

Livelihood Strategies and Food Security of Rural Households in Wolaita Zone, Southern Ethiopia

Yishak Gecho¹, Gezahegn Ayele², Tesfaye Lemma³ and Dawit Alemu⁴

1. PhD candidate, Haramaya University, Department of Rural Development and Agricultural Extension

Email: yishakgecho@yahoo.com

2. PhD, Associate Professor, Capacity Building Manager (USAID) to improve agriculture and food security

Email: ayeleg@yahoo.com

3. PhD, Assistance Professor, Haramaya University, Department of Rural Development and Agricultural Extension

Email: t.lemma41@yahoo.com

4. PhD, Coordinator, Agricultural Economics, Research –Extension Farmer’s Linkage, Ethiopian Institute for Agricultural Research

Email: dawit96@yahoo.com

Abstract

Despite the continuing economic dominance of agriculture in Wolaita, farm households widely engage in and pursue diverse livelihood activities to generate income and achieve food security. The major objectives of this study are to analyze households’ food security status as an outcome of livelihood strategies and identify factors affecting food security of rural farm households. For the purpose of this study primary data were collected from randomly selected 300 households in four woredas of the zone. The main tools of analysis for this study include descriptive statistics and logistic regression model. The finding of the survey result indicates that rural households in the study area practice diversified livelihood strategies, in that large part of the respondents (57.7%) combine agriculture with other activities (non/off-farm). Food security status of the households was analyzed based on nationally recommended calorie requirement (2200kcal) of the households. Based on this, about 57% of the sample households found to be food insecure. The relationship b/n rural households’ livelihood strategies and food security status depicted that majority of food secured households (62%) rely on farming alone as one of most important livelihood strategies. On the contrary, non-farming and off-farming activities were the common livelihood means which specifically practiced by food insecure households. Binary logit model results reveal that out of 25 explanatory variables included in the logistic model, 12 were found to be significant at less than 10% probability level. According to this, education, family size in AE, cultivated land size, frequency of extension visit, access for credit, access to farm plus off-farm activities, access to farm plus non-farm and off-farm activities, safety net aid, use of chemical fertilizer, cooperative membership and agro-ecological zone were found to be the most important determinants affecting the state of food security positively. On the other hand, family size in AE was found negatively and significantly affected food security status of the household. The finding of the study considers government and other concerned bodies to design appropriate development policies and strategies in relation to significant variables to bring sustainable livelihood improvement in attaining household food security goals.

Keywords: Livelihood strategies, determinants of food security, rural households, binary logit model, Woliata, Ethiopia

1. INTRODUCTION

The vast majority of Ethiopians lives in rural areas and engaged in rain-fed subsistence agriculture. Agriculture remains the primary means of livelihoods. About 95% of total production of agriculture is coming from small scale producers. But small-scale traditional production has come under pressure, questioning its capacity to cope with the problems of livelihood construction, food security, and environmental protection and poverty reduction (Ayele, 2005). Household food security largely depends on external factors including rainfall patterns, land degradation, climate change, population density, low levels of rural investment and the global market (WFP, 2011).

Ethiopia has struggled for many years to respond to the challenges of food insecurity and rural poverty arising from many adverse factors (FDRE, 2010). To improve agriculture between 13 and 17 percent of government expenditure has been channeled towards the sector (including natural resource management) in recent years—far more than the average for sub-Saharan African countries. Nevertheless, despite the government’s high commitment to improve agricultural performance, Ethiopia remains heavily dependent on food aid. According to WFP/FAO (2010), the number of people in need of food assistance was 4.6 million in May 2008 and rose to 6.2 million in August 2009, as high global food prices were transmitted to Ethiopian markets. Notwithstanding the claim by official statistics that Ethiopia’s overall economy has grown rapidly since the mid-2000s, in 2008 the country experienced the highest rate of inflation in its history that stood at the top in the world next to Zimbabwe

(CIA, 2009) thereby entailing high food prices and growing food insecurity.

Currently, many rural Ethiopians are food insecure at one time or another. When the rains fail even relatively well endowed some rural households may face short-term food shortages. A significant number of Ethiopians are chronically food insecure; they are usually unable to access enough food for an active, healthy life—even in the absence of shocks. Every year for the past two decades, the Government has had to appeal to the international community for food aid. Since 2000, annually between five and 14 million rural Ethiopians were needed emergency reliefs out of a total population of the country (UNDP, 2006).

The problem of food insecurity in Ethiopia has, to a large extent, been addressed by annual emergency food aid from abroad. During the past two decades, Ethiopia has been the largest recipient of food aid in Africa and one of the largest recipients in the world (Little, 2008). In 2005, to combat the persistent problem of food insecurity and to move away from the previous system of annual emergency appeals, the Ethiopian government and donors launched a new social protection program called the Productive Safety Net Program (PSNP). With an annual budget of nearly \$500 million, it is a huge program, reaching more than 7 million Ethiopians (Gilligan *et al.*, 2008).

The increasing population growth in rural Ethiopia obliged households to cultivate and make their living on extremely small size of land. For instance, 29% of grain farmers in 2006/7 had cultivated a land less than 0.5 ha per household (EEA, 2008). According to recent FDRE (2010) evidence, nearly 55 percent of all smallholder farmers operate on one hectare or less. Due to the smaller farm size and low return from farming activities, majority of rural households are exposed to food insecurity and chronic poverty. The national survey conducted in 2003/4 by EEA indicated that 63 percent of surveyed households were food deficit in Ethiopia. This evidence is supported by FAO (2010) in that about 61 percent people were undernourished in Ethiopia.

