

Determinants of Income Diversification among Rural Farm Households: The Case of Leemo District, Hadiya Zone, South Nation Nationalities People Region, Ethiopia

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Abstract: *This study was attempted on identifying and analyzing the determinants of income diversification and main income diversification sources among rural households in Leemo District, Hadiya Zone of South Nation Nationality Regional State using primary data. Structured questionnaires administered through personal interviews. Both descriptive statistics and econometric methods were used to analyse the data. Out of the total sampled households income, 57.84 % of their income obtained from farming activities, while 42.16% of their income earned from off-farm activities. In this study we identified that rural farm household's income was basically categorized into two, viz. farm and non-farm income. Farm income sources constitutes: crop, livestock, other farm income source while nonfarm income constitutes agricultural wage, off-farm employment, nonfarm wage, self employed income sources and remittance (transfer payment). The simplest measure of income diversity was the average number of income sources (of the eight listed here) that households had. It was observed that rural households in the study area had an average of two sources of income. In Multiple regression model out of eleven explanatory variables included in the model, sex of household head, education level of household head, farm size, farm income and distance to market center were found significant in number of income diversification sources. While analysis of determinants of income diversification was done by logit regression model, in which probability of households' participation in off-farm activities were used as dependent variable. In this case years of schooling of household head, farm income, landholding size/farm size, member ship in farmers cooperative and distance to the market center were found significant. Overall the result of this study suggests those stakeholders and concerned bodies who focus on promotion, encouragement and expansion of income diversification is expected to enhance educational level of household, to provide aids and subsidized inputs to improve agriculture which in turn increases farm income, to develop rural infrastructure, to create off-farm job opportunity and to take into consideration dwindling landholding size of households.*

Keywords: Determinants, Income diversification, off-farm, farm, Logit, Leemo district

1. Introduction

1.1 Background and Justification

Rural households in many different contexts have been found to diversify their income sources, allowing them to spread risk and smoothen consumption over the year (Awoniye and Salman, 2008). According to Davis *et al.*, (2010), one of the most established characteristics of rural households in developing countries is that they obtain their incomes from many different sources. Household income diversification is the norm in rural societies, and specialization in a single activity is the exception (Dimova and Sen, 2010). It is argued that diversification smoothes the flow of household income, by diversifying risks. Thus, diversification of income sources is expected to generate higher income (Demissie, 2003). As Ellis (1998) and Maitra (2001) states, this is often necessary in agriculture based peasant economies because of numerous risks such as variability in soil quality, crop diseases, price shocks, unpredictable rainfall and other weather related events which lead to low income and continually trap them in a vicious cycle of poverty.

Agriculture remains the main source of income for the majority of the rural population of developing countries. Nevertheless, a large proportion of rural households modify

their economic activities in a variety of ways under different conditions. According to Ellis (2000), diversification of income sources, assets, and occupations is the norm for individuals or households in different economies, but for different reasons. He divided the reasons for diversification of livelihoods between necessity and choice reasons. Necessity refers to push or distress reasons that enforce households to diversity such as eviction from own land, natural or manmade and environmental deterioration. Among the push factors, household income diversification could be due to "risk reduction, response to diminishing factor returns in any given use, such as family labour supply in the presence of land constraints driven by population pressure and fragmented landholdings, reaction to crisis and liquidity constraints, high transactions costs that induce households to self-provision in several goods and services, etc" (Barrett *et al.*, 2000a). Choice by contrast refers to pull reasons which attract households to diversity such as searching or seasonal employment opportunity, educating children to improve their future prospect of obtaining non-farm jobs. Pull factors could include the "realization of strategic complementarities between activities such as crop-livestock integration" or "local engines of growth such as commercial agriculture or proximity to an urban area (that) create opportunities for income diversification in productivity and expenditure-linkage activities".

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Therefore, one set of causes of household income diversification see the latter as a matter of necessity and survival, where diversification is born out of desperation, and driven primarily by the household's poverty status (Ellis, 1998). The other set of causes of household income diversification see the latter "as a matter of choice and opportunity, involving proactive household strategies for improving living standards".

Diversification, therefore refers to the patterns individuals' voluntary exchange of assets and their allocation of assets across various activities (on- and off-farm) so as to achieve an optimal balance between expected returns and risk exposure conditional on the constraints they face. As Warren (2002), observed that rural income has generally occurred as a result of an increased importance of off-farm wage (labour in household) income portfolio or through the development of new forms of nonfarm/ non-site production of non-conventional marketable commodities. In both cases, diversification ranges from a temporary change of household income portfolio (occasional diversification) to a deliberate attempt to optimize household capacity to take advantage of ever-changing opportunities and cope with unexpected constraints (strategic diversification).

The impact of income diversification on the household economy is a widely debated issue and there are differing points of view (Karttunen, 2009). Dunn (1997) outlines four possible motivations for income diversification, which is one of the risk management strategies. These motivations include poverty, risk reduction, expansion and intergenerational lurching motivations. Households engage in several distinct income generating activities to smooth their income, consumption, labor allocation, and to cope with shocks and to solve liquidity constraints.

In recent years, there is an increasing recognition of the importance of income diversification for rural household in our country, Ethiopia. Considering the dominance of the agrarian economy, ADLI (Agricultural Development Led Industrialization), the government's principal strategy for sustainable economic growth, focuses on the development of the rural sector. An important aspect of ADLI is to promote the rural non-farm sector and enable it to interact with agriculture. The main view of ADLI is that agricultural growth, based on technological advancement, leads to indirect growth in non-farm incomes and employment through processing, marketing and transporting services (Demissie, 2003). Therefore, diversification to non-farm activities is often seen as an opportunity to supplement or substitute farm income, or as an option for those not able or willing to earn their living from farm sources.

