposes including basic agro-forestry activities (WZFED, 2016). The mean annual rainfall of the area ranges from 1201 to 1600 mm. The maximum and minimum temperature of the area ranges from 17.6 to 22.5°C. The District is predominantly rural, and its dwellers depend on agriculture. The major economic activity is rain fed farming. Major crops which have grown in the District include cereals, pulses and cash crops like coffee, fruits, and root crops. Wheat and maize are the dominant cereal crops grown. However, the area is known for its low productivity due to land scarcity, land degradation, erratic rainfall and prevalence of pests. As a result, income from non-farm and off-farm activities is the second most important source of livelihood in the Districts (WZFED, 2016). The surveyed indicators shows income source of a household that could categorizes into several sources. Firstly, off-farm self-employment refers income-generating activities as processing goods for sale or providing agricultural services. Secondly, on-farm self-employment refers income-generating activities relevant to crop, livestock production. Thirdly, wage employment refers work for wages relevant to agricultural production and industrial/service sectors. Lastly, two remaining income sources are transfer and other incomes.

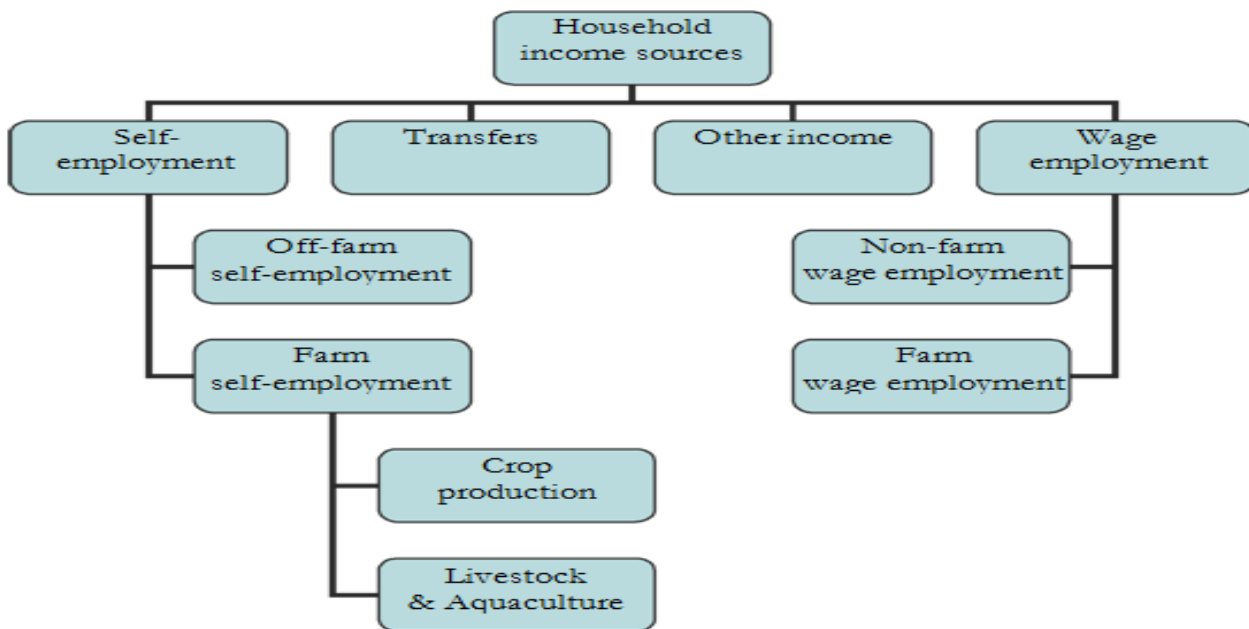


Figure 1. Classification of household income sources (Nghiem, 2010)

Data collection techniques

Data for the study were collected from both primary and secondary sources. Primary data were collected using different instruments: household interview, schedule survey, focus group discussion, field observation, and key informant interviews. Data gathered via those instruments help to realize the study. Information about personal characteristics of the household head and their income diversification were collected through individual interviews. The interview was made using a semi-structured interview schedule. Pre-test was made by distributing interview schedule to eight farmers in each site to assess whether the instruments were appropriate and suited to the study at hand. Necessary adjustments were made based on the comments obtained from pre-test responses from farmers to ensure reliability and validity. Data collectors were trained with respect to the survey techniques and ethical issues. Additional qualitative information, such as changes in income and livelihood diversification and income obtained from different sources and role of local level institutions in the promotion of participating in different income sources were collected through four focus group discussions, eight key informant interviews, and through observation. Four focus group discussions were conducted with 8 to 10 non-sample farmers. Secondary data source included journal articles, research reports and other publications, including internet sources of information.

