

Impact of Commercialization on Rural Households' Food Security in Major Coffee Growing Areas of South West Ethiopia: The Case of Jimma Zone

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Abstract

This study aimed to investigate the impact of commercialization on rural households' food security in major coffee growing districts of south west Ethiopia: the case of Jimma zone. For this purpose both primary and secondary statistics were collected and used to produce the required information. In this survey multi-stage random sampling technique was used to choose 150 smallholder farmers. The analytical tool used includes explanatory statistics, crop output market participation index (COMPI) and Logit model. The outcome showed that about 68% of the smallholder farmers were food secure household. Commercialization has positive effect on food security level of smallholder farmers. The evaluation results of the Logit model confirmed that family size, age of household, size of cultivated land, crop output market participation, access to credit were significantly affect rural household food security. The study recommend for policies interventions that will improve smallholder farmer family planning service, accesses to credits, capacity building, better land preservation practices, market information and road in designing food security policy in the study district.

Keywords: Commercialization; Rural food security and Smallholder farmers

Introduction

Agriculture is considered as a strong option and fundamental instrument for spurring growth and sustainable development, poverty reduction, and enhancing food security in developing countries like Ethiopia. Ethiopia is one of the rising economies in sub-Saharan Africa with a median GDP increase rate of 8.3% consistent with annum and agricultural sector has been a dominant contributor having a median of 45.4% to the overall GDP within 2002 and 2011[1].

Besides, smallholders plow over 96% of the full agricultural land, although average smallholder cultivates less than one hectare of arable land, and consumes greater than 65% of total production within the family [2]. In many elements of the country, market participation of smallholder family farms (measured either in terms of per capita market percentage, the degree of farm output supplied to markets or their profit reason) is restricted [2]. Thus, smallholder farms commercialization is now viewed through the government as the point of interest to the agricultural development of the nation [3]. In addition, Promoting commercialization of agricultural production is a cornerstone of the rural development and poverty reduction strategies of Ethiopia, as well as numerous other developing countries [4-6].

Commercialization complements the links among the input and output aspects of agricultural markets. Commercialization entails marketplace orientation (agricultural production decision destined for market primarily based on marketplace alerts) and marketplace participation (produce supplied on the market and use of bought inputs) [3]. Empirical proof suggests that, business transformation of subsistence agriculture is an integral pathway in the direction of economic growth and improvement for plenty agriculture dependent growing nations [4-7]. Similarly, [8] referred that sustainable family food safety and welfare also requires commercial transformation of subsistence agriculture. Besides, study made via [9] indicated that smallholder commercialization is meant to be critical in enhancing smallholder's wellbeing in terms of earnings and food security.

So far there is limited research undertaken to elicit those problems using cross sectional data to assess to the impact of commercialization

agriculture on rural household's food security in Manaa and Gomma districts of Jimma zone, especially at a household level. Thus, the study district turned into decided on from major coffee producing districts because the product is critical to the national economy, grown and marketed via smallholders for generations, excessive policy attention and intervention. This study district was preferred to represent a dominantly subsistence farming community wherein land degradation together with erratic rainfall, drought problems cause a extreme risk on households' food security in south western Ethiopia. Therefore, this study attempts to fill the gap by conducting an empirical research on identifying, analyzing, and understanding the impact of agricultural commercialization on food Security and those elements that are responsible for variation in small holder food security that is needed to device appropriate interventions and integrated efforts to combat food insecurity.

Objective of the Study

The study aimed toward analyzing the impact of agricultural commercialization on rural households' food security in major coffee growing districts of south west Ethiopia: the case of Jimma zone. More specifically the study attempts:

- ❖ To estimate the extent of agricultural commercialization.
- ❖ To determine the demographic and socioeconomic factors determining smallholders food security.
- ❖ To analyze the impact smallholders commercialization on rural households food Security.

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Literature Review

Definition and concepts of food security

Food security is defined by various agencies and organizations in a different way with no much change in the basic concept. In common, "food security" refers to that condition in which there is "access for all people at all times to enough food for an active, healthy life" [10]. Over time, most literatures on food security has been operationally defined in a number of ways; in most cases, the definitions include three most important elements of availability (supplies of food), accessibility (both physical and economic), and utilization (physiological ability to absorb and utilize consumed nutrients) [11].

Accordingly, in this study "food security" was defined and estimated as access of food by all household members to the required dietary intake at all times through various means as central core being other condition also deemed necessary for healthy life. It touches the supply in terms of availability and capacity of households to obtain sufficient amount through their own ways. Thus, among the four ways of measuring household food security outline by, household's food or calorie acquisition per AE per day is used by researchers to discover the two group, i.e., food-secure and food insecure groups within districts for this study.