The findings of Karttunen (2009) suggest that a two-fold purpose of non-farm activities: for the poorest it is a means of survival and for the wealthier it is a deliberate investment in anticipation of better returns. Diversification smoothen the flow of income of households by combining activities which give returns at different time and by diversifying portfolio of economic activities that are not perfectly covariate (Valdivia *et al.*, 1996). Hence, the theory suggests that households, in order to reduce the overall level of risk of their portfolios, should undertake international portfolio diversification.

According to Murdoch (1995), households that engaged in different activities collect their income and wealth from diverse sources and assets. As income smoothening mechanism, income diversification plays a significant role in smoothening consumptions when markets for full consumption insurance are absent. This study will contribute to the understanding determinants of income diversification among rural farm households in Leemo district. Moreover, it will provide significant information for concerning bodies such as government, policy makers, and other institutions working to enhance living standards and alleviating misery life. However different studies had been done in different areas of the world it seems to exist shortage of empirical studies on the determinants of income diversification among farm households in Leemo district in Hadiya Zone, Ethiopia.

1.2 Significances of the Study

The results of this study enhance, hopefully, our knowledge of income diversification strategies that rural households pursue to ensure income security and to smooth consumption. This study is expected to give a better insight in this regard. Given the key role income diversification can play in stabilizing incomes and alleviating rural poverty, governments in developing countries have become increasingly interested in promoting increased output diversification (Woldenhanna and Oskam, 2001). The findings from these studies were appearing mixed, warranting further empirical investigation to shed more light on the forces driving income diversification in the area.

Moreover, results of this study are expected to help policy makers in formulating effective policies aimed at alleviating rural poverty and achieving rural development by providing information on the linkage between asset endowments, diversified activities and income generated at the rural household level. The expected beneficiary of the output of this study includes the District, Hadiya Zone, researchers, practitioners, and policy makers so and so.

1.3 Objectives of the Study

1.3.1 General Objective

The general objective of this study was to identify and analyze the determinants of income diversification among rural farming households and their participation in nonfarm activities in Leemo District (LD), Hadiya Zone.

1.3.2 Specific Objectives of the Study

The study was tried to achieve the following specific objectives:

- To examine the socio-economic characteristics of respondents in Leemo District;
- To identify the possible rural farming households main income diversification sources;
- To identify determinants of income diversification sources (actual number) among rural farm households and
- To identify determinants of households (HHs) probability to participate in non-farm activities in the study area.

1.4 Research Questions

The following Basic research questions were formulated:

- 1) What are the socio economic features of the respondents?
- 2) What are the income activities of rural households?
- 3) Does income diversification differ between poor and better-off households?
- 4) Which factors determine number of income diversification sources?
- 5) Which factors influence the households' probability to participate in nonfarm activities?

2. Research Methodology

2.1 Description of the study area

2.1.1 Location of the area

The study was conducted in Leemo District (LD), which is one of the districts in Hadiya Zone, Southern Nations,

Nationalities and peoples' Regional State (SNNPRS). The district encompasses 36 kebele Administrations which are found in two different agro-ecological zones. Its geographical location is between $7^{\circ}22'$ and $7^{\circ}45'N$ and $37^{\circ}40'$ and $38^{\circ}E$. The altitude of the area ranges between 1900-2750m.a.s.l. The Administrative office of Leemo district is found in the capital town of Hadiya Zone in Hossana. Hossana is 230km far from the capital city of Ethiopia, Addis Ababa on the south-west and 160km from the regional city, Hawassa in the West (CSA,2007).

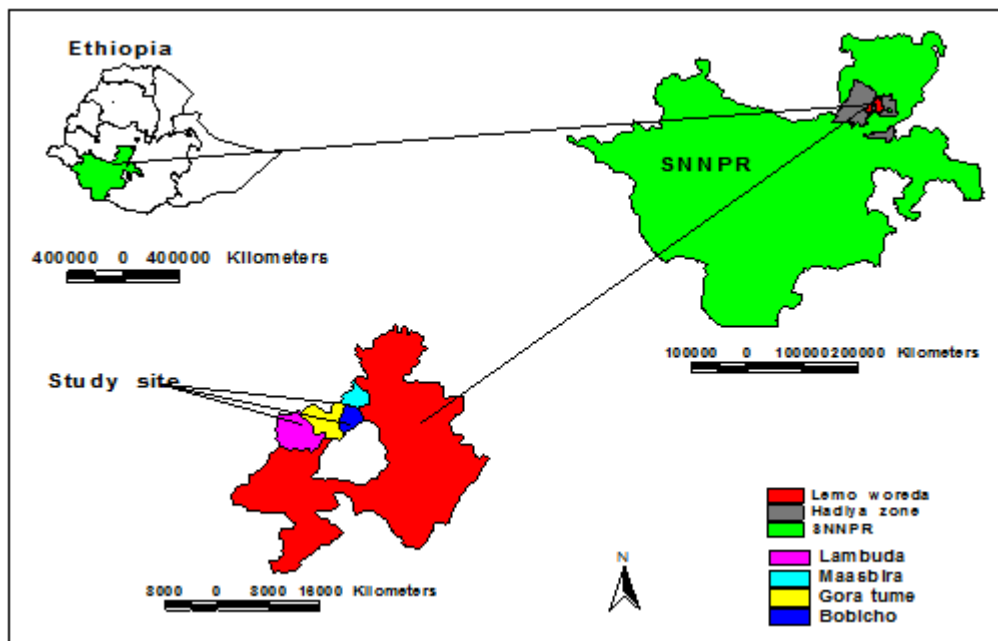


Figure 3: Map of study area
Source: adapted from (LDADO, 2011)

