



Received: 20 June 2018
Accepted: 16 August 2018
First Published: 20 August 2018

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FOOD SCIENCE & TECHNOLOGY | REVIEW ARTICLE

Income diversification and food security situation in Ethiopia: A review study

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Abstract: This review was conducted to examine the income diversification and food security situation in Ethiopia. The objective is specifically to identify the determinants of income diversification of smallholder farmers, and its effect on food security status of rural households and to review the determinants of food security status of households. Agriculture is the basic economic sector in which the country relies for its social and economic development. In spite of the fact that 80% of the population has been employed in food production, it fails to feed relatively large proportion of population from its domestic production. In Ethiopia, 83% of small-holder farmers participated in farming activities and only 27% were engaged in non-farm/off-farm economic enterprises. Non-farm employment provides additional income that enables farmers to spend more on their basic needs include food, education, cloth and health care services. Food security exists when all people at all times have the physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for active and healthy life. The basic factors influencing the food security status of small-holder farmers are the socioeconomic characteristics and resources of individual households. To make considerable improvement on food security situation, action should be taken by household heads, government of Ethiopia, national and international organizations.

Subjects: Agriculture & Environmental Sciences; Food Additives & Ingredients; Environmental Economics

Keywords: food security; household; income diversification; effect

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PUBLIC INTEREST STATEMENT

Agriculture is the basic economic sector in which the country relies for its social and economic development. In spite of the fact that 80% of the population has been employed in food production, it fails to feed relatively large proportion of population from its domestic production. In Ethiopia 83% of small-holder farmers participated in farming activities and only 27% were engaged in non-farm economic enterprises. Non-farm employment provides additional income that enables farmers to spend more on their basic needs include food, education, clothing and health care. Food security exists when all people at all times have the physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for active and healthy life.

1. Introduction

1.1. Background

In developing country, Agriculture accounts for a significant fraction of production and substantial output is produced for self-consumption. Even more striking are the shares of the labor force living in rural sectors (Ray, 1998). Its activity forms a significant part of the lives of people living. The overall numbers for production and occupational structure suggest that agriculture often has lower productivity than other economic activities and capital intensity in agriculture is at a bare minimum, and there is often intense pressure on the land.

In much of sub-Saharan Africa, agriculture is still largely in this subsistence stage as noted by Todaro and Smith (2014). The reasons as to why small-scale farmers are often resistant to technological innovation in farming techniques or to the introduction of new seeds or different cash crops. This is looked at from the angle of increased productivity. Another key factor identified in the available literature is political unrest and armed conflicts. They have prevented farmers from producing, displaced populations, destroyed infrastructure and littered the countryside with land mines (Boussard, Daviron, Gérard, & Voituriez, 2005). Considering the political history of many African states which have been plagued by conflict it is safe to admit this as a formidable challenge to agriculture. The largest size of the agriculture sector, in both its share of GDP and employment, along with the likely concentration of poverty in rural areas, points to the unique opportunities that agricultural development provides (Perkins, Lindauer, & Block, 2013). On this basis that we start to ask the key questions about how some of the challenges faced by the agricultural sector that correlates with food security can be resolved and the different opportunities that we shall be exploring in the case study.

In Ethiopia, agriculture is the basic economic sector in which the country relies for its social and economic development. Its contribution to the GDP, employment, and foreign exchange earnings of the country is about 46.3%, 83% and 90%, respectively, making it as the incontestable sector in the country's development prospect (MoFED, 2006). Despite its importance, the sector is traditional and subsistence. In spite of the fact that 80% of the population has been employed in food production, Ethiopia fails to feed relatively large proportion of population from its domestic production. And more importantly, the population do not have the productive capacity to earn wherewithal to commend its additional food requirements through commercial imports. The proportion of population undernourished was 64% in 1995. Thereafter, improved progressively to 40% in 2010 (FAO-FSI, 2013). However, the prevalence of undernourishment still remains at such a high level that effort for future improvement is required. Recognizing this fact, studies reported that it is essential for the smallholder farmers to involve in other income earning activities, besides attempting to improve production and productivity of agriculture. For instance, Dimova and Sen (2010) stated that participation and specialization of small-holder farmers in one particular activity is the exception and income diversification through participating in different activities is a custom.

This is due to the fact that income diversification could help small-holders farmers to address the problem of the risks and uncertainties (Dimova & Sen, 2010; Ellis, 1998) that their farming, which is nature dependent and rain-fed agriculture, usually encountered and also expected to create higher income (Demissie & Legesse, 2013). Being agriculture is nature dependent and the common jobs of small-holder farmers, it is usually characterized by different problems such as poor fertility of the soil, volatile rainfall, crop and livestock diseases, price shocks for crop and livestock products and other related conditions which guide to generating low income and gradually lead to food insecurity and poverty. In Ethiopia, one of the main reasons for poverty and food insecurity of the extensive agriculture based small-holder farmers is the extremely low productivity (yield) of the smallholders (Canali & Slaviero, 2010) that are the major producers of food in the

country through use of low-input, rain-fed and low-output farming systems (MOARD (Ministry of Agriculture and Rural Development), 2010).

It is increasingly believed that diversification of income sources of households and widening of crops options by the farmers during cultivation have positive impact on the food security level of rural households. Evidences from various studies (Agbola et al., 2008; Zerai & Gebreegziabher, 2011a) also indicated that if households have diversified sources of income it has a positive implication on food security status of households through increasing their total monthly income earning. In general, it is suggested that diversification of income sources has been put forward as one of the strategies that households employ to minimize their income variability and to ensure a minimum level of income diversification for improving poverty and food security status at of the country at national and farmers or households level. As studies and our experience indicated that although the smallholder farmers are involved in diverse livelihood activities, their participation into non-farm and/or off-farm activities is influenced by complex and yet empirically unidentified factors and it is not clear why some households participate in to different income generating activities while other participate in farming only (Zerai & Gebreegziabher, 2011b). It is thus, important to identify the major factors influencing non-farm or off-farm income diversification strategy activities and its effect on food security status of rural farming households and suggest possible intervention strategies of income diversification of smallholder farmers, considering the socioeconomic and biophysical circumstances of Ethiopia.

1.2. Objective

The overall objective of this review study was to assess income diversification and food security situation and its dimension in Ethiopia.

Specifically, the study was trying:

- To review the determinants of income diversification of smallholder farmers;
- To review the determinants of food security status among farming households;
- To review the effect of income diversification on food security status of rural households.

1.3. Methodology

This article is based on intensive literature review of published and unpublished materials like books, articles and other scholarly materials.

2. Review of related literature

This part will discuss some concepts and evidences about income diversification and food security in Ethiopia with specific topics of concepts and definitions applied in income diversification and food security analysis, determinants of household income diversification, effect of income diversification on food security status of rural households in Ethiopia and determinants of food security status among farming households.

2.1. Concepts and definitions applied in income diversification and food security analysis

According to Collins Essential English Dictionary (2006), income is defined as the total amount of money earned from work or obtained from other sources over a given period of time. The Free on-line dictionary (2008) defines income as the amount of money or its equivalent received during a period of time in exchange for labor or services, from the sale of goods or property, or as profit from financial investments. The same source alternatively describes income as money received by a person or organization because of effort (work) or from return on investments. There has been various ways to define diversification.