Empirical studies on agricultural commercialization

Commercialization agricultural is a procedure concerning revolutionizing of agriculture to market oriented production which leans to impacts earnings, eating and dietary setup of the farm households [9]. Although, commercialization is seen as an avenue to generate more household income due to its comparative advantages over subsistence production, it is also recognized that a shift from existence to marketable crop production can have adverse consequences through exposing households to unstable market prices in cases wherever rural markets are not well-integrated [12].

Although commercialization is seen as an avenue to generate more household earnings because of its comparative advantages over subsistence production, it's also diagnosed that a shift from subsistence to commercial crop manufacturing may have destructive outcomes by using exposing families to unstable marketplace costs in cases where in rural markets aren't well-included [12]. In general [13] found out that "different approaches are used to measure household commercialization level". Commonly, total sale to output ratio which is calculated by taking the value of sales as a proportion of total value of agricultural output is commonly used [14].

In terms of food security, there are arguments for and in opposition to smallholder commercialization as a pathway for making sure household food security. On one hand, smallholder commercialization is assumed to have damaging outcomes on household dietary and food safety status. This is due to the fact commercialization may be associated with diversion of resources from food to cash crop production, which leads to decrease food availability from personal production and extra dependence on vicinity markets [15]. Findings from various studies support this view. As an instance, [16] determined that amongst sugarcane generating families within the Philippines, multiplied family earning have been a necessary but now not enough circumstance for improving preschooler nutrition. More recently [17] determined similar consequences in Malawi.

There is additionally a controversy in desire of smallholder commercialization as a way to enhance household food protection,

health and nourishment condition; this can rise up due to the fact commercialization is believed to result in improved family earnings which allows the household to purchase a assorted mix of products and services which include meals, health care, and better housing, among others or increase the current market basket. In addition, through the earnings–food– intake linkage, commercialization is thought to boom the meals intake of family members that may improve their dietary and fitness status [13] as stated in ref. [12].

Therefore, it is argued that the process of commercialization is determined by a number of factors linked with internal or external to farming activity. Internally, households' resource endowments including land, labor and capital; and whereas, change in technology, infrastructure, demography and market institutions around the farm are among the external factors [12].

Empirical studies on determinant of households food security

Food security at household level is affected by a number of interrelated factors. It is determined by household assets ownership, occupation, demographic factors such as size, gender, and age composition of households, educational level, socio-cultural factors, access to credit and inputs, and climatic factors like variability and shortage of rainfall and drought in general [16]. In examining the causes of food-insecurity in Ethiopia it is useful to distinguish between long-term trends, which affect the vulnerability of individuals, households and nation on one hand and sudden shocks, which trigger food systems into crises on the other [18].

In Ethiopia, [19] conducted a study in six rural areas on famine and food security at the household level. According to his study, determinants of household food security are level of output, family size, farming systems (agro ecology), land size, livestock, and fertilizer use. The result of logit model analysis revealed that households who have established access to larger land size are better off than those with smaller land size. Moreover, livestock ownership was found to be serving as insurance against food insecurity in normal years.

In Ethiopian condition, the study by Mulugeta in Boke district of Western Hararghe zone revealed that about 71.8 percent of sample farmers were food insecure. The Logistic Regression Model reveals that among 14 explanatory variables included in the model 8 variables were found to be significant at less than 10 percent probability level. These significant variables include family size, number of oxen owned, the use of fertilizer, food expenditure pattern, and number of livestock owned, size of cultivated land, off-farm income and income per adult equivalent [20].

A study conducted by Yilma Muluken in the Assosa woreda of Benishangul Gumuz region, using Binary Logit model out of 16 independent variables, 6 variables were found to be statistically significant. Family size, age of household head, amount of fertilizer used per hectare, market distance, annual off-farm or non-farm income and annual total farm income are found to be significant variables while the remaining such as sex, level of education, livestock holding, cultivated land and food aid are statistically insignificant. About 79.3 percent of sample households were food insecure [21].

Empirical literature on the impact of agricultural commercialization on households food security

Studies indicated that commercialization has a great impact on the level of food security. As an example, [9] argued that "commercialization has direct effect on household's earnings degree

which likely results in a rise in food and non-meals expenditure". This hypothesis is straightforwardly associated with the famous Engel's law which suggests the inverse relationship between the proportion of food intake expenditure and overall earnings [22]. Based on this law, family are likely to spend more on food things as their earnings level grows up, however with a diminishing budget share allocated to food. In addition, it is argued that better admittance for meals relies upon on earnings increase; especially to utmost African smallholders where agriculture is the main source of earnings. This implies that improving level of market participation can have a huge impact on the status of farmers' food security [23]. Moreover, in a study [24] it is noted that "smallholders with high degree of market engagements have higher ability of enjoying better requirements of welfare".

