



Determinants of Rural Households Food Insecurity in Southern Ethiopia

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Aim: This study aimed at examining the level and determinants of food insecurity of rural households in Southern Ethiopia using a sample of 574 households and two-stage least square estimation.

Materials and Methods: A total sample of 574 rural households was selected from the three Districts proportionately: 160, 262 and 178 sample households from Demba Gofa, Kamba and Chencha District respectively. Samples of 11 kebeles or Peasant Associations were selected from the three Districts proportionately depending on the number of kebeles in each District.

Results: The mean level of household food insecurity access score is 7.1847 or about 79.83 per cent of households in the study areas are food insecure. The study found that rural households at moisture stress low lands are more food insecure compared to households at middle lands and high lands. The two-stage least square estimation also revealed that food availability theory related factors such as family size and land size significantly affect food insecurity in the study areas. Moreover, food entitlement theory related factors like market access, education, livestock ownership, off-farm participation and productive safety net participation also significantly influenced food insecurity in Southern Ethiopia. Thus, both the demand and supply side factors are the main causes of food insecurity in Southern Ethiopia.

Conclusion: Government has to invest in infrastructure so as to link production centres with consumption centres. Transforming the highly vulnerable rain-fed agriculture to more resilient irrigation-based agriculture is crucial so as to boost agricultural productivity and set an end to food

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insecurity in the country. Provision financial services and off-farm job opportunities for rural unbanked people, population control via family planning or adult education and ensuring political stability can reduce the vulnerability of the population to food insecurity in the study areas.

Keywords: Food security; household food insecurity access score; two stage least square; vulnerability; Ethiopia.

1. INTRODUCTION

Nowadays, food insecurity is one of the development challenges of developing countries in general and African countries in particular. According to FAO (Food and Agricultural Organization 2010), about one billion people are estimated to be undernourished where 98% of these people are living in developing countries. Sub Saharan Africa has the highest prevalence of under-nourishment among developing regions. For instance, the percentages of undernourished people in the world in 1990-1992 were 18.7 but, this value reduced to 11.3 in the year 2012-2014. Similarly, the percentage of undernourished people in developing countries reduced from 23.4 in 1990-1992 to 13.5 in 2012-2014. In the same periods, the percentage of undernourished people in Sub Saharan Africa reduced from 32.7 in 1990-1992 to 24.8 in the periods 2012-2014 [1]. Though the percentage of food insecure people in the world is declining through the passage of time, a greater number of people are still suffering from food insecurity in Sub Saharan Africa.

But, the percentage of undernourished population in Ethiopia in the period 1990-1992 was 75% and this number reduced to 35% in the period 2012-2014, FAO (2015). According to FAO [2], Ethiopia is ranked first in terms of the number of people in state of undernourishment (32.1 million people) followed by Tanzania (15.7 million people), Nigeria (12.1 million people), Kenya (11 million people) and Uganda (10.7 million people) respectively, among Sub Saharan Africa countries.

In Ethiopia, the trend in the growth of food production and population growth matched only up to 1960, WFP and CSA [3]. According to WFP (World Food Program [4]), Ethiopia economy has shown fast GDP growth of about 11% per annum during the past 8 years between 2004 and 2012. Yet, the country is ranked 173rd out of 186 countries in terms of human development index. Similarly, the growth of national income-per-capita is only USD 370 in 2011 which is less than

one-third of the average USD 1258 for Sub Saharan Africa.

According to the Global Food Security Index (2015), Ethiopia is ranked 86 among 109 countries with a total score of 38.5 level of food security. Moreover, Ethiopia is one of the food insecure countries in Sub Saharan Africa countries with a total people of 32.1 million or 35% of the population in the state of undernourished, ADB (African Development Bank [5]). The high-level food insecurity in Ethiopia mainly caused by the poor performance of the agricultural sector and this poor performance of the agricultural sector in Ethiopia attributes to both policy and non-policy factors. The government of Ethiopia has designed a program like productive safety net program (PSNP) so as to build the resilience of these chronically food insecure households to food insecurity.

Launched in 2005, Ethiopian PSNP has been operating in Oromia, Tigray, Amhara, Somali, SNNPR, Harari, Dire Dawa and Afar Regions. The program had 4.5 million beneficiaries in 2005 at its launch and this number increased to 7.6 million in 2012 as presented in Fig. 1. Moreover, the number of beneficiaries of this program reached 8.3 million in 2016 which is about 10% of the Ethiopian population.

Transitory food insecurity is also common in Ethiopia which is mainly caused by climate change and conflicts over scarce natural resources in the country. Drought is a common phenomenon in Eastern Africa in general and in Ethiopia in particular over the last 60 years. The 1957 drought caused food insecurity crisis in Tigray and Wollo areas and affected about 1 million farmers with about 100, 000 farmers being displaced to other areas of the country. However, one of the most serious food security crisis in Ethiopia during the Imperial regime was the 1973-74 drought caused food security crisis which affected the eastern part of Harar, SNNPRS and Bale low lands and led to the death of about 100, 000 to 200, 000 people, WFP [4]. In Ethiopian, another severe food

security crisis during the socialist government faced in 1984-85 where about 8 million people were affected by the crisis and causing the death of about 1 million Ethiopian.