According to Hengsdijk et al. (2007), diversification is defined as increasing the small-holder farmers or household income sources rather than farming activities like crop production and

livestock rearing. Diversification is defined as the procedures that small-holder farmers or households create different set of income generating activities for survival and in order to get better living standards. Depending on this definition, income diversification take place at small-holder's farmer's level in the form of increasing more activities rather than farming (Brugère, Holvoet, & Allison, 2008).

Additionally, income diversification is the process by which households widen their income base by adopting new economic activities. When we say income diversification is a process if small-holder farmers participate in income diversification activities their level of production is changed from substance or hand to mouth level to provide some amounts of product to the market (participate in commercial activities) and try to diversify from only agricultural activity to non-farm activities. In the most successful cases, income diversification creates increment in the small-holder farmer income and they try to invest in other non-agricultural activities. In contrast, income diversification may occur as a survival response to several shocks and stresses. For instance when members of poor farming households are forced to migrate in search of wage labor or sell assets because their crops fail or they face a sudden need for extra income. This situation refers to push factors (Samson et al, 2010).

According to Haggblade, Hazelland, and Reardon (2010), outside off-farm activities like shop-keepers, hand craft, petty trading, services providing activities, food processing, preparation for sale activities, etc., business enterprise are included in rural non-farm enterprise. Regardless of sectoral or functional classification which can be either wage employment or self-employment all activities left from one's own property include under non/off-farm activities (Beyene, 2008). Non-farm income includes both off-farm wage labor and non-farm self-employment (Escobal, 2001; Reardon, 1997).

Olayemi (1996) defined that food is a basic necessity of life and its importance at the household level is obvious since it is a basic means of sustenance. According to Okunmadewa (2001), the concern for food security and nutritional wellbeing in an economy is predicated by role of human element in economic development. This shows why at national level food is one of political and economic significant concept especially in issues relating and ensuring peace and stability among the populace. Food security exists when food is available to everyone at all times, they have means of access, and that it is nutritionally adequate in terms of quantity, quality and variety also that it is acceptable within the given culture (FAO, 2005). This implied food must be available to the people to an extent that will meet some acceptable level of nutritional standards in terms calorie, protein and minerals which the body needs; the possession of means by the people to acquire it and consistency in its supply at all times.

At national level, food security exists when all people at all times have the physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for active and healthy life. At household level, food security implies physical and economic access to food that is adequate in terms of quantity, quality, safety and cultural accessibility to meet each person's need (Ingawa, 2002). According to FAO (2003) in the world about 2 billion people face lack of food security intermittently due to varying degree of poverty, while up to 852 million men, women and children are chronically hanger due to extreme poverty. The work of Dimova and Sen (2010) drew attention to the critical importance of access to food, particularly at household and at individual level, as distinct from food availability.

Jrad, Nahas, and Baghasa (2010) elaborated on four dimensions of food security as food availability, food accessibility, food utilization and stability. **Food availability** refers to the physical presence of food which may come from own production, purchases from internal market or import from overseas. Whereas **Food access**: household food access is the ability to obtain sufficient food of guaranteed quality and quantity to meet nutritional requirements of all household members. Here, the food should be at right place at the right time and people should have economic freedom or purchasing power to buy adequate and nutritious food. Kuwornu, Mensah-Bonsu, and Ibrahim

(2011) explained that food access is determined by physical and financial resources, as well as by social and political factors. Access depends normally on income available to the household, the distribution of income within the household, the price of food, access to market; and social and institutional entitlement/rights. **Food utilization:** This refers to ingestion and digestion of adequate and quality food for maintenance of good health. This means proper biological use of food, requiring a diet that contains sufficient energy and essential nutrients, as well as knowledge of food storage, processing, basic nutrition and child care and illness management (Jrad et al., 2010; USAID, 2008). **Stability of food:** refers to the continuous supply of adequate food all year round without shortages (Jrad et al., 2010). To be food secure a population, household, or individual must have access to adequate food at all times. They should not be at risk of losing access to food as a consequence of a shock (e.g. an economic or climatic crisis), or cyclically (e.g. during a particular period of the year seasonal food insecurity). The concept of stability can therefore refer to both the availability and access dimensions of food security.

2.2. Determinants of household income diversification

Rural households earn their living from farm activities. However, farming alone does not provide sufficient income for sustenance among rural dwellers (Oluwatayo, 2009). Besides, farming activities in most parts of the developing world are characterized by seasonality implying that households have to rely on different options for their livelihoods in different times of the year. To safe and secure their livelihood structure, if environmental and economic situations are changing smallholder farmers have an incentive to participate in non-farm activities and get non-farm income. On the other hand factors like barriers to enter non-farm activities and risk aversion behavior of households can also hold them back from participating in non-farm activities. The motives are usually divided into two categories: “pull factors” and “push factors” (Barrett Christopher, Mesfin, & Abdillahi, 2001; Barrett Christopher, Thomas, & Webb, 2001).

According to Norman (1974), Davis and Pearce (2001), Jalan and Ravallion (1998), and Hart (1994) for small-holder farmers pull factors for income diversification are benefits from complementarities between activities, new income opportunities created by market development, improvement of infrastructure and diversification for asset accumulation respectively.

For small-holder farmers, push factors include ex-ante risk management (Harold & Paxson Christina, 1994; Hoogeveen, 2002), but for Carter Michael (1997) push factor for smallholder household are ex-post risk coping strategies, contrary for Omamo (1998), high-transaction costs is the push factor of smallholder farmers to in force income diversification. Liquidity constraints and credit market failure for Reardon, Crawford, and Kelly (1994), and the seasonality of agricultural production activity (Sahn David, 1989) are the factor which push households participate toward non-farm activities. Similarly, According to Xia and Simmons (2004), the important factor to encourage households to reallocate their productive resources to higher-return activities is market development. Whereas agricultural seasonality, frequent climatic hazards, while poor resource endowments; and poor access to financial institution like credit institution may all push rural households to undertake a wider range of activities in order to secure their livelihood. Household livelihood strategies are jointly determined by these two sets of factors.

According to Carter Michael (1997) and Reardon, Delgado, and Matlon (1992), risks play a key role in the activity diversification process. Since they strongly influence rural production, income and welfare, risks are major “push” factors that encourage households to turn to a more diversified portfolio of activities. Both on-farm and off-farm diversification can thus be seen as efficient mechanisms for households to reduce income risks (Ellis, 1998, 2000; Hoogeveen, 2002).

However, in a rapidly changing and volatile environment, uncertainty may also make agricultural households more reluctant to engage in new activities. This is particularly the case for poor households who typically have a higher absolute risk aversion (Mark & Binswanger Hans, 1992). Among small-holder farmers, the income diversification level and types depends on the availability

and accessibility of various income sources and the type of risk and uncertainties small-holder farmers are responding to which may in turn depend on household's markets like (labor and product market), human and social capital, and recurring policy changes. Some practical studies illustrate the strong factor which influences income diversification strategies are educational attainment (education level of household head) and infrastructure access for production and marketing activities are strong determinants of diversification (Barrett Christopher, Mesfin, et al., 2001; Barrett Christopher, Thomas, et al., 2001; Block & Webb, 2001).