Generally, the food security status of commercialized farm households is influenced by both family-stage technological changes that allow improved food crop production on controlled resources, and the meso and macro-stage surroundings which include marketplace conditions, market price, rural infrastructure, and admittance to credit [15]. The researcher anticipated that macro-level causes have a result on the extent of earnings a commercialized family can receive and market price, which in flip influence the household earnings-consumption linkage, whereas household-level technological changes could help to secure food self-sufficiency under a risky food-market environment.

Several studies have been carried out in different countries and come up with different results. The situation in Ethiopia isn't significantly divergent from the situation in other developing regions. But, in Ethiopia there is limited work done around this and they are generally focused on welfare impact. Moreover, as the knowledge of the researcher they are done at macro level not much at the micro level especially in the study district. However, this study aimed toward analyzing the impact of agricultural commercialization on rural households' food security in major coffee growing districts of south west Ethiopia in general and in the inspect district particularly.

Data and Methods

Description of the study district

The survey was conducted in Jimma zone in 2012/13 in Manaa and Gomma weredas, south western Ethiopia. Jimma Zone is one of the 20 administrative zones in Oromia regional state, is split under 18 administrative districts with 2.5 million populations from which 94% are rural inhabitants [25]. The zone covers up a sum total area of 15,569 km. Subsistence farming is the main type of living in the location in which only 15% of the population is in non-farm associated jobs. The location has suitable agro-ecological potential with the lowest drought threat score (298) within the country [26]. The main crops produced in the district are cereals (maize, teff-*eragrostistef*, sorghum and barley), pulses (beans and peas), *cash crops* (coffee and khat-*cathaedulis*), and root crops (*ensetventricosum*-false banana and potato. Besides, different fruits and vegetables are typically grown in which home-gardening by small holder families turned into found to raise household income and food security [27].

Description of the data

The study was limited to six kebeles of the two weredas and used one-year cross sectional data. The survey were gathered both quantitative and qualitative data pertaining to social, demographic and economic aspects of households. The main unit of analysis was household head. The survey work for the collection of primary data was done in December 1, 2014 to January 30, 2014.

For this study both primary and secondary statistics were collected and used to produce the required information. To obtain primary data, structured questionnaire with both closed and open-ended questions was used to collect data from sample farmers, informal discussion and key informants interview. Secondary data was collected from documents publications and statistics from Ethiopian disaster prevention and preparedness agency (EDPPA), ministry of finance and economic development (MoFED), Central statics authority (CSA), Ethiopia Grain Trade Enterprise, food and agriculture organization (FAO), Ethiopia commodity exchange (ECX) and other relevant offices, local authority records. Furthermore, an available document such as policies, strategies, guidelines and reports relevant to commercialization and food security was reviewed.

Sampling size and sampling method

In this study the farming households was the basic sampling unit. The study was applied a simplified formula:

$$n = \frac{Z^2 pq}{e^2} \quad (1)$$

This is valid where: n is the sample size, Z² is the abscissa of the normal curve that cuts off an area α at the tails (1 - α) equals the preferred confidence level¹, e² is the favored point of precision, p is the expected proportion of an attribute that is present in the population, and q is 1-p. developed [28] to decide the necessary sample size at 95% confidence level, e=0.08 and P=0.5 to yield a representative sample for proportions.

The study employed both purposive and stratified random sampling techniques. In this study multi-stage random sampling technique was used to select 150 smallholder farmers. With regard to purposive sampling method, in the 1st stage, Jimma zone was purposively chosen from south western Ethiopia. In the 2nd stage, Manaa and Gomma weredas was purposively chosen from Jimma zone on the ground that they are the main coffee producing district. In the 3rd stage three Kebeles or peasant associations (PA) from every weredas was chosen randomly. In 4th stage, the sample was stratified inside each peasant associations (PA) to make sure that a representative number of samples were incorporated. Finally, a probability proportional to sample size (PPS) sampling technique was utilized to select total of 150 sample farm households (Tables 1 and 2). The number of households was obtained from the 2007 Ethiopia population and housing census while the households were methodically selected from the new list of households within the peasant associations (PA) or Kebeles made during the survey.

Weredas	Name of Kebeles	Total Household	Sampled Household
Manaa	Haro	1638	38
	Gudeta Bula	614	14
	Buture Gabisa	624	15
	Sub-total	2876	67
Gomma	Bulbulu	959	23
	Omo Gurude	1374	32
	Chedero Suse	1173	28
	Sub-total	3506	83
	Grand total	6382	150

Source: Survey result.

Table 1: Sampled Kebeles and the number of sampled households.

¹The area matches to the shaded areas in the sampling distribution.