2.2 Sampling Techniques and Sample Size

2.2.1 Site Selection

Leemo District (LD) is selected purposively because it represents a rural settlement where farming is the primary occupation, geographically proxy to the administrative town of Hadiya Zone and suitable market infrastructure. Proportionally farming households were selected from four Kebeles (Gora Tume and Bobicho from Weyinadega" (Mid-land) while Lambuda and Maasbira from a little bit with Dega" (Highland) agro-climatic zones totaling 148 respondents.

2.2.2 Sample Size Determination

Numerous rules-of-thumb have been suggested for determining the minimum number of subjects required to conduct multiple regression analyses. These rules-of-thumb are evaluated by comparing their results against those based on power analyses for tests of hypotheses of multiple and partial correlations (Green, 1991). Accordingly, in this study sample size selection was based on the rule of thumb $N \geq 50 + 8m$, where, N , is sample size and m is the number

of explanatory variables (X_i) where $i=1, 2, \dots, 12$. Based on this rule the researcher had taken a total sample of 148 [$50 + (12 \times 8)$] respondents from the selected kebeles of Leemo district.

For this purpose five key informants were selected in each kebele with the help of kebeles leaders and developmental agents (DAs). Since, most of households (HHs) in the study area are farmers. As a result, households were selected randomly. Lists of all farmers in each kebele were obtained with the help of DAs and the respective kebeles officers.

2.3 Data

2.3.1 Types and Source of Data

Both primary and secondary data were collected for the study. Primary data which includes both qualitative and quantitative on household socio economic characteristics and any necessary data were obtained through a survey of 148 farming households (HHs) in Leemo District (LD), Hadiya Zone. The main instrument of data collection was

well-structured questionnaires administered to mainly farming households in the study area.

Secondary data were gathered from various sources like Agricultural Development Offices of Leemo District (LD), Zone Bureau of Agriculture and Rural Development Office annual report, Books, from different publications, articles, Journals and the like.

2.3.2 Method of Data Collection

Before actual data collection under taken, a pre-testing questionnaire was conducted in order to revise and adjust those questionnaires that couldn't provide the required answers. Next to that, the required data was collected through farm household survey using revised structured questionnaire. The interview was conduct by four enumerators who were train on the subject matter of the questionnaire and the survey was carried out from January to February 2013.

Due to the limited period of time for the study, the key informants were used to quickly generate new information through interactive learning, knowledge sharing and assurance of high-level local people's participation in research. This involved relaxed relationship, open dialogue, brainstorming and mutual sharing of knowledge, skills and experiences.

2.3.3 Data Analysis Techniques

2.3.3.1 Descriptive analysis

Both descriptive and econometric analyses were used to interpret the data obtained from household survey of the study. In descriptive statistics tables, means, frequencies and percentages were used to examine the socioeconomic characteristics of the respondents. while econometric analysis which includes both multiple linear regression analysis which helps to examine the determinants of actual number of income diversification sources among farming households and Binary logistic regression in measuring the effect of some socio economic variables on farming households' probability to participate in nonfarm activities in the study area. Econometric analysis was further explained below. The result of the questionnaire survey was analyzed by the help of statistical package for social sciences (SPSS) version 16.0 Statistical Software and Microsoft excels 2007 after editing, coding and arranging the raw data collected from survey.

2.3.3.2. Model Specifications

As proved by many scholars, econometric models have the power to generate essential information on causal relationships between household characteristics and their income-generation and diversification patterns, and they were therefore applied in the present study. In such a case an econometric model could provide an analytical framework within which to explore various dimensions in household behavior, for example. In reality, the data, especially survey data, often have their limitations and may not even include all the necessary variables, which imposes restrictions on the methods to be applied. An econometric model consists of a dependent variable, also called the left-hand-side variable, and independent variable(s), also called explanatory or right-

hand-side variable(s) and an error terms, or to be more precise stochastic disturbance terms, which stand for unobservable random variables not explicitly included in the model. The error term may also reflect randomness in human behavior or measurement errors, and has certain assumed properties such as a mean, variance and covariance (Gujarati, 1998). The estimated coefficients indicate the effect of a change in the independent variables on the dependent variable (Green, 2003).

Multiple Regression Model: - Multiple regression analysis was used to examine the determinants of number of income diversification sources among farming households. The purpose of using a multiple linear regression model when there are two or more independent variables, as in the present study, is to estimate how the included variables are related. The estimated coefficients indicate the effect of a change in the independent variables on the dependent variable (Gujarati, 1998).

The general form of the model was:

$$Y = X_i B_i + U_i \dots\dots\dots (1)$$
 Where: Y is income diversification sources (actual number), X_i explanatory variables, B_i coefficients of explanatory variables and U_i: is normally distributed with zero mean and constant variance.