Sampling techniques

In the study area, farming households are the main source for making day to day decision on farm activities. Thus, households were the basic sampling units. Three-stage sampling techniques were used to generate the required primary data. At the first stage, *Boloso Sore District* was selected purposively because it is one of the food insecure and livelihood choice practicing *Districts* of the zone. In the second stage, out of 29 *villages* within the *Districts*, five *Villages* (*Achra, Wormuma, Tadisa, Dubo, GaraGodo and Dolla*) were selected using simple random sampling technique. From these *Villages*, sample size was determined using simplified formula provided by (Yamane, 1967) and 270 households were determined by employing 94 per cent confident interval and 6 per cent margin errors based on the fact of the high homogeneity of the given population.

$$\text{That is: } n = \frac{N}{1+N(e)^2} = \frac{10,214}{1+10,214(0.06)^2} = 270.$$

A probability proportion to size (PPS) was employed to determine sample size from each *Village* and finally households were selected by using systematic random sampling techniques (Table 1).

Table 1. Sample size of the villages

Name of villages	Total households in the village	Sampled households
Achura	1882	50
Wormuma	1928	51
Tadisa	1852	49
Dubo	1548	41
Dolla	1436	38
Gara Godo	1568	41
Total	10,214	270

Source: WZFED, (2018)

Method of data analysis

The Mean of Income approach was used to estimate the income shares obtained by the farm households in the study area. This approach estimates the shares of incomes at the individual household level (Davis, 2003) by finding the share of each income source in Total Household Income (THI) for each household. The mean share for each income source for all households is then found. The general Mean of Income Shares (MIS) formula is given as:

$$MIS = (\sum_{k=0}^n y / Y) / N \quad (\text{Eq-1})$$

Where i = the income source, Y =Total Income, y = income from particular activity, n = the number of households. Equation (1) is applied in this study as: The sum of Total Household Income (THI) is given as:

$$THI = \sum_{n=1}^{20} Y \quad (\text{Eq-2})$$

Where: THI=Total Household Income, thus income coming from all sources j $j=1, 2, 3, 4, \dots, 20$, farm and Non-farm income.

(a) The mean Share of Farm Income (SFI) is given as:

$$SFI = \sum \left[\frac{\sum CI/TI}{n} + \frac{LI/TI}{n} + \frac{NRI/TI}{n} \right] \quad (\text{Eq-3})$$

(b) The mean Share of Non/Off-farm Income (SNFI) is given as:

$$SNFI = \sum \left[\frac{\sum CI/TI}{n} + \frac{LI/TI}{n} + \frac{NRI/TI}{n} \right] \quad (\text{Eq-4})$$

Where, *SFI*=share of farm income, *SNFI*=share of Non-farm/Off farm income, *THI*=total household income, *CI*=food crop income, *NRI*=natural resource income, *Li*=livestock income, *n*=number of households.

Specification of the participation equation: the Multinomial Logit Model

This model is specified to determine factors affecting household participation decision in livelihood diversification. There are situations where the dependent variable is unordered, for example in the case of categorical response, where there is no ranking or order but are essentially nominal in character. In such a situation, we have to construct a choice model where a set of independent variables determine the kind of occupation that an individual is engaged in. Multinomial logit model is a straightforward extension of the binary logit model. However, it is worth noting that this model suffers from the assumption that the choice probabilities implied by the model must satisfy an independence of irrelevant alternatives (or IIA) property. This means that the ratio of probabilities of any two choices (in response categories) will be the same, regardless of what the other alternatives are. In other words, the ratio of probabilities of any two choices for a particular observation is not influenced systematically by any other alternatives (Wooldridge, 2013). Following Gujarati (2004), the relationship between the explanatory variables and the probability of a particular outcome, when the regressors do not vary over choices, can be specified as follows,

$$P_{ij} = \frac{e^{x_i \beta_j}}{\sum_{j=0}^m e^{x_i \beta_j}} \quad J=1, 2, 3 \dots n \quad (\text{Eq-5})$$