No.	Variable Type	Variable Code	Variable definition	Working Hypothesis
1	X1	HEADAGE	Age of household head (year)	+
2	X2	FSIZE(AE)	Number of household size (AE)	-
3	X3	DISMAR(km)	Distance from market place (km)	-
4	X4	F-LAND(ha)	Farmland owned (ha)	+
5	X5	TLU	Total livestock holding per household in TLU	+
6	X6	TFINCAE (birr)	Annual farm income per AE (birr)	+
7	X7	COMPI	Crop output market participation index	+
8	X8	OFF-FI(birr)	Non-farm and off-farm employment and remittances (birr);	+
9	D1	SEX	Sex of household head (Male=1, female=0)	+
10	D2	EDUC	Education of household head (Literate=1, illiterate=0)	+
11	D3	IRRIG	Technology (irrigation) (yes=1; 0=no)	+
12	D4	ACCREDIT	Access to credit previous year (2012/13) (yes=1, no=0)	+
13	D5	INEXT	Involvement in extension program previous year (2012/13) (yes=1, no=0)	+

Table 2: List of variables, codes, variable definition and working hypothesis in the model.

Data analysis method

The study was used two types of data analysis, namely descriptive statistics and econometric analysis for analyzing the data collected.

Descriptive statistics: This method of data analysis refers to the use of ratios, percentages, means, and standard deviations in the process of comparing demographic and socio-economic factors that are correlated with household food security in the study district.

Crop output market participation (COMP): Following ref. [4], Household Crop Output Market Participation in annual crops as the proportion of the value of crop sales to total value of crop production, which the researchers refer to in this research as Crop Output Market Participation (COMP) index, was compute as follows (see equation 2)

$$COMP_i = \frac{\sum_{k=1}^K \bar{P}_k S_{ik}}{\sum_{k=1}^K \bar{P}_k Q_{ik}} \quad (2)$$

Where: S_{ik} is quantity of output k sold by household i evaluated at an average community level price \bar{P}_k and Q_{ik} is total quantity of output k produced by household i .

Measuring household food security: The government of Ethiopia has set the least amount acceptable weighted average food requisite per person per day at 2200 kcal [29]. Hence in this study 2200 kcal per Adult Equivalent (AE) per day was employed as a cutoff between Food-Secure and Food Insecure households.

For this study, among four ways of measuring household food security outlined [30], Household's food or caloric acquisition per AE per day is used to identify the two groups, i.e., food-secure and food insecure groups. Accordingly, data on food available for consumption for the last seven days to the households was obtained through probing the household to recall during interview. Finally, the results obtained were converted to kilocalorie unit (In Appendix: calorie value of food items in Kcal per Kg). Thus, those households who have energy per AE above the minimum subsistence requirement (2200 kcal) are considered to be food secured, otherwise food-in secured.

Once, the groups are categorized as food secured and food in secured, the socio-economic and environmental factors that are correlated with household food security are identified. It is hypothesized that some farm and household characteristics (such as household size, land size, livestock holding etc...) as well as policy and environmental factors have got relative importance in determining whether the households are

food secured or not. This shows that examining food security situation requires a combination of qualitative and quantitative approaches together. Hence, food security is a function of both qualitative and quantitative variables that have to be included in the model.

Econometric model (Logit model)

To investigate the impact of agricultural commercialization on food security status of the households in the study district; Binary Logit Model was employed. When one or more of the independent variables in a regression model are binary, we can represent them as dummy variables and proceed to analyze. Binary models assume that households belong to either of two alternatives and that depends on their characteristics. Thus, one purpose of a qualitative choice model is to determine the likelihood that a household will fall in one of either alternatives (in this study becomes food secure or food insecure).

In this model the dependent variable is HFSS that is dichotomous taking a value of 1 if the household is Food Secure; 0 otherwise. The information, which identifies the Food Secure from Food Insecure, was acquired by comparing poverty line. Household above this threshold, Food Secure ($Z_i=1$), if not Food Insecure ($Z_i=0$). The cumulative logistic probability model is econometrically specified as follows [31]:

$$L_i = \ln [P_i / (1 - P_i)] = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \alpha_7 X_7 + \alpha_8 X_8 + \alpha_9 X_9 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + \epsilon_i \quad (3)$$

Where: i presents the individual i , $i=1, 2, n$, L_i is log of the odds ratio which is not only linear in X_i but also linear in the parameters; P_i the probability that an individual is being Food secure; $(1 - P_i)$ is the probability that a household will not be Food insecure; α_0 : intercept or constant term, that implies the combined impact of these fixed factors on household food security; $\alpha_1, \dots, \alpha_8$: coefficients of continuous explanatory variables (X_1, \dots, X_8); β_1, \dots, β_5 : coefficient of explanatory dummy variable and ϵ_i is error term.

Before model analysis was initiated, to check the problem of the multicollinearity the Variance Inflation Factor (VIF) for continuous explanatory variable and were used in this study. Following ref. [31],

VIF is defined as:

$$VIF(X_i) = \frac{1}{1 - R^2} \quad (4)$$

Where: X_i is the i^{th} quantitative explanatory variable regressed on the other quantitative Explanatory variables and R^2 is the coefficient

of determination when the variable X_i regressed on the remaining explanatory variables.

