Analysis of Households Vulnerability and Food Insecurity in Amhara Regional State of Ethiopia: Using Value at Risk Analysis

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Abstract

This study examines household's food insecurity and the extent of future vulnerability in Amhara region, using WMS and HCES of CSA. Calorie method was employed to determine food insecurity. In addition to descriptive statistics, GLS application for vulnerability and the Logit models was used to analyze the data. The Results indicates that, demand side factor related to socio economic factors like family sizes, education, consumption, employment opportunities and asset ownership was a significant predictor of vulnerability and food insecurity. In rural areas, supply side factors like farm inputs and farm size are also related to food insecurity. Empirical finding also shows that idiosyncratic health-related shocks, covariate economic and environmental shocks have larger impact on vulnerability to food insecurity. Moreover, future vulnerability of households is highly related with current food insecurity, but not uni-directional, particularly in rural areas. Socio-Economic and location differences were also observed in the intensity of vulnerability. It shows that both transitory and chronic food insecurity are highly prevalent in rural areas. The results imply that education, diversification of livelihoods and resources which will raise consumption, will be crucial in attainment of food security. It also strongly supports promotion of family planning; enhancing livestock packages, creation of employment opportunities, delivery of targeting aid for needy groups and input access by

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the poor in the study area. Managements of hazards and risks adequately which enable the poor to escape from vulnerability are immensely vital. Overall, it showed that reducing vulnerability and attaining food security in the region requires adoption of mixed strategies and policies.

Key words: food insecurity, vulnerability, policy intervention, Amhara region
JEL Classification: Q18, I32

1. Introduction

The State of Food Insecurity in the World 2014 showed that About 805 million people were estimated to be chronically undernourished in 2012–14, down by more than 100 million over the last decade. However, about one in every nine people in the world still has insufficient food for an active and healthy life. The vast majority of these undernourished people live in developing countries, with estimated 791 million were chronically hungry in 2014. About one in eight people in these regions, or 13.5 percent of the population, remain chronically underfed. The greatest food security challenges overall remain in sub-Saharan Africa, which has seen particularly slow progress in improving access to food, with sluggish income growth, high poverty rates and poor infrastructure, which hampers physical and distributional access (FAO, 2014). Food insecurity classified as chronic or transitory. Chronic food insecurity occurs when a household is persistently unable to meet the food requirements of its members over a long period of time. It, therefore, afflicts households that persistently lack the ability to either buy food or produce their own. Structural factors contributing to chronic food insecurity include poverty (as both cause and consequence), the fragile natural resource base, weak institutions and inconsistent government policies. It is argued that chronic food insecurity at the household level is mainly a problem of poor households in most parts of the world. On the other hand, transitory food insecurity refers to a temporary decline in a household's access to enough food. It results from a temporary decline in household access to food due to crop failure, seasonal scarcities, temporary

illness or unemployment, instability in food prices, production, income or combination of these factors (FAO 2012).

Food security in Sub-Saharan Africa (SSA) is an important issue and has continued to take centre stage in policy discourses. The region has become home to more than a quarter of the world's undernourished people, owing to an increase of 38 million in the number of hungry people since 1990–92. Food availability remains low, even though energy and protein supplies have improved (FAO, 2014). Though food security as a problem at the national level, it was first felt in Ethiopia in the 1960s, it only started influencing policy in the 1980s, when food self-sufficiency became one of the objectives of the Ten-Years Perspective Plan in the early 1980s. This took place after the 1983/4 drought and famine, which claimed millions of lives (Alemu, *et al*, 2002). While efforts to ensure adequate food supplies at the national level have done well, these efforts on their own cannot ensure food availability for households and individuals. One stark indicator of the precariousness of food insecurity in Ethiopia is the rising dependence on foreign food aid. The country receives between 20 % and 30 % of all food aid to sub-Saharan Africa (Bezu and Holden, 2008). In terms of food insecurity, it is one of the top four African countries that constitute more than one third of their populations are under nutritioned in 2014. As a result, About 33 million or 35% of the populations are food insecure, which is far below the SSA average of 23.5% (FAO, 2014). Amhara region, which represents more than 27% of the national population, is one of the regions of Ethiopia suffered from food shortage every year. Most of the region's areas are incorporated under safety net program in order to rehabilitate the farmers' living standard and alleviate their food insecurity problems. However, the region is still characterized by the persistence of food security problems and the need for better intervention. According to the Household Consumption & Expenditure survey (HCES) carried out in 2011, the proportions of households who are food insecure are about 42.5% in Amhara region, much higher than the national average, which is only 33.6 %. The region ranked the highest in the country in terms of food poverty. Food insecurity is relatively higher in rural areas, with about 44.6% and 28% of household's

food insecure in Rural and Urban areas, respectively (MoFED; 2012). These all implies that food insecurity is still the persistent problem in the region even after the country has shown economic progress.

In recent years there has been increasing awareness that the analysis of food insecurity should be carried out in a dynamic context. It is essential not just to look at the current incidence of an inadequate nutritional outcome, but also to identify the individuals, households or the communities who are more at risk of suffering in the future. The main analytical concept that has been developed in order to address the issue of the future incidence of food insecurity is vulnerability analysis. The main advantages of the vulnerability approach are twofold. First, the approach is explicitly dynamic and forward-looking, in the sense that it is not simply concerned with current outcomes but looks at their future incidence. Second, the analysis is cast in a stochastic framework and can therefore fully consider the uncertainties associated with future food insecurity, such as the role of external shocks and the strategies that households, communities or public institutions can adopt in order to reduce the likelihood of negative outcomes (Capaldo *et al.,* 2010). Thus it is important to better understand the role of external shocks and the strategies that households, communities or public institutions can adopt in order to reduce the likelihood of food insecurity. Without such knowledge it will not be possible to develop effective policy strategies to tackle this problem. Therefore, the present study tried to investigate the extent of households' vulnerability to food insecurity and determines factors in influencing food insecurity in Amhara regional state at the household level.

From the existing literatures (for instance; Sila and Pellokila, 2007; Shiferaw *et al.,* 2003; Frehiwot, 2007; Frankenberger *et al*., 2007; Dercon *et al.,* 2005 and Bahiigwa, 1999) it is clear that households food insecurity is associated with a number of socioeconomic and environmental characteristics such as household income/asset, parents' education/occupation, household size, level of Employment, area of residence and access to land holdings, land size and quality. Also policy factors such as the extension services, safety net programs and access to credit have been linked with food insecurity. A

review of the literature on the household food insecurity shows that there are limited numbers of studies carried out in Amhara region. There are some studies that have been conducted on determinants of food insecurity in general. In the case of food insecurity, Teshome (2010) measures the proportion of household who are food insecure in nine district of the region. Similar analysis have been undertaken by Arega B. (2012), Lay Gaint using sample survey units and indicated that around 80% of the sampled households were food insecure. This study departs from the above mentioned studies in Amhara region in a number of ways. First, the approach is explicitly dynamic and forward-looking, in the sense that it not only concerned with current outcomes but also looks at their future incidence. There has been a recognition of the need to develop analyses to inform policies that are not only aimed at the currently food insecure but at those who are likely to become food insecure in the future. Second, it will also determine both demand and supply side factors affecting food insecurity in the region. Finally, food insecurity assessments in the Region have traditionally focused on rural areas. Nevertheless, the global increase of food price has put challenges on and increases food insecurity in urban areas. This further driven by rising unemployment and cost of living, low asset ownership, high dependency on the informal sector, and increased population pressure due to rural-urban migration. Thus it is important to better understand urban household's food security status and determinants. With these, the present study was initiated in an attempt to address questions like what are the degree of household's food insecurity and future vulnerability in the study area? What are the covariates of vulnerability to food insecurity? Without such knowledge it will not be possible to develop effective policy strategies to tackle this problem.