Logistic regression model: - Also the researcher apply logistic regression model in measuring the effect of some socio economic correlates (determinants) on farming households' probability to participate in nonfarm activities in the study area. In logistic regression, a complex formula is required to convert back and forth from the logistic equation to the OLS-type equation. The logistic formulas are stated in terms of the probability that Y = 1, which is referred to as. The probability that Y is 0 is 1 - q_{it}

$$P (Y_i=1/X_i) = \frac{\exp(X_i B)}{1 + \exp(X_i B)} \dots\dots\dots (2)$$

An equivalent form can be stated thus,

$$\frac{\exp(X_i b)}{1 + \exp(X_i b)} = \frac{1}{1 + \exp(X_i b)} \dots\dots\dots (3)$$

This can be expressed as, q_{it} = bX_{it} + u_{it}----- (4)

Where q_{it} = an unobservable latent variable for household participating on non-farm activities.
 X_{it} = vector of explanatory variables
 b = vector of parameter to be estimated
 u_{it} = error term

The observed binary (1, 0) for whether household participate in nonfarm activities is assumed as in the usual logit model (Green, 2003).

$$q_{it} = \begin{cases} 1 & \text{if } q_{it} \geq 0 \\ 0 & \text{otherwise} \end{cases} \text{ i.e. } \text{participation} = 1, \text{ otherwise} = 0$$

Probability that binary assumes the value one is, prob. (q_{it} = 1) = exp (β₀+β_x)/1+exp (β₀+β_x) = $\frac{e^{\beta_0 + \beta_x X_{it}}}{1 + e^{\beta_0 + \beta_x X_{it}}}$ exp is

the exponent function, sometimes written as e. So, the equation on the right is just the same thing but replacing exp with e. We can always tell when e stands for exp if you see

that there is a superscripted value with the e, suggesting that e is raised to some power.

Table 1: Summary of variables descriptions and expected signs

Variables	Description of variables	Expected Sign	
Dependent variables			
Participation on nonfarm activity ¹	(Binary) participation =1 and otherwise = 0		1
Number of income diversification sources (actual number) ²	Continuous refers actual number of income sources each respondents had in the study area.	2	
Independent variables and assigned symbol			
Age= X1	(Continuous) Age of respondent (in years)	-	-
Gender/Sex= X2	(Dummy) Gender/ Sex (Male = 1, Female = 0)	+	+
Marital Status = X3	(Dummy) Marital status (Married = 1, Single, Divorced or Widowed = 0)	+	+
Household Size = X4	(Continuous) Household size (number of families)	+	+
Education = X5	(Continuous) Years of formal education	+	+
Wealth Status = X6	(Dummy) Wealth status (Poor = 1, Non-poor = 0)	-	-
Farm Size = X7	(Continuous) Area cultivated in survey year in (ha)	-	-
Farm Income = X8	(Continuous) Income of respondents (in birr)	-	+
Membership in cooperative = X9	(Dummy) Participation in farmers cooperative = 1, Non-Participation = 0)	-	-
Access to Credit Facility = X10	(Dummy) Access to credit facility (Yes = 1, No = 0)	+	+
Location/ Distance = X11	(Continuous) Location/Distance to market center headquarters (Km)	-	-
Livestock Holding = X12	(Continuous) number of tropical livestock holding in TLU	-	-

2.3.5 Multicollinearity Test

Multicollinearity is a high degree of correlation among several independent variables. It commonly occurs when a large number of independent variables are incorporated in a regression model that may measure the same phenomena (Jeeshim and KUCC625, 2002). More specifically, Multicollinearity refers to a situation where it becomes difficult to disentangle the separate effects of independent variables on the dependent variable because of strong relationships among them Maddalla (1992). The existence of this situation in this study was tested using the methods of variance inflation factor and contingency coefficients.

2.3.6 Tolerance (TOL) and Variance Inflation Factor (VIF)

This method is used to detect Multicollinearity of continuous variables. As R_i^2 increases towards one that is as the collinearity of regressor X_i with other regressor increases its variance inflation factor (VIF) also increases and in the limit, it can be infinite. The larger the value of VIF, the more troublesome or collinear is the variable X_i . As a rule of thumb, if the VIF of a variable exceeds 10 (this will happen if R_i^2 exceeds 0.90), that variable is said to be highly collinear (Gujarati, 1995). Tolerance (TOL) can also be used

to detect Multicollinearity. TOL is one if X_i is not correlated with the other repressors, whereas it is zero if it is perfectly related to other regressor. The result of the VIF and TOL is presented in Appendix 3.

2.3.7 Contingency Coefficient for Discrete Variables

Contingency coefficient analysis was carried out to check for the strength of relationship among discrete variables. The contingency coefficient is a symmetric measure which indicates the strength and significance of the relation between the row and column variables of a cross tabulation. The value ranges between zero and one, with zero indicating no association between the row and column variables and values close to one indicating a high degree of association between the variables. The decision criterion is that variables with a contingency coefficient closer to one would be avoided from further consideration in the multivariate analysis. The result of the contingency coefficient for discreet variables was presented in Appendix4.

According to Gujarati (2004) heteroscedasticity does not destroy the unbiasedness and consistency properties of the OLS estimators, but they are no longer efficient, not even asymptotically (i.e., large sample size). This lack of efficiency makes the usual hypothesis-testing procedure of dubious value. However, the presence of heteroskedasticity in this study was checked by using the Breusch-Pagan (BP) test. Hence, there was no heteroskedasticity problem in the data.

3. Results and Discussion of Findings

This chapter presents the results of the descriptive and econometric analyses. Descriptive analysis made use of tools such as mean, percentage, standard deviation, frequency distribution and tabular analysis to examine and understand the socioeconomic situations of sampled respondents. Econometric analysis was employed to identify and to measure the relative importance of significant explanatory variables that affect income diversification sources (actual number) and the probability of households' participation on nonfarm activities.