If the value of VIF exceeds 10, it is used as an indicator for existence of strong multicollinearity among continuous explanatory variables [31]. Similarly, there may also be interaction among qualitative variables, which can lead to the problem of multicollinearity. To detect this problem, Contingency Coefficients were computed for each pair off qualitative variables. The Contingency Coefficients were computed as follows:

$$cc = \sqrt{\frac{X^2}{n + X^2}} \quad (5)$$

Where, C=Coefficient of Contingency, X^2 -a Chi-square random variable and n =total Sample size. Contingency Coefficient value ranges between zero and one; and as a rule of thumb variable with contingency coefficient below 0.75 shows weak association and a value above it indicate strong relationship of variables [31].

After specification of the model, the parameter of the model was estimated by maximum likelihood function (MLE) using SPSS software package version 20. The model is based on the following hypotheses:-

Results

Descriptive analysis

Descriptive statistics for dummy variables used in econometrics

Variables	HFSS		Minimum	Maximum	T-value	P- value	Total N=(15) Mean
	Food insecure Mean	Food secure Mean					
Age of the HH head	42.3	50.9	22	78	5.271	<0.001	48.1
Number of Household size (AE)	6.54	5.25	2.5	8.9	-7.555	<0.001	5.67
Annual farm income per AE (birr)	1900.6	3382.45	6400	91800	5.237	<0.00*	2908.26
livestock holding (in TLU)	2.23	2.68	0	10	1.194	0.235	2.53
Total Annual income from Off farm (Birr)	4306.25	5524.51	0	25000	1.583	0.116	5134.67
Total land Area in hectare	1.58	1.75	0.5	4.5	1.37	0.173	1.7
Crop yield of last year/qt	13.86	15.56	3	36	1.409	0.161	15.02
Value of annual crop sold (ETB)	11746.67	16605.49	0	304000	1.094	0.276	15050.67
Total Livestock sold in Birr	1514.89	2768.63	0	65000	1.214	0.227	2373.15
Commercialization index (COMPI)	0.5	0.72	0	0.89	8.346	<0.00*	0.65
Total consumption expenditure in birr / per year	17479.17	23454.51	6400	91800	2.972	0.003	21542.4
Consumption expenditure in birr per day /AE	7.41	12.54	1.97	41.57	4.968	<0.000	10.9
Distance from the nearest market (In km)	3.09	3.33	1	11	0.66	0.51	3.3

Source: Own Survey (2012/13)*.

Table 3: Descriptive Statistics for dummy variables used in econometrics for sample households.

Variables		HFSS				Chi-Square Tests (χ^2)	p- value
		Food insecure		Food secure			
		N=(48)=(32%)		N=(102)=(68%)			
		N	%	N	%		
Sex	Female	24	0.5	29	0.284	6.646	<0.001
	Male	24	0.5	73	0.716		
Can you read and write	No	32	0.667	39	0.382	10.58	0.001
	Yes	16	0.333	63	0.618		
Access to irrigation	No	42	0.875	54	0.529	16.919	<0.001
	Yes	6	0.125	48	0.471		
Access to credit	No	41	0.854	39	0.382	29.193	<0.001
	Yes	7	0.146	63	0.618		
Access to extension	No	8	0.167	24	0.235	0.916	0.339
	Yes	40	0.833	78	0.765		

Source: Own Survey (2012/13).

Table 4: Descriptive Statistics for continuous variables used in econometrics for sampled households.

analysis are given in Table 3. The result from the data revealed that about 68.0% of the sampled households are Food secure and 32.0 % of the sampled households were Food insecure in the study areas. Sex composition of the sample households head shows that 35.30% were female headed and the rest 64.70% were headed by male. Similarly, their education level indicated about 44.0% was literate and the rest 56 % were illiterate in the study areas. The result showed that about 46.7% of the respondents had access to farm credit service and 78.70% of the respondents had involvement in extension program in study areas. The finding also revealed that about 36.0% of the respondents in study areas have used irrigation.

Descriptive statistics for continuous variables used in econometrics analysis in the study areas are given in Table 4. The finding revealed that the average Crop Output Market Participation (COMP) of rural households was 0.65, indicating moderate market participation. Similarly, the mean age of households head was 48.1 years. The mean Family size in AE of the household was 5.67 with a range from 2.50 to 8.90 family sizes in AE. The mean cultivated land size of households was 1.70 hectare with a range of 0.50 to 4.50 hectare respectively in the study areas.