2. Literature Review

2.1 Determinants of Households Food Insecurity

Various studies carried out in developing countries have highlighted a number of factors considered as determinants of household's food security. Bahiigwa, (1999) showed that inadequate labour, inadequate land, not

growing enough food during the seasons and soil infertility, poor health, lack of planting materials, lack of oxen for plaguing were the main factors contributed to household food insecurity in Uganda. Study by Alarcon *et al* (1993) for smallholder farm households in west highland of Guatemala found that lack of access to credit and cash crop production displace food crops and household consumption of own production is reduced. Thus the household's vulnerability to food insecurity tends to increase. Mucavele (2001) suggested that the main factors that affect food security in urban Maputo, Mozambique, are poverty, low family income, low availability of general alimentation at the family level, floods, family crisis, high unemployment levels and low levels of schooling and training and the absence of a social security system to alleviate the urban shocks. Von Braunet *et al*., (1993), as stated in FAO, denoted that employment and wages, along with prices and incomes, play the central role in determining the food security status of households. As stated above, the situation in Ethiopia is not much different from the conditions in other developing regions. For example, World Food Programme stated (2009) that the common factors that cause household food-insecurity in urban areas of the country are: household size, age of household, sex of household head, marital status of household, education level of household, dependency ratio, access to credit, ownership of saving account, total income per adult equivalent, expenditure level, asset possession, access to social services, owner of home garden, access to subsidized food, sources of food, availability of food commodities, and supply of food commodities. Shiferaw *et al*. (2003) found technological adoption, farming system, farm size, and land quality are supply-side factors and Household size, per capita aggregate production, and access to market are demand-side factors affecting food security. Teshome (2010) compare the food security situations of the nine districts in Amhara region and the result showed that all the nine districts sample households were vulnerable to food shortage. The study also showed food coverage, landholding, and extension service are the major determinants of sample households. With respect to Amhara region, there are studies by Teshome, 2010; Frehiwot 2007; and Arega, 2012; which showed, as stated above, a mix of factors affecting households' food insecurity in the region.

3. Research Methodology

3.1 Data Sources and Sample Size

The study used data from Household Consumption & Expenditure survey (HCES)[2] and Welfare Monitoring Survey (WMS) conducted by Central Statistics Agency (CSA) in 2011. The surveys gathered qualitative and quantitative data pertaining to social, demographic and economic aspects of households. The HCE survey focuses on the expenditure dimension of poverty through measurement of consumption, expenditure, while the WM survey specializes in the non-income aspects of poverty such as health, education, and access to services. Together, the two surveys paint a complete picture of the poverty and welfare environment of Ethiopia. The WMS information supplements the information obtained from HECS and covers households that are participated in HCES and some other additional households. Accordingly, 5062 and 5085 households were covered in HICE and WM surveys in Amhara region, respectively. However, the present study based on about 4640 sample households (1957 households for rural) covered in HCEs and WMS.

3.2 Method of Analysis

Analysis carried out in two steps; first at Preliminary stage and second at Multivariate. At Preliminary stage, descriptive statistics, and correlation matrix will be construct. Descriptive statistics is used to describe, compare, and contrast various issues related to households with respect to the desired characteristics. In multivariate analysis, the study runs multiple regressions using GLS method for estimates of vulnerability analysis and Logit model for determinants of food insecurity.

In this study, the calorie intake method was used to determine a threshold food security line. Food security is defined as the extent to which total household calorie consumption per Adult Equivalent meets its

[2] In contrast to previous years the "income" component was not captured, making the 2010/2011 an HCE survey rather than an HICE survey.

subsistence requirement. Accordingly, a food poverty line, a threshold level of food consumption expenditure below which an individual is considered to be food insecure are established. Two steps—identification and aggregation—are involved in constructing the index. The food consumption behaviour of the reference group accesses to determine average quantities in per adult equivalent of basic food items that makeup the reference food basket. Identification is the process of defining a minimum level of nutrition necessary to maintain a healthy living. Calorie adequacy was estimated by dividing the estimated calorie supply for each household by the household size, adjusted for adult equivalent, and using the consumption factors for various age–sex configurations.

3.3 Theoretical Approach and Model Specifications

3.3.1 Empirical model for determinants of food insecurity

The theoretical framework underpinning empirical approach of food insecurity is a well-known model in the tradition of Straus (1983), Barnum and Squire (1979), in which a household maximizes a utility function defined over leisure, market-purchased goods& services and home produced goods. Households derive utility from the consumption of foods through the satisfaction found in a set of taste characteristics as well as the health effects of the nutrients consumed. Following Strauss (1983), the household utility function is specified as:

$$U = f(F_i, F_m, L) \quad \textbf{(1)}$$

Where Fi is home produced goods consumed by the household; Fm is a market-purchase good consumed by the household; and l is leisure. For the sake of simplistic exposition, only two goods and leisure will be considered in the model. Results can be generalized to more goods. The household, as both producer (firm) and consumer, is assumed to maximize its utility from the consumption of these goods subject to farm production, income, and time constraints specified as

$$X = f(Qi, L, R, A, K). \quad \textbf{(2)}$$

$$P(Q_i - F_i) - P_m F_m - w(L - L_f) + N = 0 \quad \textbf{(3)}$$

$$T = L_f + l \quad \textbf{(4)}$$

where X is the production function; Q_i is quantities of the goods produced on-farm; L is total labor input to the farm; R is farm technology; A is the household's fixed quantity of land; K is the fixed stock of capital; Pi is price of good i; Pm is the price of a market-purchased good; (Qi-Fi) is marketed surplus of good i; w is the wage rate; L_f is the household labor supply for on-farm use; N is non-farm income which adjusts to ensure that Equation (3) equals zero; and T is total time available to the household to allocate between work and leisure (l).

The income and time constraints can be combined into one by incorporating the time constraint (4) into the income constraint (3) as:

$$Pi\,(Qi - Fi) + Pj\,(Q\,j - Fj) - Pm\,Fm - w(L - T + l) + N = 0 \quad \textbf{(5)}$$

Rearranging (5) gives

$$P_i F_i + P_j F_j + P_m F_m + w\,l = P_i Q_i + w\,T - wL + N \quad \textbf{(6)}$$

The left-hand side of equation (6) is the household expenditure on food and leisure, and the right-hand side is the "full" income equation. The expenditure side includes purchases of its own farm-produced good i (PiFi), the household's purchase of the market good (PmFm), and the household purchase of its own leisure time (wl). The full income side consists of the value of total agricultural production PiQi, the value of the household's entitlement of time wT, the value of labor on the farm including hired labor wL, and non-farm income N. The lagrangian is:

$$\text{Max } \omega = U = f(F_i, F_m, L) + \lambda[P_i Q_i + wT - wL + N) - (P_i F_i + P_m F_m + wL)] + \mu[f(Qi, L, R, A, K)] \quad \textbf{(7)}$$

An important property of this model is its reclusiveness in the sense that production decisions are made first and subsequently used in allocating the full income between consumption of goods and leisure (Strauss, 1983). The decision on consumption of the bundle (Fi) is influenced by the decision to produce the quantities (Qi). As a consumer, the household maximizes its utility by equating the marginal rate of substitution between leisure and consumption of good i to w/Pi to the marginal product of labor. The household's supply of labor is determined by the opportunity cost of taking leisure, which is expressed in terms of the marginal product forgone.