In this model, the choice probabilities are dependent on individual characteristics and the model estimates relative probabilities. Hence, for the i^{th} respondent faced with j choices, we assume that the indirect utility of a choice is superior to other choices. In equation (5), $P_{ij}=0$, if the individual is participating in only farm activity; $P_{ij}=1$, if the individual is participating in non-farm, $P_{ij}=2$, if the individual is participating in off-farm activities and $P_{ij}=3$ if the individual is participating in combination of all activities. Where P is the probability of an employment of the j^{th} choice; j is job category; e is natural logarithm; b is the vector of parameters associated with X_i independent variables to be estimated. The number of parameters to be estimated is equal to the number of individual characteristics multiplied by the number of possible choices minus one. Each of the responses will fall into one of the categories with P_{ij} probabilities.

Estimating the level of income diversification

The Simpson index of Diversity (SDI) is used in this study to estimate the level of income diversification among farm households in the Boloso Sore District of Wolaita Zone, Ethiopia. This reason justifies the choice of the SDI as applied in this study over other measures of diversification index.

Model specification

To answer second research question, we propose the data analysis procedure as below: The general structure of the regression equations is expressed in a simple form by

$$D_i = b_i + Xc_i + U_i. \text{ (Eq-6)}$$

Where, D_i represents the income diversification, Simpson index (SDI), X represents a vector of diversified households affecting factors, U_i stands for unobserved factors, b and c are the parameters to be estimated. With a view to assess the degree of diversification in the level of income, the SDI is constructed as: first, we calculate income diversification the Simpson index (SDI) is constructed as:

$$D_i = \text{SDI} = 1 - \text{SDI} = 1 - \sum_j^i P^2 \quad \text{(Eq-7)}$$

Where, p is proportion of each income source on total household income. Income diversification index is built basing on data are extracted from different sources of income diversification. Second, the study employed by identifying appropriate variables representatives for detecting

determinants of income diversification of rural household. Because these variables are representatives for rural household's resources, they probably influence on household's income diversification. Other variables are used based on experiences, drawn from theories and empirical studies. Step three was used to apply two-limit Tobit model to analyse the determinants of income diversification. Since SDI cannot be below zero or above one, a double censored regression model, in particular a two-limit Tobit model was used to analyse the determinants of income diversification. For simplicity, indices for the i^{th} household and the j^{th} SID of each household in the sample are not included in the equation,

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_{17} x_{17} + U \dots \dots \dots (Eq - 8)$$

Denoting Y_i as the observed variable

$$Y_i = y_i^* \text{ if } 0 < y_i^* < 1$$

$$\left\{ \begin{array}{l} 1 \quad \text{if } y_i^* \geq 1 \\ 0 \quad \text{if } y_i^* \leq 0 \end{array} \right.$$

Here, X_i denotes independent variables that have a bearing on time allocation. Y^* is a latent variable indicating desired SDI while Y is the observed SID. The relationship between the observed and latent variable is provided above and u is an error term which is assumed to follow a standard normal distribution. Since Tobit model is used, a decomposition approach suggested by McDonald and Mofitt (1980) may be used to obtain the marginal effects of the independent variables on the outcome. That is, a change in an independent variable has two effects: i) it affects the conditional mean of Y^* in the part of the distribution between 0 and 1; and ii) it affects the probability that the observation will fall in that part of the distribution.