The annual total crop production of households in the study areas were 2253.00 qt from 254.55 hectare respectively. The average livestock owned by the sample respondents were 2.53 TLU (See Appendix 1 conversion factors are mentioned that are used to calculate the Tropical Livestock Units (TLU)). The mean annual income from off

farm (Birr) of sample households was Birr 5134.667. The mean Annual farm income per AE (birr) of sample households was Birr 2908.26. The mean Annual Value of crop sold in (ETB) was 15050.67 and mean annual total income from livestock sold in Birr was 2373.15. Survey result showed that the mean distance from market center for sample HHs in the study areas was 3.3 km.

Results of econometric model estimation

The estimates of the Logit model have been presented in Table 5. The result of the existence of serious problem of multicollinearity among the hypothesized explanatory variables showed that the values of VIF for each of the continuous variables were found to be less than ten thus, there is no a multicollinearity problem among all the hypothesized continuous variables included in the model (Appendix). The result of Contingency Coefficient (CC) revealed that there was no a serious problem of association among discrete explanatory variables as the Contingency Coefficients did not exceed 0.75 (Appendix). Consequently, all the hypothesized dummy variables were included in the Logistic regression model.

For analyzing Food security state of the sampled households, a total of 12 explanatory variables were included in the model. In order to identify the most important determinants from the potential hypothesized independent variables assumed to influence food security of households in the district, Binary Logit model was estimated. For the purpose, a statistical package, SPSS version 20 was used.

The Likelihood ratio has a Chi-square distribution and it is used for evaluating the significance of Logistic regression. Model chi-square provides the standard significance test for a Logistic model and the result is significant at less than 1% probability level. Further, Goodness of fit in logistic regression analysis is measured by count R^2 ; out of the twelve independent variables hypothesized to have influence on household Food security, the study has shown as the main factors affecting rural HHs food security was family size (FSIZEAE), Age of household (HEADAGE), Size of cultivated land (FLANDha), Crop Output Market Participation (COMP), Access to credit (AC-CREDIT), were found to be the significant determinants identified to influence household food security status in the study area.

Discussion

Discussion of descriptive analysis

Descriptive statistics on the distribution of mean commercialization index showed the average Crop output market participation of rural households was 0.65. This implies that 65 percent of the output was marketed, while 35 percent was used for own consumption by the HHs, indicating moderate market participation in the study area. This level is nearly two time and consistent with the one cited in ref. [14], where an average Ethiopian farmers supply 35 percent of their output to the market. The mean crop output market participation index of Food secure households was 0.72 and that of Food insecure households was 0.50 in the study area.

The mean statistical analysis revealed statistically, there was significant difference between the food secure and insecure groups in the study areas. The result of the survey revealed that 68.0% the sampled households is food secure. This implies that 32.0% of the sampled households were food insecure or not able to meet the daily recommended caloric requirement. The mean age of households in the study area was 48.1 years. Nevertheless, the mean age of food secure households was 50.9 years and that of food insecure households was 42.3 years in the study area. The mean statistical analysis showed that statistically, there was significant difference between the food secure and insecure groups in the study areas.

The mean family size in AE of the household was 5.67 with a range from 2.50 to 8.90 family sizes in AE. The result indicated that the mean age of food secure and food insecure household was 5.25 and 6.54 years respectively in the study district. Land size is considered as a critical production factor that determines the type of crops grown and the amount of crop harvested. Survey result shows the mean cultivated land size of households was 1.70 hectare with a range of 0.50 to 4.50 ha respectively in the study district. The average livestock owned by the sample respondents in the study district were 2.53 TLU. Overall, survey result shows that food secure households own more TLU than food insecure in the study district 2.23 and 2.68 respectively.

The mean annual farm Income per AE (birr) of sampled households

Variables	Coefficients	Std. Err.	Sig.	odd ratio	95% C.I. for EXP(B)	
					Lower	Upper
SEX(M)	1.131	1.197	0.344	3.1	0.297	32.343
HEADAGE	0.289	0.118	0.014*	1.335	1.059	1.683
EDUChhd (Yes)	0.55	1.252	0.66	1.733	0.149	20.168
FSIZEAE	-4.433	1.33	0.001**	0.012	0.001	0.161
TLU	0.563	0.374	0.133	1.755	0.843	3.654
FLANDha	0.03	0.012	0.015*	1.03	1.006	1.056
TFINCAEbirr	0.0002	0.0003	0.543	1.0002	0.999	1.001
OFFFbirr	0.0002	0.0002	0.188	1.0002	0.999	1.001
ACCREDIT(No)	-7.062	2.125	0.001**	0.001	0.00001	0.055
INEXT(Yes)	1.118	1.454	0.442	3.058	0.177	52.848
COMP	0.108	0.035	0.002**	1.114	1.04	1.192
DISMARKm	0.123	0.258	0.633	1.131	0.683	1.873
Constant	1.738	4.54	0.702	5.687		

** and * are significant at less than 1% and 5% probability level respectively.

Number of objects 150	Pearson Chi-square 156.991
Prob > chi ² 0.0000	Log likelihood 31.070
Percent correctly predicted (R ²) 90.8%	

Source: Model outputs or results based on survey data (2012/13).