Today, it is increasingly becoming clear that the agricultural sector alone cannot be relied upon as the core activity for rural households as a means of improving livelihood and attaining food security. One phenomenon that is gaining prominence in the rural development literature is the promotion and support for non-farm diversification opportunities (Stifel, 2010). Non/off-farm economic activities include seasonal migration, wage employment, handicraft production, trading and processing of agricultural produce, provision of agricultural services, etc. Such non-farm activities provide a way of off-setting the diverse forms of risks and uncertainties (relating to climate, finance, markets etc) associated with agriculture and create a way of smoothing income over years and seasons (Reardon, 1997; Barret *et al.*, 2001).

In order to attain food security rural household in the study area (Wolaita zone) engaged in and pursue various non-farm and off-farm activities beside agriculture. 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). The very poor are often without working labor, with no assets (i.e., land, livestock) and dependent on income transfers (Bush, 2002). The most recent evidence indicates that about 57 percent of households in the zone are possessing less than 0.25 hectare of land which could not help to attain adequately hand to mouth subsistence farming (WZFEDD, 2012). If there are no alternative means of livelihoods substituting this situation the newly born generation will face serious challenges than existing.

Moreover, the rural population in the Zone is increasingly vulnerable to droughts and famine. The zone is also categorized into highly food insecure or one of the least self sufficient areas of the country (Black *et al.*, 2011). Currently all the woredas existing in the zone involved in Productive Safety Net Program (PSNP) in order to secure livelihood and ensure food security of the household. According to the study by Dessalegn (2007), since the mid-1980s, farmers in Wolaita have suffered hunger and food shortage almost continuously. The good years in the two decades have been very few. Since then, crisis interventions by government and NGOs have occurred almost every two years or so; and a number of farm households were highly dependent on food aid and other public support programs (ibid). The resilience of onset as 'famine crop' has diminished since the major droughts of the mid-1980s (Bush, 2002). This situation has reached peak stage and challenging many people at this time due to seasonal climate variation and uncontrolled population growth. Livestock holdings are on decline because of shortage of grazing areas and feed availability, drought and animal disease. With farm size and productivity declining, scarce non-farm income and depleting assets, the capacity of the rural population has thus diminished to cope with droughts and production failures.

Like the national economy of Ethiopia, households in study area are mainly depending on small scale subsistence agriculture to derive their livelihoods. Even though with the existing farm size agriculture couldn't enable them to generate adequate food required. So, to fulfill income and food gap, farm households engage and pursue diverse off/non-farm livelihood activities. Comprehending food security status of households as an outcome of livelihood strategies is crucial to improve the response mechanisms related food security and livelihoods improvement in the study area. This study therefore aims to measure empirically the households' food security status as an outcome of different livelihoods strategies and identify factors determining the household food security.

2. METHODOLOGY

2.1. Description of Study Area

The study area, Wolaita Zone, is one of 13 Zones in southern Nation Nationalities and Peoples Regional State (SNNPRS). It is located at 390 km to southwest from the capital city of the country, Addis Ababa along the main road that passes through Shashamane to Arbaminch. Now, newly constructed Sodo-Hosana asphalted road reduced the distance to Addis Ababa, which is about 330 km away from the capital city of the country following main road that passes through Hosanna to Arbaminch. The Zone is roughly located between 6.4° - 7.1° N and 37.4° - 38.2° E, latitude and longitude respectively. It covers a total area of 4,511km² and is composed of 12 administrative weredas and 3 registered towns. According to Central Statistical Agency report of 2010, total number of population of the area is about 1,581,650. Population density of the area is estimated at 385 per square kilometer (CSA, 2010).

2.2. Sampling Techniques

In this study, multi-stage sampling procedure was employed to select sample households. In the first stage, out of the 12 woredas in the Zone, four woredas (Humbo, Damot Woyde, Sodo Zuria and Damot Gale) were selected purposively to include different agro-ecological zones existing in the area which may determine household's livelihood activities. In the second stage, the kebeles in each woreda were listed based on their agro-ecological characteristics and grouped/stratified into three ecological zones highland, midland and low land. Based on this, 16 sample kebeles were selected by using simple random sampling techniques from each categories of agro-ecological zone taking consideration the number of kebeles in each Woreda. In the third stage, sampling frame (complete village household lists) was obtained from each kebele's administrative office. Then, wealth ranking exercise was conducted with help of participatory rural appraisal (PRA) tools in order to classify households under the different wealth categories. In the fourth stage, the probability proportional to sample size methods were applied to draw the sample household from each wealth category according to the number of household in different category. Finally, a total sample of 300 households was selected by using systematic random sampling techniques, of which 145, 105 and 50 were poor, medium (less poor) and better-off households respectively.

2.3. Types and Methods of Data Collection

To utilize and describe the various data sources triangulation were applied. Both primary and secondary data were used which are qualitative and quantitative in nature. Primary data was collected from sample households using structured interview schedules. Secondary data was obtained from different relevant secondary sources. In addition to this, focus group discussion, key informant interview and wealth ranking were conducted to supplement the research finding with qualitative information.

2.4. Methods of Data Analysis

Two types of data analysis, namely descriptive statistics and econometric models were used to analyze the data collected from sample households. Quantitative categorical types of data were analyzed using percentage, frequency and chi-square test. While quantitative continuous types of variables were analyzed using one way ANOVA, minimum, maximum, mean and standard deviation. Interpretation and tabulation of data were done in order to analyze the qualitative data. After computing the descriptive statistics, binary logit model was applied to analysis the factors influencing food security status of the sampled household in the study area. The data analysis was conducted using Statistical Package for Social Sciences (SPSS) version 16 and STATA 11.