Following Strauss (1983), we can mathematically derive the production side and consumption-side equations separately. Starting with the production side, the first order conditions can be solved for the input demand (L) and output supply (Q) in terms of all prices, the wage rate, technology, fixed land, and capital as:

$$L^* = L^*(P_i, w, R, A, K) \quad \textbf{(8)} \quad \text{and}$$

$$Q^* = Q^*(P_i, w, R, A, K) \quad \textbf{(9)}$$

These solutions involve the decision rules for the quantities of labor input used and output produced (production-side). Once the optimum level of labor is chosen, the value of full income when profits have been maximized can be obtained by substituting L* and Q* into the right hand side of the income constraint (equation 6) as:

$$Y^* = P_i Q^*_i + w\,T - wL^* + N \quad \textbf{(10)} \quad \text{and}$$

$$Y^* = w\,T + \pi^*(P_i, w, R, A, K) + N \quad \textbf{(11)}$$

Where Y* is the "full" income under the assumption of maximized profit π
The first order conditions can be solved for consumption demand in terms of prices, the wage rate, and income as

$$F_k = F_k(P_i, P_m, w, Y^*) \quad \textbf{(12)}$$

Where k = i and m

These solutions involve the decision for the quantities of goods and leisure consumed (consumption demand-side). The three equations (equations 8, 9 and 12) give us a complete picture of the economic behavior of the farm household. They are combined through the profit effect. This will occur in the study region where income is determined by the households' production activities, implying that changes in factors influencing production also changes income, which in turn affects consumption behavior. Incorporating demographic factors (D), the demand for food indicated in equation (12) can be rewritten as:

$$F_k = F_k[P_i,\ P_m,\ w,\ Y^*(w, R, A, K, N),\ D] \qquad \textbf{(13)}$$

Logit model was used to analyze the determinants of food insecurity status of households. It models the influence of the set of explanatory variables on food security status of households in the study area. Since econometric analysis with cross-sectional data is usually associated with problems of Heteroskedasticity and Multicollinearity, such suspicions were tested using appropriate measures. The explanatory variables of the model were extracted from empirical studies, literature and economic theory. They include socio-economic and demographic characteristics of the household, market and institutional related factors, farm and other characteristics. Prior to the estimation of the logistic regression model, the explanatory variables were checked for the existence of Multicollinearity. Variance Inflation Factor (VIF) was used to measure the degree of linear relationships among the continuous explanatory variables and contingency coefficient was used to check Multicollinearity among discrete variables. Moreover, it is estimated separately for sample rural and urban households. Doing so will be necessary because factors that can account for urban households food insecurity may differ from rural households and the extent may also vary across areas.

3.3.2 The vulnerability model

Conceptually, vulnerability may mean different thing to different individuals. It may mean a situation where an individual feel insecure that

something harmful happens in the future. In daily language, 'vulnerable' mean something likely to be harmed or wound. Technically, vulnerability is an ex ante measure of well being (Chaudhuri, 2003), i.e., an ex ante expectation of the welfare level of a unit of analysis. In this study, vulnerability is be defined as the extent and probability that household will face food insecurity in the future. The model is based on the Social Risk Management approach (Scaramozzino 2006; Capaldo *et al.*, 2010; Holzmann and Jørgensen, 2000; World Bank, 2000) and, more specifically, on the conceptual framework drawn from it by Løvendal and Knowles (2005). In this framework vulnerability is the result of a recursive process: current socio-economic characteristics and exposure to risks determine households' future characteristics and their risk-management capacity. At every point in time households' current food security status is affected by their past status and affects their future status. In this conceptual framework, as in the family of economic models with "overlapping generations", households have a two-period lifetime consisting of the present (t0) and the future. Present characteristics are known to households and policymakers and determine households' current food security status. Future characteristics, on the other hand, are unknown to households and policymakers. Between the present and the future (t0-t1), a number of previously unknown factors (i.e. Risks of different kinds) manifest themselves and determine, depending on households' risk management abilities, the future food security status. The analytical model used here captures the conceptual framework's recursive structure in two ways: on the one hand it specifies econometrically the relationship between a measure of food security status and a set of household characteristics; on the other hand it explains how current characteristics, risks and risk management capacities affect the likelihood of a favourable (or unfavourable) future food security status.

The approach to the analysis of vulnerability developed by Capaldo *et al.*, (2010), and used in this study is intrinsically dynamic and captures the forward-looking aspects of vulnerability to future risks. The methodology in Scaramozzino (2006), and Capaldo *et al.*, (2010) analysis of vulnerability is using Risk management theory. The most relevant risk management methodology for the measurement of vulnerability in a food insecurity

context is the Value-at-Risk (VaR) analysis. This methodology is widely used for the management of the specific risks faced by financial and banking institutions, where it is employed in order to measure the risk associated with an investor's asset and liability position. This problem is akin to the decision faced by households regarding the resources that must be set aside as a contingency against negative future outcomes. VaR is a very flexible tool that can be usefully employed both for measuring and for managing risk. The VaR methodology analyses the probability that the outcome of a risky event might fall below a critical threshold, on the basis of the statistical distribution of all possible outcomes.

Let C denote the food security indicator, which summarizes the food security outcome for a household. Then the household's vulnerability to food insecurity can be defined as the expected welfare loss associated with an inadequate value of the food security indicator, conditional on a number of characteristics of the households, the strategies they put in place, risk management policies implemented by public institutions, and factors outside the control of households and of the public institutions, such as community-wide negative shocks.

The following econometric specification is an ideal specification of vulnerability process. let C_h indicate Household kilocalorie consumption and X_h be a vector of characteristics, such as household size, location, etc. each household's calorie consumption can be expressed:

$$c_h = X_h'\beta = \beta_1 x_{h1} + \ldots + \beta_2 x_{h2} + \ldots + \beta_j x_{hj} \quad \textbf{(15)}$$

Where is a vector of parameters that are the same for all households. The first step of 3GLS procedure consists of estimating the multivariate equation obtaining estimates of the parameters that explain calorie consumption but for a residual component $u = [u_1, u_2 \ldots\ldots\ldots u_n]$:

$$C = X\hat{\beta} + u \quad \textbf{(16)}$$

The predicted residuals from (16) are correlated and heteroskedastic; therefore, as a second step, the study assess their dependence on the same explanatory variables through a set of parameters γ. It estimates the equation:

$$u = X\hat{\gamma} + \varepsilon \qquad \textbf{(17)}$$

Where ε is the vector of residuals of this second estimation, showing all the desirable properties of residuals that u does not have. From the deterministic part of equation (17) and after correcting again for Heteroskedasticity, derive a consistent estimate of the household variance of food consumption. The variance used to compute each household's vulnerability to food insecurity. Assuming log normality of the calorie consumption distribution, the study estimates the probability that a household becomes Food insecure next period given X, i.e., the vulnerability estimates, as below:

$$\mathbf{Vh} = \mathbf{pr}(\mathbf{lnC}\boldsymbol{h} < LnZ\backslash X = \theta\left[\frac{\mathbf{LnZ}}{\sqrt{\mathbf{varLn(Ci\backslash x)}}} - \frac{\mathbf{E(Ln\ Ci\backslash x)}}{\sqrt{\mathbf{varLn(Ci\backslash x)}}}\right] \qquad \textbf{(18)}$$

$$= \boldsymbol{\theta}\left[\frac{\mathbf{Lnz}-\dot{\alpha}\mathbf{X}}{\sqrt{\dot{\eta}\mathbf{Xi}}}\right] \qquad \textbf{(19)}$$

Where θ is the operator for standard normal cumulative distribution, ά and ή will be estimated vector of parameters and X will be vector of covariates. The ultimate outcome of the calculations is a set of estimates (one for every household h) of the probability that each household faces of falling below the minimum energy requirement in the future. A household requires minimum of 2200 kcal per day per adult to be food secure. Based on Chaudhuri *et al.,* (2003), a household's vulnerability to food insecurity can be expressed as a probability that household fails to attain the minimum level of calorie intake in the future.

4. Results and Discussions

4.1 Extent of Households Food Insecurity

The results of the summary of the household incidence, depth and severity of food insecurity, are presented in Table 1. The FGT indices namely head

count ratio, short-fall and severity of food insecurity are used to show how much the magnitude of food insecurity looks like in the Amhara region. It shows that in 2011 in Amhara region the headcount ratio, short-fall and severity of food insecurity were 48%, 18% and 8.7%, respectively. The results revealed that the incidence of household food insecurity was 0.48. This implies that about 48% of the sampled households were not able to meet the daily recommended caloric requirement[3]. This is different from MoFED (2012), which reports that the incidence of food poverty in Amhara region is about 42%. The difference is basically due to method used to measure calorie consumption and food insecurity. MoFED (2012) used basic needs method to obtain food poverty line; which applied in identifying consumption items defined in 1995/96 that generate 2200 kilo calories valued at 2010/11 national average prices(food and non-food). As the aim of this study is food security analysis (not poverty), it used food energy intake or -calorie method valued at average food price of the region. This method has been applied in several studies with a main focus on food security. The choice among the two methods depends up on the objectives at hand. If the objective is analysis of poverty (food and non-food) across times and regions, the basic needs approach is appropriate. This method is preferred mainly to get a consistent poverty line and analysis (food and non- food) across regions & time. However, if the main focus is food security analysis, calorie energy intake method was appropriate to compute food consumption and its widely used approach in several studies.