The distribution of dependent variable in equation above is not normal distribution because its value varies between 0 and 1. The ordinary least square (OLS) estimation will give biased estimates (McDonald and Mofitt, 1980). Therefore, the alternative approach is using the maximum likelihood estimation which can yield the consistent estimates for unknown

parameters vector. Because the dependent variable will be used to measure the level of income diversification, the variables with a negative (positive) coefficient will have a positive (negative) effect on income diversification levels. Accordingly, the likelihood function of this model is shown below:

$$L_{\beta, \sigma / y_i, X_j, L_{1j}, L_{2j}} = \prod \phi \left[\frac{L_{1j} - \beta X_j}{\delta} \right] \prod \frac{1}{\sigma} \phi \left[\frac{y_i - \beta X_i}{\sigma} \right] \prod 1 - \phi \left[\frac{L_{2j} - \beta X_i}{\sigma} \right] \dots \dots \dots (Eq - 9)$$

Where $L_{1j} = 0$ (lower limit) and $L_{2j} = 1$ (upper limit) where $(.) \phi$ and $(.) \varphi$ are normal and standard density functions. In practice, since the log function is monotonically increasing function, it is simpler to work with log of likelihood function rather than likelihood function and the maximum values of these two functions are the same (9). To identify the marginal effect yields, Belasco (2007) used the proportion of uncensored variables of mortality losses and average daily gain. Tekle and Berhanu (2016) also used technical efficiency of Micro and Small Enterprises in the Wolaita Zone, Ethiopia. Apart from the estimated coefficients, the marginal effects of the probability of income diversification were calculated by multiplying the estimated coefficients by predicted value of uncensored observation which was calculated from Tobit model. This meant that it was similar to estimated coefficients multiplied by scaling factor or the proportion of uncensored observations. The important point here was that variables influencing the probability of a non-zero value need to increase or decrease the conditional mean of the values in two limit Tobit model in the same way.

Table 2. Model specification for participation in livelihood choice and detecting effect of diversification on household income

Variables	Description and measurements	Sign
Independent		
AGE	Continuous, age of household head (in years)	-
FSIZE	Continuous, family size in households (in numbers)	-
EDUC	Continuous, household heads education level (in average schooling years)	+
TCOST	Continuous, total cost for treatment spent by household head in 2018 (in dollar)	+
FARSIZ	Continuous, total farm size of household (in hectare)	+
TLU	Continuous, total livestock owned by the farm household (in TLU)	+
DMARK	Continuous, distance to market(in Km)	+
EACTIVE	Continuous, economically active members in the family(in numbers)	+
FEXT	Continuous, number of frequency extension agent visited farmers (in frequency)	+
MPHON	Dummy, having mobile phone (1=if yes; 0= otherwise)	+
ACSCR	Dummy, having access to credit (1=if yes; 0= otherwise)	+
SAVE	Dummy, household has savings account (1=yes, 0=otherwise)	+
MCOOP	Dummy, membership in Cooperatives(1=if yes; 0= otherwise)	+
SEX	Dummy, Sex of household head (1=male, 0=female)	+
TRAIN	Dummy, agricultural training (1= if yes; =0, otherwise)	+
ACSINP	Dummy, access to agricultural inputs (= 1, if yes; =0, otherwise)	+
HHAB	Continuous, household asset building(monetary values in dollar)	+

Source: From different literature and personal observation (2018). 1US dollar= 28.27 birr

Results and Discussion

Descriptive statistics

Mean share of farm and non-farm income in total household income

Share of Farm Income (SFI): In this category, crops income share had (40.41%) of the total household income and livestock share had (31.59%) of the total household income. The total on

farm income share represents (72%) of total Household Income. The results indicate the importance of farming and its related activities to the economy of the study area.

Share of Non /off-farm Income (SNFI): The household survey shows the major sources of non/off-farm activities which the farmers engaged in to diversify their income. According to the figures indicated in the table 3, Non-farm income (20.07%) share consists of handicraft, petty trade, remittance, sale of local drink and rent of pack animal share accounts for 10.07%, 4.7%, and 3%, 1.9% and 0.4% respectively and off- farm income (7.93%) share consists of daily laborer, wage labor, fire wood and grass sale share accounts for 5.2%, 2.1% and 0.63% respectively. In total, the Share of Non-farm and off farm income in total household income was found to be 28%, lower than the share of income generated from the farm sector by farm households. This finding on the shares of income coming from farm and Non/Off-farm source is in line with the findings of Yisak (2017) who found larger shares of farm income of 78.1% and 21.9% coming from the Non/Off-farm sector of farm households in Wolaita Zone, Ethiopia. This is also consistent with national estimate of the country, where more than 80% of the population is engaged in agriculture (CSA, 2010). The results reveals that the farm sector continues to be vital to farm households in the study area, since a major portion of their income is derived from activities in the sector (Table 3).