2.4.1. The econometric model specification

Both probit and logit analysis are well-established approaches in the literature to estimate dummy dependent variables (Feder *et al.*, 1985). However, when there are many observations at the extremes of the distribution then logit is preferred over probit (Liao, 1994). Also, Sharma (1997) reported that the logit model is computationally easier to use than the other type.

The logit model therefore was applied in this study to assists in estimating the probability of food security status of a household that can take one of the two values, food secure or insecure. According to Gujarati (1995), the functional form of the logit model is presented as follows:

$$P_i = E\left(\frac{Y_i}{X_i}\right) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_i)}} \quad (1)$$

$$P_i = E\left(\frac{Y_i}{X_i}\right) = \frac{1}{1 + e^{-Z_i}}$$

Where P_i is a probability of a i^{th} household being food secure and ranges from 0 to 1; Z_i is a functional form of m explanatory variables(X) which is expressed as:

$$Z_i = \beta_0 + \sum_{i=1}^m \beta_i X_i, i=1, 2, 3, \dots, m \quad (2)$$

Where; β_0 is the intercept and β_i are the slope parameters in the model. The slope tells how the log-odds in favor of a given household food security status change as independent variables change. If P_i is the probability of a household being food secure, then $1 - P_i$ indicates the probability of a given household is food insecure, which can be given as:

$$1 - P_i = \frac{1}{1 + e^{Z_i}} \quad (3)$$

Dividing equation (1) by equation (3) and simplifying gives

$$e^{Z_i} = \frac{P_i}{1 - P_i} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} \quad (4)$$

Equation (4) indicates the odds ratio in favor/in terms of a given household securing food. It is the ratio of the probability that a household will secure food to the probability he will not secure. Lastly, the logit model is obtained by taking the natural logarsim of equation (4) as follows:

$$L_i = \ln \left(\frac{P_i}{1 - P_i} \right) = \beta_0 + \beta_1 X_i \quad (5)$$

Thus, if the stochastic disturbance term (U_i) is taken into consideration the logit model becomes

$$L_i = \beta_0 + \beta_1 X_i + U_i$$

2.4.2. Description of variables used in binary logit model and their hypothesis

The dependant variable of the study: Household food security status is a dichotomous variable representing the status of household food security in the model taking value of 1 if a household is food secure and 0 otherwise. It was measured by direct survey of household consumption. The nationally recommended minimum subsistence requirement per AE per day (2,200 Kcal) used as threshold level. Accordingly, households who consume below this minimum requirement (2200 kcal per AE per day) were categorized as food insecure and those households who consume above the threshold were considered as food secure.

Review of literatures and author's knowledge of the food security situation of the study area were used to identify the potential determinants of household food security. Definitions and units of measurement of explanatory variables and their hypothesis are described in Table 1.

Table 1: Definition and units of measurement of the variables in binary logit model

Variables	Description and measurement	Sign
SEX	is a dummy variable taking value 1 if the household head is male, 0 otherwise	-
AGE	Age of household head (year).	+
EDUCTN	Formal education of household head (grades or number of years in school).	+
FAMLSZ	Family size of household in Adult Equivalent (AE)	-
DEPRAT	Dependent household members measured (number)	-
LANDCLT	Total farm land cultivated by the household measured in hectares.	+
LANDFRT	It dummy variables takes values 1 if farm land is fertile and 0 otherwise.	+
IRRIGTN	It is dummy variable takes 1 if a household has access to irrigation and 0 otherwise.	+
TRLU	Total livestock owned by the farm household (TLU).	+
OXEN	The number of oxen owned (number).	+
FERTLZR	It is a dummy variable that takes value 1 if a household use fertilizer and 0 otherwise.	+
IMSEED	It is a dummy variable takes 1 if a household use improved seed, & 0 otherwise.	+
EXTCNT	Number of time extension agent visited/advised farmer (number).	+
TRAIN	Farmer attended formal agricultural training, dummy variable (1=, if yes; =0, otherwise).	+
CREDIT	Farmers access to credit, dummy variable (=1, if yes; =0, otherwise)	+
MKTDISTN	Distance of the respondents' house from input and output market (km).	-
OFFRM	Farmers involvement in off-farm activities, dummy variable (=1, if yes; =0, otherwise)	+
NOFFARM	Farmers participation in both non-farm & off-farm activities, dummy variable (=1, if yes; =0, otherwise)	+
ONFARM	Farmers conduct only farm activities, dummy variable (=1, if yes; =0, otherwise)	+
COOP	Households membership in cooperative organization, dummy variable (=1, if yes; =0, otherwise)	+
LEADER	Households participation in local social leadership, dummy variable takes value of 1 if participated, 0 otherwise	+
PSNP	It takes value 1, if a household beneficiary of safety net program, 0 if not involved.	+
GRAINST	Farmers ownership of grain stock, dummy variable (=1 if yes, 0 otherwise)	+
MIRRN	Migration of one of a household's family members somewhere, dummy variable (=1 if yes, 0 otherwise)	+
AGROMID	It is dummy variable, takes value 1 if a household living in mid-land, and 0 if residing in low land agro-ecology	+
AGROHIGH	It is dummy variable, takes value 1 if a household living in high land, and 0 if residing in low land agro-ecology	+

