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Determinants of Rural Farm Household Food Security in Boloso Sore District of Wolaita Zone in Ethiopia

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Authors' contributions

This work was carried out in collaboration between both authors. Author TL designed the study, wrote the first draft of the manuscript, data collection and performing statistical analysis. Author BK supervised and guided the work in each step edited and proof read the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

The study was conducted to identify determinants of rural farm household food security status in *Boloso Sore district* of *Wolaita* Zone, Ethiopia. A three-stage sampling technique was utilized to obtain a sample size of 90 rural farm households. Cross sectional data were collected through structured questionnaire, focus group discussion and personal observation. Data were analyzed using head count index, food insecurity gap index, food surplus gap index and binary logit model. The result showed that only 34.5% of rural farm households were found food secure while 65.5% were food insecure. The food insecurity gap and food surplus index showed that food secured households exceeded the food security line by 34.6% while 27.8% of food insecure households fall below the poverty line. The severity of the food insecurity gap among the food insecure households was found to be 11.7%. The binary logit model result revealed that the major factors determining

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food security of rural farm households were family size in adult equivalent, total cultivated land size, annual income of household, oxen ownership of households, access to extension and credit and age of the household head. Age of household head, family size and access to extension services had a negative effect on household food security status while household income, credit access, oxen ownership and cultivable land size had a positive effect on household food security. Limiting the increasing population pressure, promoting income-generating activities, enhancing micro-financing efficiency, creating employment opportunities, information dissemination, among others can contribute to food security status of households in the study areas.

Keywords: Binary logit model; food security; rural farm households; wolaita.

1. INTRODUCTION

It is widely accepted that food is a basic necessity of life. Its importance at the household level is obvious as food is a basic means of sustenance. Adequate intake of quality food is a key requirement for healthy and productive life which indicates food security status of a household. A household is food secure if it can reliably gain access to food in sufficient quantity and quality for all household members to enjoy a healthy and active life [1]. According to [2] food security is assumed to exist "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". The inability of the poor to have access to needed food can be attributed to low income and inadequate food production which causes food insecurity. Food insecurity implies a temporary and a long term shortfall of adequate food for a proper diet [3].

Majority of poor people in developing country live in rural areas where their livelihood and food security are dependent on agriculture. Studies indicated that agricultural productivity of rural people in many developing countries is decreasing due to overuse of natural resources, climate change, among others. As a result, it is reported that low level of per capita food production is a common challenge of the countries. In order to augment agriculture, a number of livelihood diversification strategies that promote agricultural productivity, rural incomes and food production are being implemented by development practitioners. Thus achieving food security requires aggregate availability of physical food supplies, access to food supplies and utilization of food to meet the specific dietary needs of households or individuals in the households [4].

Ethiopia remains one of the poorest and most food insecure countries of the world. It was estimated that about 38.7% of the households were food insecure; and most of its population get below the minimum levels of dietary energy consumption compared with other sub-Saharan and developing countries [5]. Despite the effort from the Ethiopian Government and farmers in the community, Ethiopia stays highly vulnerable to severe and chronic food insecurity at large extent. According to [6], the number of people in need of food assistance was 4.6 million in 2008 and rose to 6.2 million in 2009. The country experienced highest inflation that is the top in the world [7] thereby entailing high food prices and growing food insecurity. As government report [8] indicated that Ethiopia has been registering high economic growth (11%) in the recent years, however, there is significant poverty and chronic food insecurity in the country. Most of these food insecure households are subsistence farmers and vulnerable to weather fluctuation and high population growth have contributed to decline to the farm size and environmental degradation stay a problem [9]. According to [10], nearly 55 percent of all smallholder farmers operate on less than one hectare of land due to smaller farm size and low return from farming activity, majority of rural households are exposed to food insecurity and chronic poverty. The evidence also supported by [11] in about 61 percent people undernourished.

In Ethiopia, the seriousness of food shortage varies from one area to another, depending on the state of natural resources and extent of development of food shortages. This condition was due to series of successive droughts, "poor and erratic" rainfall, global high food and fuel prices and global financial crisis [12]. To reverse this food insecurity situation, the government of Ethiopian formulated a long term strategy called Agricultural Development Led Industrialization strategy (ADLI) which takes agriculture as its point of departure and the growth engine [13]. The food security strategy was issued in 1996 and was revised in 2002 and 2005, highlighting the government plan to address causality and

effect of food security problem [14]. This strategy envisaged developing agricultural based economy by raising production and income of farmers. It was implemented in all food insecure *districts* all over the country.