Moreover, the consecutive failure of two rainy seasons in Ethiopia has affected the lives and livelihoods of millions of Ethiopia in 2015-16, during the current Ethiopia government. This El-Nino caused drought in the country increased the number of people requiring food assistant to 10.2 million in 2016. This was the strongest drought that has been faced in Ethiopian history, though the number of death was unreported. All the above incidences of food security crises revealed that the vulnerability of Ethiopia economy to climate change has been rising.

Southern Nation Nationalities People Regional State (SNNPRS) is not exceptional to the food security problem. As Melkamu (2011) noted food insecurity in SNNPR remains a multifaceted and complex problem in which lack of access as well as availability and quality of food still play an essential role. According to the recent estimate, 24% of the total households in SNNPR are found below the poverty line with poverty prevalent more in rural areas than urban areas (CSA and WFP, [3]). According to CSA and WFP [3], about 63% of the households are food insecure in Southern Nation Nationalities People Regional State.

Though numerous studies have examined the level and determinants of food security in Ethiopia, the studies in Southern Nation Nationalities People Regional State are scarce. Therefore, this study mainly aimed at measuring the level of food insecurity using household food insecurity access score methods in Southern Ethiopia. With this general objective, this paper specifically aimed to measure the level of food insecurity using household food insecurity access score method; to compare the food insecurity level of different ecological zones (low land, middle land and high land) and examine the determinants of food insecurity using two-stage least square estimation.

2. FOOD SECURITY: BASIC CONCEPT, THEORIES AND EMPIRICS

2.1 Basic Concept of Food Security

Food security was introduced for the first time in the literature following the world food conference

held in 1974 due to the then food crises and major famines. Since then, different researchers defined food security differently for their own purpose, Tsegay [6]. Food security was defined as the availability of adequate food at the global and national level by the UN (1970). This macro-level definition of food security only refers to the supply sides of food security by disregarding the demand side of food security. That means, it disregards the other important dimensions of food security like food access, utilization and stability and it considers only food available at the national and global level. But, food availability at global and national may not necessarily imply food security at the household level [7]. This definition of food security led to the development of the food availability decline theory of food security and different researchers tried to examine the determinants of food availability at the global and national level.

However, the food access dimension of food security has got wider attention since 1980 and the unit of analysis of food security also has shifted from global and national level to household level of food security. This shift in paradigm from the supply side to the demand side of food security came up with the new concept and definition of food security [8]. Food security was defined as access by all people at all times to enough food for active and healthy life [9]. According to this definition, food security refers to a situation in which individuals have physical and economic access to the food they need. A household is considered to be food insecure if its consumption falls below the minimum daily recommended caloric intake for an individual to be active and healthy. Still, this definition of food security does not include one dimension of food security, food utilization. This definition of food security also led to the development of the food entitlement decline theory of food security which states that food security depends on the household's entitlement to food. There are four sources of household's food entitlement and these are own production, own labour, trade and transfer.

Finally, a definition of food security which contains both the demand and supply sides and all the four dimensions of food security was given by FAO (1996). Accordingly, food security was defined as the situation when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meet their dietary needs and food preferences for active and healthy life (FAO, 1996). This shows that

food security is a broader concept and it is more than food production and food access. It consists of four pillar dimensions namely; food availability, food accessibility, food utilization and stability of food supply. Food availability refers to the physical presence of food at household level whether from own production or through markets. Food access refers to the ability of the household to obtain appropriate diet and is in particular linked to resources at the household level. Food utilization, which is related to the biological concept, refers to the individual level of food security and it is the ability of the human body to convert food into energy. Stability of food supply refers to the current and future food status at a different point in time. The term all times refers to the stability dimension in the food security definition.

Food security has both spatial and temporal dimensions. The spatial dimension of food security shows the level of analysis and food security can be analyzed at the global, national, sub-national, village, household or individual level. But, in most empirical studies on food security, the household is commonly used as a unit of analysis. The time dimension of food security refers to the time periods over which food security is considered. Accordingly, food security can be of transitory or permanent food security. Transitory food insecurity refers to a short term or transitory decline in household access to enough food due to domestic violence, the occurrence of drought, outbreak of crops diseases and the like. Permanent or chronic food insecurity refers to long term or persistent inability to meet the minimum food consumption requirements which may occur due to lack of access to productive assets and climate change, Debebe et al. [8].

2.2 Theories of Food Security

There are various theories about the determinants of the four dimensions of food security. But, these theories are categorized into three and they include, the political economy theory of food security, the food availability decline theory of food security and the food entitlement decline theory of food security. The food availability decline theory explains the supply side factors while the food entitlement theory explains the demand side determinants of food security. Besides, the political economy theory of food security blames government policies or the relationship between society and government as sources of food insecurity.

The first theory of food security is the food availability decline theory which focuses only on the supply side of food security. According to this theory, food insecurity is caused by a lack of productive assets to produce goods and services and to purchase food. This approach considers food insecurity as a shortage of food supplies per capita which can be caused by drought, floods, crop failures, population growth and other demographic factors, Diana [10]. Therefore, any factors which disrupt food production such as drought, flood, war, population growth and other demographic factors cause food insecurity. But, this theory is criticized for focusing on the supply side constraint to food insecurity.