In Ethiopia, the pastoral (rural) economy usually analyze as agrarian economy in which large number of small-holder farmers (households) are generally in farming activities like crop production and livestock rearing with small number of small-holder farmers participate in non-farm/off-farm business activities. In Ethiopia, 83% of small-holder farmers participated in farming activities and only 27% were engaged in non-farm/off-farm economic enterprises (Nagler & Naudé, 2013). Majority of the population is however dependent on marginal non-farm income sources such as petty trade (World Bank, 2009), besides the smaller farm size and low return from farming activities, exposed majority of rural households to chronic poverty. For instance, International Food and Agricultural Development (IFAD (International Fund for Agricultural Development), 2011) indicated that most of the Ethiopian rural people are poor and accessed to one or less than one hectare of land. Due to this fact that in most developing countries farm households that are highly reliant on off-farm income can have good implications if they are thoroughly considered by agricultural research and extension system of the country. As they are expected to reinvest their off-farm profit back into their farm production would improve farm productivity and household food security. If the agricultural production is low due to crop failures resulting from agro—climatic shocks and/or market failures, farm households may utilize off-farm income to stabilize aggregate income flows and secure food access.

In addition, most poor households' income from farm is not enough for the whole year consumption, and they use off-farm income in the crucial hungry period between food stores running out and the next harvest (Kilic, Carletto, Miluka, & Savastano, 2009). Therefore, off-farm income can be used as a mechanism to stabilize the household income and reduces early harvest consumption or distress selling at early harvest time. Moreover, under scarce land and imperfect land market it enables to create more job opportunity for some rural household members and this contribute for the reduction of rural unemployment.

For instances, in southern Ethiopia livelihood strategies include livestock keeping, crop cultivation, remittance and handcraft (Eneyew, 2012) and in Kenya consist of gifts, petty business and formal employment (Wanyama et al., 2010). Specifically the study revealed that educational status, access to market for farm products, and farm characteristics' (farm to farm capital, availability of animal ploughs) are determinants of income diversification strategies among rural households.

Similar finding is reported by Oluwatayo Isaac (2009) in Nigeria but Asmah (2011) in Ghana differs from this opinion. Elsewhere in Kenya where primary occupation of farmers is animal keeping, male-headed households have greater chances of diversifying into crop production due to their relative advantage of access to land.

According to Olale, Henson, and Cranfield (2010) reported greater likelihood of men diversifying than their female counterparts. Most studies in the area of off-farm/non-farm income indicated that farm characteristics of the household are considered as main factors determining the decision of participation in off/non-farm activities.

For example, using data on 200 households selected from 40 villages of Southeast Nigeria, Ibekwe et al. (2010) examined factors determining non-farm income. This indicates that increase in the size of farm land increases farmers' willingness to operate in farm activities than participating in off-farm activities. This may further show the fact that small-sized farmers are driven out of farm activities in the study areas. Amsalu, Kindie, Belay, and Chaurasia (2013) studied factors

determining the decisions to participate in off-farm work in western Ethiopia. The finding of their study shows that variables on access for credit and size of farm land are major determinants of decisions to participate in off-farm activities.

Various explanations for diversification behaviors can be found in the economic literature to explain both incentives and disincentives for rural households to combine traditional crops with new crops (Norman David, 1974), agricultural crops with animal husbandry or forestry activities (Takashi, 1997), and/or agricultural activities with off-farm activities such as migration and tourism (Barrett Christopher, Mesfin, et al., 2001; Barrett Christopher, Thomas, et al., 2001; Rachel, 1999). Education and training produce a labor force that is skilled.

Oluwatayo Isaac (2009) indicates for small-holder farmer household heads with formal education, married, engaged in farming as primary occupation and those living far away from headquarters of state or local government are less diversified than those with no formal education, single/divorced/widowed, non-farming households and those living very close to the state or local government headquarters. The implication of this is that respondents with formal education (especially those educated up to tertiary level) are engaged in better and well-paid salaried jobs than those with no formal education hence they have lower likelihood of combining two or more jobs (multiple job holding). This is because education enhances the potential of respondents and makes them access available opportunities with little or no stress. Gender relationships are important in shaping diversification process. Social organization and culture can significantly influence the relative access of diverse gender (and age groups) to household's capital assets (Bechara, Dolan, & Hinder, 2002; Ellis, 2000). Gender is an integral and inseparable part of rural livelihoods. Men and women have different assets, access to resources, and opportunities. Ellis (2000) found that women rarely own land, may have lower education, and their access to productive resources as well as decision-making tend to occur through the mediation of men. Women typically confront a narrower range of labor markets than men, and lower wage rates. In general, therefore, diversification is more of an option for rural men than for women. In this sense, diversification can improve household livelihood security while at the same time trapping women in customary roles.

Ibekwe et al. (2010) in their work on determinants of farm and off-farm income among farm households in south east Nigeria noted that the age of household head was significant and negatively correlated with farm income. This may be due to the fact that the older the farmer the less productive the farmers will be. This equally has implication for farm productivity. According to Readon et al. (1998), the small size of farm holdings has been one of the factors that are driving small-holder farmers out of farm business and has been regarded by many authors as one of the push factors. Family size is an important factor for livelihood diversification. Ibekwe et al. (2010) reported that farm household size was significant and correlated with farm income diversification. Individuals own asset base helps both directly and indirectly in livelihood diversification. Asset offers a store of wealth as well as provides an opportunity to invest in alternative enterprises.

According to Amsalu et al. (2013) on the work of determinants and patterns of income diversification among smallholder farmers in Akaki district, Ethiopia, two-stage random sampling with proportionate probability sampling was used to collect cross-sectional data from 155 farm households using structured questionnaire. The data were also supported with documents from agricultural and rural development office and farmers cooperatives in the study area. The Tobit model was used to analyze the factors determining the income diversification. From the descriptive statistics, sales of homemade farm implements and drinks, and non-farm employment was found to be the most important sources of off-farm income in the study area. The results from Tobit model indicate that, family size; number of extension visit per year and education level has a positive significant effect over income diversification. On the other hand, age of the household head; land size and average distance from market have negative and significant influence on the household's decision toward diversification.

Gecho (2017) identifies factors which affect rural farm households' income diversification in the case of Wolaita, his survey result also shows that out of the total sample households (300), about 246 households (82%) pursued agriculture as a primary income source. About 51 respondents (17.3%) reported that agriculture was their second alternative giving first priority to either non-farm or off-farm activities while only three respondents (1%) put agriculture in the third place. On the other hand, 37 respondents (12.3%) reported that non-farm activity was their primary income source. Within the non-farm category about 90 respondents (30%) claimed non-farm is the second income source, next to farm. Out of the total sample respondents, about 134 sample households (44.6%) pursue non-farm activities beside agriculture. Off-farming is a source of income for poor households on which they mainly depend for their livelihood due to low resource endowment, especially farm land. Out of total sampled households, about 17, 33, and 12 respondents ranked off-farm activity as first, second and third in that order. By applying binary logit model to investigate factors influencing the households' participation in income diversification eight variables were significant with respect to income diversification with less than 10% of the probability level. These variables include sex, education, oxen ownership, tropical livestock, farm size, distance to market, participation in local leadership and annual farm income.