[3] Additionally, though not reported here, the calculated calorie consumption of households differ from CSA (2012) and MoFED (2012). This study showed that the mean net calorie consumed in Kcal per day per adult person was 2943 in the region. However, CSA (2012) reported that it was 2145Kcal. The difference is basically the method used to compute calorie consumption. While the computed calorie in this study based on per adult terms which adjusted for sex and age composition of household members, the reports are stated in percapita terms (household size without adjusted for various age and sex compositions).

Table 1: Summary of household incidence and severity to food insecurity

Variables	Total	Rural	Urban
Incidence of food insecurity (Head count ratio)	0.486	0.708	0.341
Depth of food insecurity (Food insecurity gap)	0.18	0.12	0.061
Severity of food insecurity(Squared food insecurity gap)	0.0879	0.062	0.025

Source: Author's calculation from WMS and HCES

The calculated value of food insecurity gap was 18 %. Each food insecure household needs 18% of the daily caloric requirement to bring them up to the recommended daily caloric requirement level besides their per capita consumption and the relative deficiency among food insecure households is 8.7 %. A disaggregated analysis of the extent of food insecurity by location presents a more complete picture of the food consumption pattern of the region. The results of the summary of the household incidence, depth and severity of food insecurity by location of households are also presented in Table 1. Food insecurity was worse in rural household with food insecurity headcount index, short-fall index and severity of 70.8%, 12% and 6.2%, respectively, than the urban counterpart of 34.1%, 6.1% and 2.5%.

Household food security status with reference to various socio-economic characteristics was analyzed in appendix tables (Table A1). The results show that there is significant mean difference between food secure and insecure households with respect to age, dependency ratio, consumption, household size, and access to market. Accordingly, Food insecure households possess more than five of family size and large number of dependents than the counterparts. Dependency ratio shows that higher the dependency ratio more the burden on a household to meet food demand. Mean dependency ratio is less for food secure households than for food insecure households. On average food secure households have three family members with standard deviation of 1.54 while food insecure households have five members with SD of 1.95. Due to poverty and lack of welfare, increasing family size tends to exert more pressure on consumption than it contributes to production. Thus, it affects the food security status of households negatively as food

requirements increase in relation to the number of persons in a household. The t value confirmed that both in urban and rural areas there is a significant mean difference between food insecure and secure household.

4.1.1 Food insecurity coping strategies

Coping strategies are activities that households resort to in order to obtain food, income and/or services when their normal means of livelihood8 have been disrupted. Most coping activities are based on the household's endowments and constraints as well as the availability of opportunities. The potential coping strategies practiced in the study areas include reduce the expenditure of the household to the least to buy food, borrow food from relatives, friends and neighbours, and reduction in food consumption frequency in their order of importance. The analysis revealed that most food insecure households, in Amhara region, tend to reduce the quantity of meal per day (62.26%) and turn to the consumption of low quality and cheaper food stuff (54.34%) in times of food deficit. There is significant difference among the locations in terms of use of coping and mitigation strategies.

Table 2: Households' strategies of coping and mitigation of food insecurity by location

Mitigation or coping strategies	Total	Rural	Urban
Minimizing Risks (Reductive Strategy)			
Turn to low quality and cheaper food stuff	54.34	44.14	93.96
Borrow food, or rely on help from friend	44.38	50.07	13.43
Buy food by debt	41.47	43.12	37.43
Absorbing Risk (Depleting Strategy)			
Reducing the quantity of meals	62.26	55.64	72.75
Reduce number and adults' food consumption	40.14	45.15	31.55
Seek alternative income sources	6.74	5.24	9.66
Risk Taking (Maintaining Strategy)			
Skip entire days without eating	9.23	9.8	8.00
Sale of livestock or other assets	12.81	11.2	9.66
Other Alternative Strategies[G]	11.55	10.64	17.67

*This includes out migration, send children for help, begging for money and food and the like.

Households in rural areas, most often depend on reducing the quantity of meals (55.6%), borrow food (50%) and restrict household food consumption to secure the need of children for food strategies (45%). While the coping strategies employed by rural households under conditions of distress are well documented, little is known about how poor households cope with food insecurity in the city. As it is shown in Table 2, the majority of urban households are more likely use less preferred and less expensive (93.9%) strategies.

Additionally, reduce the quantity of food consumption, and borrow food from relatives, friends and neighbours were re reported as consumption smoothing strategies. Disruptive coping strategies such as migration of the family, selling productive assets and begging were practiced more in the urban areas, indicating that food insecurity is a chronic problem in this area where households depend up on purchased foods. This shows that it is advisable to diversify livelihood sources to adapt to food insecurity and promote activities that can increase mitigation capacity of the households.

4.2 Econometric Results for Determinants of Food Insecurity

Table 3 presents determinant factors for household food insecurity in the study area. Logistic regression model was used to identify determinants factors. The dependent variable is household food insecurity which takes a value equal to 1 if household is unable to meet its minimum calorie requirement (2200net kcal per adult equivalent), 0 otherwise[4]. Many studies proved the relevance of household education in reducing household food

[4] Before entering the variables, contingency coefficient was calculated. Contingency coefficient value ranges between0 and 1, and as a rule of thumb variable with value below 0.75 shows weak association and value above it indicates strong association of variables. Since the value for dummy variables was less than 0.75 that did not suggest Multicollinearity problem. Similarly, variance inflation factor of less than 10 are believed to have no Multicollinearity and those with VIF of above 10 are subjected to the problem. The computational results of, the variance inflation factor for continuous variables confirmed the non-existence of association between the variables.

insecurity and malnutrition. In this respect the results indicate that household head education has significant and positive impact on reducing chronic food insecurity in urban and rural areas. This implies the importance of human capital investments in improving household's food security status. The result for rural sample shows that, other things being constant, the odds ratio in favour of being food insecure decrease by a factor of 0.394 as education of the family increase by one unit. This is as expected, since the level of education should positively affect the income earning capacity and level of efficiency in managing the household's food resources. The effect of education on food security works indirectly by influencing the actions of the person in how to make a living. Literate individuals are very ambitious to get information and very curious to accept agricultural or livestock extension services, and soil and water conservation practices including any other income generating activities. The result coincides with the theoretical evidences that educational improvement could lead to awareness of the possible advantages of modernizing agriculture and improve the quality of labour.

Consistent with the hypothesis, the result shows positive and significant influence of household size on food insecurity of a household. This means that each additional member of a household increases household food insecurity. The odds ratio in favour of food insecurity increases by a factor of 2.476 as household size increases by one in rural areas. This finding is consistence with theoretical and empirical. Household size exerts more pressure on consumption than it contributes to production [Shiferaw *et al*., (2003)]. The model also reveals the important role of household consumption expenditure in contributing to household food security as expected. For urban, consumption increases by one Birr odds ratio in favour of being vulnerability to food insecurity decrease by a factor of 0.99, other variables assumed to be constant. This result is in conformity with the findings of Pearce *et al*., 1996; Amsalu *et al*., 2012. The magnitude of coefficient is small suggesting that the impact of annual expenditure must be explained for an increase of 1000 instead of a one birr increase.