Though the food availability theory blames population growth as a cause for food insecurity in the agrarian economy, they are two competing theories regarding the relationship between population growth and food availability. The first one argues that unless the population increase is checked, food production increase cannot keep pace with it, Malthus (1798). According to him, population growth causes food shortage and thereby, food insecurity. Malthusian theory of population criticized the ground that it ignores the role of technological improvement which increases the productivities of scarce resources and leads to higher outputs. Boserup (1965) considers population growth as sources of invention and innovation of new technologies that expand agricultural production and thereby reducing vulnerability to food insecurity. She argues that the positive effect of population on food supply can be realized by making better investments in infrastructures like water supply, irrigation, energy, transport and improved production technologies.

The second theory of food security is the food entitlement decline theory of food security which focuses on the demand side of food security as the causes for food insecurity. Sen [11], shifted the focus of attention from supply-side constraint to demand-side constraint. As opposed to food availability decline theory of food security, the food entitlement theory of food security emphasizes access to food, or people's relationship to food, rather than availability of food [12]. Sen [11] discovered that food insecurity affects people who cannot access adequate food because of exchange failures irrespective of food availability at national or global levels. The main argument of this theory is that the presence or availability of food in the

economy doesn't necessarily imply consumption and hence food insecurity may occur without any decline in food availability (Getachew, 1995).

The food entitlement decline theory of food security has some merits over the food availability decline theory of food security in a number of ways. First, it suggests that demand side matters as opposed to the supply side. Second, it allows the vulnerable group to be identified at the household level. Finally, it suggests more appropriate policy intervention than food availability decline theory of food security. But, the food entitlement decline theory of food security is not free from criticism. It is criticized on the ground that some people with ample entitlement may prefer to go food insecure at certain times rather than selling their assets fearing of a future crisis, Ali [13].

The political economy theory of food insecurity states that food insecurity is not only caused by lack of food production or food access but due to political powerlessness. According to this theory, rather than focusing only on food availability and food access as a means of coming out of food insecurity problem, due attention should be given to state reconstruction, good governance and accountability. That means the relationship between society and the government actors is important to ensure food security in addition to managing the demand and supply of food. So, according to this theory, food insecurity may result from wrong government policies, domestic violence, government failure to intervene and conflicts over limited natural resources, Arega (2013).

2.3 Empirical Literatures

The review result revealed that family size is negatively and statistically significantly affects food security. In other words, as the number of children increases, the probability of being food secure of household decreases. This may be due to the fact that large family size or dependency ratio reduces the capacity of households to provide sufficient quantity and quality of food to all its members, to care for them when they fall ill and to ensure a good education for children. The studies conducted by Shiferaw et al. [14], Hiwot [15], Abonesh et al. [16], Kidane et al. [17], Ejigayhu [18], Ahmed et al. [19], Jemal [20], Dawit et al. [21], Tsegaye [22], Seid et al. [23], Kwadwo et al. [24], Ahmed [25], Indris et al. [26], Sisay et al. [27], Mesfin [28], Ramakrishna et al. [29], Bogale et al. [30] and Girum [31] found

negative and statistically significant relationship between family size and food security.

The studies conducted by Fekadu et al. [32], Yilebes [33], Ahmed [25], Sisay et al. [27], Mesfin [28], Ramakrishna et al. [29], Bogale et al. [30], Girum [31], Guyu et al. [34], Shishay [35], Eyob (2012), Mequanent et al. [36], Amsalu et al. [37], Sisay [38], Seid et al. [39], Nigatu [40] and Tsegamariam et al. [41] found positive and statistically significant relationship between education and food security.

Previous studies found that the probability of being food secure of household decreases as age increases [42]. This may be due to the fact that as the age of household head increases, most of the productive household members may leave the household due to marriage, education, rural out-migration and the like. This will affect the household level performance of agricultural production due to the scarcity of labour. Most of the reviewed studies found similar results, Hiwot [15], Kidane et al. [17], Ahmed et al. [19], Jemal [20], Tsegaye [22], Kwadwo et al. [24], Indris et al. [26], Mesfin [28], Ramakrishna et al. [29], Bogale et al. [30] and Girum [31].

Regarding financial capitals, studies conducted by Abonesh et al. [16], Kidane et al. [17], Ejigayhu [18], Kwadwo et al. [24], Ahmed [25], Mesfin [28], Ramakrishna et al. [29], Eyob (2012), Abayineh et al. (2017), Sisay [38], Nigatu [40], Tsegamariam et al. [41], Abayineh et al. (2017), Malla et al. [43], Aschalew et al. [44], Tagese et al. [45], Mebratu [46], Teklay et al. [47], Girma [48] and Karale [49] found positive and statistically significant relationship between food security and off-farm participation. Off-farm activities in rural areas affect the demand side of food security by affecting the access dimension of food security.

More importantly, the result of some previous studies showed that physical capital like the number of ox, tropical live units and land size are also important determinants of food security in Ethiopia. Whether in rural or urban areas, access to land is a major determinant of the probability of being food insecure. This is because, the lives and livelihoods of the rural population are married with agricultural production, crops and livestock productions, which by itself depends on access to land. So, studies conducted by Hiwot [15], Abonesh et al. [16], Fekadu et al. [32], Kidane et al. [17], Ahmed et al. [19], Dawit et al. [21], Tsegaye [22], Yilebes [33], Seid et al. [23],

Kwadwo et al. [24], Ahmed [25], Sisay et al. [27], Ramakrishna et al. [29], Bogale et al. [30], Girum [31], Guyu et al. [34] and Shishay [35] found statistically significant and positive relationship between land size and the level of food security in Ethiopia.