3. RESULT AND DISCUSSION

3.1. Descriptive statistics

Descriptive statistics was applied to characterize the sample households' social, economic, demographic and institutional factors based on their wealth positions (poor, medium and better-off). According to descriptive analysis, the mean difference was observed between the three wealth groups in terms of various explanatory variables (Table 2 and 3). As indicated in the tables below, the three wealth groups differ in their family size, education, age, farm size, livestock ownership, frequency of extension contact, improved seed use, chemical fertilizer use, access to credit, membership in cooperative and participation in local leadership. The result of study shows presence of wide variation in land holding size among the three wealth groups. The large proportion, about 54.5% of poor households have less or equal to 0.25 ha, whereas none of the medium and better of households lie in this interval. Contrary to this, large number of better-off households owned greater than one hectare, which is accounted 64% of better-off respondents (Table 2). On comparison, mean value of farm holding for better-off households was greater than the rest of two categories. Moreover, mean value of education shows the variation in education level of among three groups, which was 3.1, 4.93 and 5.68 for poor, medium and better-off households respectively. This figure indicates that average value of education for medium and better-off households was greater than poor. Similarly, the mean value of TLU for poor, medium, and better-off households was 1.72, 4.31 and 7.90 respectively. On average better-off households owned more number of TLU than the rest two groups (Table 2). Compared to the poor, large proportion of better-off and medium households were the users of chemical fertilizer and improved seed. The percentage of chemical fertilizer users among the poor, medium and better-off households was 37.9%, 87.6% and 98%, respectively. Similar trends were also observed among improved seed users (Table 3). From this result, fertilizer and improved seed usage decrease as the households become more poor and poor. The variations also observed in other explanatory variables.

Further, ANOVA analysis and chi-square tests were applied to identify the presence or absence of difference between the three wealth groups with respect to various explanatory variables. F-test analysis revealed that out of 9 hypothesized continuous independent variables, the three groups of households differ significantly in 8 of them (Table 2). On the other hand, out of 13 hypothesized discrete variables, the three wealth categories were differentiated with 10 of them (Table 3)

Table 2: Descriptive statistics for continuous explanatory variables

Variable	Household wealth category				F-value
	Poor	Medium	Better-off	Total	
	Mean	Mean	Mean	Mean	
Family size (AE)	4.53	5.67	6.75	5.30	36.620***
Dependency ratio	1.20	1.00	0.75	1.05	5.392***
Age	40.57	44.31	49.12	43.3	13.63***
Education	3.083	4.933	5.684	4.164	12.880***
Farm size	0.36	0.83	1.81	0.76	79.312***
TLU	1.72	4.31	7.90	3.65	170.170***
Extension	3.85	13.70	19.36	9.88	120.93***
Market distance	7.42	7.73	7.63	7.56	.157
Income	2702.4	5990.4	13126.3	5590.5	198.748***

Source: survey result, 2013. Note: ***, represents significant at 1%

3.1.1. Household livelihood strategies

Even if agriculture dominate the livelihood and economic activities of rural households in the study area, the caring capacity of the sector deteriorating from time to time due to various factors. The situation has forced people to look for alternative employment option. Today, a significant number of rural households engage in diverse livelihood strategies away from purely crop and livestock production towards non-farm and off-farm activities that are undertaken to generate additional income to ensure food security and attain livelihood improvement. As observed from the survey result, large parts of the respondents (57.7%) combine agriculture with other activities like non-farm and off-farm. The remaining, accounted for about 42.3% of the total sample house households depend solely on agriculture (crop and animal production) for their livelihood strategies. The non-farm and off-farm activities help farmers to fill income and food gap that agriculture unable to do. In this regard, about 37% of the total sample households derived their livelihood from farm + non-farm activities. Various types of non-farm activities pursued by respondents include petty trade, handcrafts, weaving/spinning, sale of local drink, rent of pack animal and remittance. On the other hand, proportionally about 13.3% of the sample respondents drive their livelihood by combining farm with off-farm activities, while low number of the sample households diversifies livelihood strategies into farm + non-farm + off-farm, which constituted about 7.3% of the total sample households (Table 4). The chi-square test shows the significant difference b/n the three wealth groups regarding to the livelihood strategy choice at 1% probability level. This difference in livelihood strategies choice implies the existence of significant barriers in selection of the most remunerative livelihood

strategy.

Table 3: Descriptive statistics result for discrete explanatory variables

Variable	Category	Household wealth category								χ^2 -value
		Poor		Medium		Better-off		Total		
		n	%	N	%	n	%	n	%	
Sex	Male	108	74.5	95	90.5	46	92	249	83.0	14.484***
	Female	37	25.5	10	9.5	4	8	51	17.0	
Agro-ecology	<i>Dega</i>	25	17.2	18	17.1	8	16.0	51	17.0	.336
	<i>W/ Dega</i>	81	55.9	61	58.1	30	60.0	172	57.3	
	<i>Kolla</i>	39	26.9	26	24.8	12	24.0	77	25.7	
Irrigation	Yes	5	3.4	9	8.6	3	6	17	5.7	3.003
	No	140	96.6	96	91.4	47	94	283	94.3	
Fertilizer	Yes	55	37.9	92	87.6	49	98	196	65.3	94.655***
	No	90	62.1	13	12.4	1	2	104	34.7	
Improved seed	Yes	24	16.6	62	59	45	90	131	43.7	97.072***
	No	121	83.4	43	41	5	10	169	56.3	
Credit access	Yes	42	29	45	42.9	13	26	100	33.3	6.741**
	No	103	71	60	57.1	37	74	200	66.7	
Training	Yes	36	24.8	75	71.4	46	92	157	52.3	90.862***
	No	109	75.2	30	28.6	4	8	143	47.7	
Safety net aid	Yes	50	34.5	6	5.7	0	00	56	18.7	46.969***
	No	95	65.5	99	94.3	50	100	244	81.3	
Migration	Yes	27	18.6	16	15.2	6	12	49	16.3	1.334
	No	118	81.4	89	84.8	44	88	251	83.7	
Non-farm activity	Yes	75	51.7	50	47.6	8	16	133	44.3	19.93***
	No	70	48.3	55	52.4	42	84	167	55.7	
Off-farm activity	Yes	53	36.6	8	7.6	0	00	61	20.3	46.78***
	No	92	63.4	97	92.4	50	100	239	79.7	
Coop. membership	Yes	24	16.6	55	52.4	36	72	115	38.3	61.841***
	No	121	83.4	50	47.6	14	24	185	61.7	
Local Leadership	Yes	12	8.3	36	34.3	31	62	79	26.3	60.584***
	No	133	91.7	69	65.7	19	38	221	73.7	