Zerai and Gebreegziabher (2011b) on the study of effect of non-farm income on household food security in eastern Tigray, Ethiopia by using Heckman selection model (two stage) they examine the household decision with respect to participation in non-farm employment using probit model. they found that land size, age, family size, special skill, electricity, credit, distance to the nearest market and access to irrigation are the most influencing variables in determining farmers to participate in non-farm activities.

According to Demissie and Legesse (2013) on the research titled determinants of income diversification among rural households: The case of small-holder farmers in Fedis district, Eastern Hararghe zone, Ethiopia by using Tobit model Participation in non/off-farm employment activities and the level of income derived are found to be influenced by human capital related variables (gender and age of household head, number of economically active family members, education level of household head and presence of children attending school), livelihood assets (livestock holding, size of cultivated land), livelihood diversifying strategy (crop based diversification through number of crops grown and harvested) and infrastructure related variable (proximity to market). The results imply that these factors need to be considered by policy makers in the planning of agricultural and non-agricultural initiatives in this study area.

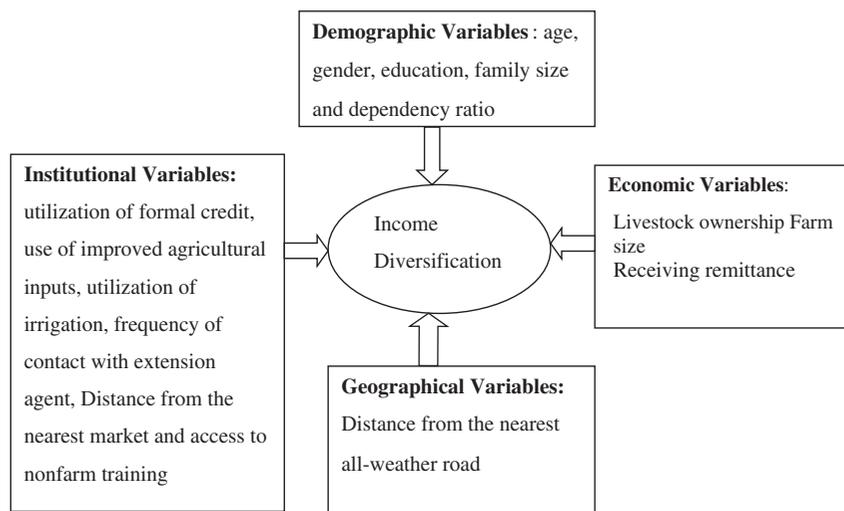
Ahmed (2016) examined what factors contribute to the income differential? With the evidence from east Hararghe, Oromia, Ethiopia, he used linear regression model to identify contributing factors and the model output indicated that, irrigation use, livestock holding, education level of household head, cultivated area, age and amounts of fertilizer used were the significant variables that contribute to farm income differential in the study area. Therefore, the policy implication of the study is that increasing and proper utilization of the aforementioned variables should obtain due attention to speed up the enhancement of rural farm household income (Figure 1).

2.3. Effect of income diversification on food security status of rural households

For small-holder farmers, income diversification or participating in non-farming activities has both positive and negative impacts (Reardon et al., 1998), and also there is some controversy about the impact of income diversification on food access which are short run and long run effect. In the short run participating in income diversification or non/off-farm activities, raising the cash is important to fill the food deficit. However, the controversy comes from the long run effect of income diversification or participating non/off-farm activities may reduce the availability of food and gradually it leads to food insecurity. According to Agbola

Figure 1. Conceptual framework for determinants of income diversification.

Source: Modified from Demissie and Legesse (2013).



et al. (2008), income diversification strategies are fruits, vegetables and sold farm labor to supplement cash income and to reduce household food insecurity. Households that combined enterprises were better off and able to meet their capital expenditure.

Similarly, according to Zerai and Gebreegziabher (2011a), non-farm employment provides additional income that enables farmers to spend more on their basic needs include food, education, clothing and health care. This implies that non-farm employment has a significant role in maintaining household food security. Additionally, according to Tolossa (2005), small-holder farmers often feel food secure throughout the year by participation in crop production and livestock rearing or through running own non-farm ventures or to work with somebody else. As he further explains, a small-holder household is food insecure when it is incapable of sufficiently feed its household members from its own production or purchase from the market in return to own cash, which may be earned from the exchange of self-endowment.

In addition to the above studies according to Yizengaw (2014), the coefficient of Herfindahl diversification index is positive and significance at 5% level of significance. In other words, the higher the level of the household income diversification, results with, the more food secure of the households. The possible explanation for this as our prior expatiation, diversification of income sources provides an additional income that enables farmers to spend more on their basic needs include food consumption, education, clothing and health care. Increase in the level of income diversification helps the households to revitalize from different shocks which make farm households food insecure.

This result was also consistent with the study of Edward and Spencer (2012) in Nigeria, and estimated coefficient of income diversification (0.877) was positive and significant at 5% level of significance. This implies that, as income diversification increases, food security status of the households increase. According to Birhanu, Assefa, Woldie, and Morankar (2010), participation in off-farm activities was found to be significantly and positively associated with food security, a finding similar with Nyariki, Wiggins, and Imungi (2002) who found involvement in off-farm activities positively and significantly affect food security in Kenya.

According to Naznin, Dev, Sultana, and Elias Hossain (2017) on the work of analysis of the impact of income diversification strategies on food security status of rural households in Bangladesh, income diversification has significant implication on the food security status of the rural farming households in Bangladesh. Income diversification has been identified as essential strategy for

raising income and reducing rural poverty. The level and type of income diversification depends on the accessibility and availability of different income sources. Similarly the status of food security depends on average kcal per day consumed by all members of a household. To examine the impact of income diversification on food security status of the rural farming households in Rajshahi district, a survey was conducted in district Rajshahi of Northern Bangladesh covering three Upazilas with 138 households.

The Simpson Index of Diversity (SID), Food Security Index and Binary Logistic Regression model are employed to analyze the data. To estimate the model, data has been collected from sample households from three upazilas—Puthia, Paba and Mohonpur. The SID is used to measure the extent of income diversification and the Food Security Index is used to measure the household food security status.

The results of SID revealed that diversification of income sources (SID = 0.25) is very low and the value of the food security index is 0 to 1. It is also found that the mean value of FSI is 0.91 for the food insecure households whereas 1.06 is the mean value of FSI of food secure households. Three factors are found to be statistically significant namely age of household heads, educational status and household size.