Table 3. Major off-farm/on- farm activities and their contribution

Activities	Contribution (%)
Handicraft	10.07
Petty trade	4.7
Sale of drinks	1.9
Rent pack animals	0.4
Remittance	3
Daily laborer	5.2
Wage labor	2.1
Sales of grass and trees	0.63

Source: Own computation, 2018

Empirical findings

Household participation in livelihoods diversification choice and its effect on household income in the study area

The dependent variable in the multinomial logit model was defined as agriculture, off-farming and non-farming. Choosing for comparison purposes thus allowed asking whether the other occupational categories could be regarded as systematically different in any way.

Firstly, the result indicates that among 17 hypothesized explanatory variables, four, five and eight variables were found to positively or negatively influence choice of farm + non-farm, farm + off-farm and combination of all, respectively. The multinomial logit model's result indicates that Age (AGE), sex (SEX), education level of household (EDUC), livestock ownership (TLU), economically active members (EACTIVE), distance to the market (DMARK), mobile phone ownership (MPHON), members in cooperatives (MCOOP) and training (TRAIN) were determining farmers choice of livelihood strategies. It has to be noted that the multinomial logit estimates are reported for three of the four categories of livelihood strategies choice. The first, alternative (i.e. selecting farming only) was used as a benchmark alternative against which the choice of the other three alternatives was seen (Table 4).

Secondly, empirical estimates of two limit Tobit model was presented in table 5 below. The overall goodness of fit for the model parameter estimates was assessed based on several criteria. First, it was found that the correlations between the dependent and independent equations was significantly different from zero the ($\rho \neq 0$), which confirmed that the application of two limit Tobit model was valid and it was statistically a true stochastic specification. The distributions are independent if and only if $\rho = 0$. The relationship between the dependent and independent equations can be estimated consistently with the Tobit method. All independent variables presented in model specification (Table 5) are included in the model, regardless multicollinearity issue among independent variables. Multicollinearity indicator- VIF ranged from 1.18 to 1.79 and Tolerance index ranged from 0.795 to 0.689. As a result, it suggested that regression coefficients did not suffer from Multicollinearity among the independent variables. The "general to specific" estimation strategy is employed to treat the estimates of the model. The Tobit model result indicates that Age (AGE), family size (FSIZE), education level of household (EDUC), frequency in extension contact (FEXT), economically active members (EACTIVE), access to credit (ACSCR), mobile phone ownership (MPHON) and farm size (FARSIZ) were determining level

of household income diversification (Table 5). The plausible implication and marginal effects of the significant explanatory variables on the choice of households' livelihood decision and its effect on income level of households are presented as follows:

Age (AGE): As expected, the age of household head influenced by negatively and significantly the participation decision of farm + non-farm, farm+ off farm and mixed all together activities at less than 1% probability level. It also negatively influenced the level of household income diversification at less than 10% per cent probability level. This implies that supply of labor to sole and combined non/off-farm activities was higher for younger households than older households. Hence, younger households rely on non/off-farm employment to support their livelihoods while the older ones concentrate on farming instead of opting for engagement in non/off farm work. Existence of entry barriers and lack of a priori exposure might be the push factors for the elderly, while shortage of arable land and ability to meet graduation requirements are the pull factors, for the rural youth. This is a common phenomenon reported in many studies across the developing world; for instance, Sosina et al. (2010) for Ethiopia. A one year increase in age would decrease the probability of involvement in non-farming, off-farming and mixing three together jobs by 4.7%, 3% and 6% respectively and the household diversified level of income decreased by 8.9% while keeping others variables constant (Table 4 and 5).