Boloso sore district is one of the most densely populated districts. Similar to many other districts, the district mainly depends on small scale subsistence agriculture to derive its livelihood and as a result categorized as highly food insecure or one of the least self sufficient in the country [15]. In addition to that the existing farm size of households couldn't enable them to generate adequate food. The majorities of the population live on subsistence margin with little or no land and livestock and depend on marginal non-farm income sources i.e. petty trade and causal labor and depend on distant migration as a way to maximize across a season and cope with food shortage has been a long history [9]. Besides the most recent evidence indicates that about 75% of households in the district are possessing less than 0.25 hectares of land [16]. Livestock holdings are on decline because of shortage of the grazing area and unavailability of animal feed. Therefore, currently to fulfill food gap the district involved in productive safety net program (PSNP) in order to secure livelihood and ensure food security of the households.

The aim of the program was to provide security against abrupt income changes and to improve availability and access to food to rural households. This was believed to be strengthened through access to credit, extension services, veterinary services, and improved agricultural inputs. In addition, security against abrupt income can be guaranteed by giving food aid in exchange for labor effort to construct public works [17]. This includes many building blocks guided towards local development such as block grants are made accessible to workdays for activities such as water harvesting, irrigation, feeder roads and household agricultural packages and direct sustenance for elderly, the handicapped, pregnant women [18]. While the problems of food insecurity have big diversity and multiple dimensions, which range from the global, regional, country, household to the individual level, so far in the study area little demand driven study was undertaken to elicit these problems. More attention was given to the county level. Moreover, the various and complex and interrelated causes of household food insecurity and local responses during the crises situation were not studied in detail at individual household level.

Given these all efforts, the question of how the policy factors affect the food security situation in *Boloso Sore district* reminded unanswered for policy makers in the *district* as well as in the country. This study therefore attempted to fill the gap by conducting household level study to identify factors determining rural farm household food security in *Boloso Sore district* of the *Wolaita* Zone, Ethiopia.

2. METHODOLOGY

2.1 Descriptions of the Study Area

Boloso sore district is one of 135 *districts* in the Southern Nations Nationalities and Peoples Region (SNNRP) State. It is 26 km to the northeast of *Sodo* town, the seat of *Wolaita* zone administration. The total number of rural households in the district is 38,935 out of which 89.87% are men and 10.13% are women households. The total population of the *district* was estimated to be 196,582 out of which 49.27% were male and 50.73% were female. The population density of the *district* is 636 persons per Km^2. The average household size is 5.1 and dependency ratio is 91 which are also high [16]. The total size of the *district* is 24,286 ha out of which 65.80% is used to grow annual crops, and 13.3% for perennial crops. The rest of the land is used for grazing, forest, degraded and small portion of land for other communal purposes.

The *district* is predominantly rural, and depends on agriculture. The major economic activity is rain fed farming. Major crops grown in the *district* include cereals, pulses and cash crops like coffee, fruits, and root crops. Wheat and maize are the dominant cereal crops grown. However, the area is known for its low productivity due to land scarcity, erratic rainfall and prevalence of pests. As a result, income from non-farm and off-farm activities is the second most important source of livelihood in the *districts*. Especially, trading plays an important role in generating income for both non-farm and off-farm activities. Apart from trading, income from daily labor and seasonal workforce movement during harvest time is another source of income.

2.2 Sampling Technique

In the study area, farming households are responsible for making day to day decision on farm activities. Thus, households were the basic sampling unit. Three-stage sampling techniques were used to generate the required primary data. At the first stage, *Boloso Sore district* was selected purposively because it is one of the food insecure *districts* of the zone. In the second stage, out of 29 *villages* within the *districts,* four *villages* (*Dolla, Doge Woybo, Shye Homba and Bassa Gofera*) were selected by simple random sampling techniques. From these *villages*, sample size was determined using simplified formula provided by [19]. A probability proportion to size (PPS) was employed to determine sample size from each *village* and finally 90 households were selected by using systematic random sampling techniques (Table 1).