From the review of related literature, another variable which affects the access dimension of food security is the distance to market for inputs and outputs. It is evidenced by different studies that distance from the market in kilometres negatively and statistically significantly affects the probability of being food secure of the household. There are four sources of entitlement to food which by intern affect food access and these are; own production, trade, own labour and transfer. Access to market is, therefore, important particularly rural households to have entitlement to food via trade. Those previous studies conducted by Shiferaw et al. [14], Abonesh et al. [16], Ahmed et al. [19], Tsegaye [22], Indris et al. [26], Sisay et al. [27], Mesfin [28], Girum [31], Shishay [35], Seid et al. [39], Nigatu [40], Abayineh et al. (2017), Mequanent et al. [50], Getachew et al. [51], Fekede et al. [52], Misgina (2014), Abraham et al. [53], Mebratu [46], Fekadu et al. [32], Teklay et al. [47], Tibebu et al. [54], Adugna et al. [55], Amsalu et al. [37], Karale [49] and Amsalu et al. [56] showed negative and significant relationship between distance from market and food security in Ethiopia. Thus, connecting production and consumption centres is important in addressing the problem of food insecurity in developing countries where infrastructural developments are poor.

In addition, as indicated by various studies, the use of irrigation by household increases the probability of being food secure and statistically significant at 1% level of significance. Uses of irrigation decrease the vulnerability of agricultural production to vagaries of nature and households are more resilient to food insecurity. One cause for the poor performance of Ethiopian agriculture is its vulnerability to climate change, mainly drought. The vulnerability of Ethiopia economy to climate change has also been increasing through time and this has been evidenced by the rise in the number of people affected by drought over time. Many studies showed the positive and significant effect of irrigation use on food security, Teklay et al. [57], Abonesh et al. [16], Fekadu et al. [32], Seid et al. [23], Kwadwo et al. [24], Ahmed [25], Bogale et al. [30], Girum [31], Guyu et al. [34], Shishay [35], Abayineh et al.

(2017), Seid et al. [39], Getachew et al. [51], Abraham et al. [53] and Karale [49]. Since water is a major input in livestock as well as crop production, irrigation development using ground and surface water will play a vital role in transforming Ethiopian agriculture by reducing its vulnerability to recurrent drought.

3. MATERIALS AND METHODS

3.1 Data Sources and Sampling Techniques

To achieve the stated objectives and answer the research questions, this study used the primary sources of data. The data were collected from three sample Districts in Southern Ethiopia. The three Districts were selected purposively from different ecological zones. Chench District was selected from high land areas, Kamba District from low land areas and Demba Gofa from middle land areas. A total sample of 574 rural households was selected from the three Districts proportionately: 160, 262 and 178 sample households from Demba Gofa, Kamba and Chench District respectively. Samples of 11 kebeles or Peasant Associations were selected from the three Districts proportionately depending on the number of kebeles in each District.

List of all households in each Peasant Association was prepared by District officials and sample households from each sample Peasant Association were selected using systematic random sampling technique. Data from each sample household was collected by Development Agents in that Peasant Association after two days of intensive training and pilot survey. A total of 11 Development Agents, one from each Peasant Association, were participated in the data collection process from a total of 574 rural sample households so as to collect data on human capital, financial capital, natural capital, physical capital and the like. The data collected from a total of 574 rural sample households were used to answer the basic research questions of this study.

3.2 Conceptual Frame Work

Not only identifying the determinants of food security, but the measurement aspect of food security has also paramount important for the quantification of the level of food security and identification of the vulnerable group of

individuals, households, villages or nations. So, to deal with the problem of food insecurity, the quantification of the extent of the problem using an appropriate method of measurement should not be undermined. Though there are different methods of quantifying the level of food insecurity in the empirical literature, this study used household food insecurity access score, HFIAS, method of measuring food insecurity.

Food and Nutrition Technical Assistant (NAFTA) of USAID, developed household food insecurity access scale (HFIAS) as a method of measuring food insecurity in 2007. HFIAS is based on the idea that the experience of food insecurity causes predictable reactions and responses that can be captured and quantified through a survey and summarized in a single scale. In this method, respondents are provided with 9 questions about the uncertainty, quantity and the quality of the food they had used in the last month. If the response of the respondent is yes to the occurrence question, he/she is provided with the frequency question with three alternatives namely; rarely (1), sometimes (2) and often (3).

HFIAS is a continuous measure of the degree of food insecurity access in the household in the past four weeks (30 days). First, each respondent is provided with 9 questions of occurrence with three frequencies of occurrence. The frequency of occurrence of each question coded as 1, 2 and 3. The household food insecurity access score (HFIAS) is calculated for each household by summing the codes for each frequency-of-occurrence question. The maximum score for a household is 27 and this will occur if the household response to all nine frequency-of-occurrence questions is coded with a response code of 3. The minimum household food insecurity access score is 0 and this will occur the household responded no to all occurrence questions.