3.1 Descriptive Analysis

The result of descriptive analysis revealed that age distribution of respondents shows that the highest, 66(44.59 percent) of the total number of respondents belong to 31-45 age group. And the average age of the sample farm household heads was 48.61 years with the overall standard deviation of 10.93 at range of 30 to 76 years.

This study also revealed that most respondents are males representing 131(88.51 percent) while very few respondents are females 17(11.49 percent). This indicates that most men have the sole responsibility to carter or serve for the family and female headed family are fewer proportional to the male headed families in the study area.

In terms of the number of household members, 98(66.22 percent) of the respondents have 5-8 family size, 26(17.57 percent) of them have 9-12 members and 23(15.54 percent) of them have 1-4 family size, while the rest 1(0.68 percent)

of farm households have more than or equal to 13 members. It is obvious that households whose membership is large easily diversify their income due to readily available family labour than those with few members. The overall average family size was 6.74 members that range between 1 to 13 members with standard deviation of 2.21.

Most respondents had primary education accounting for 66(44.59 percent), 60(40.54 percent) had no formal education, 15(10.13 percent) had secondary education and only 7(4.73 percent) had tertiary education, various years of schooling ranging from zero year of schooling to 15 years of schooling. The average years of schooling of household head was 4.530 years with the standard deviation of 4.357. It is therefore noteworthy that educational level is low among the farming households which undoubtedly affect their income diversification patterns

According to the distribution of respondents by disaggregation based on the criteria such as: farm size, quality of house, being a member of safety net program, income level and livestock holding showed that about 30(20.27 percent) are considered as poor whose income relying on less than one US dollar a day, an indication that they are poor. But out of the total sampled respondents the remaining 118(79.73 percent) were non poor. This distribution is further alluded or mention to by the income level of the respondents in which case over 20.27 percent of them earn farm income below 1000ETB per year.

The distribution of respondents by net farm income level is that about half 74(50 percent) of those surveyed earned 1000 up to 2000 net farm income. Those earning between 2001 up to 5000, <1000 and 5001-10000 constitute about 28(18.82 percent), 41(27.70 percent), and 4(2.70 percent) respectively while only 1(0.68 percent) earned above 10, 000. The overall average net farm income was 2095.61 ETB that range between 0 to 11000 ETB with standard deviation of 1789.58. The distribution generally indicates that the income level of respondents is very low considering the average household size of 7.

The study revealed that Livestock's are important physical assets for rural farm households next to land in study area and serve as means of household income and other service rendering assets. The result of this survey indicates the average livestock holding in Tropical Livestock Unit (TLU) was 4.349 with 2.223 standard deviation that range 0.25 and 12.49 minimum and maximum, respectively.

This study examined the diversity of income sources; household income was divided into eight categories: crop, livestock, other farm income source, agricultural wage, nonfarm wage, self employed income sources and remittance. The simplest measure of income diversity was the average number of income sources (of the eight listed here) that households had. It was observed that rural households in the study area had an average of 2 sources of income. The result of descriptive analysis on primary activity shows that about 148 (100 percent) of those surveyed are fully engaged in agriculture activities especially in crop production. This is closely followed by those engaged as livestock rearing 146(98.65 percent) the

remaining engaged in other agricultural activities constitutes 20(13.51 percent).

It was revealed that the major income diversification sources in the study area were crop income, livestock income, and other agricultural income diversification sources while nonfarm diversification sources include off farm wage employment 27(25 percent), agricultural wage employment 19(17.59 percent), self employment 16(14.81 percent), remittance or private transfers 40(37.04 percent) and other nonfarm income diversification sources participation rate constitute 6(5.56 percent).

Rural farm household's income was basically categorized into two, viz. farm and non-farm income. Out of the total income of rural farm households 58 percent were earned from farm sources while almost 42 percent came from non-farm sources. This is highly consistent with the work of (Ibekwe *et al.*, 2010). While rural farm households try to diversify their income within agricultural sector, highest percentage of such income comes from cropping activities (45.49 percent), followed by livestock activities (11.94 percent) while other agricultural activities were 0.41 percent of the total income shares.

3.2 Econometric Analysis

3.2.1 Determinants of number of income diversification sources (NIS)

Table 16: Multiple Regression Result

Explanatory Variables	Estimated Coefficients	Standard Error	T-statistics	Sig.
Constant	1.145	0.504	2.272*	0.025
AGE (X1)	-0.006	0.007	-0.880	0.380
SEX (X2)	0.965	0.483	2.200*	0.054
HHs (X3)	0.031	0.034	0.905	0.367
EDUC (X4)	0.042	0.017	2.470***	0.098
WEALTH (X5)	-0.024	0.192	-0.123	0.902
FARMS (X6)	-0.326	0.130	-2.509**	0.013
FARMI (X7)	0.000	0.000	2.429**	0.014
MSFC (X8)	-0.131	0.225	-0.583	0.561
ACF (X9)	-0.185	0.155	-1.194	0.235
DISTANCE (X10)	0.176	0.054	3.263***	0.001
LIVSTOCK (X11)	0.003	0.042	0.083	0.930
Sample size = 200 R ² = 72.4 Adjusted R ² = 71.4				

***, **, * are significant at 1, 5 and 10% probability level, respectively

Source: Computed from survey data, 2015

The fundamental objectives of the regression is to determine how the explanatory variables (age, sex, educational level, household size, wealth status, farm size, farm income, membership in farmers cooperatives, access to loan, distance from market and tropical livestock holding) determine income diversification sources (actual number) in Leemo District, Hadiya Zone and ascertain the population of variation in diversification that is explained or captured by these variables. Marital status was omitted from the regression due to the multicollinearity problem. The fulfillment of these objectives is justified by the regression equation:

$Y = 1.145 - 0.006X_1 + 0.965X_2 + 0.031X_3 + 0.042X_4 - 0.024X_5 - 0.149X_6 - 0.001X_7 + 0.131X_8 - 0.185X_9 + 0.176X_{10} - 0.003X_{11} + u_i$
t - Value (2.272) (-0.880) (2.200) (0.905) (2.470)
(0.126) (-1.085) (2.429)
(-0.583) (-1.194) (3.263) (-0.083)
 $R^2 = 72.4$ Adjusted $R^2 = 71.4$, and Dubin-Watson = 2.002

The number of income sources that each household has at a given point in time is used as a measure of income diversity while the difference in the number of income sources that one household has at different points in time indicates the level of income diversification pursued by that household over that corresponding period. Accordingly, households with more income sources are treated as households with higher levels of diversity in income and the greater the increase in the number of sources over time the greater increase in diversification over time. This indicator, the number of income sources, has the advantage that it is simple to understand and provides an easily visible picture of income diversification.

The empirical result of this study is startling and forcefully persuasive in general. The empirical result is both consistent and inconsistent with the theoretical postulations of the model. The coefficient of multiple determination of .724 indicates that about 72% of the variation in the income diversification sources in the study area has been captured by the model. This clearly shows that the model is strong and has good predictive ability. The implication of this outcome is that 72% of income diversification is induced/caused by the explanatory variables. The multiple correlation coefficient of .761 also indicates strong positive relationship between the variables. Furthermore, the adjusted R^2 of .714 which is significant has further consolidated the goodness of the model, hence, its econometric significant and reliability.

The coefficients on explanatory variables such as: distance from the market, sex, education, and farm income is statistically significant and confirmed expected outcome except distance from market. The F-statistic is significant and Dubin Watson statistic reveals a minimal autocorrelation of random variables implies little fall in the efficiency of the econometric model. Significant explanatory variables were interpreted as follow:

4. Interpretation of Significant Variables

Gender affects diversification sources, including the choice of income-generating activities (both farm and non-farm) due to culturally defined roles, social mobility limitations and differential ownership of/access to assets (Galab *et al.*, 2002). In the study, as expected sex of household head is found to positively and significantly influence income diversification sources (actual number) at 10% of significance level. Thus, keeping the influence of other factors constant; the number of diversification sources increase by 96.5 % when the sex of household head is male (male headed households). The opposite is true for the female counterparts. This result is in agreement with

previous studies conducted by Adugna (2005) and Berhanu (2007).

As expected, the level of education is significant at 10% level of significance, and has a positive relationship with the income diversification sources (actual number). This implies as the level of education (years of schooling) of the household increases, the number of income diversification sources increases by 0.042, *ceteris paribus*. The explanation for this result is quite obvious. Education increases human capital and hence, increases the skill of the farmer to secure non-farm jobs rather than retaining only in farm activities. This is consistent with (studies that found similar results as this study are (Bogale A., and K. Hagedorn 2003; Dercon and Krishan, 1996; Abdulai and Crole Rees, 2001; Babatunde and Qaim, 2009 and Minot *et al.*, 2006).

As expected, households with more land have fewer income sources, being more specialized in crop production. So it is interesting to find that farm size in this study, is found significant at 5% significance level and has a negative relationship with the number of income diversification sources. This result implies that if households' farm size increases by one hectare the number of diversification sources will decrease by 32.6 %, *ceteris paribus*. It is not surprising, because when farm size increases rural farm households engaged only on farm activities to produce different types of farm products rather than diversifying income sources. This confirms the works of (Minot *et al.*, 2006).

The results reveal that distance to market center is found to have a significant (at 1% and 5% level of significance) and have a positive correlation with number of income diversification sources. This positive relationship tells us the effect of other factor holding constant that the far the distance from market center the more the tendency of households to diversify and vice versa. The possible justification could be households who are far from the market centers and road have much cost to access market incentive for diversification of income sources. This implies that meeting consumption needs through diverse economic activities may be motivated by the combination of diverse consumption needs and high transaction costs in purchasing consumer goods. In economic terms, high transaction costs imply that production and consumption decisions are not separable, so that consumption needs affect production decisions. For example, if a household lives far from roads and markets, the cost of buying and selling goods will be high, forcing it to diversify in order to satisfy its own demand for different types of food and nonfood goods. The coefficient of the variable also confirms that when a household is far from market centre by one kilometer, diversification sources increases by a factor of 17.6. This finding is in agreement with that of Ibrahim (2009), Omamo (1998) but, contrary to Adugna (2005) and Minot *et al.*, (2006).

On the contrary, other coefficient on the explanatory variable such as: age, household size, wealth status, membership in farmers cooperatives, access to loan and tropical livestock holding) are inconsistent with the theoretical postulations but, are having signs that are

expected. These coefficients have t-value that is statistically insignificant at 0.05 level of significant. This of course may be due to the unreliability of income diversification data for that period rather than to short comings inherent in the model. Nevertheless, the fact that this equation does not fit well for the targeted area calls for care in the interpretation of the result reported but the model cannot obviously be out rightly discarded.