Table 1. Sample size of the villages

Name of villages	Total households in the village	Sampled households
Doge woybo	762	13
Dolla	1358	23
Bassagofera	1773	30
Shyehumba	1387	24
Total	**5280**	**90**

2.3 Sources of Data and Methods of Data Collection

Both qualitative and quantitative data were collected from primary and secondary sources. Data from primary sources such as households, and *district* officials were collected through household survey, key informant interview, focus group discussions and observations. The survey included questionnaire such current households' dietary food intake status, socioeconomic, demographic, institutional and natural factors. Secondary sources of data were collected from Central Statistical Authority (CSA), reports of line ministries, internet browsing and journals.

2.4 Analytical Technique and Variables Measurements

2.4.1 Food security index

Two objective methods of food security measurement have been widely used in most food security studies [20]. One is to estimate gross household production and purchases over time which estimates the growth or depletion of food shock held over that period of time and presume that the food that has come into the household possession and disappeared has been consumed. The other one is to undertake food consumption recall for individual members of the households or for households as a whole and analyze each types of food mentioned for calorie content. In this study, a 7 day food consumption recall method was used and the estimated quantities of every food item consumed by the household in the 7-day period were calculated. The quantities were converted into grams and the calorie content estimated by using the nutrient composition table of commonly eaten food in Ethiopia [21]. Per capita calorie intake was calculated by dividing estimated total household calorie intake by the family size after adjusting for adult equivalent using the consumption factor according to sex and age of the household members. To get the household daily per capita calorie intake, the household per capita calorie intake was divided by seven. Thus, those households beyond the estimated calorie requirement level (≥2100 kcal per person per day) were deemed to be food secure and otherwise food insecure.

To determine factor determining rural farm household food security, a food security index (Z) was constructed which determine the food security status of each household based on the food security line using the recommended daily calorie requirement. The food insecurity gap, the severity index, the surplus index and head count ratio of food security were calculated based on food security line. The food insecurity gap (P) measures the extent to which poor households are food insecure and the surplus index measures the extent by which food secure households exceeded the food poverty line. The head count ratio (H) measures the percentage of the population of the households that are food insecure/secure.

$$Z_i = \frac{Y_i}{R} \quad (1)$$

Z_i= Food security status of **ith** household which takes the value 1 for food secure households and 0 for food insecure households.

Y_i = Daily per capita calorie intake of ith households.

R= the recommended per capita daily calorie intake (2100 kcal Z_i = 1 for Y_i greater than or equals to R, Z_i =0 for Y_i less than 0

Food insecurity Gap (P) $= \frac{1}{M}\sum_{i=1}^{m} G_i$ (2)

Where, M= the number of food insecure households

G_i= Per capita calorie intake deficiency intake for a household.

$$G_i = \frac{R-Y}{R}$$

Therefore,

Food insecurity Gap (P) = $\frac{1}{M}\sum_{i=1}^{m} \frac{R_I - Y}{R}$ (3)

Food severity index **(L)** $= \frac{1}{M}\sum_{i=1}^{p} P^2$ (4)

Food surplus gap index (S)= $\frac{1}{T}\sum_{i=1}^{m} \frac{YI-R}{R}$ (5)

Head count index (H_{in}) = $\frac{M}{N}$ (6)

Head count index (H_s) = $\frac{S}{N}$ (7)

Where, S= Food Surplus gap index, N= total sample households, T= food secure households.

2.4.2 Logistics model

Based on the household food security index (Z_i), Logistic model was estimated to identify the determinants of food security among rural farm households. The implicit form of the model was expressed as

$$Z_i = \beta X'_i + U_i \quad (8)$$

Z_i= the food security status of the i^{th} household, X'_i=the Vector of explanatory variables

U_i= the error terms, β = Vector of the parameter estimates.