The analysis found that income diversification has positive but insignificant impact on household food security status in the study area. Finally, the obtained results have important policy implications which imply that programs targeted to engage people in other income generating activities would augment their income sources which are made to increase the food security status of household level in Bangladesh. According to Zerai and Gebreegziabher (2011b) on the study of effect of non-farm income on household food security in eastern Tigray, Ethiopia to examine the effect of non-farm employment indicates that non-farm employment provides additional income that enables farmers to spend more on their basic needs include food, education, clothing and health care. The result of the study implied that non-farm employment has a role which is significant in maintaining household food security.

2.4. Determinants of food security status among households

According to African Development Bank (2014), Ethiopia is one of the most food insecure and famine affected countries. A large portion of the country's population has been affected by chronic and transitory food insecurity. The situation of chronically food insecure people is becoming more and more severe. Food security situation in Ethiopia is highly linked to recurring food shortage and famine in the country, which are associated to recurrent drought. According to Fao (2010), more than 41% of the Ethiopian population lives below the poverty line and above 31 million people are undernourished. By using the threshold of 2,550 kcal per adult equivalent per day, 40% of Ethiopian households for whom their majority reside in rural parts of the country were food insecure and undernourished (WFP and CSA, 2014).

Food insecurity is a reality for hundreds of millions of people around the world, with the most affected countries being those in East Africa. In Ethiopia, the problem of food insecurity is exacerbating around pastoral areas due to the influence of a number of socioeconomic and environmental factors. According to Sanusi, Badejo, and Yusuf (2006), the basic factors influencing the food security status of small-holder farmers or households are the socioeconomic characteristics and resources of individual households. According to Fekadu and Mequanent (2010), in the study on determinants of food security among rural households of central Ethiopia using binary logistic regression model observed that age of household head, educational level of household head, off-farm/non-farm income, use of chemical fertilizer, size of cultivated land, livestock ownership, oxen ownership and soil and water conservation practices were found to be significant in determining household food security.

The result reveals that age of the household head, the size of land cultivated, use of fertilizer, oxen ownership, and soil conservation has positive impact on food security status of household but household size and education has negative impact on food security status of smallholder households.

The possible explanation for the unexpected output might be literate households might not have chance to apply their knowledge toward achievement of household food security. Similarly, Garrett and Ruel (1999) found negative and significant association between educational level of a household head and with food security. Whereas, others found out that it is mother's attendance of primary education that positively contributes to food security (Bigsten, Kebede, Shimeles, & Tadesse, 2003). In our sample, a greater proportion of female-headed households are food insecure, in agreement with this finding.

Agbola (2004) in a study on food security in Osun State using Tobit regression model observed that household size and diversification extent had a negative effect on food security, while gender of household head, child dependency ratio, input usage, remittance, total expenditure, food allocation and crop output had a positive effect on food security. The study further revealed that age of household head, education level, farm size, commercialization, cooperative membership, fertilizer and chemical had no significant effect on food security.

Similarly to Sanusi et al. (2006) and Babatunde, Omotesho, and Sholotan (2007) noted that household income, household size, education status of the household head and quantity of food obtained from own production determined the food security status of farming households in North Central Nigeria. They concluded that socioeconomic variables of the households are important determinants of their food security or insecurity status.

According to Siraje and Bekele (2013) on the work assessment of food insecurity and coping mechanisms among pastoral households of Afar national regional State in the case of Chifra district, Ethiopia, with specific objectives of assessing the status of food security, the local food insecurity coping strategies employed by different food security status groups and identifying the major determinants of food insecurity. Results of descriptive and inferential statistics indicate that using the calorie intake approach, 65.8% of sample respondents were food insecure, while 34.2% were food secure. Further analysis showed that sale of sheep and goats (shoats), reducing number and size of meals; seasonal migration (some of the family members), receiving food aid and borrowing cash or food from neighbors or relatives were the frequently practiced coping strategies by pastoralists of the study district.

On the other hand, analysis of the logistic regression model resulted in eight statistically significant variables affecting the food security status of the sampled households in the district. Family size, age of household head, dependency ratio, livestock disease incidence were causing food insecurity, whereas sex of household head, herd size, income from livestock production and non-farm income were working against food insecurity. The study recommends that appropriate policy measures must be taken toward limiting dependent population size through integrated and accessible health and education services, improving the contribution of the pastoralist women through trainings that could help remove cultural barriers and supporting the livestock sector through proper forage development as well as extended veterinary service and disease control programs.

Finally, considering the fact that non-farm income of the sample households significantly affected households' food, pastoral households' insecurity in the district should be assisted to diversify their sources of income so that they may be able to cope with the prevailing problem and meet at least their minimum food requirement particularly during the drought season.

Sisay and Edriss (2012) on their work of "Determinants of food insecurity in Addis Ababa City, Ethiopia" by using Tobit regression model and the result shows that household size,

household income, household head age, household head education, ownership of bank account and income from remittance and gift were found to be significant determinants of food insecurity in the study area.

Kidane, Alemu, and Kundhlande (2005) analyzed determinants of food security in Oromia region of Ethiopia using the rural household survey data. The authors used logistic regression to identify the determinants of food security in the region. The empirical evidence revealed that access to fertilizer, educational level of household heads, access to land, access to family planning improve the probability of food security in the study area.

According to Girma Gezimu gebre (2012) on “Determinants of food insecurity among households in Addis Ababa City, Ethiopia” by using Foster, Greer and Thorbeck distributional measure of food insecurity while econometric analysis used binary logistic regression model to analyze the data of a set of socioeconomic variables as explanatory variables and food insecurity as independent variable. The head count index shows that 58.16% of the total households are below the food insecurity line. The food insecurity gap and severity were 20% and 9.4% respectively. The result of the logistic regression model estimate indicates that out of the 10 factors included, six were found to have a significant influence on the probability of being food insecure at less than 10% significance level. The variables considered were household size, age of household head, household head education, and access to credit, household asset possession, and access to employment which agrees with the finding of Sisay and Edriss (2012).

Aragie and Genanu (2017) examine the “Determinants of food security in north Wollo zone for econometric analysis,” a logistic regression procedure was employed on household socioeconomic characteristics the 15 variables fitted in the model; the age of household head, dependency ratio, average monthly expenditure, non-farm income, family size, distance from input market, farmland size, the number of oxen and livestock ownership were found to be significant. About 42% of the sample households were measured to be food insecure. Also, the incidence of food insecurity, food insecurity gap, and severity of food insecurity was 42%, 14% and 7% respectively. These results have important policy implications for the expansion of non-farm activities and the introduction of livestock stocking programs at the household level to improve the food security status of households.

The study conducted by Kabsay and Messay Mulugeta (2014) in Laelay Maichew Woreda Tigray, Ethiopia by using multiple regression analysis by taking calorie availability as dependent variable sex, education, off-farm income, utilization of irrigation, and uses of fertilizer are positively and also insignificantly affect calorie availability but age of household head and adult equivalent ratio affect negatively but land size was positive and Significantly.

3. Conclusion and recommendation

The negative and significant influence of farm size on income diversification suggests concerned bodies to develop appropriate strategies and policies especially for land resource-poor farmers. The presence of very small size of land also calls for giving emphasis in agricultural intensification to enhance the productivity of the land so that generate adequate income and food. The negative and significant impact of livestock and oxen ownership in income diversification suggests designing development strategy for livestock sector through improving livestock breeds, veterinary services, forage development, marketing, access to credit and overall management of livestock production.