Source: survey result, 2013. Note: *** and **, represents significant at 1% and 5%

To compare the three wealth categories, more proportion (84%) of better-off households engaged solely on farming, while only 23.4% and about 48.6% of poor and medium households respectively pursue the same activities. Non-farm activities play a crucial role in livelihood of the poor and medium households, which accounted about 39.3% of poor and 43.8% of medium households. Only 16% of better-off households derive their livelihood from farm + non-farm activities. As the survey data indicates combining farming with off-farming activities is a main livelihood strategy of poor households, which proportionally constitutes about 24.8% of the poor, while only 3.8% of medium and none of better-off households diversified livelihood strategies into farm + off-farm activities. From the three wealth groups, very low percent of respondents combine livelihood strategies into farm + non-farm + and off-farm activities (Table 4). The finding of this study depicts that large number of poor households engaged in non-farm and off-farm activities in addition to agriculture. Many scholars also confirm this truth in that non-agricultural employment (non/off-farm activities) arises from the survival strategies of rural households unable to obtain employment or self-employment in agriculture (Ghosh and Bharadwaj, 1992; Mujib *et al.*, 2008; Babatunde *et al.*, 2010). According to them, it is a last resort rather than an attractive alternative livelihood.

Table 4: Distribution of sampled household by livelihood strategies and wealth category

Livelihood strategies	Household Wealth category								
	Poor		Medium		Better-off		Total		
	n	%	N	%	n	%	n	%	
Farm alone	34	23.4	51	48.6	42	84	127	42.3	
Farm + non-farm	57	39.3	46	43.8	8	10	111	37	
Farm + off-farm	36	24.8	4	3.8	0	00	40	13.3	
Farm +, non-farm + off-farm	18	12.4	4	3.8	0	00	22	7.3	
χ^2								79.896	
P-value								.000	

Source: survey result, 2013

3.1.2. Livelihood strategies and food security status of the households

Agriculture is the dominant livelihood strategies in the study area. Even though, many farmers are living with very small plot of land, which couldn't enable them to drive sufficient livelihood outcome from agriculture. Due to this, most of the farming communities are shifting their livelihood choices from farming to other alternatives. Therefore, diversifying livelihood strategies at current time is a common phenomenon in the study area.

The survey result also verified this fact that the majority of the sample farmers (57%) engaged in other livelihood strategies beside agriculture. Surprisingly, some farmers were pursuing non-farm and off-farm activities as the primary livelihood strategies rather than agriculture. As discussed in preceding part, out of the total sample households, only 42.3% of the respondents pursue agriculture alone as livelihood strategies. These households may be endowed with better productive resources like land compared to those who engaged in non/off farm activities. Among the two groups, high proportion (62%) of food secure households were driving their livelihood from farming alone, while 27.5% of food insecure households generate from the same strategies. Non-farm and off-farm activities were also the most important livelihood strategies among the respondents. In this regard, a significant number of the sample respondents from both food-secure (30.2%) and insecure (42.1%) groups were pursuing farming with non-farming activities (Table 5). Compared to food secure households (7.8%), high proportion of food insecure households (30.4%) was engaged in off-farming activities. According to this result, off-farming activity plays as a survival strategy specifically for poor/food-insecure households. As outlined in previous section, many of poor households engage in off-farming activities when their piece of land not enables them supply the required livelihood (see Table 4). Table 5 shows similar result in which off-farming activities mostly pursued by food insecure households due to land shortage to produce sufficient food for consumption. The chi-square test result also reveals statistically significant difference among the two groups with regard to livelihood choices at 1% probability level.

Table 5: Distribution of the sample Households by livelihood strategies and food security status

Livelihood strategies	Food security status of household					
	Food secure		Food insecure		Total	
	n	%	n	%	n	%
Farm alone	80	62	47	27.5	127	42.3
Farm + non-farm	39	30.2	72	42.1	111	37
Farm + off-farm	5	3.9	35	20.5	40	13.3
Farm + non-farm + off-farm	5	3.9	17	9.9	22	7.3
Total	129	43	171	57	300	100
χ^2						42.382
p-value						.000

Source: survey result, 2013

3.2. The model results

In this section, the selected explanatory variables were used to estimate the logistic regression model to analyze the determinants of household food security. A logit model was fitted to estimate the effects of the hypothesized explanatory variables on the probabilities of being food secure or not. SPSS version 16 was used for the econometrics analysis. The logit model results used to study factors influencing the food security status of household are shown in Table 6.