The binary logistic model was applied to estimate the effect of explanatory variables on household food security status. In the model the dependent variable was household food security (HFS) that is dichotomous taking the value of 1 if the household is food secure, 0 otherwise. Identification of food security households from food insecurity was obtained by comparing the total calorie available for consumption in the household per adult equivalent to the minimum level of subsistence requirements per adult equivalent 2100 kcal [21]. A household beyond this threshold is said to be food secure households, otherwise not. The cumulative logistic probability model specified as [22] estimates as follows.

$$L_{ij} = \text{Ln}\left(\frac{P}{(1-P)}\right) = Z_{ij} = \beta_0 + \sum_{i=1}^{j} \beta_i X'_i + U_{ij} \quad (9)$$

i = j = 1, 2… 13, Where: L_{ij}= is log of the odds ratio which is equal to Z_{ij}, which is not only linear in X_i but also linear in the parameters. It shows how log odd in favor of food security change as the respective independent variable change by a unit and X_i= Vector of relevant explanatory variables; B_i= Vector of unknown coefficient; U_i = Error term. The parameters were estimated using maximum livelihood techniques.

2.5 Description of the Variables Used in the Binary Logistic Model and Their Hypothesis

2.5.1 The dependent variable of the study

Household food security status is a dichotomous variable representing the status of the household food security in the model taking the value of 1 if the household is food secure and 0 0therwise. Review of the literature and authors knowledge the food security situation of the study area was used to identify the potential determinants of household food security. The explanatory variables, their description and measurements are given in Table 2.

3. RESULTS AND DISCUSSION

3.1 Socioeconomic Characteristics of the Households

The socioeconomic characteristics of households indicated that about 62.3% of the farmers were within the age 25-44 years. This indicates that the households are expected to be very active on farm activities being more responsive to extension programs. This could also lead to a boost of agricultural activities with the fact that young people are energetic and have the capacity to use innovations. About 32.2% of the households were females and the rest 67.8% were males. Only 33.4% of the household heads did not have any formal education whereas 65.6% of them had gone through primary and secondary education and only 0.1% of them had their higher diploma and degree. The education status of rural households enable them acquire

knowledge and skill and this in turn increase their productivity. The majority of the households (65.6%) owned less than 1 hectare of land. As expected the proportion of landless households account for about 3.3% which is nearly similar to the figures in many studies (Table 3).

Table 2. Variables and their measurements

Variable code	Description and measurements	Hypothesized sign
Foods	Is a dummy dependent variable taking the value 1 for food secure households and 0 otherwise	
Litracystat	Is a dummy variable taking the value of 1 if the household is literate, 0 otherwise	+
Agehhh	Age of the household head (years)	+
Hhfsize	Family size of the households in Adult Equivalent(AE)	-
Sexhhh	Is a dummy variable taking the vale 1 if the house hold head is male, 0 otherwise	-
Chfertuse	Is dummy variable taking the value 1 if the household uses chemical fertilizers, 0 otherwise	+
Crediutl	Is the dummy variable taking the value 1 if the household access credit, 0 otherwise?	+
Extserice	Is the dummy variable taking the value 1 if the household utilizing extension service, 0 otherwise	+
Landsize	Total farm land cultivated by the households measured in hectares	+
Oxenowened	Oxen owned by the household in TLU	+
Livestockown	Total livestock except oxen owned by farm household TLU	+
Nearmark	It is the dummy variable taking the value 1 if household access market, 0 otherwise	+
Imseed	It is the dummy variable that takes the value 1 if a household use improved seed, 0 otherwise	+
Tothhincome	The total income from on-farm, farm and off farm income in Birr	+

Table 3. Socioeconomic characteristics of households

Variables	Categories	Frequency	Percentages
Age (years)	15-24	2	2.2
	25-34	23	25.6
	35-44	33	36.7
	45-54	19	21.1
	55 and above	13	14.4
Sex	Male	61	67.8
	Female	29	32.2
Household size (adult equivalent)	1-3	4	4.4
	4-6	48	53.3
	7-9	31	34.4
	10 and above	7	7.8
Marital status	Single	-	-
	Married	64	71.1
	Divorced	8	8.9
	Widowed	18	20
Education level	Illiterate	30	33.4
	1-4	37	41.1
	5-8	13	14.5
	9-12	9	10
	Diploma and above	1	0.1
Total		**90**	**100**