The strong significant association of total annual cash income on diversification calls for policy measures in order to pave the way to solve financial problems through developing and strengthening financial institution, creating credit access and promoting better income generating options. The significant and positive effect of households’ local leadership participation on the diversification points the direction to create access to information and other

necessary services like credit for people in the same community. This also considers government and other responsible bodies in building capacity through education and training so as to participate actively in social activities and leadership.

Income diversification is considered as the most important strategy for raising income and food security status in Ethiopia. From the above review it is clear that income diversification has significant impacts on households' food security status. Moreover, the review also implies that scaling-up of the supply of chemical fertilizer can immensely contribute to enhancing food security. Policies and strategies that involve regulation of the trend of increases in the prices of agricultural products vis-à-vis chemical fertilizer and introducing necessary adjustments are essential to sustain this positive effect. Absence of this might cause a disproportional increase in input prices that will in turn create disincentives for farmers to purchase such inputs.

As household size and food insecurity are positively related serious attention has to be given to limit the increasing population Ethiopia. This can be achieved by creating sufficient awareness to effective family planning in the urban households. Further, household heads are advised to reduce the size of their household and their dependency ratio. The effect of education on household food insecurity confirms the significant role of the variable in consideration for betterment of living condition. The more household head educated, the higher will be the probability of educating family member and familiar with modern technology, which the twenty-first century so badly demands. So, strengthening both formal and informal education and vocational or skill training should be promoted to reduce food insecurity in Ethiopia. Access to employment opportunity negatively related with food insecurity in Ethiopia.

4. Recommendation

To make considerable improvement on food security situation in Ethiopia the following measures and actions should be taken by household heads, government of Ethiopia, national and international organizations.

- The concerned body has to work more to increase the access to education in Ethiopia in order to explore the existing opportunity of income diversification via non-farm activities. Expansion of education coverage with quality will enhance income diversification of households.
- Infrastructure like road construction, electricity and telephone services should be developed in order to facilitate income diversification both through on-farm and off-farm activities.
- Gender had significant and negative influence on household income diversification, and this considers government and other responsible bodies to design necessary strategies so as to create awareness among the community to participate women equally with man in all development activities.
- Access to job helps urban households to diversify their income which in turn alleviates the food deficiency among poor households. Therefore, both government and civil society organizations have roles to play in addressing these issues.

Generally, the households and productive aged members of the household should participate in different income generating activities and diversify their livelihood strategies that help them to escape from wider state of food insecurity and undernourishment's. It needs to invest more on pro-poor development programs and improve social accountability to increase the ability of citizens to provide feedback on the services they receive; the international NGOs, local organizations, private sector and government should continue to work together on strengthening the livelihoods, rural market structures and providing the climate resilience services that improve the ability of poor households to cope up different shocks.

Funding

The authors received no direct funding for this research.

Competing Interest

The authors declare no competing interests.

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Citation information

Cite this article as: Income diversification and food security situation in Ethiopia: A review study, Mohammed Adem, Esubalew Tadele, Habtamu Mossie & Mezegebu Ayenalem, *Cogent Food & Agriculture* (2018), 4: 1513354.

References

- African Development Bank. (2014). *Africa Food Security Brief: Special focus on climate Africa Food Security change Impacts*. Vol. 5: Statistics Department. April 2014.
- Agbola, P. O. (2004). *Economic analysis of household food insecurity and coping strategies in Osun State, Nigeria*. Unpublished PhD Thesis. Ibadan, Oyo State, Nigeria: Department of Agricultural Economics, University of Ibadan.
- Agbola, P. O., Awotide, D. O., Ikpi, A. E., Kormawa, P., Okoruwa, V. O., & Babalola, D. A. (2008). Effect of income diversification strategies on food insecurity status of farming households in Africa: Result of analysis from Nigeria. In *Paper presented at the presentation at the 12th EAAE congress people, food and environments: Global trends and European strategies*. Belgium: Gent.
- Ahmed, B. (2016). What factors contribute to the income differential? *ISSN(e): 2223-1331/ISSN(p) Evidence from East Hararghe, Oromia, Ethiopia*;2226-5724.
- Amsalu, B., Kindie, G., Belay, K., & Chaurasia, S. P. R. (2013). *Off-farm labor supply decision of adults in rural Ethiopia: Double hurdle approach*.
- Aragie, T., & Genanu, S. (2017). Level and Determinants of Food Security in North Wollo Zone (Amhara Region—Ethiopia). *Journal of Food Security*, vol. 5(6), 232–247. doi:10.12691/jfs-5-6-4.
- Asmah, E. E. (2011). Rural livelihood diversification and agricultural household welfare in Ghana. *Journal of Development and Agricultural Economics*, 3(7), 325–334.
- Babatunde, R. O., Omotesho, O. A., & Sholotan, O. S. (2007). Socio-economic characteristics and food security status of farming households in Kwara State, North-Central Nigeria. *Pakistan Journal of Nutrition*, 6 (1), 49–58. doi:10.3923/pjn.2007.49.58
- Barrett Christopher, B., Mesfin, B., & Abdillahi, A. (2001a). Income diversification, poverty traps and policy shocks in Côte d'Ivoire and Kenya. *Food Policy*, 26(4), 367–384. doi:10.1016/S0306-9192(01)00017-3
- Barrett Christopher, B., Thomas, R., & Webb, P. (2001b). Nonfarm income diversification and household livelihood strategies in rural Africa: Concepts, dynamics, and policy implications. *Food Policy*, 26(4), 315–331. doi:10.1016/S0306-9192(01)00014-8
- Bechara, A., Dolan, S., & Hindes, A. (2002). Decision-making and addiction (part II): Myopia for the future or hypersensitivity to reward? *Neuropsychologia*, 40(10), 1690–1705. doi:10.1016/S0028-3932(02)00016-7
- Beyene, A. D. (2008). Determinants of off-farm participation decision of farm households in Ethiopia. *Agrekon*, 47(1), 140–161. doi:10.1080/03031853.2008.9523794
- Beyene, F., & Muche, B. (2010). Determinants of food security among rural households of Central Ethiopia: An empirical analysis. *Quarterly Journal of International Agriculture*, 49(4), 299.
- Bigsten, A., Kebede, B., Shimeles, A., & Tadesse, M. (2003). Growth and poverty reduction in Ethiopia: Evidence from household panel surveys. *World Development*, 31(1), 87–106. doi:10.1016/S0305-750X(02)00175-4
- Birhanu, Z., Assefa, T., Woldie, M., & Morankar, S. (2010). Determinants of satisfaction with health care provider interactions at health centres in central Ethiopia: A cross sectional study. *BMC Health Services Research*, 10(1), 78. doi:10.1186/1472-6963-10-302
- Block, S., & Webb, P. (2001). The dynamics of livelihood diversification in post-famine Ethiopia. *Food Policy*, 26(4), 333–350. doi:10.1016/S0306-9192(01)00015-X
- Boussard, J. M., Daviron, B., Gérard, F., & Voituriez, T. (2005). Food security and agricultural development in sub-Saharan Africa: Building a case for more support. Policy Brief No. 1. *Background Document, CIRAD for FAO* ((1)), 1–7.
- Brugère, C., Holvoet, K., & Allison, E. H., 2008. Livelihood diversification in coastal and inland fishing communities: Misconceptions, evidence and implications for fisheries management. FAO, Rome, Italy: *Working Paper, Sustainable Fisheries Livelihoods Programme (SFLP) FAO/DFID*.
- Canali, M., & Slaviero, F., 2010, July. Food insecurity and risk management of smallholder farming systems in Ethiopia. In *Ninth European IFSA Symposium*, Vienna, Austria (pp. 4–7).
- Carter Michael, R. (1997). Environment, technology, and the social articulation of risk in West African agriculture. *Economic Development and Cultural Change*, 45 (3), 557–590. doi:10.1086/452291
- Demissie, A., & Legesse, B. (2013). Determinants of income diversification among rural households: The case of smallholder farmers in Fedis district, Eastern hararghe zone. *Ethiopia*, 5(3), 120–128.
- Dev, T., Sultana, N., & Elias Hossain, M. (2017, 2016). Analysis of the impact of income diversification strategies on food security status of rural households in Bangladesh: A case study of Rajshahi District, *American Journal of Theoretical and Applied Business*, 2(No. 4), 46–56. doi:10.11648/j.ajtab.20160204.13
- Dictionary Collins English. 2006. Retrieved May 5 2009]. from: <http://www.thefreedictionary.com/income>.
- Dimova, R. D., & Sen, K., 2010. Is household income diversification a means of survival or a means of accumulation? Panel data evidence from Tanzania.
- Edward, O., & Spencer, H. (2012). Determinants of income diversification among fishing communities in Western Kenya. *Fisheries Research*, 125, 235–242.