4.2.2 Determiants of households probability to participate in off-farm activities

Table 17: Binary Logistic Regression Result

Explanatory variables	Estimated Coefficients	Standard Error	Sig.	Odds ratio
Constant	-1.745***	0.231	0.000	0.175
AGE (X1)	0.033	0.064	0.612	1.033
SEX (X2)	-17.818	7.358E3	0.998	0.000
HHs (X3)	-0.211	0.274	0.440	0.809
EDUC (X4)	0.222*	0.134	0.097	1.248
WEALTH (X5)	-14.189	5.985E3	0.998	0.000
FARMS (X6)	-1.933*	1.328	0.096	0.145
FARMI (X7)	0.002***	0.001	0.005	1.002
MSFC (X8)	-2.078**	1.563	0.049	0.125
ACF (X9)	-0.079	1.636	0.629	0.454
DISTANCE (X10)	-0.877**	0.717	0.021	0.416
LIVSTOCK (X11)	0.948	0.686	0.167	2.580
Number of observation =148 R ² = 0.633				

***, **, * are significant at 1, 5 and 10% probability level, respectively

Source: Computed from survey data, 2015

Logit regression was used to determine the probability of participation of household members in non-farm activities since they are basically farmers. The model predicts participation in non-farm activities with a given level of significant probability values. With respect to individual characteristics of household heads, education level (years of schooling, farm size, farm income, distance from market center and membership in farmers cooperatives affect participation in the non-farm employment. Participation in non-farm activity is positively related to education and farm income but, farm size, membership in farmer's cooperatives and distance from market center were negatively related and does significantly determine the participation of rural household in non-farm activities. Engagement in nonfarm activities is not dependent on variables like age, gender, household size; livestock holding and wealth status which are not important participation criteria in non-farm employment among rural farm households in the study area. This is in line with results of Awudu (2001), de Janvry *et al.*, (2005).

Interpretation of significant variables

Participation in nonfarm activities is influenced by different human capital variables and development of infrastructure which affect the capacity of rural inhabitants to divert from pure farm activities. Thus, better educated individuals, especially with higher or vocational education, are more likely to choose pure nonfarm activities or a mixture of farming and non-farming, mostly because they are better qualified for formal nonfarm jobs (Atamanov, 2011). Similarly, as expected the result of Logistic regression in

this study show that, the level of education (years of schooling) is significant at 10% level of significance and positive correlation with the probability of participation on nonfarm activity. This implies as the level of education of the farmer increases, the probability of the farmer participation on nonfarm activity increases. In fact, the odds ratio of education implies that if education of the farmer increases by one year, the likelihood of the farmer participation increases by a factor of 1.45, *ceteris paribus*. The explanation for this result is quite obvious. Education increases human capital and hence, increases the chances of the farmer to secure non-farm jobs). This result is in agreement with the works of (Schwarze, 2004, Dercon and Krishan, 1996; Abdulai and Crole Rees, 2001; Babatunde and Qaim, 2009).

As expected, the area of farm land owned by the household has a significant at 10% level of significance and negative correlation with the probability of participating on nonfarm activity. The results of this study suggest that rural households with more farm land tend to follow agricultural extensification rather than diversifying from agriculture since they draw incentives of land productivity. This implies the chances of choosing agriculture in the context of having large land size decreases the probability of participating on nonfarm activities. On the other hand the probability of diversifying income sources to nonfarm activity decreases by increasing land size as farmers with more land supposed to stay on farm since land stimulates farming. Increased role of off/nonfarm activities such as nonfarm wage employment, agricultural wage employment, self employment and remittance especially for poor households with less land holding and other necessary resources, signify how households respond to a decreasing ratio of farm size to household. This supports the view that off-farm and on-farm activities compete over the limited household resources.

It also implies that those households who expect secured agricultural income stay on farm and lower off-farm intensity. In fact, the odds ratio of farm size implies that if farm size of the farmer increases by one hectare, the probability of the farmer participation decreases by a factor of 0.145, *ceteris paribus*. Lanjouw (1995) also found out that landholdings per capita are negatively correlated with participation in low productivity occupations. This result is in line with that of Berhanu (2007) and Mulat *et al.*, (2006). The implication is that farmers just switch away from off-farm activities when the farm activity is promising; and hence, this supports the necessity argument as opposed to the choice argument. Farmers consider off-farm activities as a last resort income source if crop production fails.

It is also interesting to find that farm income, is found significant at 1% level of significance and has a positive relationship with the probability of household's participation on nonfarm activity. This result implies that if farm income of household increases in one birr the probability of participating in non-farm activities will increases by 0.2%. In fact, the odds ratio of farm income implies that if income of the farm increases by one birr, the probability of the farmer participation increases by a factor of 1, *other things remaining constant*. This is may be farm income increases financial capacity which in turn helps households to invest

on nonfarm activities. This finding appears to confirm the finding of (Adewunmi *et al.*, 2011 and Babatunde and Qaim, 2008).

Membership of farmers' cooperative is a dummy variable refers to the participation of household in farmers' cooperative that play a significant role in supplying input for agriculture and it represents the social capital. As expected, in this study the membership of farmers in cooperative organizations found negative correlation with probability of household participation on nonfarm activity. This implies as the membership in farmers cooperative increases, the probability of the farmers participation in nonfarm activity decreases. In fact, the odds ratio of membership in cooperative implies that if membership in farmers cooperatives increases by one, the likelihood of the households participation decreases by a factor of 0.125, *ceteris paribus*. The reason is that most cooperative serve farmers by supplying input with credit and farmers may not worry for purchase of input or additional income for purchase of input. Hence, they are interested to expand farm activities rather than participating in nonfarm activities. It is significant at 5% significance level. This result is in agreement with Olale (2011).