Table 5: Logit estimation results for the impact of agricultural commercialization on rural household food security.

in the study district was Birr 2908.26. The mean annual income per AE of food secure and food insecure household in the study areas was Birr 3382.45 and 1900.60 respectively. The mean annual value of crop sold in (ETB) was 15050.67 and the mean annual total income from livestock sold in Birr was 2373.15. The mean Annual income from Off farm (Birr) of sample households in the study areas were Birr 5134.667. The mean Annual income from Off farm (Birr) of food secure and food insecure household in the study areas was Birr 5524.510 and 4306.250 respectively. The statistical test showed a significant mean difference between food secure and food insecure household groups in terms of annual income per AE at 1% probability level in the study areas.

The mean annual consumption expenditure for sampled households in the study areas were Birr 21542.40. The mean annual consumption expenditures for food secure and food insecure households in the study areas were Birr 23454.51 and 17479.17 respectively. The mean daily consumption expenditure per AE for sample households in the study areas were Birr 10.90. The mean daily consumption expenditures per AE for food secure and food insecure households in the study areas were Birr 12.54 and 7.41 respectively.

Survey result showed that the mean distance from market center for sample households in the study areas was 3.3 km. The mean distance from market center for food secures and food insecure household the study areas in (km) were 3.33 and 3.09 respectively in the study areas. Distance from market center in (km) is positively and significantly related to the probability of being food secure. The positive relationship is explained by the fact that households that have proximity to market and other public infrastructure may create opportunities of more income by providing off/non-farm employment and access to transportation facilities, market information. On the other hand, further distance to nearest market detract farmers from crop inputs and outputs market participation and also increasing marketing costs.

Sex of household head was hypothesized to be one of the variables that make a difference on the level of food security. The survey result in the study areas shows that 35.30% of the sample households were female headed and the rest 64.70% were headed by male; out of 34.7% of female headed households in the areas, about 28.40% of food secure and about 50.0% of food-insecure households and out of 64.70% of male headed households in the areas, about 71.6% of them food secure and about 50.0% of them food-insecure households. The chi-square test revealed that the relationship between Sex of household head and food security was statistically significant at 5% probability level in the areas.

It was hypothesized that as the level of education increases, the probabilities of being food secure increases. The survey results in the study areas shows that out of 38.2% illiterate households, 66.7% of the food insecure was illiterate and 39% of the food secure was illiterate. The chi-square test revealed that the relationship between education status of head and food security was statistically significant at 5% probability level in the study areas. Credit service improves food security status of households through purchase of agricultural inputs like improved seed and chemical fertilizers. Credit helps to improve the ability of farmers at critical times of the year to buy inputs and encourage farmers to adopt new technology. Out of 46.7% of households in areas, 61.8% of them are food secure and 14.6% are food-insecure households have access to farm credit. The chi-square test revealed that the relationship between access to farm credit and food security was statistically significant at 5% probability level in the areas. Even if the climatic condition in a given area is conducive, then it would be far better to be supplemented with irrigation so that increased output could be attained.

Survey result shows about 36.0% of the respondents in study areas have used irrigation in previous year; out of 36.0% of households in study areas 47.10% of food secures and 12.50% of food-insecure households have used irrigation previous year. The chi-square test revealed that the relationship between irrigation and food security was statistically significant in the study area at 5% level of significant. Survey result shows about 78.70% of the respondents in study areas have Involvement in extension program previous year; out of 78.70% of households in study areas 76.50%, of food secure and 83.30% of food-insecure households have Involvement in extension program previous year. The chi-square test revealed that the relationship between household Involvement in extension service and food security was not statistically significant in the study area at 5% level of significant.

Discussion of econometric analysis

The model results demonstrated that the logistic regression model properly predicted 90.8% of sampled households (which is greater than 0.50) in the study area. Consistent with several former findings in other places the discussion and interpretation of the significant explanatory variables in the Binary Logit model estimation are presented as below.

The survey result on the impact of agricultural commercialization on rural household food security found out that agricultural commercialization (Crop output market participation) affect the rural households food security in the study area due to the significance of the crop Commercialization index at 1% probability level in the Logit model used and it has a positive coefficient of showing a positive relationship to food security or likelihood of being food secure which is in line with a previous expectation. This means that the higher the smallholder farmer's commercialization, the higher the probability of being food secure. These specify that those farmers with higher commercialization index are associated with higher agricultural income suggesting the likely positive effects of market participation on farmers' food purchasing power. Other things being constant, the odds ratio in favor of being food secure increase by a factor of 1.114 as commercialization increase by one unit. This result is in agreement with the findings previously [9,24,32].