Table 3: Logistic results for determinants of household's food insecurity

Variables	URBAN				RURAL			
	Coefficients	**Standard error**	**z-value**	**odds –ratios**	**Coefficients**	**Standard error**	**z-value**	**odds -ratios**
household size	0.8092***	0469	17.22	2.2463	0.9066 ***	0.0655	13.83	2.476
age of household	0 .0021	0 .0036	0.59	1.0021	0.0091**	0.0040	2.28	1.0091
sex of households(male)	0. 3703***	0. 1224	3.03	0 .6904	0 .3073*	0.1654	1.86	1.3598
real percapita expenditure	-0.0001***	0.00002	-4.76	0 .9998	-0.0002***	0.00004	-3.77	0.9998
ownership of house	0. 1525	0.1234	1.24	1.1647				
household education	-0.0522***	0. 0114	-4.56	0.9491	-0.0668**	0.0319	-2.09	0.9353
livestock (TLU)	-0.02901	0 .0208	-1.39	0.9714	-0. 0521**	0.0261	-1.99	0.9492
unemployed	1.010*	0 .6098	1.66	2.748				
access to micro-credit	0. 0971	0. 1767	0.55	1.1020				
access to market	- 0.1021***	0. 0290	-3.52	0 .9028	0 .0109	0.0068	1.60	1.011
price shocks	0 .1457	0 .1938	0.75	1.1569				
remittances	-0.6958***	0 .2396	-2.90	0.4986				
off-farm activity					0.1447	0.2866	0.50	1.1557
farm size					-0.0256*	0.01507	-1.70	0 .9746
agricultural extension services					-0.1093	0.1675	-0.65	0.8963
local migration network					-0.3792**	0.1630	-2.33	0.6843
use of fertilizers					-0.1374	0.1631	-0.84	0.8716
dummy for Drought shock					1.3660**	0.5612	2.43	3.9199
dummy for illness					0.436	0.3213	1.36	1.5466
constants	-2.0952***	0 .3690	-5.68	0.123	-1.9832***	0.4039	-4.91	0.1376
number of observations	2460				1803			
Wald chi2(12)	474.19***				320.51***			
Pseudo R^2	0.3631				0.362			
Sensitivity	68.12%				92.05%			
Specificity	91.07%				62.40%			
Correctly classified	83.37%				83.69%			

Note: Standard errors are Robust standard errors and significant at * p<0.1; ** p<0.05; *** p<0.01

Physical access to market as proxied by time spent to get to the market was also found to have a negative and significant relationship with food security, indicating that the farther the household is away from the market place and information about market prices, the less likely the family is food secure. Access to employment opportunities help to diversify and increase amount of income received by households. The fluctuation in access to employment determines food insecurity of urban households. The Odds-Ratio shows that other things remaining equal, the odds ratio in favour of food insecurity increases by a factor of 2.748, as Household become unemployed. This result confirms the finding of Mucavele, 2001 and Von Braun *et al* (1993) the sign of the coefficients of age and sex of the household head showed a positive relationship with food insecurity. The interpretations of the results require great caution; they cannot be interpreted as correlations and needs further disaggregate analysis. As stated in the next part, widowed women are more vulnerable and thus more likely to face reduced food consumption. However, the puzzling results are not uncommon (for instance, Frehiwot, 2007; find the same results for age in rural Amhara and Amsalu *et al.*, 2012, for sex of households). Similarly, livestock size is negatively and significantly associated with the probability of being household vulnerability to food insecure. The result indicates that, other things held constant, the odds ratio in favor of being food insecure decrease by a factor of 0.9492 as the total livestock holding increase by one TLU. This result is in agreement with the prior expectation and the findings of Shiferaw *et al* (2003). The negative relationship is explained by the fact that households with large herd size have better chance to earn more income from livestock production. This in turn enables them to purchase food when they are in short of their stock, and invest in purchase of farm inputs that increase food production, and thus ensuring food security at household level. The result with regards to the Access to off-farm work was found to be in contrary with what we were expecting for. Access to off-farm work did not have a significant impact on the probability of household food security. The low magnitude of the "partial" effects is most probably related to the low level of wages and unavailability of jobs as needed. The coefficient of farm size is negative in sign and statistically significant at the 10% level, meaning that farm size

exhibits a negative relationship with the food insecurity status of a household. That is, households with larger farm sizes tend to be more food secure than those with smaller sizes, and vice versa. This means households with large cultivated land produce more for consumption and for sale and have better chance to be food secure than those having relatively small size of cultivated land[1].

In rural areas, where the farmers face crop failure and livestock product is inadequate, transfer income earned from relatives and migrated household member are an important means of acquiring food. Accordingly, the success of farm households and their family members in coping with food insecurity is highly determined by their ability to get access to migration network opportunities. The result suggests that household's accesses to remittances are endowed with additional income and less likely to be vulnerable to food insecurity. This is plausible because households that have other sources of income in addition to farming alone tend to be more resilient in times of food crisis than those engaged in farming alone. Finally, Consistent with the hypothesis, vulnerability of rural households to food insecurity is likely to increases with shocks faced by the households like illness, drought, crop failure and others. It indicates that, the odds ratio in favour of being food insecure increases by a factor of 3.9199 as the as Household faced drought. This confirms the importance of reducing the malign effect of shocks is as to reducing poverty.

4.3 Estimates of Households' Future Vulnerability to Food Insecurity

The regression estimates of the models of per adult calorie consumption and the variance of consumption are stated appendix (Table A2). The study

[1] Shiferaw *et al.*; 2003, observed that greater efficiencies in the use of resources are associated with the large farms than the small farms. They pointed out that the smallness of holdings deters the use of modern technology. This results in low productivity and low income, and consequently incidence of food insecurity among the farm households.

employs three regression specifications in order to estimate expected per capita calorie consumption and its variance. The first (left-hand panel) is a total one for all size in which household demographics, preferences, assets, access to infrastructure, incidence of shocks and coping capacity are used as explanatory variables for per adult capita food consumption. The second is rural specification (middle), incorporates variables that capture agriculture-specific features since this is the dominant livelihood activity in rural areas and the third specification (right-hand panel); incorporates variables that capture urban specific features. Discussion of the parameter coefficient is beyond the purview of the present research, but some results are worth pointing out.

As shown in appendix, variables related to household demographics and assets perform as expected. Assets and human capital positively contribute to higher levels of calorie consumption, in all specifications; widowed households are more vulnerable and thus more likely to face reduced food consumption in the future, whereas female headed households are likely to consume more kilocalories percapita. Consistent with logit estimation, household size are negatively related with calorie consumption of the households. Ownership of assets and quality of houses are positively affect food consumption on households. In particular, ownership of mobile, sturdy roof, the number of rooms in a home use (an approximation of household wealth), have the largest positive correlation with the level of food consumption. Idiosyncratic health shocks and Covariate climate & economic shocks have negatively affects per capita calorie consumption of the households, with specific to rural and urban areas. As expected, schooling of household shows the usual positive and sheepskin effect on household calorie consumption. In both areas of households, education of household head has positive impact on calorie consumption and the coefficient is significant both in rural and urban areas. As is generally established, education provides individuals with greater ex-post risk coping ability and the findings from different studies confirm such a view. Literatures show that additional income received increases the stable income so that capacity of the households to consume more will increase. Thus, the additional

income received increases the stable income so that capacity of the households to consume more will increase. With these, Households with migrant family members in rural areas and access to remittances in urban areas significantly determine food consumption and face smaller variance in their food consumption. This possibly indicates the positive impact of remittances on food consumption resulting from a more diversified income. The result is in line with above finding and standard economic theory on domestic migration. Better access to public infrastructure also positively correlates with food consumption; increased distance from a public road is strongly linked to a reduction in the level of food consumption. However, the greater distance from a public road is also associated with lower variance in food consumption, possibly indicating low transmission of market volatility. This result is robust across all regression specifications. The positive association between 'access to assistance programs' and variance in food calorie consumption, though not significant, may reflect poor targeting or design imperfections, as frequently discussed in the literature. The results are not statistically significant, possibly because of the binary specification of the variables, which means that there is limited information on the amount and intensity of the assistance that each household has experienced.

Covariate shocks, particularly weather-induced fluctuations in production and idiosyncratic health shocks are the main drivers of increased vulnerability of farm households. This suggests that households exposed to higher yield risk—presumably associated with adverse local geo-climatic conditions—tend to have lower long-term consumption levels after controlling for a wide range of other household characteristics. Additionally, covariate economic shocks, price shock, are negatively effect on per capita per adult calorie food consumption and significant in first and urban specifications. This show in urban areas as households depend on purchased food consumption, an increase in price will significantly affect the consumption. These findings are important for policy interventions in rural and urban Amhara region. Since budget is necessarily constrained, programs should be targeted toward the most vulnerable people. To do so, specific area profiles can provide valuable information on the impact of both idiosyncratic

and covariate shocks on vulnerability either it observable or unobservable shocks. Finally, in the rural areas, land ownership explains the strong positive impact of land ownership on food consumption and negative on its variance. Consistent with the logit estimation, the larger the size of cultivated lands the lower the volatility in food consumption. On the other hand, the livestock ownership has a significantly positive impact on food consumption, suggesting that households that earn part of their livelihoods from marketing their agricultural produce are less vulnerable to becoming food insecure. Possession of livestock seems to be a good insurance instrument against food shocks.