As expected, the distance from market center was found negative relation with probability of household participation on nonfarm activity. It is significant at 5% significance level. This result implies that when we far one kilometer away from market center the probability of participating in nonfarm activity will decrease. Other variables holding constant in fact, the odds ratio of distance from market center implies that if one kilometer far (increases) in distance the likelihood of the farmer participation decreases by a factor of 0.416. The probable reason is that the far distance to market center increase the transportation cost to market center to deliver rural products and to frequently participate in off-farm employment in market centers. This is why because the market center is found in the capital of the district. Due to this high opportunity cost related to distance to market center in participation of off-farm activities farm households less probable to participate in off-farm activities, hence diversification, relative to farming only livelihood strategy as their resident get larger distance to market center. This result revealed that road infrastructure is the most important factor in participation of off-farm activities in all cases of rural income diversification strategies to earn income from off-farm employments in addition to farming income. This result is consistent with findings of (Adugna, 2005 and Debebe, 2012).

5. Summary, Conclusions and Recommendations

5.1 Summary and Conclusions

In this study, we have examined the main determinants of income diversification among rural households in Leemo district to come up with evidence for sustainable livelihood. In view of that, the study was focus on determinants of number of income diversification sources and households probability to participate in off farm activity to spread risk, smoothen consumption and reduce poverty among rural farm households. Most rural farm households have been

adopted rural economic activity diversification, while some households did not engage in any off-farm activities rather they rely on agricultural activities alone. On the other hand, the number of income diversification sources and the probability of household's participation on nonfarm activity were not the same among farm households. Hence, this study was focused on the determinants of both number of income diversification sources and households probability to participate in off farm activity among rural households by taking data from 148 sample households from Leemo District, in Hadiya Zone.

The descriptive analyses of this study revealed that below half (42.16 percent) of the respondents earned income from off-farm employments, while over half (57.84 percent) of households obtained income from farming. Demographic, socio-economic and access for rural infrastructure were found the main factors for rural income diversification. On the other hand, multiple regression models was used for the analysis of number of income diversification sources among rural farm households while Binary logit model was employed to analysis the determinants of households' probability to participate in nonfarm/off-farm activity.

It can be concluded from the econometrics results that number of income diversification sources was significantly influenced by sex of household head, education level of household head, farm size, farm income and distance to market center, while sex of household head, education level of household head and distance to market center were influenced the number of diversification sources positively. On the other hand, years of schooling (level of education) of head, farm size/land holding size, farm income, membership in farmers cooperatives and distance to market center were found the main determinants for households probability to participate on nonfarm activity. Years of schooling (level of education) of head and farm income were influenced participation positively while the remaining significant variables were influenced negatively.

From the result development of human capital through education, by years of schooling, is the most important factor that encourage farm households' decision to engage into off-farm activities. As expected, farm income was found a positive influence in participation of farm households in nonfarm activities rather than relying only on farming activities. But, farm size, member ship in farmers cooperatives and distance from market center were the most influential factors that negatively enforced households to participate in nonfarm activity, in order to obtain additional income from off-farm activity.

In general, multiple regression model estimation allowed us to understand which explanatory variables play an important role in number of income sources. The regression result shows that sex of household head, education level of household head, farm size, farm income and distance to market center were significantly influence number of income sources. To identify and analysis the determinants of income diversification in terms of the probability to participate in off-farm income sources, Logit regressions was carried out. As a result, years of schooling of household head, farm income, farm size, member ship in farmers'

cooperative and distance to market center were found significant explanatory variables.

5.2 Recommendations

Based on the findings of the study, the following policy directions are recommended;

- Human capital development through education was found to be important factor for promotion and expansion of rural income diversification sources. This finding implies that education should be given for rural communities to promote and expand off-farm activity and to enhance high income earning capacity of farmers from income diversification strategies. Therefore, enhancing the capability of farm households through education is expected from concerned stakeholders.
- The finding of this study revealed that farm income was found positive and significant influence on income diversification and participation in off-farm activities. To increase farm income improving agriculture is important. Therefore, Aids and subsidized inputs should be provided for rural farm households to improve agriculture to increase farm income which in turn improve financial capacity of households to diversify nonfarm activity.
- The results of this finding suggest that farm size is an important variable that was found negative and significant in income diversification and participation in off-farm activities. This implies that household with large farm size is less likely to participate in off-farm activities and less income diversification sources (concentrate on farm). However, increasing agricultural production and employment opportunities through farmland expansion without environmental degradation in the area becomes very difficult. Thus, to overcome underemployment and limited agricultural income, adopting income diversification strategies are preferable alternatives to sustain farmers' life in the study area. So, policy makers and other concerned bodies supposed to create, expand and encourage off-farm job opportunities, particularly for small landholders, rural farmers.
- Rural infrastructure is crucial factor in maintaining sustainable rural livelihood, especially road accessibility play vital role in facilitating access to markets, which in turn opens up opportunities for households to diversify their economic activities. Therefore, a need for government to provide more rural roads and rehabilitate eroded ones in order to reduce the high transaction cost of buying from or selling to markets, as transaction cost reduces the returns from market sales. This will encourage the development of rural road to facilitate farmers' participation in diversified economic portfolio.
- Finally, attention should be focused at understanding and developing the rural non-farm sector in the study area to make the sector more jobs providing and rewarding as more farm households members involved in the activities but without jeopardizing the food basket sector of the nation.

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