Table 6: Logit model estimates for factors affecting households' food security status

Variables	Coef.	S.E.	Wald	Sig.	Exp(B)
AGROMID	1.385	.728	3.617	.057*	3.994
AGROHIGH	3.777	1.121	11.344	.001***	43.682
SEX	.450	.784	.329	.566	1.568
AGE	.044	.032	1.872	.171	1.045
EDUCT	.228	.082	7.772	.005***	1.256
FAMSZ	-.649	.178	13.342	.000***	.523
DEPRAT	.052	.338	.024	.877	1.054
LANDCLT	1.663	.981	2.875	.090*	5.273
SOILFRTLY	1.457	.950	2.356	.125	4.295
IRRGTN	.967	1.309	.546	.460	2.630
TRLU	1.112	.264	17.735	.000***	3.041
OXEN	.382	.524	.533	.465	1.466
FERTLZR	1.901	.771	6.083	.014**	6.695
IMSEED	.615	.613	1.005	.316	1.849
EXTNCNT	.074	.036	4.282	.039**	1.077
TRAIN	.368	.582	.400	.527	1.445
CREDIT	1.185	.565	4.404	.036**	3.271
MRKDST	.071	.061	1.347	.246	1.074
COOP	1.005	.535	3.525	.060*	2.732
LEADER	-.175	.628	.078	.780	.839
NOFFARM	1.693	.860	3.878	.049**	5.435
OFFARM	1.695	.965	3.087	.079*	5.449
ONFARM	.252	.606	.172	.678	1.286
PSNP	1.385	.639	4.693	.030**	3.993
MGRTN	.793	.712	1.240	.266	2.209
GRAINS	.478	.757	.399	.528	1.613
CONSTANT	-14.209	3.500	16.483	.000	.013
-2 Log likelihood Ratio				133.079	
Chi-square (χ^2)				276.914***	
Correctly predicted overall sample (%)				90.3	
Correctly predicted food secure (%)				88.4	
Correctly predicted food insecure (%)				91.8	
Sample size				300	

Source: computed from survey data, 2013. Note: *=significant at $p < 0.1$; **=significant at $p < 0.05$; ***=significant at $p < 0.001$

As noted earlier in methodology part, the dependent variable (households' food security status) is a dichotomous, with an expected mean value of 1 indicating the probability of being food secure and 0 otherwise. Among the 25 variables used in the model, 12 variables were significant with respect to households' food security status with less than 10% of the probability level. These variables include family size (FAMSZ), agro-ecology (AGRECO), education (EDUC), tropical livestock unit (TRLU), cultivated land (LANDCLT), access to credit (CREDIT), fertilizer use (FRTLZR), extension contact (EXTCNT), membership in cooperative (COOP), farm plus off-farm access (OFFARM), access to farm plus non-farm plus off-farm activities and safety net aid (PSNP), whereas the rest 13 of the 25 explanatory variables were found to have no significant influence on food security status of the household. The effect of the significant explanatory variables on households' food security status in study area is discussed below:

Family size in AE (FAMSZ): As the model result shows, family size was found negatively and significantly affected food security status of farm households at less than 1% probability level. Its inverse relation implies that a probability to be food insecure increases as household size in adult equivalent increases. This result suggest that those households with large number of family size could face most likely food insecurity because of high dependency burden created as a result of parting available limited resources including food. In short, increase in family size most probably creates more mouth to be fed from the limited resources and this in turn increases the burden on the limited available food in the household. The odds ratio for household size shows that, other variables being constant, the odds ratio in favor of being food secure drops by a factor of 0.523 as household size increase by one unit in AE. This verifies that those families with large economically inactive family members tend to be food insecure than those with small family size. This idea is supported by the findings of Abebaw

(2003), Webb *et al.* (1992), Ermias (2011), Alem (2007) and Yilma (2005), they stated that large family size results in increase of food demand ultimately ends up with food insecurity.

Livestock ownership (TRLU): Livestock production play vital role in food security of rural households in the study area. The model result also indicates that number of tropical livestock unit affected positively and significantly the probability of household food security status at less than 1% probability level. This result shows that those farmers with large number of tropical livestock units are more likely to be food secure than those who own small number of TLUs. The positive relationship indicates that the probability of being food insecure decreases as the household's ownership of livestock increases. This might be due to a household with more livestock produce more milk and milk products for direct consumption and owner could be more food secured. Further, farmers with large herd size have better chance to earn more income from livestock production. This in turn enables them to purchase food when they face the shortage, and invest in purchasing farm inputs that increase food production, and thus ensuring food security at household level. Serving as draft power and manure source are also the main attributes of livestock, which help in ensuring household food security. Other things held constant, the odds ratio of 3.041 for number of TLU shows that, as the number livestock units increases by one TLU, the odds ratio in favor of being food secure increases by a factor of 3.041. This finding agrees with the study undertaken by Tsegay (2009), Genene and Wagayehu (2010), Tilaye (2004) and Ramakrishna and Demeke (2002) in that households' food security status has positive relationship with livestock ownership.

Education (EDUCT): As expected, this variable was found to have positive association with household food security and significant at less than 1% probability level. This result implies that farmers with high level of education are more likely to be food secure than those who have low level of education. The justification of this result is that educational attainment by the household head could lead to awareness of the possible advantages of modernizing agriculture by means of technological inputs; enable them to read instructions on fertilizer packs and also believed to have a chance to diversify household's income source, which in turn would enhance households' food supply. Moreover, educated household has the capacity to innovate and adopt timely the available technologies and better in managing their farm activities. The odd ratio reveals that, holding other variables constant, a change in household head education level by one unit will increase a probability of being food secure by a factor of 1.256. Thus, education is a fundamental instrument in equipping farmers with necessary skill which enables them to diversify income sources and reverse food insecurity problems than uneducated ones. This study also inline with the finding of Tsegay (2009), Sultana and Kiani (2011), Ermias (2011), and Webb *et al.* (1992).