Based on the regression analysis, the vulnerability indicator is computed using predicted kilocalorie consumption and its variance for each household in each of the three specifications. Moreover, an arbitrary threshold of 0.5 (standard in the literature) at and above which a household is considered vulnerable is chosen. Accordingly, the degree of households' vulnerability to food insecurity was estimated using the method stated in the data analysis part[2]. In line with Chaudhuri (2003), choosing the focal point to be 0.5 where the household becomes vulnerable to food insecurity, it revealed that about 52% of the sampled households in Amhara region were found to be vulnerable to food insecurity in the future, whereby the average probability for a household to fall below the food insecurity threshold is about 51.8 percent. The analysis of vulnerability to food insecurity indicates that in the rural areas the average degree of vulnerability is about 76%, which is much higher than the region average. However, urban households are supposed to be less vulnerable to food insecurity, with mean vulnerability of 32.1%) compared to the rural one. The analysis shows that, estimates of mean and incidence of vulnerability are much higher in rural than in urban areas of the region. This is common in standard poverty analysis, rural areas always fare worse than urban and the conclusion is not different in food insecurity vulnerability assessment.

[2] Since the main purpose of this study is to analyze and estimate vulnerability, the study ignores possible econometric complications that are not directly relevant.

Table 4: Probability of falling into a state of food insecurity in the future in Amhara region

	Amhara Total		Rural		Urban	
Vulnerability	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
	0.518	0.419	0.763	0.341	0.321	0.373

Source: Author's calculation from WMS and HCES

The relationship between current food security status and vulnerability to food insecurity revealed statistically significant association between the two (Table 5). It indicates that the average degree of vulnerability in the study area is about 52.3%. With this, of the current food insecure households, about 84% are chronically food insecure or likely to remain insecure in the future (vulnerable) where as the remaining are not vulnerable to future food insecurity. On the other hand, about 20.8% of the current food secure households are vulnerable to food insecurity (likely to be food insecure in the future) in the Amhara region. The result also brings to light the fact that vulnerability in terms of food insecurity prospects is largely a rural phenomenon. Households in rural areas of the region are highly vulnerable to both transitory and chronic food insecurity and, of the current food insecure households in rural areas, about 93% are likely to remain food insecure in the future (vulnerable) where as only about 57.3% current food secure households are not vulnerable to future food insecurity. In the other case, only about 6.5% of the rural households are food insecure but non-vulnerable to food insecurity in the future. There is statistically significant difference in vulnerability to food insecurity across the current food status and locations of the households. This indicates that district specific coping strategies are needed. Hence, food security intervention programs needs to give priority to highly vulnerable areas where there are no diversified livelihood mechanisms.

Table 5: Percentage distribution of current food security status and vulnerability to future food insecurity

	Amhara total				Rural sample			
Current status:	**vulnerable**	**non-vulnerable**	**total**	χ^2	**vulnerable**	**non-vulnerable**	**total**	χ^2
Food insecure	84.64	15.36	49.38	2.1***	93.45	6.55	70.98	580.6***
Food secure	20.77	79.23	50.62		42.61	57.39	29.02	
total	52.31	47.69	100		78.69	21.31	100	

Source: Author's calculation from WMS and HCES

A cursory look at Table 6 also reveals that those with current, food insecure, are the ones mostly vulnerable and with the highest incidence. As the table shows, only 40.1% of total households enjoy stable levels of food security in Amhara region; that is they are food secure and not vulnerable. On the other hand, 41.79% of the population is undernourished (food insecure) while also being vulnerable; these are considered chronically food insecure. 7.6% of households are currently undernourished but only temporarily (transient food insecure). Most importantly, about 10.52% of households in total sample are food secure at present, while being at risk of being undernourished (food insecure) in the future. Therefore, in the case of interventions a targeting error could potentially affect about one fifth of the population (10.52%+7.6%=18.12%). Forward-looking analysis of vulnerability to food insecurity allows correcting these potential errors in policy design.

Overall, in about 52.31% of sample households are vulnerable to food insecurity, exhibiting an average vulnerability of 89%. The situations are very severe in rural areas; with about 78% sample households are vulnerable to future food insecurity, exhibiting an average vulnerability of 93%. Further, Decomposition of vulnerability into rural and urban households, show that only 4.65% of the sampled rural population is in a transitory condition, falling in and out of food insecurity, while the remaining are found to be in a stable condition, being either food secure or food insecure. Most importantly, about12.36% of households in rural sample are food secure at present, while being at risk of being food insecure in the future;

while its about 8% in urban areas. On the other hand, about 66.3% and 23% of rural and urban households are chronically food insecure respectively, i.e, they are food insecure while also being vulnerable. This again highlights the fact that vulnerability in terms of food insecurity prospects is largely a rural phenomenon. Food security-oriented policies based on a static analysis of food security (emphasizing current vulnerability) may not capture the imminent needs of a large share of the population, while targeting households whose needs are of a temporary nature only. The results also show a positive relationship between vulnerability to food insecurity and households' dependence on farming activities. The estimates also suggest that there is no bi univocal correspondence between current undernourished households and vulnerable ones. The two groups overlap but are not identical. Consequently, policy measures based on static food security analysis would include errors of exclusion and of inclusion; resources would be directed to undernourished households, a large proportion of which are unlikely to remain insecure even without assistance, while those households currently sufficiently well-nourished are vulnerable to future food insecurity.

Table 6: Distribution of household shares by current and future vulnerability to food insecurity[G]

	Amhara Total			**Urban**			**Rural**		
Current status:	**(Food Insecure In Future)**	**Vulnerable Food Secure In Future)**	**Total**	**(Food Insecure In Future)**	**Vulnerable (Food Secure In Future)**	**Total**	**ood Insecure In Future)**	**Vulnerable (Food Secure In Future)**	**Total**
	(Vh [0.5)	**(Vh Y 0.5)**		**(Vh [0.5)**	**(Vh Y 0.5)**		**(Vh [0.5)**	**(Vh Y 0.5)**	
Food insecure	41.79 [0.93]	7.6 [0.2]	49.38 [0.81]	23.05 [0.87]	10.58 [0.18]	33.63 [0.65]	66.33 [0.95]	4.65 [0.23]	70.98 [0.90]
Food secure	10.52 [0.78]	40.1 [0.09]	50.62 [0.23]	8.11 [0.731]	58.26 [0.072]	66.37 [0.15]	12.36 [0.82]	16.66 [0.14]	29.02 [0.43]
Total	52.31 [0.89]	47.69 [0.11]	100 [0.52]	31.16 [0.84]	68.84 [0.09]	100 [0.32]	78.69 [0.93]	21.31 [0.16]	100 [0.76]

Source: Author's calculation from WMS and HCES ∗In brackets, average probability of vulnerability, vh)

4.3.1 Shocks and vulnerability status of households

The probability of becoming food insecure in the future is determined by the present conditions, the risks potentially occurring within a defined period and the capacity to manage the risks. What happened yesterday is reflected in today's status and what happened today influences tomorrow's status. Risk factors threaten food security today and cause vulnerability. Crop production risks, such as crop failure due to pests and diseases, livestock dearth, drought, and volatility of income were the major features of rural households. Rural poor households are much more exposed to natural disasters and agricultural-related shocks, while the urban-poor are found to be more vulnerable to economic shocks specific to the formal economy. Since urban and rural households face different prices particularly for food stuff, and given the pre-eminence of expenses on food in total household income, across areas may be inflating vulnerability incidence. Covariate shocks, particularly weather-induced fluctuations in production and idiosyncratic health shocks are the main drivers of increased vulnerability of farm households /rural households. The test results presented in Table 7 also shows that there is a systematic association between vulnerability and the incidence of each predictor variables. Households that have been exposed to a shock have higher levels of vulnerability compared to households that have not, suggesting a difficulty in recovering from these and a need to strengthen risk management capacities. In particular, Drought frequently affected rural population and has the worst outcome in terms of increasing the average probability that a household will be undernourished, taking their vulnerability to the relatively higher levels; the average probability is 93 %; which is 13 percentage points higher than households that have not experienced drought shocks. An illness of a member of the household households that have experienced illness have a 82 % probability to be food insecure in the near future, which is 6 percentage points higher than households that have not experienced an illness.