Sex (SEX): Sex of household head became a significant and positive determinant of participation decision in non-farm, off-farm and mixed of all activities at 1, 5 and 1% probability level respectively and it also affected level of household income at less than 1% probability level. It implies that the male headed households were able to participate in non/off-farm employment activities compared to female headed households. Perhaps this may be because in Ethiopia and other developing country mostly female's spent more of their time on domestic tasks such as cooking, fetching water, firewood collection, cleaning, child care etc. Opposite to this, male household heads have more tendency of engaging in different activities and then this improves their income. As observed in study area there is traditional culture lead gender disparity which creates female-headed households to have less chance to participate in nonfarm/ off-farm activities. Other things keep constant, the likelihood of a household diversifying non-farm, off-farm and all mixed activities together increased by a unit household participation decision enhanced by 8.9%, 5.4% and 0.5% respectively when household head become male. One unit

increment in dependent variable it would also increase the level of income diversification by 4.18% (Table 4 and 5). This result is consonant with the finding of Amare and Belaineh (2013). Economically active members (EACTIVE): The presence of large number of economically active members in the household had a positively significant effect on participation in Farm +non-farm, Farm+ off-farm and mixed of all the three forms of activities at less than 5%, 1% and 1% probability level. It also affected level of household income at less than 1% per cent probability level. A possible explanation is that households with abundant economically active and working age members could participate in non/off-farm employment activities with a view to generate more income by absorbing the available extra labor force from the farm work. Other things keep constant; marginal effect shows a one member increase in household would increase the likelihood of a household diversification decision for non-farm, off-farm and all mixed activities together increased by 26%, 15% and 28% respectively when household head become male. It also increases the level of household income by 4.18% (Table 4 and 5). This result is consonant with the finding of Amare and Belaineh (2013) and Yishak (2017).

Educational level (EDUC): Educational level of household head is found to have a significant and negative effect on participation choice of Farm +non-farm, Farm +off-farm and mixed of all the three forms of activities at less than 1% probability level. It also affected the level of household income diversification at less than 1% per cent probability level. This is due to most probably educated person gain better skill, experience, knowledge and this again help them to engage in diversified livelihood strategies. Literate individuals are very ambitious to get information and use it. And it also determines the capability of finding a job. From the model result, the marginal effect reveals that likelihood of a household diversifying nonfarm, off-farm and combination of all activities increase by 9.7%, 25% and 12%, respectively, for those farmers with one more level of education. In other words, adding one grade education can increase the chance of choosing non-farm and off-farm activities by aforementioned percent. It also marginal effect indicated that a unit change in education would increase the level of household diversified income by about 5.8% (Table 4 and 5). This is also confirmed by the study of Ersado (2003) and Yishak (2017).

Distance to the market (DMARK): Distance to the main market centre appears to determine participation decision of farming +off-farm and mixed all activities significantly and negatively at 5% probability level. The possible reasons for obtained results might be farmers residing at far

distant locations from market centres are less likely to participate in off/non-farm activities. Besides, the households living in area with better roadway can obtain higher likelihood of participating off-farm activities. Improved infrastructure, especially roads to district centres probably opens the chance of increasing off-farm activities for people. The marginal effect indicates that as a market distance increases by one kilometre would decrease the probability of farm off and combination of all diversification activities by 5% and 8% respectively, other things being constant (Table 4). This result is in agreement with the finding of Ersado (2003).

Livestock holding (TLU): The multinomial logistic regression analysis result shows that the livestock holding significantly and positively influence participation decision on off/ + farm and all mixed activities at less than 5% probability level. Households with more livestock holding do have the capacity to participate in lucrative non/off-farm employment activities, putting them in a better position than those households with no or small size livestock holding. More number of livestock ownership, particularly oxen, provides an opportunity for increased crop production and better capacity to generate capital needed for non/off-farm activity participation and thereby increased total household income. Livestock wealth is a key asset of rural livelihood in the districts like Boloso Sore because livestock, particularly oxen, serve as means of draught power, source of capital and serve as prestige. Hence the policy environment shall aim at supporting the livestock subsector development, in this study area. Other things held constant, the marginal effect shows that, as a number livestock increase by one TLU, the marginal effect in favour of appears to increase participation decision into farming +off-farm and mixed all activities by 16% and 25% respectively (Table 4). This result is in agreement with the finding of Amare and Belaineh (2013) and Yishak (2017).