- Ellis, F. (1998). Household strategies and rural livelihood diversification. *Journal of Development Studies*, 35(1), 1–38. doi:10.1080/00220389808422553
- Ellis, F. (2000). *Rural livelihoods and diversity in developing countries*. Oxford university press.
- Eneyew, A. (2012). Determinants of livelihood diversification in Pastoral Societies of Southern Ethiopia. *Journal of Agriculture and Biodiversity Research*, 21(2), 40–61.
- Escobal, J. (2001). The determinants of nonfarm income diversification in rural Peru. *World Development*, 29(3), 497–508. doi:10.1016/S0305-750X(00)00104-2
- Eshetu, S., Belete, B., Goshu, D., Kassa, B., Tamiru, D., Worku, E., ... Abebe, Z. 2010. Income diversification through improved irrigation in Ethiopia: Impacts, constraints and prospects for poverty reduction, research-inspired policy and practice learning in Ethiopia and the Nile Region, Evidence from East Harerge Zone, Working Paper 14, Oromiya Region, Ethiopia
- FAO. (2005). *The state of food insecurity in the world*. Rome, Italy: Food and Agriculture Organization of the United Nations.
- FAO (Food and Agricultural Organization). (2003). *Food and Agricultural Organization*. Rome: Committee on World Food Insecurity in the World.
- Fao, W. (2010). *The state of food insecurity in the World 2010, Addressing food insecurity in protracted crises*. WFP, FAO. *Journal of Rural Studies*, 29, 101–112
- Free Online Dictionary. 2008. Retrieved April 5 2009. Retrieved from: <http://www.answers.com/topic/income?cat=biz-fin>.
- Garrett, J. L., & Ruel, M. T. (1999). Are determinants of rural and urban food security and nutritional status different? Some insights from Mozambique. *World Development*, 27(11), 1955–1975. doi:10.1016/S0305-750X(99)00091-1
- Gecho, Y. (2017, 2017). Rural farm households' income diversification: The case of Wolaita Zone, Southern Ethiopia, *Social Sciences*, Vol. 6(No. 2), 45–56. doi:10.11648/j.ss.20170602.1
- Gillian, H. (1994). The dynamics of diversification in an Asian rice region. *Development or Deterioration*, 47–71. *Nature genetics*, 6(2), 130
- Girma Gezimu gebre. (2012). *Determinants of food insecurity among households in Addis Ababa city*. Ethiopia. *Interdisciplinary Description of Complex Systems: INDECS*, 10(2), 159–173.
- Haggblade, S., HazellandT., P. B. R., & Reardon. (2010). *Transforming the RuraNonfarmEconomy: Opportunities and threats in the developing world* (1st ed.). Baltimore: Johns Hopkins University Press and International Food Policy Research Institute.
- Harold, A., & Paxson Christina, H. (1994). Do the poor insure? A synthesis of the literature on risk and consumption in developing countries. Springer *Economics in a Changing World*, pp. 48–78. Palgrave Macmillan, London.
- Hengsdijk, H., Guanghuo, W., Van Den Berg, M. M., Jiangdi, W., Wolf, J., Changhe, L., ... Van Keulen, H. (2007). Poverty and biodiversity trade-offs in rural development: A case study for Pujiang county, China. *Agricultural Systems*, 94(3), 851–861. doi:10.1016/j.agsy.2006.11.018
- Hoogeveen, J. G. M. (2002). Income risk, consumption security and the poor. *Oxford Development Studies*, 30(1), 105–121. doi:10.1080/136008101200114921
- Ibekwe, U. C., Eze, C. C., Onyemauwa, C. S., Henri Ukoha, A., Korie, O. C., & Nwaiwu, I. U. (2010). Determinants of farm and off—Farm income among farm households in South East Nigeria. *Academia Arena*, 2(10), 58–61.
- IFAD (International Fund for Agricultural Development). (2011). *Rural poverty report*. Rome, Italy: New Realities, New Challenges, New Opportunities for Tomorrow's Generation.
- Ingawa, S. A. (2002). Keynote address at the 8th Annual conference of the agricultural extension society of Nigeria held in Benin City, 16–19 September. *Processing of the Agricultural Extension Society of Nigeria*.
- Jalan, J., & Ravallion, M. 1998. Geographic poverty traps? Institute for economic development, *Discussion Paper* 86. Boston: Institute for Economic Development, Boston University.
- Jrad, S., Nahas, B., & Baghasa, H. (2010). Food security models. Ministry of agriculture and agrarian reform, national agricultural policy center. *Policy Brief*, 33, 32. Syrian Arabic Republic.
- Junior, D., & Douglas, P. (2001). The non-agricultural rural sector in Central and Eastern Europe. *World Bank Technical Paper*, 111–130.
- Kahsay, S., & Messay Mulugeta,. (2014). *Determinants of rural household food insecurity in Laelay Maichew Woreda Tigray*. Ethiopia. *Afr J Agric Food Secur*, 2(1), 105–11.
- Kidane, H., Alemu, Z. G., & Kundhlande, G. (2005). Causes of household food insecurity in koredagaga peasant association, Oromiya Zone, Ethiopia. *Agrekon*, 44(4), 543–560. doi:10.1080/03031853.2005.9523727
- Kilic, T., Carletto, C., Miluka, J., & Savastano, S. (2009). Rural nonfarm income and its impact on agriculture: Evidence from Albania. *Agricultural Economics*, 40(2), 139–160. doi:10.1111/agec.2009.40.issue-2
- Kuwornu, J. K., Mensah-Bonsu, A., & Ibrahim, H. (2011). Analysis of foodstuff price volatility in Ghana: Implications for food security. *European Journal of Business and Management*, 3(4), 100–118.
- Mark R, R., & Binswanger Hans, P. (1992). *Wealth, weather risk, and the composition and profitability of agricultural investments* (Vol. 1055). World Bank Publications
- MOARD (Ministry of Agriculture and Rural Development). (2010). *Ethiopia's agricultural sector policy and investment framework 2010-2020*. Addis Ababa, Ethiopia: Federal Democratic Republic of Ethiopia (FDRE).
- MoFED, (Ministry of Economic Development) E. (2006). *Ethiopia: Building on progress a plan for accelerated and sustained development to end poverty (PASDEP)*.
- Nagler, P., & Naudé, W. (2013). Non-farm entrepreneurship in rural Africa: Patterns and determinants of income diversification.
- Norman David, W. (1974). Rationalising mixed cropping under indigenous conditions: The example of Northern Nigeria. *The Journal of Development Studies*, 11(1), 3–21. doi:10.1080/00220387408421509
- Nyariki, D. M., Wiggins, S. L., & Imungi, J. K. (2002). Levels and causes of household food and nutrition insecurity in dryland Kenya. *Ecology of Food and Nutrition*, 41(2), 155–176. doi:10.1080/03670240214493
- Okunmadewa., F. (2001). *Poverty reduction in Nigera*. Ibadan: Afour point Agenda Gust Lecture of the House University of Ibadan.
- Olale, E., Henson, S., & Cranfield, J. 2010. Determinants of income diversification among fishing communities in Western Kenya. Selected Paper Prepared for Presentation at the Agricultural and Applied Economics Association 2010 AAEA, CAES and WAEA Joint Annual Meeting, July 25–27, 2010, Denver, Colorado.