In sum, the common truth from the above analysis is that rural households' vulnerability stems from idiosyncratic health and disease shocks and

covariate climate shocks, which are translated into low average living standards, while urban households' vulnerability is largely explained by high volatility in living standards which arising from idiosyncratic health and Covariate economic shocks which are specific to the formal economy. This shows risks are different and more diverse, particularly for the poor who are usually unable to participate fully in the economy and resources that could mitigate their situation in times of need.

Table 7: Estimates of mean and incidence of vulnerability of households by shocks

Locations	HH affected by shocks		t-stat
	yes	no	
	Mean vulnerability	Mean vulnerability	
Rural Sample			
drought	0.93	0.76	-3.39***
illness	0.82	0.76	-1.64*
income volatility	0.80	0 .76	-0.83
crop damage	0 .85	0 .76	-1.89**
flood	0 .86	0.76	-2.34***
livestock Losses/dearth	0 .89	0 .76	-2.71***
Involuntary loss of land	0.877	0.764	- 0.662
Urban Sample			
price shock	0.359	0.318	-1.579*
illness	0.497	0.317	-3.91***
income volatility	0.334	0.324	-0.49

Source: Author's calculation from WMS and HCES

With regard to education Table 8 reveals that; those with no formal education are the ones mostly vulnerable and with the highest mean incidence. Educated people can adapt more easily to changing circumstances, therefore showing greater ex post coping capacity. Almost 63 per cent of those with no schooling are vulnerable compared to a 19.5 per cent for those with university degree. Besides, in rural areas more than 90 per cent of those belonging to the group with no formal education and less than secondary enrolment are chronically poor or trapped into food insecurity. These results were in any case expected and confirm the well

established hypothesis of the negative correlation between vulnerability and education (Schultz, 1975; Christiansen and Subbarao, 2005). This makes clear that policies that aim at improving and stabilizing household's income streams in the medium and long term would better achieve its goal through accumulation of human capital, specifically education.

Table 8: Vulnerability estimates by educational attainment

Educational level	**Amhara Total**			**Rural sample**		
Read and Write	**Mean vulnerability**	**vulnerability incidence**	i^2	**Mean vulnerability**	**vulnerability incidence**	i^2
	(vh > 0.5)			**(vh> 0.5)**		
Yes	0.42	43.86	142.3***	0.789	81.14	
No	0.60	61.32		0.750	77.51	3.36*
Total	0.52	52.31		0.763	78.68	
Educational Attainment						
No Schooling	0.625	63.68		0.76	78.72	
Primary	0.544	54.92	510.8***	0.795	81.80	49.3***
Secondary	0.217	20.93		0.33	32.14	
University Or Higher	0.209	19.53		0.20	20.0	

Source: Author's calculation from WMS and HCES

Numerous studies have shown a statistically significant positive association between total household per capita income and dietary diversity. The close association between income and diets can be shown by using household consumption. The following table shows the distribution of households' vulnerability in terms of the lowest (Q1) and highest (Q5) quintiles according to per capita consumption expenditure. Households having higher income are obviously less likely to be food insecure, as compared to households with low income. Households with high income can spare more money on food after meeting other needs. Higher physical wealth/income reduces transient as well as chronic poverty and food insecurity. Results given in Table 9 show, out of total households from the lowest quintiles

group (the lowest 40%), over three-quarters (76.2%) of them are vulnerable to food insecurity, with mean vulnerability of more than 80percent.

Table 9: Vulnerability estimates by consumption quintile total and urban sample

Consumption Quintiles	Amhara Total	Urban Sample			
	Mean Vulnerability	Vulnerability Incidence (Vh > 0.5)	Mean Vulnerability	Vulnerability Incidence (Vh > 0.5)	¡ 2
Quintile 1	0.82	84.64	0.64	66.22	
Quintile 2	0.74	76.22	0.53	54.49	
Quintile 3	0.61	63.04	0.42	40.84	
Quintile 4	0.49	48.42	0.32	29.49	458.1***
Quintile 5	0.20	18.66	0.14	11.96	

Source: Author's calculation from WMS and HCES

Looking at the vulnerability ratio across consumption groups, it has a monotonic relationship with vulnerability. In all cases they are smaller for the least vulnerable class than for the most vulnerable one Vulnerability is more concentrated (i.e. widespread) at lower levels of quintile (Table 9). More than 66 percent of the first quintile poor households in the urban areas are vulnerable to food insecurity while less than 12 percent of the richest quintiles are vulnerability; shows low income prospects of vulnerability. The underlying truism that you pay for most of your needs in the city makes income indispensable for household food insecurity, particularly given that most poor urban households are net food purchasers. Similarly, chi-square tests for the variables indicate that greater proportions of less vulnerable households are from high consumption quintiles in urban areas. Decomposition of vulnerability into income prospects sets clear that relatively high level of consumption inequality among urban households which results in higher incidence of vulnerability.

5. Conclusions and Implications

Understanding the causes and level of food security would help policy makers to design and implement more effective policies and programs for

the poor. Food security interventions based on static food security analyses do not capture the imminent needs of a potentially large share of the population that is likely to change its food security status in the near future, particularly in rural areas. It appears necessary to understand why transitorily or structurally poor households are exposed to volatility that may contribute to vulnerability. The purpose of this study was to carry out empirical estimation on household food insecurity and future vulnerability in Amhara region. An attempt has been made to identify factors that determine the household food insecurity. The study also examines factors related to why transitorily or structurally poor households are exposed to food calories consumption volatility which will contribute to vulnerability. A two-stage process involving the application of the vulnerability model and the Logit model was employed to analyze the data. Accordingly, the study revealed that almost about half of the households were not able to meet the daily recommended caloric requirement. Further, the descriptive statistics shows that there was evidence of location and socio-economic differences in intensity of food security. There are significant mean difference between vulnerable and non-vulnerable households with respect to various demographic, socio-economic variables and incidences of risks. The Results indicate that for both rural and urban households, demand side factor related to demographics like family sizes, age, dependency ratio, marital status, socio economic factors including education, consumption, alternative employment opportunities and asset ownership was a significant predictor of vulnerability and food insecurity. It is found that, vulnerability to food insecurity is negatively associated with wealth/asset holding, human capital and alternative source of income for households. This shows, Ownership of household assets is considered to be one of the strategies for enhancing households' resilience in the face of economic crisis and adverse circumstances, such as crop failure, drought, and so on. In rural areas supply side factors like farm inputs and farm size, as well as environmental shocks are related to vulnerability and food insecurity. Empirical findings also show that idiosyncratic shocks, in particular health-related shocks, covariate economic and environmental shocks have larger impact on vulnerability to food insecurity. The vulnerability analysis also shows differences in the

intensity of future vulnerability among rural and urban areas. It clearly reveals that vulnerability to food insecurity is still mainly a rural phenomenon and that this is induced by so many factors. Moreover, future vulnerability of households is highly related with current food insecurity, but not uni-directional, particularly in rural areas.

From a policy perspective, the results of the study have a number of implications. It implies that expansion of education, diversification of livelihoods and access to resources which will raise consumption, will be important in reduction of vulnerability and attainment of food security in the region. 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 the study area. This finding also strongly supports that promotion of family planning in order to reduce the increasing pressure on the available scarce resource; enhancing livestock packages, creation of employment and income generating opportunities, delivery of targeting aid/safety net for emergency needy groups, input access by the poor can mitigate vulnerability to food insecurity in the study area. Management of shocks and risks adequately which enable the rural poor to adopt suitable livelihood strategies is important to an escape from food insecurity. Moreover the policy initiatives that will do most to enhance the potential for self-employment, stabilization of covariate economic shocks and alternative income opportunity are basic in reducing vulnerability in the urban areas. In general, the results of this study produce the implication that reducing vulnerability and attaining food security in the urban and rural areas of Amhara region requires adoption of mixed strategies and policies.