So, the higher the score, the more food insecurity (access) the household experienced. The lower the score, the less food insecurity (access) a household experienced. Since the HFIAS is a continuous variable, it is possible to model the determinants of household food insecurity access score by using a linear model like the ordinary least square method of estimation. So, once the food insecurity index is constructed as stated above, it is possible to use as a dependent variable to identify the determinants of food insecurity in the study areas. Accordingly,

the following empirical model is formulated so as to examine the determinants of food insecurity in Southern Ethiopia.

$$\text{Food Insecurity} = f(H, P, F, S)$$

Where H, P, F & S refer to human capital, physical capital, financial capital and social capital respectively. But, the basic limitation of ordinary least square method of estimating the relationship between the continuous dependent variable and various covariates is the problem of endogeneity. That means, there may exist endogenous covariate which may lead to biased and inconsistent estimates. The way out of such problem is to use an instrumental variable (IV) method, two stages least square (2SLS), three stages least square (3SLS) and the like. Therefore, this study used two stages least square method of estimation to account for the problem of endogeneity.

3.3 Description of Covariates

According to Demeke et al. [58], family size, age of household head, adult equivalent, extension visits and level of education are key factors representing human capitals and influence food security at the household level. Regarding financial capitals, off-farm income, remittance and market surplus are included as covariates in the above model following, Aidoo et al. (2013). Off-farm participation and remittance are assumed to influence food security by smoothing consumption of households at a time of food shortages. According to the food availability decline theory of food insecurity, family size, age of household head and adult equivalent are the major factors influencing food availability at the household level.

With regard to physical capital; land size, distance from the market and irrigation uses are used as covariates in the above model and these two variables are key factors of agricultural production in rural areas. In developing countries in general and in Ethiopia in particular, the lives and livelihoods of the majority of the rural population are married with land resources. This is because almost all livelihood sources of the rural population depend on the land resources since capital and entrepreneurs are scarce in rural areas. The two abundant factors of production in rural areas are labour and land out of the four factors of production. Land size, off-farm participation and remittance are also key factors which affect households access to food

according to the food entitlement decline theory of food security. Participation in Productive safety net program is included as social capital in this study. Launched in 2005, Ethiopian PSNP has been operating in Oromia, Tigray, Amhara, Somali, SNNPR, Harari, Dire Dawa and Afar Regions. The program had 4.5 million beneficiaries in 2005 at its launch and this number increased to 7.6 million in 2012. Moreover, the number of beneficiaries of this program reached 8.3 million in 2016 which is about 10% of the Ethiopian population [59]. The productive safety net program primarily targets those households who have limited agricultural resources, farm income and off-farm income in rural areas or unemployed urban people. In other words, the productive safety net program has been designed to graduate chronically food insecure households in rural areas to food secure households via time. Thus, in this study, both the supply side factors and demand-side factors of food security are included in the above model.

Off-farm, participation is expected to be an endogenous covariate in the food insecurity model and appropriate instruments were chosen to avoid the problem of endogeneity in the above model. Accordingly, adult equivalent and distance from the market are selected as instrumental variables for off-farm participation. These two variables are assumed to correlate with off-farm participation (relevancy) and less correlated with food insecurity (validity). They were tested for their relevancy and found that they are relevant instruments for off-farm

participation instruments. Thus, these two variables were used in the first stage regression and absent from the second stage regression of two stages least square estimation.

4. RESULTS AND DISCUSSION

4.1 Constructing Food Insecurity Index and Descriptive Statistics

Based on the method developed by NAFTA (2007) to measure food insecurity at the household level, household food insecurity access score (HFIAS) was constructed depending on the data collected from a sample of 574 respondents. The sample respondents from the three Districts were asked the nine occurrence questions about the uncertainty, quality and quantity of food available to food in the past four weeks or one month. If their response is yes to the occurrence question, respondents were provided with the frequency question with three alternatives: rarely, some times and often which are coded as 1, 2 and 3 respectively. Finally, based on the frequency of experiencing the situation, the food insecurity index was calculated for each household by directly summing the responses of respondents to the frequency questions. Accordingly, a continuous index of food insecurity was constructed with a value between 0 and 27. For the sample of 574 respondents, the minimum HFIAS value is 0 and the maximum score of the food insecurity index, HFIAS was 26 in the study areas. The average household food insecurity index, HFIAS in the study areas is 7.1847.

Table 1. Descriptive Statistics of some continuous variables of sample households

Covariates	Chencha N=160		Kamba N=236		Demba Gofa N=179	
	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation
Age of household head	50.3	13.4	44.6	9.4	43.5	9.2
Education	2.9	3.7	1.9	2.7	3.6	3.7
Family Size	6.5	2.9	6.8	2.6	6.4	2.0
Adult Equivalent	5.5	2.5	5.1	2.1	5.5	2.0
Land Size	0.51	0.8	0.6	0.6	1.1	1.2
Food Shortage	3.8	2.8	5.2	3.6	2.8	2.1
Off-farm income	1472.6	1770.7	200.4	421.2	498.8	785.7
Farm income	9304.4	8459.9	6633.5	11235.9	10620.5	7951.2
Tropical live unit	3.4	2.8	2.7	2.3	4.6	6.0
Cons. per capita	537.5	433.0	487.1	370.4	699.1	517.5
HFIAS	7.11	5.65	9.34	4.58	4.38	3.20