Farm size (FARSIZ): It was found that farm size had negatively and significantly influence the probability of household engaged in income diversification at less than 1% probability level. As the estimated result shows in study area the size of the land has negative relationship with the share of time spent on non-farm/off-farm activity and share of non-farm income because as land holding decreases the probability that the household to engage in non-farm/off-farm activity increases. Besides, declining land sizes under population pressure may encourage rural households to diversify their sources of income. From the qualitative response of households in the study area, households who earn much more income from agriculture want to invest their

income in off-farm activities within and outside their district. As we have discussed earlier, households who earn more of their income from agriculture have excess income to invest in other activities. The marginal effect indicates that as the farm size decrease by one hectare would increase the probability of engagement in income diversification by 35.9 per cent while keeping all others variables constant. The survey result implies that after a certain level of income farmers want to establish an additional source of income to improve their livelihood. That means that we can't say any household who generate more of his/her income from agriculture can diversify; rather those households who can generate agricultural income which is higher than their subsistence, could diversify their income (Table 5). The result is consonant with the finding of Amare and Belaineh (2013) and Yishak (2017).

Mobile Phone: It was found that mobile phone had positively and significantly affects the probability of household engaged in income diversification at less than 1% probability level. It also determines participation decision of farming +off-farm/non-farm activities significantly and positively at 1% probability level. Having mobile phone is expected to positively effect on income diversification because it means better communication and information as well as improvement of individual mobility. The marginal effect indicated that as a change in the usage of mobile phone by one unit would increase the probability of engagement in level of income diversification by 3.56 per cent other variables kept constant (Table 4 and 5). This result is consonant with the finding of Ersado (2003).

Family Size (FSIZE): with regard to the household labor resources result shows that household size was found to have positive and significant effect on income diversification at 5% probability level. The positive relationship indicates that as the number of working age family members' increases, the probability of the household to earn non/off-farm self-employment income also increases. This could mean that households with large economically active labour force were able to participate in different self-employment activities and earn more income compared to households with small number of working labour force. Holding other variables constant, an extra member increase of the household would increase the share of non-farm/off-farm level of income by 5.75 percentage point (Table 5). This result is consonant with the finding of Walle and Cratty (2004).

Table 4. Multinomial logit model results

Variable	Farm +non-farm			Farm +off-farm			Mixed All		
	Coeff	t-value	Marg	Coeff	t-value	Marg	Coeff	t-value	Marg
AGE	-0.248	-3.12***	-0.047	-0.07	-0.89	-0.03	-0.75	0.79	0.06
FSIZE	0.40	0.76	0.032	0.005	0.18	0.004	0.71	1.24	0.009
EDUC	2.48	2.76***	0.097	0.01	2.26***	0.25	2.51	2.56***	0.12
TCOST	-0.072	-0.91	-0.006	-0.02	-0.13	-0.002	-0.08	-0.21	-0.007
FARSIZ	3.55	0.74	0.36	2.73	0.61	0.23	0.50	0.89	0.38
TLU	1.67	1.52	0.101	0.58	2.28**	0.16	1.57	2.45**	0.29
DMARK	-0.84	-1.73	-0.096	-1.26	-2.05**	-0.05	-1.07	-2.79***	0.08
EACTIVE	3.30	2.45**	0.26	2.02	2.85***	0.15	0.045	3.20***	0.28
FEXT	0.016	0.92	0.043	0.04	1.25	0.002	0.003	1.64	0.009
MPHON	0.012	1.12	0.008	1.32	1.53	0.006	0.022	2.98***	0.034
ACSCR	-0.13	-0.98	-0.087	-0.14	-0.97	-0.04	-0.08	-0.95	-0.012
SAVE	-0.45	-0.88	-0.002	-0.98	-0.76	-0.21	-0.98	-0.05	-0.051
MCOOP	-0.32	-0.52	-0.042	-0.68	-1.27	-0.03	-1.98	-2.38**	-0.053
SEX	5.82	3.37***	0.089	3.24	2.24**	0.054	3.76	2.89***	0.005
TRAIN	-0.18	-0.89	0.21	-0.79	1.28	0.031	-1.88	-2.43**	0.13
ACSINP	0.15	0.10	0.023	0.07	1.52	0.001	1.12	1.63	0.012
HHAB	-0.27	-1.54	0.007	-0.60	1.32	0.002	0.21	1.67	0.07
No. of obs.	270								
Log likelihood	-								
	189.589								
LR chi2(57)	202.13								
Prob> chi ²	0.0000								
Pseudo R ²	0.385								

*, **and *** indicate significant at less than 10, 5 and 1% probability levels, respectively.