3.2 Household Food Security Status

The calculated household available energy was compared with the minimum subsistence requirement per adult equivalent per day (i.e. 2,100 kcal). The result revealed that 65.5% and 34.5% of households were found food insecure and food secure, respectively. The mean energy available for food insecure and secure households was 1,487.29 and 2,929 Kcal/AE/day, respectively. The mean energy intake of all sample households was 2,020 kcal. The minimum and maximum energy intake for food insecure and secure households was 713.55 and 2,098 Kcal, respectively. The minimum and maximum energy intake of food secure households was 2,150 and 3,758 Kcal, respectively. The findings show that the study area could be regarded as food insecure given the fact that only 34.5% of the households were able to meet the recommended calorie intake of 2,100 Kcal per capita per a day. The food insecurity gap index (p) shows that food secure households exceeded the calorie requirement by 34.5% while the food insecure households fell short of the calorie requirement by 27.8%. The food insecurity gap shows that if it is possible to mobilize resources that can meet 27.8% of calorie requirement of every food insecure households and distribute to the recommended daily caloric requirements level, then theoretically food insecure can be eliminated. On the other hand, the severity of food insecurity was 11.7%. The t-value 27.1 confirmed that there is a significant mean difference between food insecure and secure households (Table 4).

The average age of household heads was 39 years of which 33.3% was headed by females of which only 27% of female households was food secure. The finding revealed that average household size was 4.8 which are lower than the average household size of *Wolaita* zone (5.1) [23], The result shows that there is significant mean difference between food secure and insecure households with respect to age, household size, total income, landholding, livestock ownership and oxen ownership (Table 5).

Table 6 provides a chi-square test for discrete variables that were hypothesized to affect food security status of rural farm households. About 88% of the illiterate households were food insecure as compared with only 12% of food secure households. On contrary, 53% of the food secure households were literate as compared with 47% of food insecure households. The chi square test shows that there is a significant difference between food secure and insecure households with regards to education. The finding signifies that as education level of household advances, there is a chance to be out of food insecurity condition. There was a significant difference between food secure and food insecure households in terms of use of chemical fertilizer, credit services, and extension of services, improved seed, chemical fertilizers and distance to the market.

3.3 Determinants of Rural Farm Household Food Security

The model results showed that the binary logit model correctly predicted 93.4% of the food security status of households. The model chi-square value with 91.684 shows that inclusion of the explanatory variables contributed to improvement in fit of the full model. The Cox and Snell and Nagelkerke pseudo R-square values were 0.632 and 0.8744, respectively. The Hosmer-Lemeshow test result reported chi-square value of 8.1 with p-value of 0.904 which is greater than 0.10 and 0.05 levels showing that there is no difference between the observed and the predicted values and hence estimates of the model fit the data very well in an acceptable level. As a result, out of the hypothesized variables which were included in the binary logit model, 7 variables showed statistically significant relationship with household food security. These are age of household head, household size, access to credit and extension services, cultivated land size, oxen ownership and annual farm income (Table 7).

3.4 Age of the Household Head

The age of a household head was negatively and significantly affected food security of households at 10% probability level showing an inverse relationship with household food security. This means for every unit increase in farmer's age, the odd ratio is in favor of household's food insecurity by a factor of 0.881, keeping other variables constant. The finding was consonant with [24,25] who demonstrated that age of household head has negative relation with household food security status. The policy implication is that young aged household heads have more likely to be innovative and are engaged in multidimensional livelihood strategies. In doing so, they relatively have better food security status than old aged household heads.

Table 4. Food security of rural farm households

Calorie consumed per adult equivalent in (kcal/person/day	Food secure (N=31)	Food insecure (N=59)	Overall mean (N=90)
Minimum	2150	713.55	713.55
Maximum	3758	2098	3758
Mean	2929	1487.29	2020
Std. Dev	417.2	406.9	800.6
Surplus/short fall index	0.346	0.278	--
Severity index	--	0.117	---
Head count ratio (**M/N**)	0.345	0.655	1
t-value = 27.1 p-value = 0.000			

Source: Household survey (2014)

Table 5. Mean of food security of rural farm households

Variables	Total (N=90)		Food secure (N=31)	Food insecure (N=59)	t-value
	Min(Max)	Mean(SD)	Mean(SD)	Mean(SD)	
Age	20(67)	39(11)	36(9.9)	41.7(11.2)	2.1*
Household size (AE)	2(9)	4.8(1.69)	3.7(0.99)	5.4(1.7)	5.8***
Land holding (ha)	0.1(3.2)	1.1(0.9)	1.6(0.95)	0.7(0.6)	5.1***
Livestock ownership(TLU)	0(10)	3.9(2.5)	5.4(2.2)	3.1(2.3)	4.4**
Number of oxen	0(3)	0.98(0.67)	1.38(0.6)	0.7(0.6)	4.7**
Household income per annum (Birr)	700(50140)	6849(8282)	12,269(8810)	4005(6419)	4.6**