Source: Own Survey, 2018

As indicated in Table 1, the average land size in Demba Gofa District is higher than the average land holding in the other two Districts. The average land holding of Southern Nation Nationalities People Regional State is about 0.5 hectare per household and the average land holding of Chencha and Kamba Districts are closer to the Regional average land holding. This variable is a key factor which affects the access dimension of household food security according to food entitlement theory of food security. The lives and livelihoods of about 80% of the population in rural areas of Ethiopia are married with agricultural production and this by itself depends on the access to land by households. This may cause, therefore, the difference in the level of food insecurity among these Districts since the land resource is a binding factor of production in rural areas of Ethiopia.

Respondents were also asked the number of months they experienced food shortage for the last 12 months and the average months of food shortage in the study areas are presented in Table 1. The respondents in Chencha District reported that they experienced food shortage for about 4 months of the year while the respondents in Kamba and Demba Gofa Districts reported that they experienced food shortages for about 5 months and 3 months respectively. This indicated that moisture stress low land area, Kamba District, is more vulnerable to the problem of food insecurity compared to middle land high land areas.

The mean age of rural household head at Chencha, Kamba and Demba Districts are 50.304, 44.555 and 43.500 years respectively. Similarly, the mean consumption per adult equivalent per month at Demba Gofa District (699.068) is higher than the mean consumption per adult equivalent per month at Chencha (537.534) and at Kamba District (487.126). As evidenced from Table 1, the mean monthly income from off-farm activities at Chencha District (1472.594) is higher than the mean monthly income from off-farm activities Kamba District (200.394) and Demba Gofa District (498.764). This may be due to the fact that rural households at Chencha District are mainly engaged in weaving activities as they are living with Dorze people who are the creators as well as teachers of weaving.

The household food insecurity access score (HFIAS) is a continuous measure of the degree of food insecurity (access) in the household in

the past four weeks. The maximum score for a household is 27 and this will occur if the household response to all nine frequency-of-occurrence questions is coded with a response code of 3. The minimum household food insecurity access score is 0 and this will occur the household responded no to all occurrence questions. So, the higher the score, the more food insecurity (access) the household experienced. The lower the score, the less food insecurity (access) a household experienced. The result in Fig. 1 revealed that household food insecurity access score is higher for the Kamba District compared to the other two sample Districts in the study areas. The mean household food insecurity access score is 4.38 for Demba Gofa District which is lower than the other two Districts. This value is higher for Kamba District which is known by scarce and less productive land resources and frequent drought compared to the other two Districts.

4.2 Econometric Results of Determinants of Food Insecurity

Since the HFIAS is a continuous variable, it is possible to model the determinants of household food insecurity access score by using a linear model like the ordinary least square method of estimation. But, the basic limitation of ordinary least square method of estimating the relationship between the continuous dependent variable and various cause variables is the problem of endogeneity. That means, there may exist endogenous cause variable which may lead to biased and inconsistent estimates. The way out of such a problem is to use an instrumental variable (IV) method or two stages least square (2SLS) method of estimation. To model, the determinants of HFIAS, age of household head, family size, level of education of household head, off-farm income, consumption per capita, migration, land size, participation in irrigation, market surplus and frequency of extension visit are used as covariates. But, there may exist a bidirectional relationship between off-farm income and household food insecurity access score. So, the preferred model to estimate the determinants of household food insecurity access score in this study is the two-stage least square (2SLS) method of estimation. Two instrumental variables are selected in such a way that they directly affect off-farm income but does not directly affect household food insecurity access score. The selected instrumental variables are adult equivalent and distance from the market which is measured in kilometres.