Cultivated land (LANDCLT): As hypothesized, the variable cultivated land found to be significant (at less than 10% probability level) and positive relationship with food security of farm households in the study area. This implies that farmers who cultivate larger farmland would be less food insecure than those with smaller land size. Increase in size of cultivated land has positive relationship with the amount of production to be harvested as far as the similar situations concerned. This means that households with large cultivated land produce more for household consumption and for sale and have better chance to be food secure than those having relatively small size of cultivated land. The odds ratio for this variable implies that, holding other variables constant, as increase in one hectare of cultivated land will increase food security status of the household by a factor of 5.273. Study by Tefera (2009), Workicho (2007), Ramakrishna and Demeke (2002) and Alem (2007) also found a significant and positive influence of total cultivated land on food security status.

Contact development agents/frequency of extension visit (EXTNCNT): had significant (at less than 5% probability level) and positive influence on the probability of households' food security. This implies that households would be in a better position of food status if there is frequent contact with development agents. The possible justification is that the higher the linkage between farmers and development agents, the more the information flows and the technological (knowledge) transfer from the development agents to the farmer. Those farmers who have frequent contacts with development agents are more likely to produce better than others. Other things remain constant, the odds ratio in favor being food secure increase by a factor of 1.077 as the number of contacts of the households with extension agent within a year increase by one unit. The result, therefore, confirm the hypothesized positive role extension would play in reducing food insecurity at household level. Similar study by Menale *et al.* (2012) and (Bahiigwal, 1999) indicated that food security status increases with frequent and regular visit of extension workers.

Credit Access (CREDIT): the logistic regression model result reveals that access to credit was found to have positive and significant impact on food security of the households at less than 5% probability level. This implies that those households who have access to credit are more likely food secure than those who have no credit access. This might be due to farm households who have an opportunity of accessing farm credit would build their capacity to produce more through purchasing of agricultural inputs. Credit also gives the household an opportunity to be involved in income generating activities (petty trading and other non-farm activities) so that derived revenue increases financial capacity and purchasing power of the household to escape from risk of food insecurity. Credit some time used directly to purchase food for consumption when household faces with hard

time. Hence, the households with more access to farm credit have possibility to reduce the probability of being vulnerable to food insecurity. Holding other things constant, the odds ratio in favor of food security increases by a factor of 3.271 as a household has access to credit. Ermias (2011) and Abebaw (2003) found inverse and significant relationship b/n participation in credit and food insecurity.

Access to farm + off-farm activities (OFFARM): For many smallholder farmers food and income from their own farm is not sufficient to fulfill family requirement. Off-farming activity is one of the important sources of income particularly for poor farmers. The model result also revealed that this variable influenced households' food security positively and significantly at less than 10% probability level. This implies that those farmers who have access to off-farm income opportunities are less likely to become food insecure than those who have no access. This might be due to the fact that households engaged in off-farm activities are better endowed with additional income and more likely to escape food insecurity. Further, increased access to off-farm activities have a potential of increasing the chances of household being food secure through diversifying the sources of farm households' income. The odds ratio indicates that, other things being constant, the probability of the household to be food secure increases by a factor of 5.449 as the household get access to off-farm activities. Similar study by Mequanint (2009), Yilma (2005) and Zerihun (2009) indicated positive relationship b/n access to off-farm activities and food security of household.

Access to farm plus non-farm and off-farm activities (NOFFARM): The model result indicated that access to both non-farm and off-farm activities influenced positively and significantly food security status of the sample households at less than 5% probability level. The implication of this result is that those households who are conducting combination of livelihood strategies have more chance to be food secure than those have not. This might be engaging in non-farm and off-farm activities could enable households to modernize their production by giving them an opportunity to apply the necessary inputs, and reduce the risks of food shortage during periods of unexpected crop failure through purchases. Moreover, pursuing diversified livelihood strategies plays supplementing role to the income of the households, which helps to overcome financial problem in accessing food from available sources. The odds ratio in favor of 5.435 for this variable indicates that, keeping other factors constant, the odds ratio in favor of being food secure increases by a factor of 5.435 as a household conducts farm with non-farm and off-farm activities. This result inline with the prior study conducted by Teferea (2009), Mequanint (2009), Omotesho et al. (2006), and Yilama (2005), in which involvement in non-farm and off-farm activities found to positively and significantly influenced food security status of the household.

Safety net aid (PSNP): this refers to support given to poor households by government in order to help them mitigate temporary food shortage, avoid sale of household assets or consumption of seeds and build their livelihood asset in long run. It is also believed to overcome financial problems of a household to get access to food. The model result shows positive and significant association between households' food security and safety net aid at less than 5% probability level. The implication of this result is that those households who have access to participate in safety net program are more likely to be food secure than those who have not. The possible explanation is that the program plays supplementing role to the income of the households, which helps the realization of food entitlement/access through purchase. In the model result the odds ratio indicates that, other things being constant, the probability of the household to be food secure increases by a factor of 3.993 as the household get access to safety net aid. The study by Zerihun (2009) indicated that income from safety-net significantly affect the likely of being food secure positively.