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Appendices

Table A1: Association between household food security status and selected predictor variables

Variables	Food security status	Total	Urban		Rural	
		Mean [SD]	Mean [SD]	t [P-Value]	Mean [SD]	t [P-Value]
family size	FS	2.939 [1.545]	2.56 [1.294]	-38.4*** [0.0000]	2.84 [1.42]	-29.3*** [0.0000]
	FI	5.302 [1.954]	4.762 [2.077]		5.46 [1.899]	
average annual percapita Expenditure	FS	7892.88 [10398.7]	10342.23 [18122.9]	10.7*** [0.0000]	6886.78 [3768]	18.3*** [0.0000]
	FI	4396.72 [2868.40	5455.68 [4469.55]		4299.4 [2653.1]	
kcal consumption/adult/day	FS	3900.75 [1903.7]	4576.15 [2426.15]	37.6*** [0.0000]	3623.3 [1560.2]	51.1*** [0.0000]
	FI	1293.5 [455.55]	1541.33 [421.461]		1270.8 [451.8]	
dependency ratio	FS	0.7382 [0.767]	0.481 [0.646]	-9.9*** [0.0000]	0.843 [0.788]	-8.4*** [0.0000]
	FI	1.153 [0.772]	0.784 [.742]		1.18 [0.76]	
age of household head	FS	43.377 [18.995]	36.78 [16. 31]	-11.8*** [0.0000]	46.06 [19.36]	-0.47 [0.317]
	FI	46.304 [14.416]	44.30 [14.84]		46.48 [14.36]	
distance to the nearest market	FS	5.926 [8.882]	1.145 [2.10]	0.25 [0.601]	7.879 [9.8]	-1.59* [0.0551]
	FI	8.175 [10.67]	1.125 [1.615]		8.81 [10.9]	

Source: Author's calculation from WMS and HCES

Table A2: Regression results for calorie consumption and variance of calorie consumption

Variables	Total Amhara Sample		Rural Sample		Urban Sample	
	Log pc kcal consumption	Variance of consumption	Log pc kcal consumption	Variance of consumption	Log pc kcal consumption	Variance of consumption
Female headed HH	0.18***	-0.12	0.08**	0.06	0.22***	-0.14
	(0.02)	(0.09)	(0.03)	(0.19)	(0.02)	(0.11)
Female head of HH is widow	-0.11***	0.07	-0.12***	-0.13	-0.09***	0.22
	(0.02)	(0.13)	(0.04)	(0.23)	(0.03)	(0.16)
Log HH size	-0.72***	-0.25***	-0.82***	-0.11	-0.70***	-0.40***
	(0.01)	(0.07)	(0.02)	(0.12)	(0.02)	(0.09)
Log age of HH head	-0.09***	-0.19*	-0.17***	-0.15	-0.05**	-0.05
	(0.02)	(0.11)	(0.03)	(0.16)	(0.03)	(0.15)
Access to safe water	-0.001	-0.02	0.01	0.13	-0.01	-0.02
	(0.02)	(0.09)	(0.03)	(0.15)	(0.02)	(0.11)
Access to assistance Govt/NGO	-0.01	0.05	0.03	0.01	-0.01	0.17
	(0.02)	(0.09)	(0.02)	(0.11)	(0.02)	(0.14)
dummy for Price shock	-0.07***	-0.06	-0.03	-0.08	-0.06**	-0.02
	(0.02)	(0.13)	(0.04)	(0.19)	(0.03)	(0.17)
dummy for drought	-0.19***	-0.32	-0.13**	-0.23		
	(0.06)	(0.31)	(0.06)	(0.34)		
dummy for Illness	-0.08**	0.26	-0.04	0.35	-0.11**	0.33
	(0.03)	(0.18)	(0.04)	(0.24)	(0.05)	(0.29)
access to Small loan	-0.02	-0.09	0.02	-0.23	-0.03	0.15
	(0.02)	(0.10)	(0.03)	(0.15)	(0.03)	(0.14)
Log no livestock owned (TLU)	0.01*	0.03	0.03***	0.02	0.002	0.04
	(0.01)	(0.03)	(0.01)	(0.05)	(0.01)	(0.04)
Log years of education of HH	0.06***	-0.06	0.05***	0.02	0.07***	-0.01

	(0.01)	(0.04)	0.01	(0.08)	(0.01)	(0.05)
Log distance to nearest major road	-0.03***	-0.02	-0.03***	-0.01	-0.02*	-0.01
	(0.01)	(0.04)	(0.01)	(0.04)	(0.01)	(0.07)
Log land owned (ha)	-0.002	-0.01	0.05***	-0.09	-0.01	0.10
	(0.01)	(0.07)	(0.02)	(0.10)	(0.02)	(0.11)
cement floor	0.06***	0.02	0.35*	0.59	0.04*	0.10
	(0.02)	(0.12)	(0.19)	(1.02)	(0.02)	(0.13)
Log time to nearest health facility	0.01***	-0.02	0.02**	0.03	0.01**	-0.03
	(0.01)	(0.03)	(0.01)	(0.05)	(0.01)	0.03
sturdy roof	0.10***	-0.29***	0.13***	-0.33**	-0.004	-0.01
	(0.02)	(0.10)	(0.02)	(0.13)	(0.04)	(0.22)
log no, of mobile owned	0.08***	-0.19	0.24	-1.46	0.01	0.17
	(0.02)	(0.13)	(0.17)	(0.91)	(0.03)	(0.14)
Log no of radios owned	0.03	0.04	0.03	0.03	0.02	-0.01
	(0.02)	(0.11)	(0.03)	(0.14)	(0.04)	(0.19)
Log no of TVs owned	-0.01	-0.13	-0.03	-8.90***	-0.002	-0.09
	(0.03)	(0.19)	(0.06)	0.33	(0.04)	(0.24)
ownership of electric mitad	0.07*	-0.50**			0.02	-0.34
	(0.04)	(0.20)			(0.04)	(0.21)
Log distance to nearest primary school	-0.001	0.04	-0.01	-0.03	0.01	0.07
	(0.01)	(0.03)	(0.01)	(0.05)	(0.01)	(0.06)
Log no of bikes owned	-0.13	-0.45	-0.46	-88.43***	-0.14	-0.46
	(0.14)	(0.75)	(0.61)	(3.28)	(0.14)	(0.77)
Log no of rooms	0.07***	-0.09	0.01	0.13	0.05**	-0.09
	(0.02)	(0.08)	(0.03)	(0.14)	(0.02)	(0.11)
off-farming activities	0.03	0.05	-0.02	-0.02		
	(0.02)	(0.12)	(0.04)	(0.23)		
Access to HH migration network	0.10***	-0.07	0.10***	-0.17		

	(0.01)	(0.08)	(0.02)	(0.12)		
use of fertilizers			0.02	-0.18		
			(0.03)	(0.15)		
agricultural extension services			-0.05**	0.04		
			(0.03)	(0.14)		
dummy for livestock loss/Death			-0.19***	0.22		
			(0.06)	(0.33)		
log of modern bed					0.07***	-0.14
					(0.02)	(0.09)
ownership of fridge					0.05	-0.16
					(0.03)	(0.19)
log no tables and other assets					-0.002	-0.01
					(0.01)	(0.07)
ownership of Sofa					-0.01	-0.25*
					(0.03)	(0.15)
dummy for loss of job					-0.04	0.71
					(0.09)	(0.50)
access to remittances					0.07*	0.10
					(0.04)	(0.20)
Constant	8.62***	-1.81***	9.00***	-2.07***	8.58***	-2.57***
	(0.08)	(0.42)	(0.12)	(0.63)	(0.11)	(0.61)
R -squared	0.62	0.13	0.54	0.44	0.56	0.11
No of observations	4640	4640	1957	1957	2683	2683
F(26, 4613) =	293.54	8.37	79.77	54.33	118.29	11.04
Prob > F	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Note: all variables in logs except shares and binaries, standard errors are in parenthesis and significant at * p<0.1; ** p<0.05; *** p<0.01