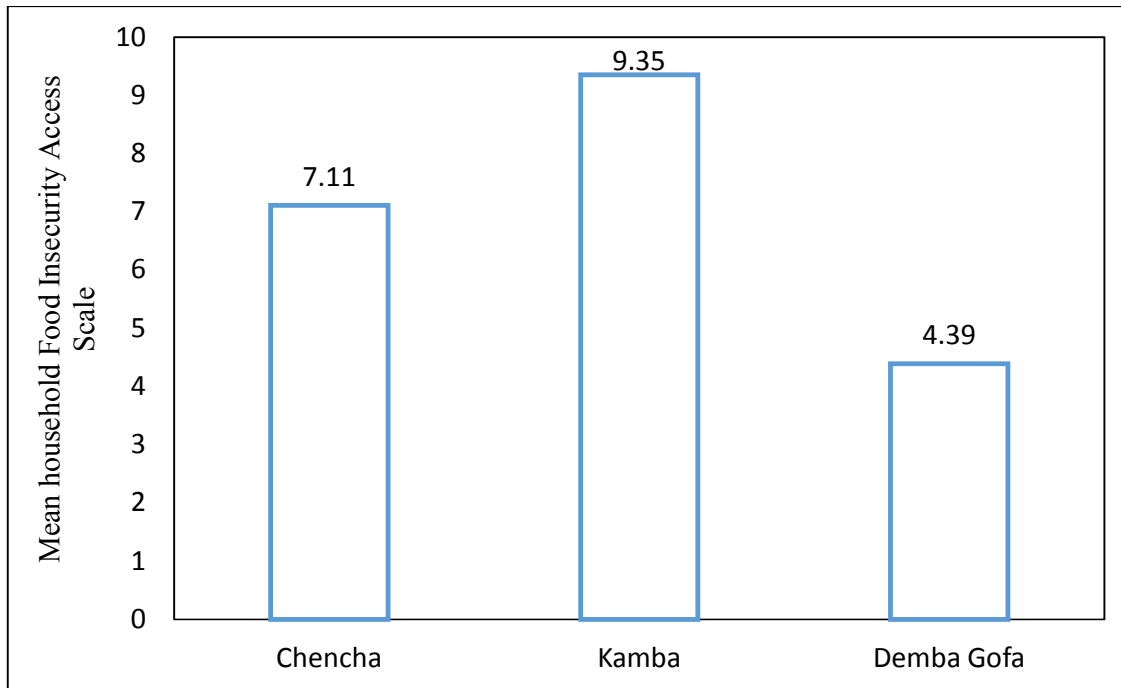


Fig. 1. Mean households food insecurity access score (HFIAS) by Districts

As can be seen from the above first stage regression, land size, irrigation use, tropical livestock unit, remittance, per capita consumption and adult equivalent carried significant positive sign which means that they promote rural households participation in off-farm activities. But, distance from market negatively and statistically significantly related to off-farm income as evidenced in Table 2.

As economic theory predicts, the level of education and adult equivalent are important determinants of off-farm participation of rural farm households and the present study also revealed that these two variables carried significant positive signs. This result is in agreement with the study conducted by Barrett et al. (2001), Galab et al. (2002) and Berhanu (2007). The very objective of the first stage regression is to obtain the predicted value of farm income to use as an explanatory variable in the second model and avoid the problem of endogeneity. The coefficients of adult equivalence and distance from the market are statistically significant and this implies that the two instruments are valid in a sense that they are a relevant instrument for off-farm participation.

The second stage estimation result revealed the determinants of food insecurity measured by

respondents' self-reported method of measuring food insecurity, HFIAS. This variable is a continuous variable which ranges between 0 and 27 where a score of zero shows no problem of food insecurity and a score of 27 shows that that household is severely food insecure. By accounting for the problem of endogeneity, the regression result in Table 3 was obtained.

Among the variables included in the second stage regression as covariates, off-farm income negatively and statistically significantly related to the outcome variable, self-reported household's food insecurity status. Previous studies conducted by Kidane et al. [17], Ejigayhu [18], Kwadwo et al. [24], Mesfin [28], Ramakrishna et al. [29], Eyob (2012), Abayineh et al. (2017), Sisay [38], Nigatu [40], Tsegamariam et al. [41], Abayineh et al. (2017), Malla et al. [43], Aschalew et al. [44], Tagese et al. [45], Teklay et al. [47], Girma [48] and Karale [49] found negative and statistically significant relationship between food insecurity and off-farm participation.

As presented in Table 3, the education level of the household head is negatively and statistically significantly related to the self-reported household food insecurity index. That means, like years of schooling of household head

increases, HFIAS decreases. As education increases, labour productivity increases which in turn decreases the probability of being food insecure. This is in line with the economic theory which predicts that household asset accumulation increases as years of schooling increases. Studies conducted by Yilebes [33], Ahmed [25], Sisay et al. [27], Mesfin [28], Ramakrishna et al. [29], Bogale et al. [30], Girmu [31], Guyu et al. [34], Shishay et al. [35], Eyob (2012), Amsalu et al. [37], Sisay [38], Seid et al. [39], Nigatu [40] and Tsegamariam et al. [41]

found negative and statistically significant relationship between education and food security.

The coefficient of land size in the second stage regression is negative and statistically significant. It seems that as land size increases, the probability of being food insecure decreases. The land is the most important factor of production in the rural part of Ethiopia which is closely related to food insecurity. The other two factors of production, capital and entrepreneurs, are

Table 2. First stage regression result of instrumental variables estimation

Dependent variable: Off-farm participation		First stage regression result		
Number of observations= 574		F (11, 562) =22.03		
R Square =0.3047		Prob>F =0.0000		
Adjusted R square =0.2909 Root		MSE =1004.9868		
Covariates	Coefficient	Std. error	t	P- value
Family Size	19.93	21.34	0.93	0.351
Age of household head	1.53	4.53	0.34	0.735
Level of Education	0.81	14.75	0.05	0.956
Land Size	202.09	67.81	2.98	0.003
Irrigation use	540.15	130.05	4.15	0.000
Remittance	415.38	113.83	3.65	0.000
Tropical livestock units	121.18	27.48	4.41	0.000
Productive safety net	0.27	0.11	2.36	0.019
Extension visits	-1.41	1.08	-1.31	0.192
Adult equivalent	82.46	27.44	3.01	0.003
Distance from market	-3.12	0.56	-5.59	0.000
Constant	-246.80	296.28	-0.83	0.405

Source: Own survey, 2018

Table 3. The second stage estimation result of instrumental variable (2SLS) regression