****, **, * at 1, 5, and 10% significant level, respectively, Source: Household survey (2014)*

Table 6. Proportion of food security of rural farm households

Variables	Categories	Food insecure (%)(N=59)	Food secure (%)(N=31)	Chi-square
Sexhhh	Male	61	39	
	Female	76	24	1.5
Litracystat	Illiterate	88	12	
	Literate	47	53	16.5***
Chfertuse	Users	59	41	
	Non-users	83	17	5.2**
Extserice	Users	39	61	
	Non-Users	83	17	18.8***
Impseed	Users	32	68	
	Non-Users	83	17	23.3***
Creditut	Yes	44	66	11.2***
	No	79	21	
Distmark	Yes	59	31	5.2***
	No	84	16	

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

3.5 Household Size in Adult Equivalent

Household size in adult equivalent has a negative and significant relationship with household food security at 1% probability level. This means that the larger the household size in adult equivalent the more likely they are to be food insecure. Keeping other variables constant, a unit increase in household size in adult equivalent reduces the odds of household food security by a factor of 0.116. Consequently, a unit decreases in the household size in adult equivalent increases the odds ratio of a household food security by 11.6%. Importantly, household size in adult equivalent increases the number of consumers putting pressure on household resources; particularly food and household with high dependency ratio are prone to food insecurity. The result agrees with [25,26].

3.6 Access to Credit Services

The sign of the coefficient of access to credit showed a positive relationship with food security

and is significant at 10% probability level. The positive relationship implies that households with access to credit service have more chance to be food secure than households without access to credit. The result is fully in conformity with the prior expectation. This is due to the fact that credit gives the household an opportunity to be involved in income generating activities so that derived revenue increases and purchasing power of the household to escape from risk of food insecurity advances. Moreover, it helps to smooth consumption when household face with temporary food problem. Holding other variables constant, the odds ratio in favor of food security increases by a factor of 55.780 as household's access to credit increases by one unit. The findings coincide with similar study conducted by [9,27].

3.7 Access to Extension Services

The coefficient of access to extension services is statistically significant at 1% significant level and has a negative relationship with food security status of a household. This implies that households with access to extension services tended to be food insecurity than those that did not have such access and vice versa. In principle, extension services are meant to enhance the chances of a household having access to better crop production techniques, improved inputs, and production incentives that positively affect farm productivity and production. However, leaving the right business aside, extension agents are engaged in collecting fertilizer and improved seed credit. As a result, it was easily observed that high level of technical inefficiency among smallholder farmers highly attributable to low availability of extension services and information about technical aspects of crop technologies. Other variables remain constant, the odds ratio in favor of being food secure decrease by a factor of 0.022 as access of households to extension service within a year increases by one unit. The result is therefore in contradiction to the hypothesized positive role extension service would play in the reducing food insecurity at household level. The study was consonant with [28].

3.8 Size of Cultivable Land

The coefficient of cultivable farm size has positive sign and statistically significant at the 5% probability level, meaning that farm size exhibits a positive relationship with the food security status of a household. The implication is that the probabilities of being food secure increases with farm size. That is, households with larger farm sizes tend to be more food secure than those with smaller sizes, and vice versa. This is possibly because that the size of landholding is a proxy for a host of factors including wealth, access to credit, capacity to beer risk and income. Larger farms are associated with greater wealth and income and increased availability of capital, which increase the probability of investment in purchase of farm inputs that increase food production and ensuring food security. One could observe that greater efficiencies in the use of farm resources are associated with the large farms than the smallholding farms. They pointed out that the smallness of holdings deters the use of modern inputs due to lack of purchasing power in the hands of small farmers. The odds ratio for the variable implies that, holding other variables constant, as increasing one hectares of cultivated land increases food security status of the households by a factor of 9.268. Study by [9,29] have found a significant and positive influence of the total cultivable land on food security status.