Family size (FSIZEAE) was significant at 1% probability level and negatively connected with the status of food security. The result indicated that larger household size tends to be food insecure compared to smaller family size which is in line with a priori expectation. Other things being constant, the odds ratio in favor of being food secure decreases by a factor of 0.012 as family size increase by one AE Unit (In Appendix 2 conversion factors are mentioned that are used to calculate consumption in AE [18-21]).

The sign of the coefficient of change in age of the household head showed a positive relationship with food security and is significant at 5% probability level. This means that an increase in the age of the household head increase the likelihood of the household to become food secure; keeping other factors unchanged, the odds ratio in favor of food security increase by a factor of 1.335 when age of the household head increases by one year. This result is in agreement with a prior expectation and the findings of [18,21,32].

Size of cultivated land (FLANDha) coefficient came out to be positive and significant at 5% probability level. The probable explanation is that as the cultivated land size increases, provided other associated production factors remain normal, the probability that the holder get more output is high. The odds ratio in favor of food security increases by a factor of 1.03 as the size of cultivated land increases by

one hectare; keeping other factors constant. This result is in harmony with a previous expectation and the findings of [18-21].

Access to credit (AC-CREDIT) is statistically significant at 1% probability level with the expected sign. The probable explanation is that those households who received farm credit have possibility to invest in farming activities, which is important component in small farm development programs. The odds ratio of 0.001 for this variable indicates that, assuming other factors are constant, the odds ratio in favor of being food secure decreases by a factor of 0.001 as a farmer decreases the use of credit by one unit. This result is in agreement with a prior expectation and the findings [33].

Finally, the remaining explanatory variables sex of household head (SEX), total annual farm income per AE (TOTFARIN), total Annual income from Off farm (Birr) (OFFFBirr), education of household head (EDUCHhd), livestock size (TLU) and access to extension service does not affect the rural households' food security in the study district due to the non-significance in the Logit model used; on the other hand, it has a positive coefficient of showing a positive relationship to food security or probability of being food secure [34,35].

Conclusions

This study aimed to investigate the impact of commercialization on rural households' food security in major coffee growing districts of south west Ethiopia: the case of Jimma zone. The Descriptive analysis result of the survey showed that 68.0% of the sampled households is food-secure; on the contrary, 32.0% of the sampled households were food insecure or not able to meet the daily recommended caloric requirement. Based on the survey data, demographic and socio-economic factor related to food security were estimated using the descriptive statistics and the results revealed that family size in AE, age of the households head, sex of households head, education of households head, access to irrigation, access to credit, Crop output market participation, off-farm income per AE, annual agricultural income per AE (birr) and total consumption expenditure in birr per year contributed significantly to a better food security status in the study districts.

The model significance test for a logistic model showed that the likelihood ratio has a chi-square distribution and the result is significant at less than 1% probability level. Further, Goodness of fit in logistic regression analysis is measured by count R^2 ; accordingly, the model results showed that the logistic regression model correctly predicted 90.8% of sample households (which is greater than 0.50) in the study district.

Based on the maximum likelihood estimates of the Logit model; the survey result of the impact of agricultural commercialization on rural household food security found out that agricultural commercialization (Crop output market participation) affect the rural households food security in the study area due to the significance of the crop commercialization index at 1% probability level in the Logit model used and it has a positive coefficient of showing a positive relationship to food security or likelihood of being food secure; which is in line with a previous expectation. This means that the higher the smallholder farmer's commercialization, the higher the probability of being food secure. Further, the study has revealed the major factors affecting rural food security was family size (FSIZEAE), Age of household (HEADAGE), Size of cultivated land (FLANDha), Crop output market participation (COMP), Access to credit (AC-CREDIT), were found to be the most important determinants identified to influence household food security status in the study district.

Finally, based on the overall result and conclusion of the study, the following policy recommendations are forwarded. Smallholder farmers' agricultural commercialization and food security are strongly and positively related in the study district. This implies that any policy interventions intended at creating efficient tie among smallholder farmers' and market will improve the performance of agricultural production thus promotes agricultural commercialization of rural households and ultimately improves food security. Therefore, the study recommend for policies interventions that will improve smallholder farmer family planning service, accesses to credits, capacity building, better land preservation practices, market information and road in designing food security policy in the study district.

Competing Interests

We declare that we have no any competing interests.

Author's Contributions

IM: involved in conception, designing of the study and monitored the data collection, conducting, analysis and interpretation, drafting the manuscript and write up. WM: involved in protocol development, data analysis and interpretation, manuscript revision and write up. BK: involved in data collection, manuscript revision and assisted data analysis and interpretation. All authors reviewed and approved the final manuscript. IM: is responsible for manuscript submission.

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