Source: Field survey data, 2018

Access to Credit (ACSCR): The positive association between access to credit and income in this study is statistically significant at the 1 percent probability level. It is expected that those who have access to either formal or informal credit have a higher probability to diversify their income than those who do not have access. Households that have access to credit have the ability to

invest not only in agricultural production but in other income generating activities as well. The marginal effect indicated that as a change in the access of credit by one unit would increase the probability of engagement in level of income diversification by 10.15 per cent other variables kept constant (Table 5). This result is in agreement with the finding of Ersado (2003).

Table 5. Model results for effects on income diversification

Variables	Coefficient	P-Values	Marginal Effect
AGE	-.0379	0.087*	-.089
FSIZE	.035	0.054*	.0575
EDUC	.2551	0.000***	.0586
TCOST	0.000437	0.2017	0.0076
FARSIZ	-1.6520	0.010***	-.3597
TLU	.1418	0.736	.0206
DMARK	-.0248	-0.558	-.0047
EACTVE	0.024775	0.0000 ***	0.04
FEXT	0.061014	0.0000***	0.032
MPHON	0.02229	0.0003***	0.0345
ACSCR	.4922	0.000***	.10152
SAVE	0.232	0.77	0.004
MCOOP	.2263	0.602	.0557
SEX	0.125	0.000***	0.0418
TRAIN	.1907	0.698	.02013
ACSINP	.4064	0.420	.08349
HHAB	.7515	0.13	.1721

Dependent Variable: SDI
 Sample size: 270
 Log likelihood = 198.82
 LR χ^2 (17)= 145.79
 Prob(χ^2)>F=0.0000

*** p<0.01, ** p<0.05, * p<0.1; Source: Computed from 2018 survey data

Lastly, all the correlation coefficients of error terms between pairs of livelihood choice categories are negative indicating that the choice of one livelihood category decreases the likelihood of choosing another category. The effect is more prominent between farm activity and off/non-agricultural livelihood, which is expected, implying that households engaged in agricultural livelihood are less likely to choose off/non-employment which, in turn, provides substantially lower level of income.

Conclusion and policy implications

The study attempts to examine the determinants of household income diversification and its effect on household income. The results from multinomial logit model reveals household age, market distance, members in cooperatives, participation in livelihood choices significantly and negatively affected while educational level, economically active members at home, sex, training, owning mobile phone had positively and significantly determined participation in livelihood choices. Household age, family size and farm size determined level of income diversification significantly and negatively while educational level, economically active members at home, sex, frequency of extension visit and credit access had positively and significantly determined level of income diversification.

Policy implications drawn from the research have stated below:

Human capital in both quantity and quality dimensions plays a substantial role in encouraging rural households to diversify their income-created activities. Rural households with higher education level have more diversification ability and tend to be more diversified in their income source. Hence, education and training in diversification of livelihood strategies has to be given attention in promoting farmers' education. The education should be strengthening and establishing through both formal and informal type of education at farmers' training centres, technical and vocational schools.

Removing the bottlenecks associated with credit access should be considered. Advancing loans to farmers through microfinance institutions, saving and credit cooperatives, and other banks would have positive impact on participation on livelihood choices and enhance household income. In addition, banks (government and private owned) should come forward to advance low interest rate loans to the farmers.

The contributions of livestock ownership in livelihood security suggests to design development strategy for livestock sector through improving livestock cross breeds, veterinary services, forage development, marketing, access to credit and overall management of livestock production that aimed at improving rural household food security status.

Furthermore, targeted interventions are needed to enable female-headed households to participate in any of the three livelihood categories. Targeted interventions to improve education vis-à-vis skills of female-headed households would enable them to take up non-agricultural livelihoods which are more financially rewarding.

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