Instrumental Variables (2SLS) Regression		Observations=564		
Wald chi-square =124.32		Probability>chi-square =0.0000		
Root MSE = 4.9045				
Dependent variable: Food insecurity index (HFIAS)				
Dependent variable (HFIAS)	Coefficient	Standard error	t	P_value
Off-farm income	-0.002	0.001	-1.93	0.054
Family Size	0.114	0.052	2.23	0.043
Age of household head	0.000	0.022	0.01	0.990
Education	-0.158	0.072	-2.20	0.028
Land Size	-1.603	0.362	-4.42	0.000
Irrigation use	-0.435	0.775	-0.56	0.574
Migration	1.609	0.701	2.30	0.220
Tropical livestock unit	-0.570	0.155	-3.69	0.000
Productive safety net program	-0.001	0.001	-2.17	0.030
Extension visits	0.002	0.054	0.35	0.726
Constant	9.726	1.357	7.17	0.000
Test result for the existence of endogeneity		Test result for the validity of the instrument		
Chi-square =9.84		Chi-Square =3.6833804		
Prob>chi2=0.0017		P_value =0.05495732		

Source: Own survey, 2018

lacking in rural economy in developing country in general and rural Ethiopia in particular. So, rural households who have limited land size or no land at all, are vulnerable to food insecurity. This is because, the lives and livelihoods of the rural population are married with agricultural production, crops and livestock productions, which by itself depends on access to land. Studies conducted by Hiwot [15], Abonesh et al. [16], Fekadu et al. [32], Kidane et al. [17], Ahmed et al. [19], Dawit et al. [21], Tsegaye [22], Yilebes [33], Seid et al. [23], Kwadwo et al. [24], Ahmed [25], Sisay et al. [27], Ramakrishna et al. [29], Bogale et al. [30], Girum [31], Guyu et al. [34] and Shishay [35] found statistically significant and negative relationship between land size and the level of food security in Ethiopia.

Regarding family size, the regression result showed that family size and food insecurity are positively and statistically significantly related. This is in line with the prediction of the Malthusian theory of population growth and food production. This theory states that population increases geometrically and food production increases arithmetically and this will create an imbalance between food demand and food supply. This may be due to the fact that large family size or dependency ratio reduces the capacity of households to provide sufficient quantity and quality of food to all its members, to care for them when they fall ill and to ensure a good education for children. Studies conducted by Hiwot [15], Abonesh et al. [16], Kidane et al. [17], Ejigayhu [18], Jemal [20], Dawit et al. [21], Tsegaye [22], Kwadwo et al. [24], Ahmed [25], Sisay et al. [27], Mesfin [28], Bogale et al. [30] and Girum [31] also found positive and statistically significant relationship between family size and food security.

The Hausman test results in Table 3 revealed that the null hypothesis of the homogeneity of off-farm income is rejected and the alternative hypothesis of endogeneity of off-farm income is accepted and therefore, the use of two-stage least square estimation of the above model is appropriate. Moreover, the above two-stage least square estimation is also tested for the validity of the instruments and the test results revealed that the instruments are unrelated to the disturbance and therefore, they are valid instruments.

5. CONCLUSIONS

Food insecurity and poverty are the most challenging development problems in developing

countries in general in Ethiopia in particular. Agriculture is the backbone of Ethiopian economy as about 80 per cent of the population is employed in this sector. But, the agricultural sector is still the most vulnerable sector to climate change due to the fact that Ethiopian agriculture heavily depends on rainfall. The vulnerability of the Ethiopian economy to food insecurity has been increasing over time as the number of drought-affected people, productive safety net users, total population and rate of deforestation have been rising through time.

This study aimed at examining the level and determinants of food insecurity of rural households in Southern Ethiopia using a sample of 574 households and two stages least square estimation. The mean level of household food insecurity access score is 7.1847 or about 79.83 per cent of households in the study areas are food insecure. The study found that rural households at moisture stress low lands are more food insecure compared to households at middle lands and high lands. The two stages least square estimation also revealed that food availability theory related factors such as family size and land size statistically significantly affect food insecurity in the study areas. Moreover, food entitlement theory related factors like market access, education, livestock ownership, off-farm participation and productive safety net participation are also significantly affected food insecurity in Southern Ethiopia. Thus, both the demand and supply side factors are the main causes of food insecurity in Southern Ethiopia.

6. RECOMMENDATIONS

The government has to invest in infrastructures like roads, telecommunication and power provision so as to link surplus producing regions with deficit regions and thereby build resilience to food insecurity by rural poor people. The future of agricultural development and food security in Ethiopia depends to a great extent on whether production systems move away from a rain-fed system to irrigation based system of livestock and crop production. Provision of financial services and off-farm job opportunities for rural unbanked youth has paramount importance to reverse the current high wave of rural-urban migration by better educated, unmarried and productive age population. In addition, population control via family planning or adult education is one of the mechanisms that reduce the pressure on existing limited natural resources in general and agricultural resources in particular. This is

because, rapid population growth may lead to land fragmentation, deforestation, higher demand for public services and conflicts over scarce resources in rural areas.

Increasing awareness of rural farmers on the use of available agricultural technologies like improved seeds, fertilizers and small scale irrigation has also paramount important for increasing farm outputs and this by itself increases the resilience of rural household to food insecurity.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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