- Olayemi, J. K. (1996). Food security in Nigeria. Development policy Center Policy Report 2 Ibadan. Reardon, T. (1997).
- Oluwatayo Isaac, B. (2009). Poverty and income diversification among households in rural Nigeria: A gender analysis of livelihood patterns. University of Ado-Ekiti.
- Omamo, S. W. (1998). Transport costs and smallholder cropping choices: An application to Siaya District, Kenya. *American Journal of Agricultural Economics*, 80(1), 116–123. doi:10.2307/3180274
- Perkins, D. R. S., Lindauer, D., & Block, S. (2013). *Economics of Development. Journal of World Business*, 50(2), 357–367.
- Rachel, M. (1999). Return migrant entrepreneurs and economic diversification in two counties in south Jiangxi, China. *Journal of International Development*, 11(4), 661. doi:10.1002/(SICI)1099-1328(199906)11:4<661::AID-JID609>3.0.CO;2-I
- Ray, D. (1998). *Development economics*. Princeton University Press. Jan 12.
- Reardon, T. (1997). Using evidence of household income diversification to inform study of the rural nonfarm labor market in Africa. *World Development*, 25(5), 735–747. doi:10.1016/S0305-750X(96)00137-4
- Reardon, T., Crawford, E., & Kelly, J. (1994). *Links between nonfarm income and farm investment in African households: Adding the capital market perspective. American journal of agricultural economics*, 76(5), 1172–1176.
- Reardon, T., Delgado, C., & Matlon, P. (1992). Determinants and effects of income diversification amongst farm households in Burkina Faso. *The Journal of Development Studies*, 28(2), 264–296. doi:10.1080/00220389208422232
- Sahn David, E. (1989). Seasonal variability in third world agriculture: The consequences for food security. 9 851–864
- Sanusi, R. A., Badejo, C. A., & Yusuf, B. O. (2006). Measuring household food insecurity in selected local government areas of Lagos State and Ibadan, Nigeria. *Pakistan Journal of Nutrition*, 5, 62–67. doi:10.3923/pjn.2006.62.67
- Siraje, I., & Bekele, A. (2013). Assessment of Food Insecurity and Coping Mechanisms among Pastoral Households of Afar National Regional State: The Case of Chifra District, Ethiopia.
- Sisay, E., & Edriss, A. K. (2012). Determinants of food insecurity in Addis Ababa City, Ethiopia. *Journal of Economics and Sustainable Development*. issn 2222-1700 (paper) issn 2222-2855 31:2012.
- Takashi, K. (1997). Production risk and advantages of mixed farming in the Pakistan Punjab. *Developing Economies*, 35(1), 28–47. doi:10.1111/j.1746-1049.1997.tb01185.x
- Thomas, R., Kostas, S., Balisacan, A., Cruz, M. E., Julio, B., & Banks, B. (1998). Rural non-farm income in developing countries. *The State of Food and Agriculture*, 1998, 283–356.
- Todaro, M. P., & Smith, S. C. (2014). *Economic Development* (12th ed.). Harlow, Pearson & Addison Wesley: London.
- Tolossa, D. (2005). *Rural livelihoods, poverty and food insecurity in Ethiopia: A case study at Erenssa and Garbi communities in Oromiya Zone, Amhara National Regional State*. Norwegian University of Science and Technology, Faculty of Social Sciences and Technology Management, Department of Geography, ds food security in Southern Ethiopia: The case of Shashemene District.
- USAID. (2008). *Madagascar Food Security Development programming Framework, From the American People*. Madagascar: United States Agency International Development.
- Wanyama, M., Mose, L. O., Odendo, M., Okuro, J. O., Owuor, G., & Mohammed, L. (2010). Determinants of income diversification strategies amongst rural households in maize based farming systems of Kenya. *African Journal of Food Science*, 4(12), 754–763.
- WFP and CSA. (2014). *Comprehensive food security and vulnerability analysis in Ethiopia*. Ethiopia: Addis Ababa.
- World Bank. (2009). *Diversifying the rural economy: An assessment of the investment climate for small and informal enterprises in Ethiopia*, Report Number 49564-ET, October 6, 2009.
- Xia, Q., & Simmons, C. (2004). Diversify and prosper: Peasant households participating in emerging markets in Northeast Rural China. *China Economic Review*, 15(4), 375–397. doi:10.1016/j.chieco.2003.09.001
- Yizengaw, Bassie (2014). *Determinants of Household Income Diversification and Its Effect on Food Security Status in Rural Ethiopia: Evidence from Ethiopia Longitudinal Rural Household Survey*. (Doctoral dissertation, Master's thesis, Addis Ababa University, Addis Ababa, Ethiopia).
- Zerai, B., & Gebreegziabher, Z. (2011a). Effect of nonfarm income on household food security in eastern Tigray, Ethiopia: An entitlement approach. *Food Science and Quality Management*, 1, 1–22.
- Zerai, B., & Gebreegziabher, Z. (2011b). Effect of nonfarm income on household food security in Eastern Tigray. *Ethiopia: An Entitlement Approach*, 1, 2011.



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