3.9 Oxen Owned

Oxen are the main source of traction power among rural households in the study area. This is clearly indicated in the model where oxen ownership was positively and significantly associated with household food security at 5% probably level. The odds ratio in favor of household food security increases by a factor of 10.926 for each additional ox owned, ceterius paribus. Study by [27] has found a significant and positive influence of oxen owned on food security status.

3.10 Total Annual Farm Income

The total annual income was hypothesized to have positive influence on food security. In agreement with the hypothesis, its coefficient came out to be positive and significant at 5% probability level. The probable explanation is that those farmers who have better access to different types of income sources are less likely to become food insecurity. Keeping other variables constant, the odds ratio in favor of food secure increases by a factor of 1.01 for a unit increases in household total annual income. In a study conducted by [26], they found similar result to this finding.

Table 7. Determinants of rural farm household food security

Variables	B	SE.	Wald	Sig	Exp(B)
Litracystat(1)	-.355	1.274	.077	.781	.702
Agehhh	-.127	.075	2.844	.092*	.881
Hhfsize	-2.158	.855	6.969	.002***	.116
Chfertuse(1)	-3.132	2.253	1.933	.164	.044
Creditutl(1)	4.022	2.421	2.759	.097*	55.78
Extserice(1)	-6.424	2.437	6.949	.004***	.022
Landsize	2.227	1.130	3.885	.049**	9.268
Oxenowned	2.396	1.644	4.123	.045**	10.976
Livestokown	.419	.370	1.285	.257	1.521
Nearmark(1)	.371	1.371	.073	.787	1.449
Imseed(1)	.000	1.749	.000	1.000	1.12
Tothhncome	.001	.000	4.260	.039**	1.01
Sexhhh(2)	12.248	.004	.000	1.000	0.199
Constant	6.704	4.296	2.435	.119	20.99
Log-likelihood ratio test		115.909			
Pearson Chi-square		91.684			
Cox and Snell R^2		0.63			
Negelkerke R^2		87.9			
H-L model significant test result		8.1			
Correctly predicted over all sample (%)		93.43			
Correctly predicted food secure (%)		87.44			
Correctly predicted food insecure (%)		96			

****, **, * at 1, 5, and 10% significant level respectively, Source: Household survey (2014)*

4. CONCLUSION AND RECOMMENDATIONS

The study was conducted to identify factors determining food security status of farming households in *Boloso Sore districts.* Data for the study was collected from 90 rural farm households from four villages. The study employed headcount index, food insecurity gap index, and food surplus gap index, food severity index and logistic regression model to analyze the generated date. The result of headcount index showed that only 34.5% of rural farm households were food secure while 65.5% were food insecure. The food insecurity gap and food surplus index showed that food secure households exceeded the food security line by 34.6%, while 27.8% of food insecure households fall below the poverty line. The severity of food insecurity gap among food insecure households was 11.7%. The logistic regression result revealed that family size, total cultivated land size, annual income, chemical fertilizer use, oxen owned, livestock holding, gender, access to extension services, market access, access to credit, access to improved seed, literacy rate and age of households affected food security status of rural farm households. As a result the following policy recommendations were made.

1). Proper attention should be given to limit the increasing population. This could be achieved by proper awareness creation about practicing family planning activities. Hence, family planning activities should be geared up so that family size would be controlled through integrated health and education services.

2). The credit advancing institutions such as microfinance should make loan distribution time table like reducing the gap between application date and loan distribution date. This will help distribution of loan in time. Thus, encourages farmers to utilize the loan for a given objectives as intended.

3). Shortage of cultivated land size was found to be significantly affecting households' food security due to population pressure. Therefore, proper attention should be given to increase food production and productivity through improving better access and availability to improve agricultural technologies such as livestock management practices, improved crop varieties with full management practices, and diversification of farm products with value addition and strengthening market linkages. Besides, encouraging off-farm and non- farm income generation interventions such as public work and

community projects could help in ensuring food security.

4). Extension agents, when disseminating information on improved farm practices should pay close attention to rural farm households that have enhanced exposure and use information and knowledge from extension services to improve agricultural production, natural resource and overall well-being of the society. In addition, home economics components of agricultural extension should be strengthened with a view of educating rural farm households on the use of local resource to improve nutritional status of their households.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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