Use of chemical fertilizer (FERTLZR): The model result shows that using fertilizer has a positive relationship with household food security status and significant at less than 5% probability level. This result indicates that those farmers who have access to fertilizer use are more likely to be food secure than those who have no access. The possible reason is that those who use fertilizer may produce more per unit area and can have access to large quantity of food. It is fact that fertilizer helps farmers to enhance productivity and boost production. Hence, those who use fertilizer have high probability to be food-secure than those who don not use. The odds ratio of 6.695 for this variable indicates that, holding other factors constant, the odds ratio in favor of being food secure increases by a factor of 6.695 as a farmer gets access to the use of fertilizer. This result inline with the finding of Yilma (2005), Haile *et al.* (2005), Tsegay (2009) and Ramakrishna *et al.* (2002) in which use of chemical fertilizers influenced food security status of the households positively.

Cooperative membership (COOP): Conducting activities in collective base helps farmers to reduce transaction cost and achieve economies of scale. Then this in turn enhances the production and income of the farmers. According to the model result, membership in cooperative was found to have a significant and positive relationship with household food security at less than 10% probability level. This result implies that those farmers who have participated in cooperative organization are less likely to be food insecure than those who don not have access to it. Becoming a member of cooperative benefits farmers in many aspects like creating access to credit, input supply, output marketing and develop important social network in which experience and information exchanged. In this way, membership can solve financial problem, promote timely supply of inputs with fair price, marketing farm output with reduced costs. Further, these benefits may lead those households

who participate in cooperative toward better production, more income and finally help to ensure the household food security. Keeping other variable being constant, the odds ratio for cooperative membership indicates that, the probability of the household to be food secure increases by a factor of 2.732 as the household get access to cooperative membership. Similar study by KPI *et al.* (2004) indicated that being a member of cooperative have negative influence on food insecurity,

Agro-Ecological zone (AGRECO): This variable was found to influence positively and significantly food security status of the sample households in high-land and mid-land agro-ecological zones at less than 1% and 10% probability level respectively. This result implies that the magnitude of household food security increases as we go from low land to middle and high land areas. On the other word, the degree of household food insecurity decreases as we go from middle and high land agro-ecological zones to low land agro-ecological zones. The two possible justifications can be drawn in both middle and high altitude for their positive association in terms of household food security. First, with the regard to high land area, the positive effect may indicate absence of much moisture stress due to drought problem. Rainfall distribution in high land area is much better than low land. This situation may help farmers to produce food and cash crops without facing drought problem as in low land. Further, in high land area 'enset', the perennial drought tolerant crops widely produced. It can be consumed at any time when household face food shortage. As the survey result indicates, non-farm activities especially handicrafts also widely practiced in high land area due to presence of bamboo tree, which serve as additional income sources to overcome food deficit. Second, in middle land the suitable/moderate climatic conditions allow farmers to produce diversified food and cash crops. Especially s/potato, taro, and 'enset' crops are the most dominant food crops produced in this agro-ecological zone. Like in high land area, in mid-land rainfall distribution is better than low land area.

Generally, the positive influence might be due to differences in the quality of land, the amount and distribution of rainfall that influence the quality and amount of food crops between highlands, midlands and the lowlands. The odd ratios indicates that, other things being constant, the probability of the household to be food secure increases by a factor of 43.682 and 3.994 for high and middle land areas, respectively, as we go from low land agro-ecological zone. This result is in line with Webb *et al.* (1992), Toulmin (1996) and Esthetu (2000).

4. CONCLUSION

Food security of a household is a reply of available livelihood strategies, which in turn determined by the availability of productive assets especially agricultural land and opportunities for employment. Even if agriculture dominate the livelihood and economic activities of rural households in the study area, the caring capacity of the sector deteriorating from time to time due to diminishing farm size, uncontrolled population growth and recurrent drought. This situation has forced people to look for alternative employment option. Today, a significant number of rural households engage in diverse livelihood strategies away from purely crop and livestock production towards non-farm and off-farm activities that are undertaken to generate additional income to ensure food security and attain livelihood improvement. It is increasingly becoming clear that the agricultural sector alone cannot be relied upon as the core activity for rural households as a means of improving livelihood and achieving food security. As observed from the finding of the survey, large parts of the respondents (57.7%) combine agriculture with other activities (non/off-farm). The national average daily food energy per adult equivalent estimate of 2,200 kcal was considered to classify the households as food insecure and food secure and results of analysis indicated that 57% of the respondents were food insecure and 43% of them were food secure. The result of the study revealed that food secured households are better endowed with socio-economic or productive resources than food insecure households. Because of this, resource poor farmers are more suffer from food insecurity situation.

The study also tried to see the linkage b/n household livelihood strategies and food security status, in that larger proportion (62%) of food secured households depend on agriculture alone as a livelihood strategies, where as it was accounted about 38% for those who select combined livelihood strategies. In contrary, majority (72.5%) of food insecure households relied on combination of livelihood strategies. The finding further indicated that most of food secured households use agriculture alone as their livelihood strategies found to be in a better position in terms of calorie consumption per Adult Equivalent than food secured non-users. Binary logit regression was employed to estimate determinants of the probability of being food secure as a function of various household characteristics among sampled households of the study area. The model results reveal that among 25 explanatory variables included in the logistic model, twelve were found to be significant at less than 10% probability level. According to this, education, cultivated land size, frequency of extension visit, access for credit, access to farm plus off-farm activities, access to farm plus non-farm plus off-farm activities, safety net aid, use of chemical fertilizer, cooperative membership and agro-ecological zone were found to be the most important determinants affecting the state of food security and has shown positive impact on the probability of being food secure. On the other hand, family size in AE was found negatively and significantly affected food security status of the household. Thus, due attention and policy consideration should be given by government and other concerned

bodies to those significant variables which have a potential impact in determining household food security status in the study area.

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